AN ABSTRACT OF THE DISSERTATION OF

Adonara E. Mucek for the degree of Doctor of Philosophy in Geology presented on May 15, 2017.

Title: Investigating Timescales of Resurgence at Large Calderas: Post-74 ka Activity at Toba Caldera, Sumatra, Indonesia.

Abstract approved: _____

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The Toba Caldera Complex is the youngest resurgent caldera in the last 100 kyrs, formed from four overlapping eruptions starting 1.2 Myrs ago. The last caldera-forming eruption, the Youngest Toba Tuff eruption, occurred ~74 kyrs ago, emitting 2800 km^3 of ash and pumice into the atmosphere and forming the caldera outline seen today. The amount of ejecta released into the atmosphere potentially affected the global climate and regional human evolution. The youth of this caldera system has made it the perfect natural laboratory for investigating resurgence, the last stage in the caldera cycle, associated with volcanic effusions

and structural deformation and uplift. Organic-rich sediments found on the uplifted caldera floor provide a well-preserved and detailed history of the resurgent uplift, while lava extrusions along faults running through and around the caldera provide geological context for the initiation of resurgent activity at Toba Caldera. New data reveal details of the post-caldera history at the Earth's youngest resurgent supervolcano, Toba caldera in Sumatra. Resurgence after the caldera-forming ~74 kyrs ago Youngest Toba Tuff eruption uplifted the caldera floor as a resurgent dome, Samosir Island, capped with 100 m of lake sediments. ^{14}C age data from the uppermost datable sediments reveal that Samosir Island was submerged beneath lake level (~900 m a.s.l) at 33 kyrs ago. Since then, Samosir experienced 700 m of uplift as a tilted block dipping to the west. ^{14}C ages and elevations of sediment along a transect of Samosir reveal that minimum uplift rates were ~5.6 cm/year from ~33.7 to 22.5 kyrs ago, but diminished to ~0.7 cm/year after 22.5 kyrs ago. Localised uplift activity continued along the eastern coast of Samosir associated with volcanic effusions, with ^{14}C ages of sediments found blanketing lava domes as young as ~2.7 kyrs ago, producing localized uplift rates of ~1.9 cm/yr. Zircon U-Th crystallization and (U-Th)/He ages reveal resurgence commenced at 69.7 ± 4.5 kyrs ago progressing westward across the caldera, as reflected by post-caldera effusive lava eruptions and uplifted lake sediment. Previous geochronology for four of these lava dome localities (North Samosir, Tuk Tuk Samosir, North Pardepur, South Pardepur) by combined U-Th-disequilibrium/(U-Th)/He zircon geochronology yielded eruption ages ranging from 69.7 ± 4.5 kyrs ago to 56.9 ± 3.9 kyrs ago, implying resurgent volcanic activity started almost immediately after the climactic eruption and continued for ~20,000 years. $^{40}Ar/^{39}Ar$ ages

from sanidine and plagioclase feldspar crystals from the same lava domes have returned ages that are contemporaneous with the climactic eruption, between 74.3 ± 0.4 and 71.4 ± 8.2 kyrs ago for North Samosir, Tuk Tuk Samosir, and South Pardepur, with only North Pardepur showing a substantially younger $^{40}Ar/^{39}Ar$ crystallization age of 23.6 ± 9.8 kyrs ago. These ages overlap with the (U-Th)/He ages, but the younger error weighted average (U-Th)/He eruption ages imply that the process of resurgence is more complex. Using eruption temperatures and a simple argon diffusion model, the difference between the weighted mean (U-Th)/He age and stacked plateau $^{40}Ar/^{39}Ar$ ages can be explained by a difference in closure temperatures between argon and helium. Sanidine and plagioclase feldspar crystals from three lava domes record the YTT eruption age and are interpreted to be antecrysts that remained in the remnant magma system below argon closure temperature (T_c) in sanidine/plagioclase (350°C). In contrast, the younger North Pardepur lava dome $^{40}Ar/^{39}Ar$ inverse isochron plagioclase age of 47.9 ± 11.1 kyrs ago overlaps with the (U-Th)/He age, implying that plagioclase crystals are either autocrysts, formed during the eruption of the North Pardepur dome, or YTT antecrysts that have been reset due to their host magma remaining above argon T_c for >700 yrs. Matrix glass analyses represented on the quartz-albite-orthoclase (Qz-Ab-Or) ternary plot indicate that the Samosir dome magmas equilibrated over a deeper range of pressures (200-50 MPa) than the YTT (100-50 MPa), while the Pardepur dome magmas record the lowest pressures (50-0.1 MPa). Fault and drainage analysis of the resurgent dome shows that the southern half of Samosir Island is much more dissected than the northern half of the island. Drainage basins in the south are much more developed, with very little sediment cover left and basement rock

observed to be exposed in some areas. Using drainage basin analysis tools in ArcGIS and the Geomorph Tools program in Matlab, the stream networks were analysed and channel profiles were created. Combining the identified locations of knickpoints along these channel profiles with assumed erodibility paramters, the minimum amount of time needed for the drainage basins to develop was calculated. Based on these calculations, drainage basins in the north and south took the same amount of time to develop. This means that the difference in drainage development is a result of another factor. One possible explanation is that pre-existing faults may underlie the thick intracaldera YTT deposit on the southern half of Samosir. These faults may have been from the previous half of the OTT resurgent dome, Uluan, which Samosir has appeared to take the place of. Pre-existing faults could have resulted in areas of weakness that were exploited during drainage basin development, thus making the southern drainage basins develop faster than the northern drainage basins. A more detailed study is required, however, to fully develop this potential hypothesis. A major active stratovolcano north of Toba, Sinabung, shows strong geochemical kinship with Toba, through $^{87}Sr/^{86}Sr$ isotopes, whole rock chemistry, and ^{238}U-^{230}Th disequilibrium ages of zircons from recent eruption products. This suggests that Toba's climactic magma reservoir, which was tapped during resurgence, may extend beneath Sinabung and is being tapped during current Sinabung eruptions. This implies that resurgence at the Toba Caldera system may have continued as eruptions at Sinabung.

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Investigating Timescales of Resurgence at Large Calderas: Post-74 ka Activity at Toba Caldera, Sumatra, Indonesia

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APPROVED:

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Dean of the College of Earth, Ocean, and Atmospheric Sciences

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Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

_____

Adonara E. Mucek, Author

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CHAPTER 1: INSIGHTS INTO TOBA CALDERA'S PAST

A General Introduction

ABSTRACT

The Toba Caldera Complex is the youngest resurgent caldera in the last 100 kyrs, formed from four overlapping eruptions starting 1.2 Myrs ago. The last caldera-forming eruption, the Youngest Toba Tuff eruption, occurred ~74 kyrs ago, emitting 2800 km^3 of ash and pumice into the atmosphere and forming the caldera outline seen today. The amount of ejecta released into the atmosphere potentially affected the global climate and regional human evolution. The youth of this caldera system has made it the perfect natural laboratory for investigating resurgence, the last stage in the caldera cycle, associated with volcanic effusions and structural deformation and uplift. Organic-rich sediments found on the uplifted caldera floor provide a well-preserved and detailed history of the resurgent uplift, while lava extrusions along faults running through and around the caldera provide geological context for the initiation of resurgent activity at Toba Caldera. This general introduction provides an overview of the geologic background of Toba Caldera's evolution and the framework for the remaining chapters of this dissertation.

INTRODUCTION

The term 'supervolcano' brings to mind an image of fiery destruction, catastrophic eruptions, and regional catastrophe. From a geologic perspective, supervolcanoes are the foci of the buildup of hundreds of thousands, even millions, of years of silicic magmatic activity, culminating in a climactic supereruption and the formation of a large caldera, varying in size, from 10 to 100 km across. These large silicic caldera systems hold the rapt attention of the public and media because of the widespread danger they pose. Caldera-forming eruptions associated with these systems can eject hundreds to thousands of

cubic kilometers of ash, pumice, and volcanic debris into the stratosphere and blanket the surrounding region up to distances of thousands of kilometers from the vent. In addition to regional destruction, these catastrophic eruptions have also been known to affect global climate by causing a fall in global temperatures (Oppenheimer, 2002; Williams et al., 2009). The location of these caldera systems is also a source of concern; many communities live either near or in these calderas, for example the city of Kagoshima (population of over 600,000 (Kagoshima City, 2015)) in Aira Caldera, Japan, or the town of Taupō (population of over 24,000 (Stats NZ, 2016)), on the shore of Taupō Caldera, New Zealand. Any eruptions or volcanic activity associated with these calderas would affect both the immediate communities in the area and the surrounding region. There is also great interest in these large caldera systems as they are associated with the formation of ore and mineral deposits, as well as the development of hydrothermal and geothermal energy systems; these areas are of economic importance both to the communities and countries in which these calderas are found (Wohletz and Heiken, 1992).

The source for greatest concern for many volcanologists is that despite such well studied caldera systems, such as at Yellowstone, Valles, and Long Valley calderas (all in the USA; Bailey et al., 1976, Wicks et al., 2006, Wolff et al., 2011), there is still a great need to understand the timing associated with magmatic and volcanic activities at these systems. In particular, the last stage of activity associated with calderas after the climactic eruption, resurgence, is still not well constrained, despite all known active large calderas being in a state of resurgence (Newhall and Dzurisin, 1988). Resurgence at caldera systems is related to renewed activity both in and around the caldera. Within the caldera,

the floor of the caldera (or roof of the collapsed magma reservoir) is uplifted as a result of renewed magmatic activity (and other mechanisms which will be discussed in later chapters; Smith and Bailey, 1968; Marsh, 1984). This uplift leads to the formation of a dome, known as a resurgent dome, in the middle of the caldera. Faulting associated with this uplift provides paths of weakness for the extrusion of lava domes along the resurgent dome. Renewed activity within the remnant magma reservoir also leads to volcanic extrusions along the caldera ring faults, previously the origin locations for the climactic caldera-forming eruption. Both resurgent structural uplift and volcanic activity pose hazards to communities that have developed within the large caldera systems and on the flanks.

Thesis Framework

The question of the timescale of resurgence is one of importance in mitigating hazards associated with renewed activity at large-scale caldera systems. Determining how long resurgent domes take to develop and when volcanic activity occurs during the period of resurgence is paramount in understanding better the hazardous events related to resurgence. This thesis aims to better constrain the timing and activity of resurgence by using Toba Caldera, in Indonesia, as a natural case study. Considered the youngest resurgent caldera in the last 100 kyrs, Toba Caldera has shown both associated volcanic activity and structural deformation within the caldera related to the period of resurgence, capturing detailed information of caldera floor uplift in well-preserved sediment stratigraphy and young effusive lava domes. This thesis will combine the use of radiocarbon dating, (U-Th)/He disequilibrium dating, and $^{40}Ar/^{39}Ar$ dating to determine the uplift rates of Toba's resurgent dome and

the timing of the volcanic extrusions along faults through the resurgent dome and around the caldera. An analysis of the drainage network development on the surface of the resurgent dome will constrain the timing of uplift of the resurgent dome. This analysis can also provide information as to whether uplift is consistent across the entire dome. Analyses of matrix glass data from the lava domes will conclude this thesis by providing a scenario of emplacement for the lava domes. The concluding chapter will also include strontium isotope and zircon crystal age analyses from a currently active volcano north of Toba Caldera, Sinabung, showing that resurgence at Toba Caldera may not have ended, and may in fact be represented by the current eruptive products at Sinabung.

LOCATION

Geographical Overview

Toba Caldera is located on the northern end of the island of Sumatra, Indonesia, in the middle of the province of North Sumatra (Figure 1.1). Nestled within the uplifted Barisan Mountain range at an elevation of 906 m above sea level (Genrich et al., 2000), Toba Caldera is expressed as a caldera lake, known as Lake Toba, only 90 km from the capital city of Medan, where a population of over 2 million people live (UNData, 2010), the third largest city in Indonesia. Within Lake Toba is an island, known as Samosir Island, where a population of over 95,000 live, their livelihoods based on agriculture and tourism.

Regional Tectonic Setting

Toba Caldera is an ellipsoid topographic depression, measuring 100 km by 30 km, sitting on the Eurasian continental plate (Masturyono et al., 2001; Kuolakov et al., 2009; Chesner, 2012). 200 km off the coast of Sumatra lies the

Sunda trench, where the Indo-Australian oceanic plate is being obliquely subducted underneath the Eurasian plate at rates of 5.2 – 6.0 cm/yr; rates of subduction increase from 2°N to 6°S along the Sunda Trench (DeMets et al. 1990; Koulakov et al., 2009; Sieh et al., 2000). As a result of this oblique subduction, two parallel (to the Sunda Trench) faults have developed, the Mentawai Fault separating the forearc basin from the forearc accretionary ridge (and the location of the 2004 M9.0 earthquake and tsunami; Koulakov et al, 2009; Sieh et al, 2000; Chesner, 2012), and the Sumatran Fault, running parallel to the Barisan Mountain range (Figure 1.1; Genrich et al., 2000; Chesner, 2012). The Sumatran Fault is a right-lateral strike slip fault accommodating dextral motion of the two converging plates, with slip rates varying between 2.3 to 2.6 cm/yr, increasing from south to north in the North Sumatra province (Genrich et al., 2000; Sieh et al., 2000). Toba Caldera lies 20 km to the east of the Sumatran Fault, its major axis parallel to the orientation of the fault. The current elliptical shape of Toba Caldera is thought to be the interaction between the building of the magmatic system and the accommodation of the right-lateral motion of the Sumatran Fault, elongating the magmatic system parallel to the fault (Holohan et al., 2007; Chesner, 2012). Toba Caldera also lies at the center of an oval, elevated terrain, encompassing a part of the Barisan Mountain range and other volcanic structures north of Toba, such as Sinabung and Sibayak volcanoes, and Mt. Sibuatan. This elevated region (>1000 m in elevation) is known as the Batak Tumor (Figure 1.1; van Bemmelen, 1939).

Local Tectonics and Topography

On the surface, Toba Caldera measures approximately 100 km NW-SE by 30 km NE-SW, with Samosir Island (measuring 40 km NW-SE by 20 km NE-

SW) almost centered in the middle of the caldera. The walls of the caldera are at an elevation of 1500 m above sea level (a.s.l.) along the west rim and 1200 m a.s.l. along the east rim (Figure 1.2A). The western rim of the caldera is bounded by the West Marginal Fault Zone, which passes through the Pusuk Buhit volcano, while the eastern rim of the caldera is bounded by the East Marginal Fault Zone, passing through the town of Parapat (Figure 1.2B; Aldiss and Ghazali, 1984). Samosir Island sits in the middle of the lake (906 m a.s.l.) with the highest point at 1630 m a.s.l. along the main Samosir Fault on the eastern part of the island. The western side of Samosir Island gently slopes down back to lake level, dissected only by faults running circumferential to the island forming the Samosir Graben. Between Samosir Island and the eastern rim of the caldera lies the Latung Graben, which dissects Samosir Island from an uplifted block on the eastern rim of the caldera, the Uluan peninsula (Figure 1.2A; van Bemmelen, 1939). The Uluan peninsula (also known as the Sibolangit peninsula) is an elevated region found within the inner collapse scarp of the current caldera topography. The highest point of the Uluan peninsula lies at approximately 1200 m a.s.l.. Bathymetry of Lake Toba shows the deepest part being 500 m (therefore 400 m a.s.l.) in the northern section, close to the town of Haranggaol (Figure 1.2C).

Magma Reservoir

Seismic tomography studies have shown that the crust beneath Toba Caldera is approximately 29 to 40 km thick, with the top of the magma reservoir located between depths of 8 to 14 km (Sakaguchi et al., 2006) or between depths of 5 to 15 km (Koulakov et al., 2009), with low velocity regions extending all the way to the subducting slab (at a depth of around 100 km;

Figure 1.3A). The magma reservoir itself is represented to be more of a complicated magmatic sill complex, with partially molten sills that have accumulated incrementally over time to form large enough magmatic volumes as seen during the caldera eruptions (Figure 1.3B; Jaxybulatov et al., 2014). The eruptible melt volumes are thought to originate from the shallower depths of the magma reservoir (between 5-8 km; Reid and Vasquez, 2016).

GEOLOGIC HISTORY

The topographical expression of Toba Caldera today is a result of four previous eruptions superimposed on each other, forming a caldera complex. These volcanic events were distinguished by analysing the products of each eruption using a variety of geological techniques. Through paleomagnetism (using anisotropy of magnetic susceptibility (AMS); Knight et al., 1986) and geochronology (Chesner and Rose, 1991; Chesner et al., 1991), a detailed stratigraphic framework of the different eruptive units was produced to distinguish four main ignimbrite units that make up the majority of the Toba Caldera complex seen today (Figure 1.4A). The oldest ignimbrite forming eruption is the Haranggaol Dacite Tuff (1.2 Myrs ago), followed by the Oldest Toba Tuff (0.8 Myrs ago), then the Middle Toba Tuff (0.5 Myrs ago), and lastly the Youngest Toba Tuff (0.075 Myrs ago).

Basement Rock

The observed basement rock, identified in exposed walls of the caldera, range from Permo-Carboniferous metasediment to Late Permian basaltic andesites. Permo-Carboniferous metasediments, consisting of metamorphosed mudstone, wacke, and limestone, part of the Bohorok Formation, can be found

in exposed sections in the west, south, and east of the caldera (Aldiss et al., 1982). Basaltic andesite lava flows overlying Late Permian rocks found in the north, near the town of Haranggaol, returned K-Ar ages (on pyroxenes) of 1.3 ± 0.4 Myrs ago (Yokoyama and Hehanussa, 1981). Similar basaltic andesite flows can be found in the southern section of the caldera, near the town of Muara; these flows have been classified as part of the Haranggaol Volcanic Formation (Clarke et al., 1982).

Haranggaol Dacite Tuff (HDT)

Volcanism at Toba commenced with the eruption of dacite magma in the northern section of the caldera near the town of Haranggaol, depositing the Haranggaol Dacite Tuff (HDT). Fission track dating on a zircon from the HDT gives an age for the eruption at 1.20 ± 0.16 Myrs ago (Nishimura et al., 1977). The HDT crops out mainly in the northern section of the caldera (< 100m thick), above the sequence of andesite lavas from the Haranggaol Volcanic Formation. Commonly exhibiting columnar jointing, the HDT unit is densely welded and can contain extremely stretched and elongated pumices (fiamme) up to 1 m long (Chesner and Rose, 1991). Exposed in only three main outcrops, the unit is reversely magnetized (Knight et al., 1986), contains phenocrysts of plagioclase, orthopyroxene and clinopyroxene, and gives a bulk rock composition of 63-66 wt. % SiO_2 (Figure 1.4B; Chesner, 1998). The limited exposure and thickness of this unit has led to volume estimates of ~35 km^3 dense rock equivalent and dispersal areas >700 km^2. (Chesner and Rose, 1991; Chesner 2012). The eruption associated with the emplacement of the HDT would have been a large stratovolcano eruption that formed a caldera in the north of the current Toba Caldera outline; however, there is no current

remaining topographical expression of the caldera that might have formed (Figure 1.4A; Chesner, 2012).

Oldest Toba Tuff (OTT)

The second eruptive episode at Toba Caldera was the eruption of the Oldest Toba Tuff (OTT), focused in the southern section of the current Toba Caldera, forming the Porsea Caldera. The current southern structural feature shows the previous outline of the Porsea Caldera (which overlaps with the current caldera outline; Figure 1.4A; Knight et al., 1986). Past $^{40}Ar/^{39}Ar$ dating on sanidine, biotite, and hornblende returned an average eruption age of 0.84 ± 0.03 Myrs ago (Diehl et al., 1987) for exposed sections found in the Porsea Caldera, however recent $^{40}Ar/^{39}Ar$ dating on sanidines from these same locations returned OTT eruption ages of 0.7920 ± 0.0012 Myrs ago and 0.7850 ± 0.0016 Myrs ago (2 sigma; full errors (internal and external experimental errors); Mark et al., 2017). As with the HDT, the OTT commonly exhibits columnar jointing and is densely welded; fiamme can be up to 30 cm. Reversely magnetized, the OTT units commonly exhibit phenocrysts of quartz, sanidine, plagioclase, biotite, and amphibole, along with metasedimentary lithics; the most distinctive feature, however, are the pink quartz phenocrysts, which are not present in any of the other ignimbrite units (Knight et al., 1986). The bulk rock composition shows that the OTT is compositionally zoned, with fiamme locally ranging from 61-74 wt. % SiO_2 (Chesner, 1998). A majority of the exposed stratigraphic sections showing the OTT are found in and around the old Porsea Caldera, and in the cliffs of the Uluan Peninsula. An isolated outcrop in the northern part of Toba has led to previous studies expanding the areal spread of the OTT to the north (Figure 1.4B; Chesner and Rose, 1991). Furthermore, OTT ash has been

found in deep-sea cores in the South China Sea and in the Indian Ocean, leading to calculations of 1800 km^3 of ash added to 500 km^3 from the OTT ignimbrite (total DRE 2300 km^3; Knight et al., 1986; Pattan et al., 2010).

Middle Toba Tuff (MTT)

The third eruption at Toba Caldera was the Middle Toba Tuff (MTT) eruption, returning the eruption activity focus to the northern section of the current caldera outline. Found in three exposed outcrop sections near Haranggaol, the MTT is emplaced on top of the HDT; further similarities with the HDT lie in the fact that the caldera formed from the MTT eruption has not been recognized (Figure 1.4A & B). Past $^{40}Ar/^{39}Ar$ dating on sanidine date the eruption at 0.501 ± 0.005 Myrs ago (1 sigma; Chesner et al., 1991), while recent 40Ar/39Ar dating on sanidine return an eruption age of 0.502 ± 0.0014 Myrs ago (2 sigma; full errors (internal and external experimental errors); Mark et al., 2017). The MTT is the most distinctive Toba ignimbrite, with prominent black and glassy fiamme in a black to grey matrix of columnar joints (Chesner and Rose, 1991). The deposition of the ignimbrite is reversely zoned, from 72 to 76 wt. % SiO_2 from base to top (Chesner, 1998), while paleomagnetically it is normally magnetized, unlike the other Toba deposits. Mineraologically, it is similar to the other Toba tuffs, with phenocrysts of sanidine, quartz, plagioclase, and biotite (Chesner, 2012). The tight distribution of exposed MTT units (~180 m thick) with the HDT units suggests that the vent source for the MTT eruption is similar to that of the HDT eruption. Deposits of the MTT have an aerial distribution of ~400 km^2 and a dense rock equilivent volume of 60 km^3 (Chesner and Rose, 1991; Chesner, 2012).

Youngest Toba Tuff (YTT)

The most recent caldera activity at Toba Caldera was the eruption of the Youngest Toba Tuff (YTT). This eruption is likely the most famous and well researched of all the Toba eruptions, given its young age and high magnitude and eruptive intensity. The current elongated caldera outline, as filled in by the caldera lake, is believed to represent this eruption being imprinted on the previous three eruptions and reactivating any old ring faults of the Porsea Caldera (Figure 1.4A). The most recent $^{40}Ar/^{39}Ar$ dating of sanidine and biotite from the YTT dates this eruption at 73.88 ± 0.64 kyrs ago and 75.0 ± 1.8 kyrs ago (2 sigma; full errors; Storey et al., 2012 and Mark et al., 2014, respectively). Normally magnetized, the YTT ranges from incipiently to densely welded at the base and non-welded in the middle and top. Non-welded sections contain pumice blocks (coarse with more biotite crystals vs. finer-grained with less biotite), which vary in bulk rock chemistryfrom 68 to 77 wt. % SiO_2, indicating compositional zoning (Chesner, 1998; Chesner, 2012). Phenocrysts present are similar to the MTT, with quartz, sanidine, plagioclase, biotite, and amphibole crystals. Intracaldera fill can be found on Samosir Island, making up 600 m of the 700 m of relief on the island, while the outflow sheet covers almost 20,000 km^2 (thicknesses from 100 to ~400 m; Figure 1.4B; Aldiss et al. 1982; Chesner and Rose, 1991). YTT ash fall is also recorded in deep-sea cores in the Indian Ocean, South China Sea and Malaysian Peninsula (Ninkovich et al., 1978; Rose and Chesner, 1987; Shane et al., 1995; Westgate et al., 1998), resulting in a calculation of an additional 800 km^3 to the calculated 2000 km^3 of ignimbrite (total DRE 2800 km^3; Chesner, 2012).

Post YTT Activity

Following the YTT eruption, Toba Caldera under went several changes that have resulted in the caldera seen today. Almost immediately after the eruption, the caldera was filled with water to its current lake level at 906 m a.s.l., from precipitation and runoff. Calculations using current precipitation rates have set this time period to be around 1,500 years after the eruption (Chesner, 2012). After the caldera was filled with water, sedimentation within the lake commenced, forming layers of lake sediment on the floor of the caldera. Concurrently with this lake sedimentation, Toba Caldera experienced a period of resurgence. Resurgence is defined as the structural uplift and deformation of the caldera floor, after a caldera-forming eruption, to form a resurgent dome, and any associated volcanic activity along faults running through the caldera and around the caldera ring fracture (Figure 1.5; Smith and Bailey, 1968; Marsh, 1984, Kennedy et al., 2012). As part of this period of resurgence, the floor of the caldera was uplifted and formed the island seen in the middle of the caldera today, Samosir Island (Figure 1.5). Uplift of the floor of the caldera also uplifted sediments deposited from suspension within the lake. Samosir Island currently has a highest point of elevation of 1630 m a.s.l. and 700 m of relief. The upper 100 m of this is lake sediment overlying 600 m of YTT intracaldera fill (Chesner and Rose, 1991; Chesner, 2012).

Lava domes were also erupted both along faults running through Samosir Island (along Samosir Fault), as well as along the caldera ring faults (Figure 1.4A; Chesner and Rose, 1991; Chesner, 2012). Lava domes on Samosir Island can be found in the north, in the Simanindo area, as well as the east, forming the Tuk Tuk peninsula (Figure 1.4A). Both lava domes found on Samosir Island are rhyolitic in composition (69-76 wt. % SiO_2) and similar to the YTT in terms

of mineralogy (Chesner, 1998; Chesner, 2012). In the north of the caldera, two lava domes occur, named Sipisupisu (also known as Tanduk Benua) and Singgalang (Figure 1.4A). These two lava domes are basaltic andesite to andesitic in nature (54 to 62 wt. % SiO_2), unlike any of the lava dome compositions seen elsewhere in Toba. Along the west of the caldera, they form several lava flows on the composite volcano, Pusuk Buhit (Figure 1.4A). Pusuk Buhit itself is complex, displaying several lava flows of andesite to dacite compositions varying from 61 to 69 wt. % SiO_2 (Chesner, 2012). In the south of the caldera, lava domes associated with resurgence can be found both on the caldera rim (blanketing OTT and the Haranggaol Volcanic Formation flows) as well as forming a small island, collectively known as the Pardepur lava domes (Figure 1.4A). The island is known as Pulau Sibandang (or Pardepur Island according to Chesner, 2012). The Pardepur lava domes collectively have a limited dacitic range, from 66 to 69 wt. % SiO_2.

Understanding of the Current Caldera

The outline of the YTT caldera (current caldera) incorporates the Porsea Caldera in the south. It is thought that during the eruption of the YTT, the ring faults of the Porsea Caldera were re-activated, causing further subsidence of the Porsea Caldera (Chesner, 2012). The amount of collapse of the Porsea Caldera was less, however, than the major and conspicuous collapse of the main portion of the YTT caldera. The Uluan peninsula is part of the north eastern section of the Porsea Caldera outline, yet is considered to be part of the resurgence of the YTT caldera; there has been some debate as to whether Uluan and Samosir are part of the same resurgence doming (Figure 1.5). Cliffs along the Uluan peninsula are reversely magnetized, implying they were OTT, while the Samosir

Island cliffs were normally magnetized, concluding they were YTT. As such, Knight et al. (1986) concluded Uluan, consisting of OTT, was part of the resurgence related to the Porsea Caldera after the OTT eruption, while Samosir Island, consisting of YTT, was part of the resurgence related to the YTT eruption. Chesner and Rose (1991), however, disagreed with these findings and used observations of lake terraces and lake sediments to argue that the Uluan peninsula was the "semi-symmetrical counterpart to Samosir Island", supporting the idea that Uluan and Samosir were two half domes of a resurgent dome separated by a graben, the Latung Strait (van Bemmelen, 1939; Smith and Bailey, 1968). There is agreement, however, that the Uluan peninsula has undergone some amount of uplift due to the warping of lake terraces found within the ignimbrite cliffs (whether these cliffs are of OTT origin or YTT origin; Verstappen, 1961; 1973).

The current lake level is at 906 a.s.l., stabilized by hydroelectric dams located at the Asahan valley outlet, the only outlet for Lake Toba (Verstappen, 1973; Chesner, 2012). The current understanding of the lake level is that it has been at the current level since stabilizing soon after the formation of the YTT caldera (1500 years after, according to Chesner (2012)). Several lake terraces occur in the southeastern portion of Toba of the Uluan peninsula (Figure 1.6A). The two main terraces are found at 1,160 m and 1,050 m. 1,160 m is the highest lake level to ever occur at Toba and is formed within the "old Toba ignimbrite"; these terraces have been interpreted as having formed post-OTT, and therefore are not related to the lake formed after the YTT eruption. This terrace height can be traced along the eastern caldera wall to Prapat, and to the southwestern side near Balige. The 1,050 m lake terrace is the second highest, found along the

caldera wall between Porsea and Prapat. Because of strong tilting of the walls, these heights vary as they are traced out around the southern section of the caldera, but these highest lake stand values are recorded at Porsea, near the outlet of the Asahan valley (Figure 1.6B). Verstappen (1973) states that the Asahan valley outlet has always drained Lake Toba, indicating that the high stands at Asahan reflect the natural threshold for Toba. Several lower terraces are also mentioned, also found formed in the tuff between Balige and Prapat. However, these lower terraces are found locally cannot be found uniformly across the southern section. It is possible that both the two main terraces, as well as any other terraces that might have formed, might be found elsewhere along the caldera wall, but factors such as hard rock (resisting incision) and slumping (mass movement) would prevent the identification of these terraces elsewhere. The problem that is raised with this study of the high lake terraces is that Verstappen (1973) does not provide any ages for these terraces. The terraces are found incised into OTT, not YTT, meaning they could have been high stands from a previous paleo lake after the OTT eruption (Figure 1.6A). Furthermore, the dominance of these lake terraces in the south, located within the Porsea Caldera and not the main YTT caldera, suggest that these terraces were present before the YTT eruption. There are no observations of lake terraces present in the sediment cover on Samosir, so this is taken to be evidence that Samosir experienced posteruption uplift, during a time when the lake level was stable (Verstappen, 1973; Chesner, 2012). In order to determine how the lake level has changed for Toba, ages would have to be provided for the two main terraces and evidence for the lake level being different than what it is today (at 906 m) would have to be present in both the intracaldera YTT as well as the

Samosir lake sediment (especially if the lake level was changing as Samosir was uplifting).

TOBA AND SOCIETY

YTT and Climate Change

The YTT eruption, as a result of being the youngest and largest caldera-forming eruption in the last 100 kyrs, has been at the forefront of discussions on volcanic eruptions and their impact on climate change. First proposed by Rampino and Self (1992), the amount of ash and sulphur aerosols calculated to have been injected into the atmosphere was suggested to have brought about a volcanic winter, with surface temperatures decreasing by 3-5°C. Measurements of volcanic sulfate from the Greenland ice core at the eruption age of the YTT (~73 kyrs ago) showed a sulphate spike, supporting the hypothesis that the core marked an onset of 6-7.5 years of global cooling following the YTT eruption (Figure 1.7A; Zielinski et al., 1996). Several models following this initial calculation have attempted to better constrain the amount of aerosols injected into the stratosphere and the impact it would have on the climate (Robock et al., 2009; Costa et al., 2014). Arguments against these models have ranged from the potential temperature changes being over estimated (1°C instead; Oppenheimer, 2002), to the timing of the YTT eruption coinciding with the period of last glaciation that was already underway before the YTT eruption (Figure 1.7C; Zielinski et al., 1996; Oppenheimer, 2002; Williams et al., 2012). It has been agreed upon, however, that the YTT eruption was recorded in ash layers in marine cores and sulphate spikes in ice cores (Figure 1.7A & B). However the degree of cooling from the 'volcanic winter' and the length of time affected by this cooling is still under serious debate.

YTT and the Human Bottleneck

Another area of controversy is the effect of the YTT eruption on the evolution of hominids in the region. Based on the argument of a volcanic winter lasting 6 years after the eruption, some studies have argued for the case of a severe population bottleneck (i.e., the struggle to survive in a cooler climate would have differentiated the human population; Ambrose, 1998; Rampino and Ambrose, 2000). Some studies showed that as a result of the affected environments, associated with volcanic induced cooling, migration out of Africa was accelerated, resulting in the first modern humans from Africa (Ambrose, 2002). On the other hand, other studies showed no impact on these populations. One such example is in Jones et al. (2012); populations in India did not appear affected post-YTT, with hominins returning to ash-affected valleys. The population numbers pre- and post-YTT did not change. Furthermore, mitochondrial DNA studies narrow the bottleneck age to occur around 200,000 years ago, before the YTT eruption occurred (Harpending and Rogers, 2000; Hawks and Wolpoff, 2001). A human population bottleneck around 70 kyrs ago is still hotly contested, although most studies agree more archeological and anthropological research is needed to support either side of the argument.

THESIS OBJECTIVES AND SCOPE

Toba Caldera's young geologic and eruptive history, as well as recent resurgent history, provides a unique opportunity to shine a spotlight on issues related to post-caldera activity that is still poorly understood. While other calderas have also undergone resurgence, there is much resolution lost in the geologic record at these older calderas, such as at Long Valley Caldera (0.76 Myrs ago; Bailey et al., 1976), Valles Caldera (1.2 Myrs ago; Phillips et al.,

2007), and Yellowstone Caldera (0.64 Myrs ago; Girard and Stix, 2009). Toba's YTT Caldera, formed only ~74 kyrs ago, along with a resurgent dome, Samosir Island, that contains well-preserved 100 m thickness of detailed lake sediments, and young lava domes both on the resurgent dome and around the caldera, provides a natural laboratory for high resolution dating and stratigraphy of the process of resurgence. This thesis will aim to constrain details associated with resurgence, such as the timing related to when resurgence started, how long it has continued on for, as well as determining magma dynamics related to the process of resurgence and the uplift of Samosir Island and eruption of the lava domes.

Question 1: Is resurgence at Toba episodic and does it occur at different rates?

Chapter 2 will delve deeper into the process of resurgence, looking at what uplift rates are associated with the formation of the resurgent dome and what styles of uplift are commonly seen at resurgent calderas. This chapter will then apply the developed understanding of resurgence to Toba Caldera, and constrain resurgence at Toba Caldera using a combination of observed geology and neotectonics, and initial radiocarbon ages obtained from the organic-rich lake sediments found on Samosir Island. Based on these measured rates, Chapter 2 will answer the question of resurgence at Toba: (a) Is resurgence uplift at Toba Caldera episodic or continuous? (b) Does this uplift occur at a same continuous rate or different rates?

Question 2: When did resurgence start after the YTT eruption and has it been continuing?

Chapter 3 will look at the volcanic activity associated with resurgence, specifically looking at the post-YTT lava domes that have extruded both on the

resurgent dome of Samosir Island and along the caldera ring fracture. This chapter will constrain the period of volcanic resurgence by dating these lava domes using combined ^{238}U-^{230}Th and (U-Th)/He dating on zircon crystals to get eruption ages of the lava domes. Based on the eruption ages, Chapter 3 will answer the timing question of resurgence at Toba: (a) When did volcanic resurgence activity start at Toba following the YTT eruption? (b) How long has resurgence continued?

Question 3: Can Toba's resurgence be readily identified by different geochronological means?

Chapter 4 will also look at the volcanic activity at Toba Caldera, as seen in Chapter 3, however using a different geochronological technique. Instead of obtaining ^{238}U-^{230}Th and (U-Th)/He ages on zircon crystals, $^{40}Ar/^{39}Ar$ dating will be applied to sanidine crystals from the same post-YTT lava domes to compare the two geochronological methods. Past $^{40}Ar/^{39}Ar$ dating on the post-YTT lava domes have failed to yield ages different from the YTT age, so this technique will be attempted here to obtain sanidine crystallization ages to be compared to the zircon eruption ages. Based on the comparison of these two geochronological techniques, Chapter 4 will answer the questions: (a) Can volcanic activity related to resurgence at Toba Caldera be identified by more than one geochronological technique? (b) What are the implications for similarities/differences in the ages from the two techniques on the resurgent magmatic system at Toba Caldera?

Question 4: How long did it take for the resurgent dome to uplift?

Chapter 5 will look at the drainage basin evolution of the landscape on Samosir Island, Toba's resurgent dome. The relief of the north of Samosir

compared to the south of Samosir is very different; the north does not have as developed or incised a drainage network as the south. This chapter will use calculations for a detachment-limited model to determined the minimum amount of time needed for the development of the drainage network and basins seen in the south of Samosir. Based on these calculations, Chapter 5 will answer the question of resurgent dome development: (a) What is the minimum amount of time needed for the drainage basin in the south to develop compared to the north? (b) Does this time limit fall within the timescale of resurgence (period of time after the caldera-forming eruption) or does it imply antecedent drainage from a time before the YTT eruption?

Question 5: Is resurgence at Toba a result of remobilized remnant magma?

Chapter 6 will delve into the magma dynamics associated with the post-YTT magmatic system. This chapter will combine detailed microprobe analyses of matrix glass from the post-YTT lava domes with geochemical data from whole rock analyses to identify the magmatic processes related to the resurgent volcanic activity of the post-YTT lava domes. Chapter 6 will also include analyses from recent products of a currently active volcano 30 km north of Toba Caldera, Sinabung, to investigate the potential link between the Toba Caldera system and this active volcano. Based on the magmatic narrative from the geochemical and geophysical data, Chapter 6 will tie together all previous information to answer the question: (a) What are the magmatic processes responsible for the extrusion of the post-YTT lava domes? (b) Is resurgence at Toba a result of remobilized remnant magma? (c) Is resurgence at Toba continuing at another location?

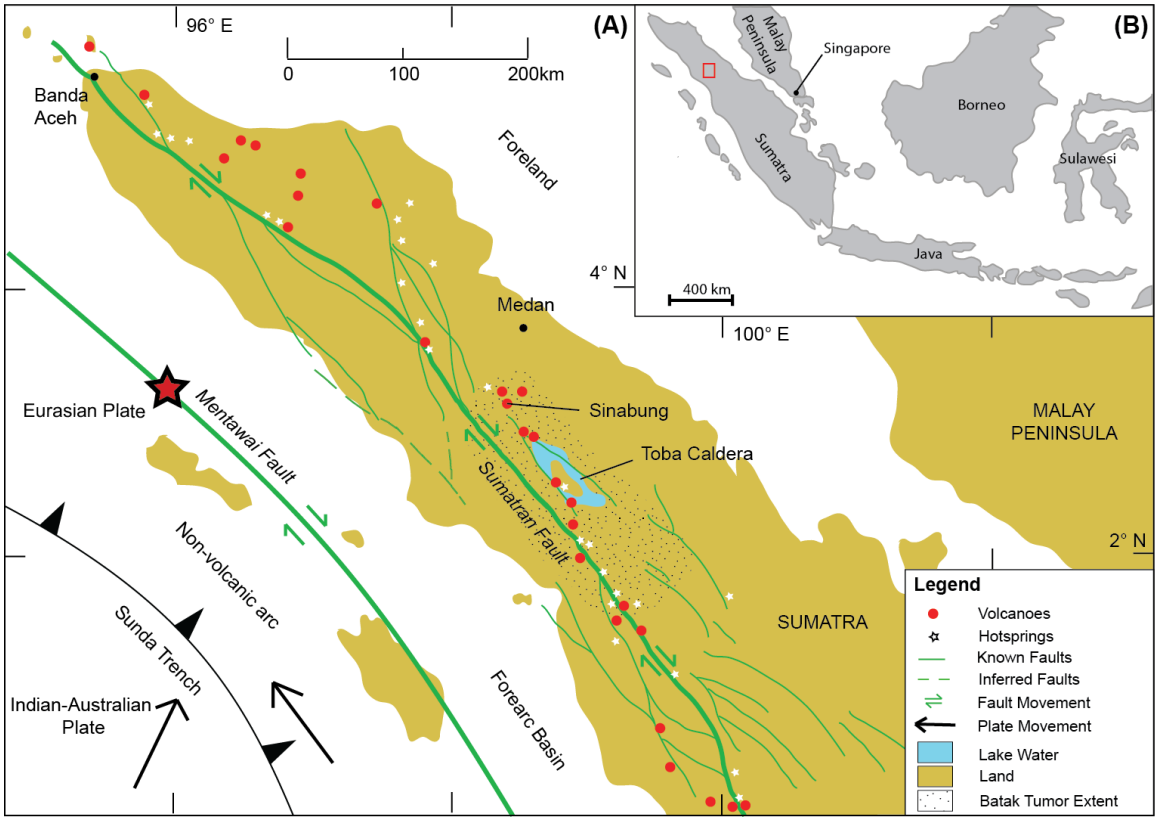


Figure 1.1: Tectonic Setting of Toba Caldera

(A) Indian-Australian Plate being subducted beneath the Eurasian plate; arrows show relative plate motion. The Barisan Mountain range can be traced along the western coast of Sumatra by following the line of volcanoes. Mentawai Fault is marked by thick green line, parallel to the fore-arc basin. Red star marks location of the 2004 earthquake and tsunami. The main Sumatran Fault running west of Toba Caldera has been traced in green. The extent of the Batak Tumor is shown by the small dotted pattern. Data modified from Aldiss and Ghazali (1984).
(B) Inset of South East Asia, with the Toba Caldera area, shown in (A), is outlined in the red box.

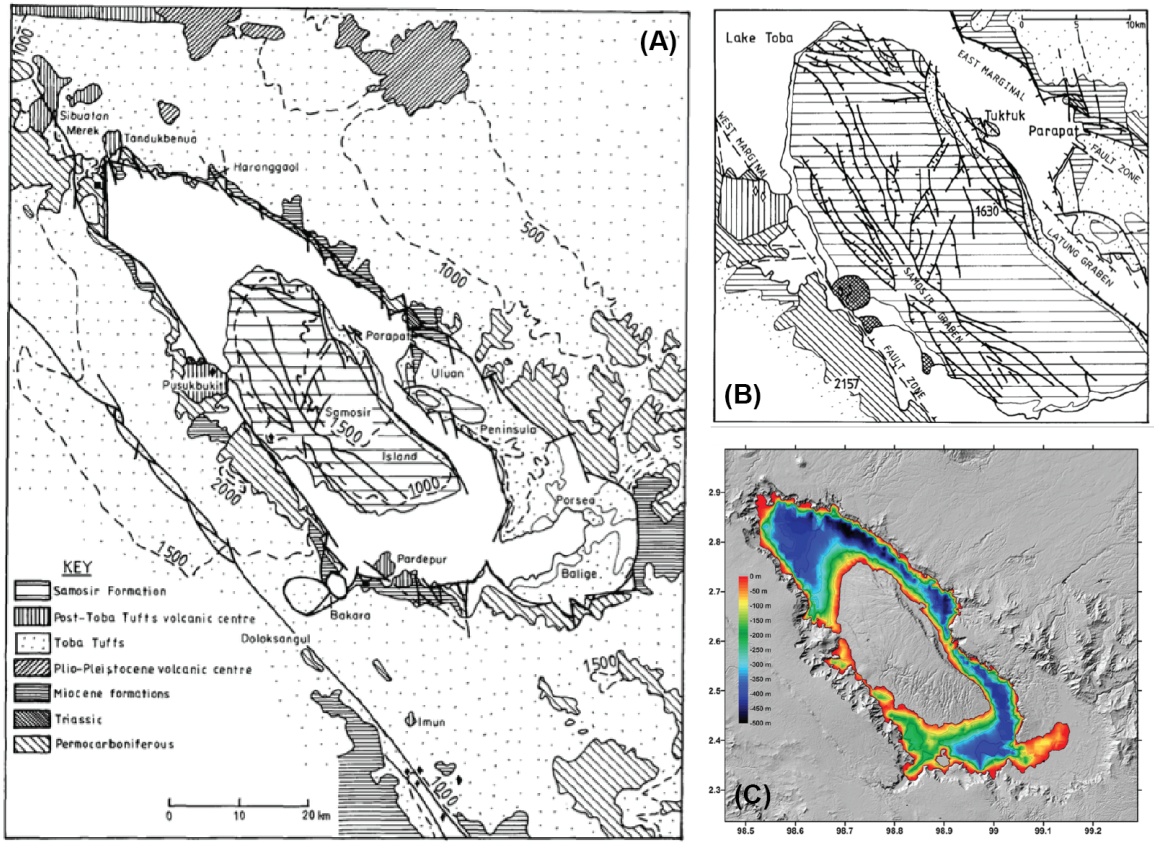


Figure 1.2: Local Tectonic Setting and Bathymetry of Toba Caldera

(A) (From Aldiss and Ghazali, 1984) Overview of the volcano-tectonic depression and local faults running through Toba Caldera. Main Sumatran Fault is marked by thick black line running parallel to the caldera on the west side. Broken dashed lines are contours in meters. Filled diamonds indicate clusters of hot springs. Filled squares mark intrusive phases of the Toba ignimbrite. S: Siguragugura waterfall in the Asahan Valley. The Uluan Peninsula is bounded by the outer faults of the Porsea Caldera and the inner faults of the Latung Graben.
(B) (From Aldiss and Ghazali, 1984) Local faulting regime bounding Samosir Island and the Uluan peninsula. Ticks indicate direction of downthrow. Broken dashed lines are faults that are inferred. The west and east sides of the caldera rim are bounded by the West Marginal Fault Zone and East Marginal Fault Zone, respectively. Cross-hatching indicates domed sediments. Other patterns are according to the key found in (A).
(C) (From Chesner, 2012) Bathymetry of Lake Toba. Depths of lake as indicated by the color bar. Deepest part of the lake (500 m deep which is 400 m a.s.l.) is found near Haranggaol.

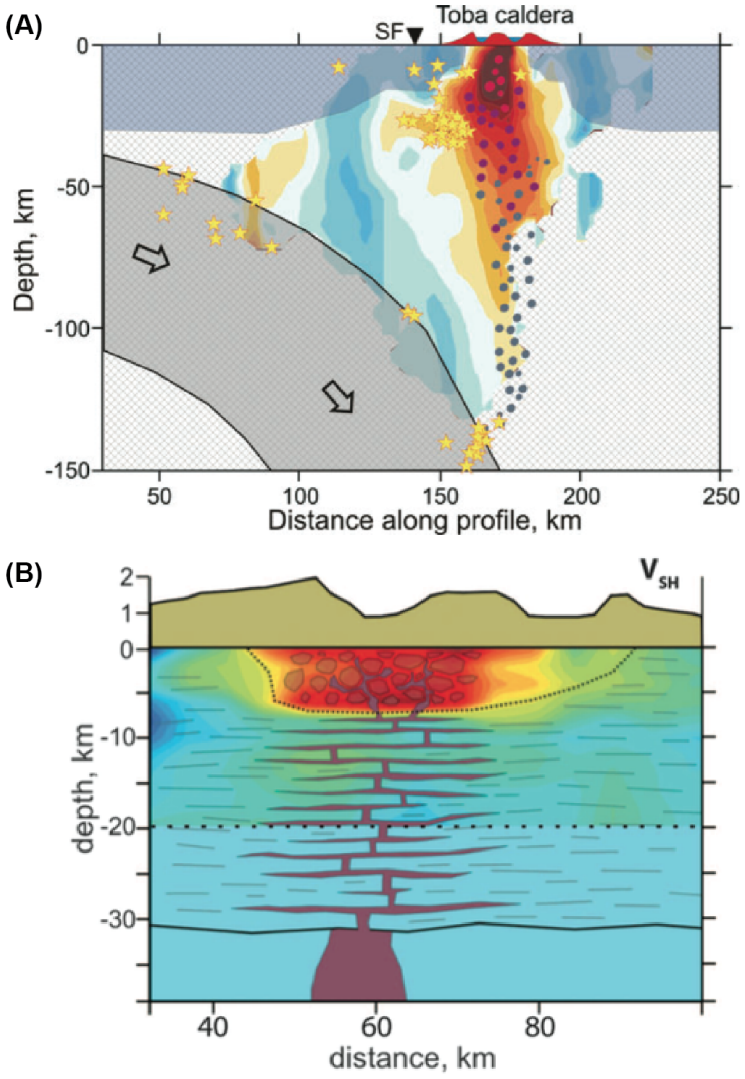


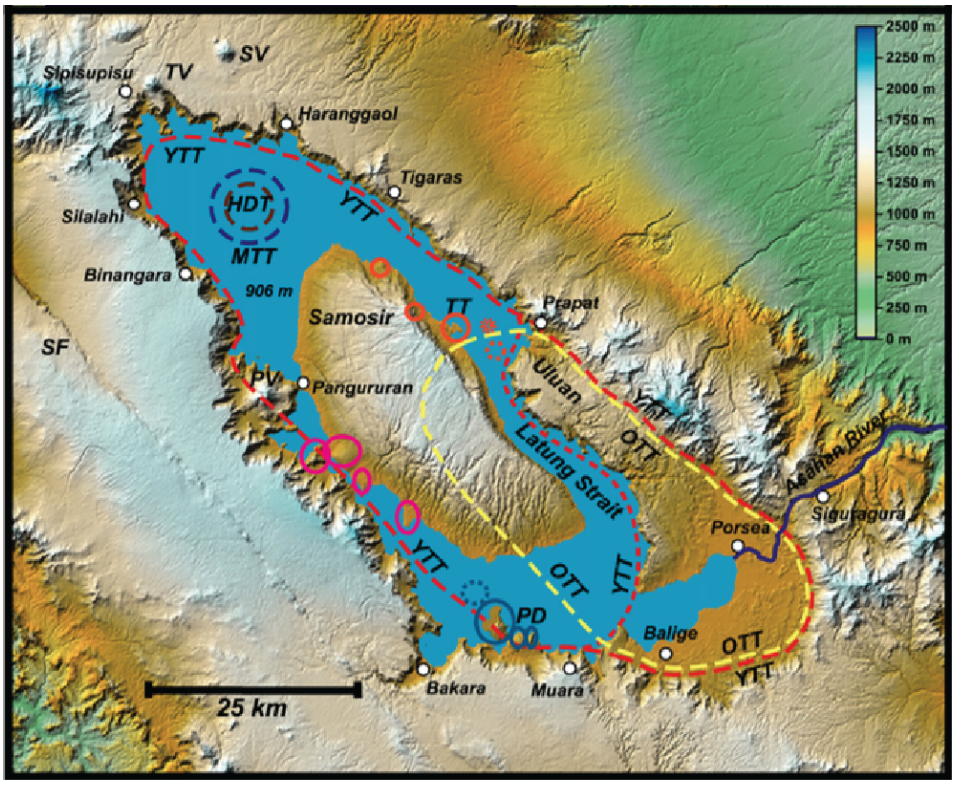
Figure 1.3: Seismic tomography showing depth of subduction below Toba Caldera and inferred magma reservoir of the Toba Caldera system

(A) (From Koulakov et al., 2009) Background shows the distribution of P-velocity anomalies. Final locations used in this study are denoted by yellow stars. Dots of blue, violet, and red show schematic path for ascending melt and fluids. Sumatran Fault marked by black triangle.
(B) (From Jaxybulatov et al., 2014) A schematic interpretation of the magma reservoir beneath Toba Caldera. Background shows distribution of horizontally polarized shear wave speed. Dotted line indicates low-velocity area below which any stratification is most likely not preserved due to being affected by the most recent eruption at Toba.

Figure 1.4: Eruption outlines and products of the four ignimbrite eruptions at Toba

(A) (From Chesner, 2012) Inferred caldera outlines from caldera-forming eruptions shown in colored dashed lines; vent is assumed to be within these caldera outlines. Haranggaol Dacite Tuff (HDT) in brown, Oldest Toba Tuff (OTT) in yellow, Middle Toba Tuff (MTT) in dark blue, and Youngest Toba Tuff (YTT) in red. YTT outline shows two potential outlines: the larger one incorporating the OTT caldera if the OTT caldera was reactivated during the YTT eruption, and the smaller outline which excludes the OTT caldera, marking where the main YTT caldera is seen today. Lava domes and domed sediment indicated by colored circles (dashed circles indicate subaqueous domed regions as seen in bathymetric analyses in this study): Samosir lava domes in orange, Pardepur lava domes in blue, and domed lake sediments in pink. Towns marked by name and white circle. TT: Tuk Tuk peninsula, PD: Pardepur Domes, PV: Pusuk Buhit volcano, SF: Sumatran Fault, TV: Tanduk Benua lava dome (also known as Sipisupisu), SV: Singgalang lava dome. Elevation is shown by background colored digital elevation model and colored elevation bar scale.
(B) (From Chesner and Rose, 1991) Outcrops for sampling of each of the four eruptions show in filled circles. Interpreted extent of outflow of ignimbrite for each eruption shown in stippled pattern. Each panel shows outcrops and tuff extent for each eruption: (A) Haranggaol Dacite Tuff; (B) Oldest Toba Tuff; (C) Middle Toba Tuff; (D) Youngest Toba Tuff.

(A)


2500 m
2250 m
2000 m
1750 m
1500 m
1250 m
1000 m
750 m
500 m
250 m
0 m
SV
TV
Sipisupisu
Haranggaol
YTT
HDT
MTT
Tigaras
Silalahi
Binangara
906 m
Samosir
TT
Pratpat
SF
PV
Pangururan
Uluan
Latung Strait
OTT
Porsea
Siguragura
PD
Balige
Bakara
Muara
25 km

(B)

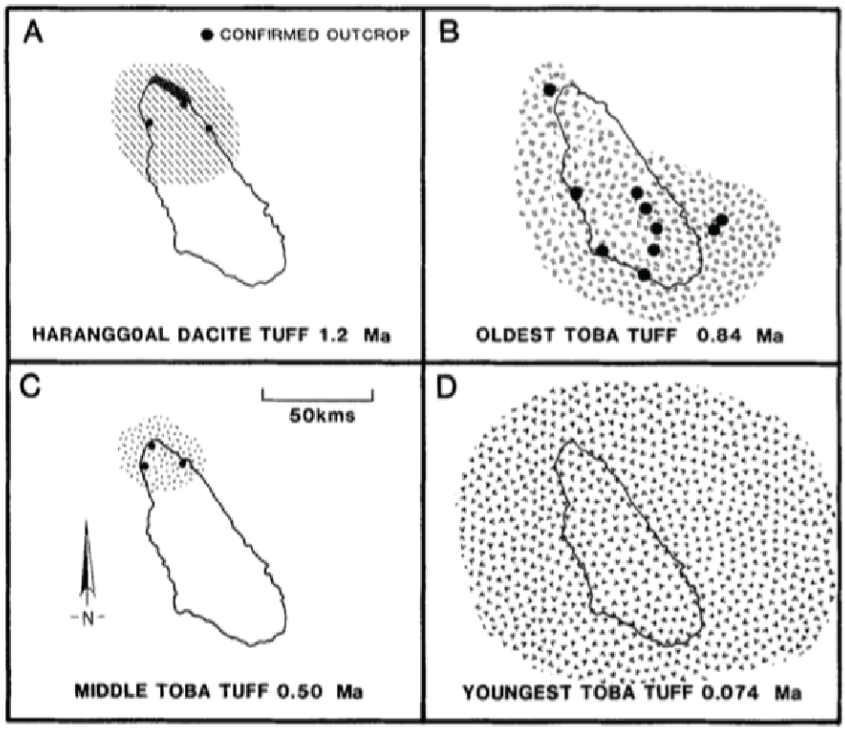

A
CONFIRMED OUTCROP
HARANGGOAL DACITE TUFF 1.2 Ma
B
OLDEST TOBA TUFF 0.84 Ma
C
50kms
N
MIDDLE TOBA TUFF 0.50 Ma
D
YOUNGEST TOBA TUFF 0.074 Ma

Figure 1.5: Schematic interpretation of formation of the Youngest Toba Tuff caldera and resulting resurgence

(Modified from van Bemmelen (1939)) Three panels show sequence of interpreted events leading up to the current caldera formation we see today. Wavy lines: Neogene marine deposits. Cross-hatching: Pre-tertiary basement. Black: Basaltic and andesitic lava. Small cross marks: Welded rhyolite tuff and breccia. Light grey: Loose rhyolitic-dacitic tuff. Large cross marks: Granite batholith of Toba. Annotations have been added on for better clarification.
(A) The development of the Batak Tumor and subsequent ring fracture eruption during the YTT eruption.
(B) The caldera formed after the YTT eruption and infilling of the caldera with water and lake sediment deposition.
(C) The subsequent resurgent doming of both Samosir Island and the Uluan peninsula (according to this interpretation both are part of the resurgent process after the YTT) and the extrusion of both Samosir lava domes and Pusuk Buhit lava flows along faults through the resurgent dome and along caldera ring fractures.

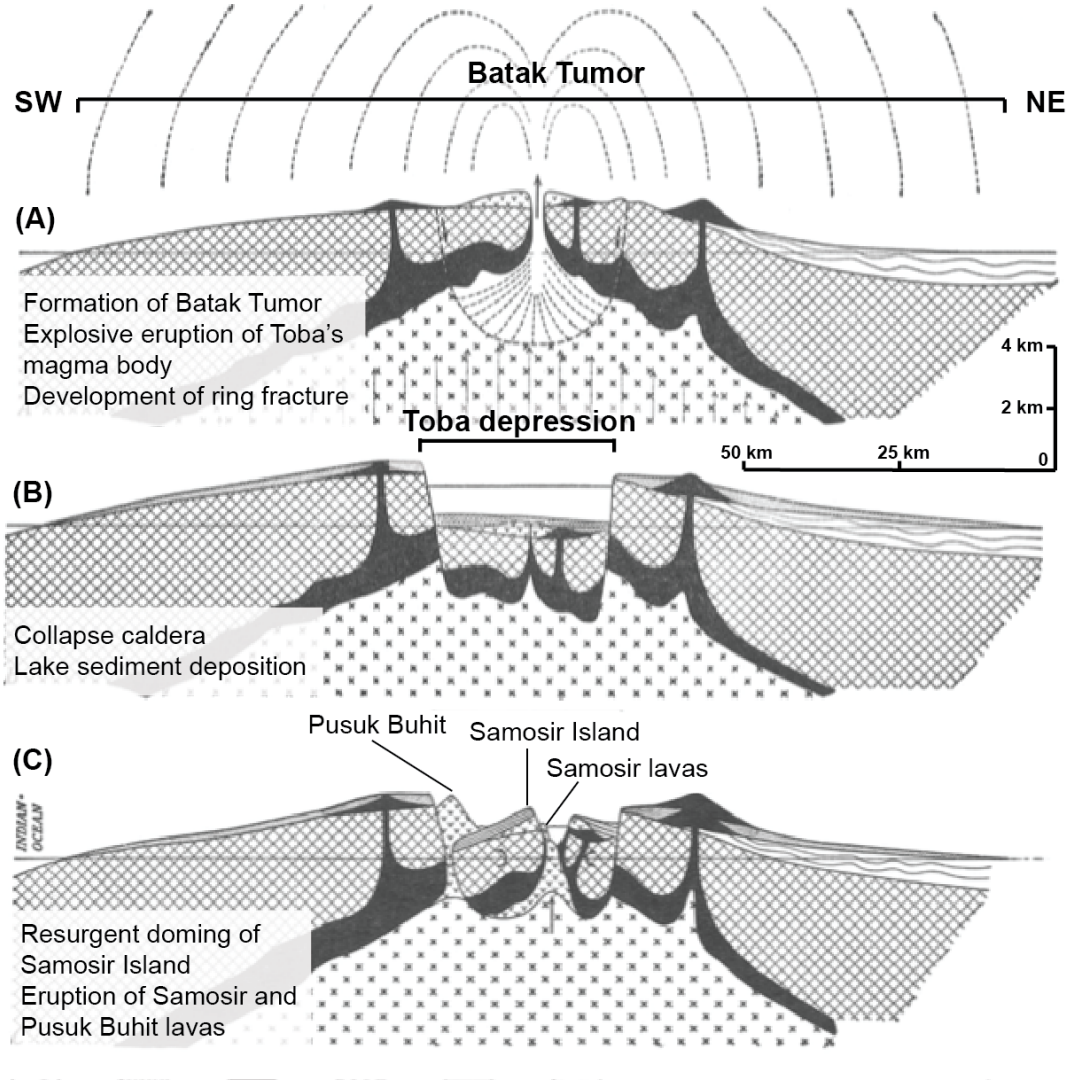
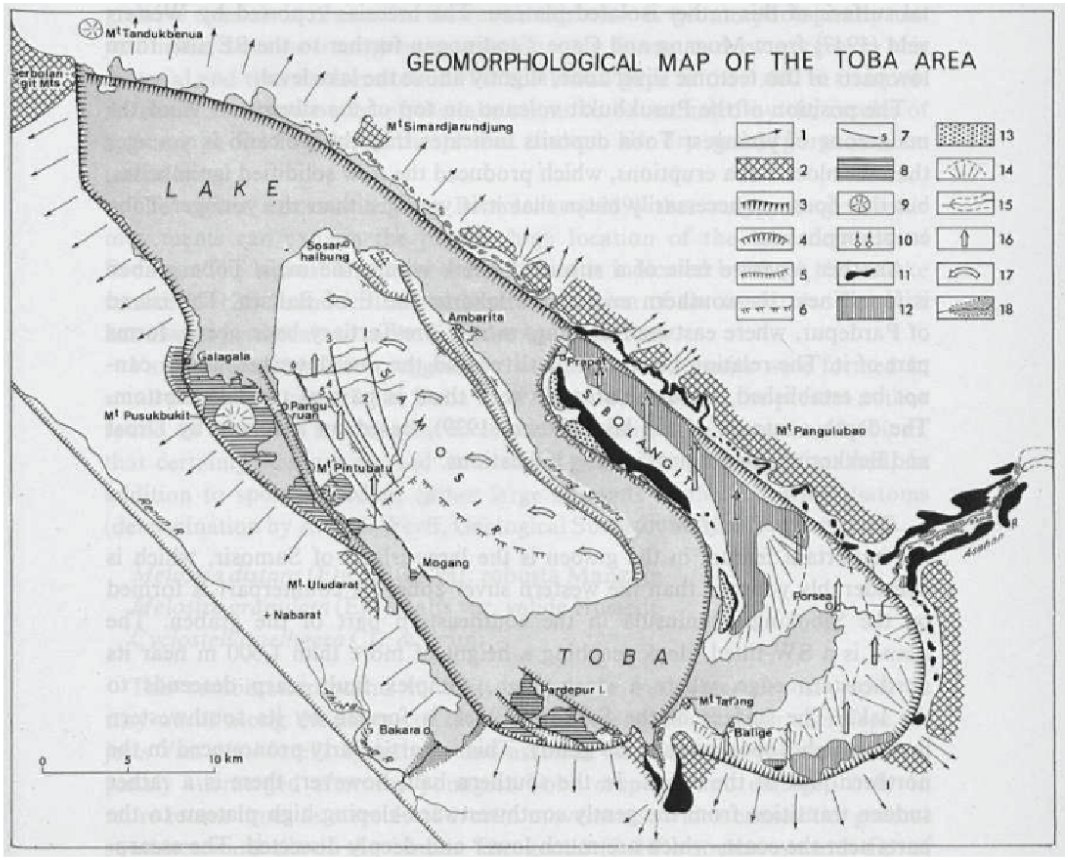

Batak Tumor
SW
NE
(A)
Formation of Batak Tumor
Explosive eruption of Toba's
magma body
Development of ring fracture
Toba depression
4 km
2 km
50 km
25 km
0
(B)
Collapse caldera
Lake sediment deposition
Pusuk Buhit
Samosir Island
Samosir lavas
(C)
INDIAN OCEAN
Resurgent doming of
Samosir Island
Eruption of Samosir and
Pusuk Buhit lavas

Figure 1.6: Geomorphological features and lake terraces found on the Uluan peninsula (Sibolangit peninsula)

(From Verstappen, 1973)
(A) An overview of the location of the lake terraces found on the Uluan peninsula. Key for the numbered features is as follows: 1. Ignimbrites of most recent Toba eruption (arrows indicate places of overflow). 2. Pre-Toba rocks emerging from tuff cover. 3. Major fault scarps. 4. Medium-sized fault scarps. 5. Minor fault scarps. 6. Probable fault scarps. 7. Minor faults or grabens. 8. Slivers and other subsided blocks. 9. Post-Toba volcanic cones. 10. Solfataras. 11. Toba terrace 1 (1160 m). 12. Toba terrace 2 (1050 m). 13. Areas emerging from Toba terrace 1 along the Uluan peninsula. 14. Multi-cycle fluvio-volcanic fans. 15. Asahan amphitheatre. 16. Post-Toba uplift/warping. 17. Post-Toba tilting. 18. Alluvial plains.
(B) Warped lake terraces as traced along the eastern rim of Toba Caldera between Parapat and Porsea. A: Terrace 1 (1160 m) along the outer Porsea Caldera fault scarp (behind the Uluan peninsula). B: Terrace 1 seen on the cliffs of the Uluan peninsula. C: Terrace 2 (1050 m) seen along the Parapat-Porsea road (located between the outer Porsea Caldera fault scarp and the Uluan peninsula cliffs).

(A)


GEOMORPHOLOGICAL MAP OF THE TOBA AREA
M¹ Tandukbenua
M¹ Simardjarundjung
LAKE
Sosar halbung
Amberita
Galagala
Prapat
M¹ Pusukbukit
Pangu ruan
SIBOLANGIT
M¹ Pangulubao
M¹ Pintubatu
Mogang
M¹ Uludarat
+ Nabarat
Porsea
TOBA
Pardepur I.
M¹ Tarung
Bakara
Balige
0 5 10 km

(B)

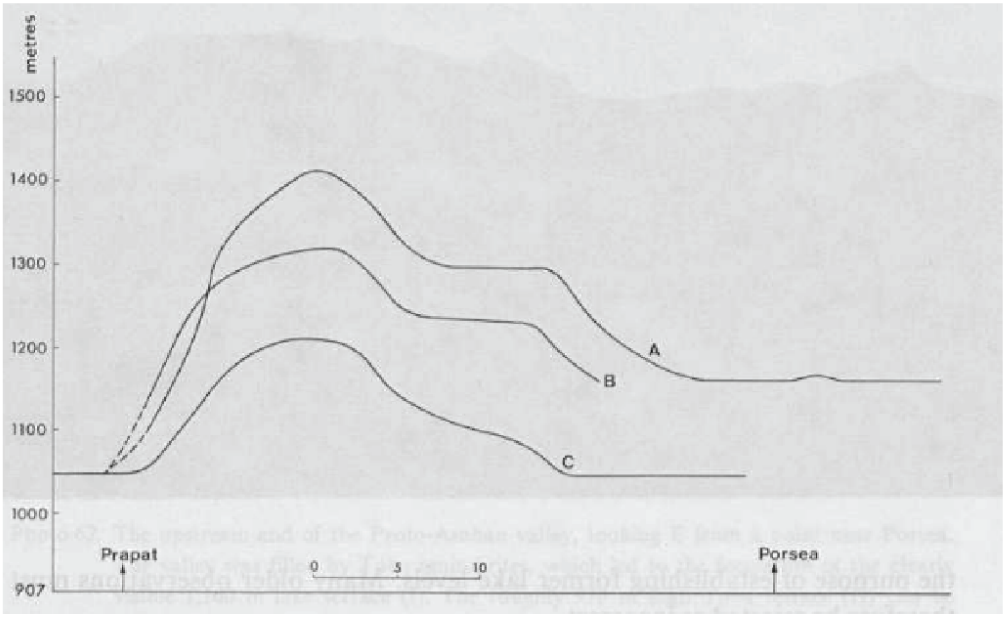
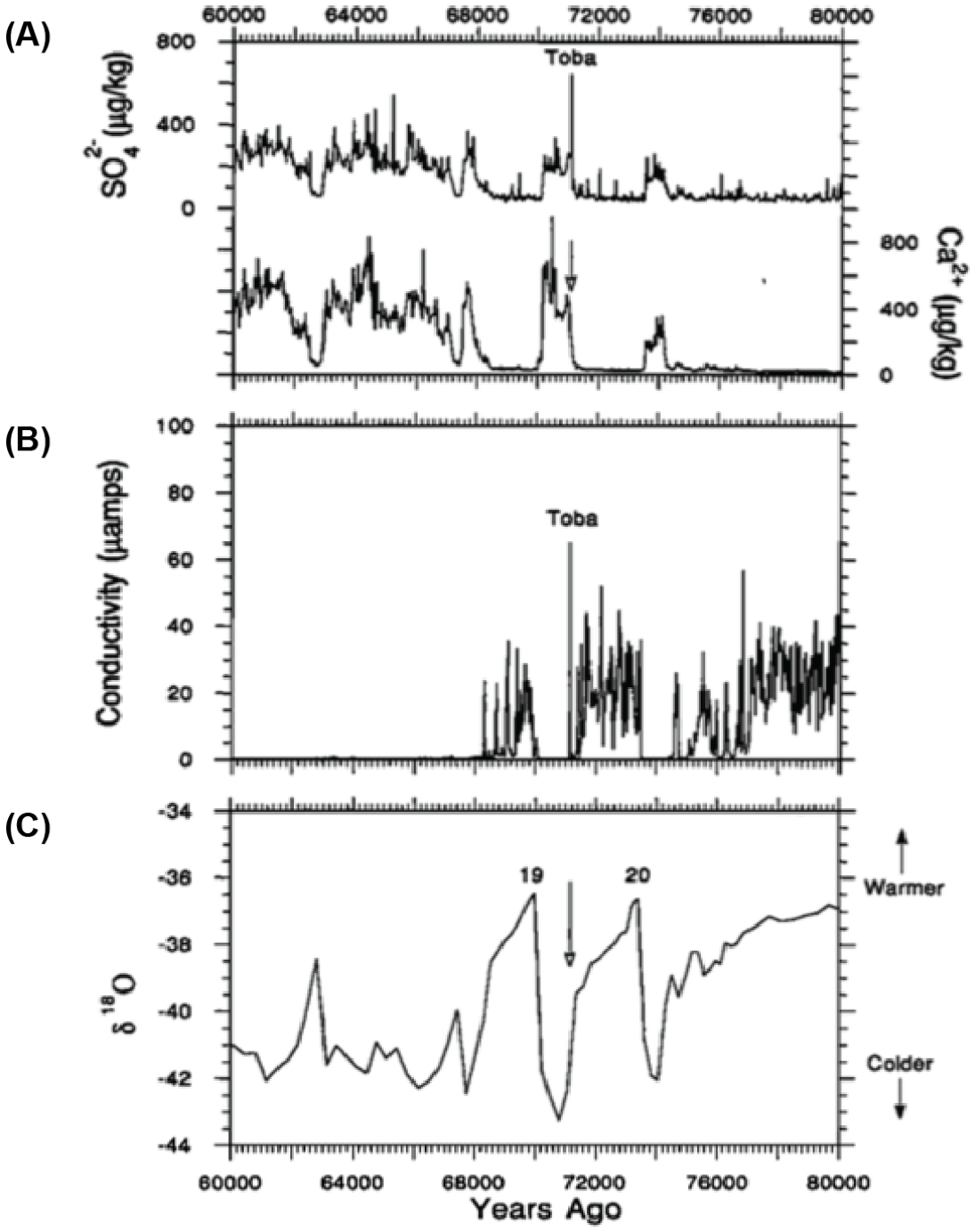

metres
1500
1400
1300
1200
1100
1000
907
A
B
C
Prapat
Porsea
0 5 10

Figure 1.7: Toba's YTT eruption marked in Greenland ice cores and correlation with climate change

(From Zielinski et al., 1996)
(A) Time series of changes in sulphate in the Greenland ice core; spike indicates increased amount of sulphate, attributed to volcanic input from the YTT eruption. The YTT is dated at 71 kyrs ago in this study.
(B) Time series of conductivity within the Greenland ice core; conductivity marks changes in material found within the core, meaning a spike at the eruption age of the YTT is attributed to a colder, dusty period compared to a warmer, less dusty period.
(C) Time series of the oxygen isotope record in the Greenland ice core. Interstadial events 19 and 20 are marked; between these two events cooling was already occurring. Arrow marks where there is a sudden drop in temperature, and if this correlates to the timing of the YTT eruption, could be attributed to a cooling affect brought about by a triggered volcanic winter.


(A)
60000
64000
68000
72000
76000
80000
800
400
0
Toba
SO_4^{2-} (µg/kg)
800
400
0
Ca^{2+} (µg/kg)
(B)
100
80
60
40
20
0
Toba
Conductivity (µamps)
(C)
-34
-36
-38
-40
-42
-44
19
20
$\delta^{18}O$
Warmer
Colder
60000
64000
68000
72000
76000
80000
Years Ago

CHAPTER 2: A RESURGENT TOBA: THE AFTER PARTY TO THE BIG DANCE

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de Silva, Shanaka

Gregg, Patricia

Pratomo, Indyo

(Rewritten and modified from data published in de Silva et al., 2015 in *Frontiers*)

ABSTRACT

New data reveal details of the post-caldera history at the Earth's youngest resurgent supervolcano, Toba caldera in Sumatra. Resurgence after the caldera-forming ~74 kyrs ago Youngest Toba Tuff eruption uplifted the caldera floor as a resurgent dome, Samosir Island, capped with 100 m of lake sediments. ^{14}C age data from the uppermost datable sediments reveal that Samosir Island was submerged beneath lake level (~900 m a.s.l) at 33 kyrs ago. Since then, Samosir experienced 700 m of uplift as a tilted block dipping to the west. ^{14}C ages and elevations of sediment along a transect of Samosir reveal that minimum uplift rates were ~5.6 cm/year from ~33.7 to 22.5 kyrs ago, but diminished to ~0.7 cm/year after 22.5 kyrs ago. Localised uplift activity continued along the eastern coast of Samosir associated with volcanic effusions, with ^{14}C ages of sediments found blanketing lava domes as young as ~2.7 kyrs ago, producing localized uplift rates of ~1.9 cm/yr.

INTRODUCTION

Large caldera systems, such as Long Valley, Yellowstone, and Toba, have been documented to produce large catastrophic eruptions of over thousands of cubic kilometers (Cole et al., 2005). Of those mentioned, the largest eruption was Toba with a total estimated volume of 2800 km^3 (Chesner and Rose, 1991; Cole et al., 2005). These large catastrophic eruptions have also been linked to changes in the environment and climate (the Toba eruption affected global climate, devastated certain environmental ecosystems, and affected the migration of modern humans (Williams et al., 2009; Jones, 2012; Oppenheimer, 2012). Today, these active volcanic systems pose persistent hazards to

communities living on and around calderas. Several caldera systems, are very densely populated (e.g., Campi Flegrei has 1.5 million inhabitants living in the region; Acocella, 2010) due to the socio-economic benefits of the terrain (nutrient-rich soils, geothermal energy and ore formation; Wohletz and Heiken, 1992; Stix et al., 2003), many inhabitants unware or apathetic to the hazards associated with the active volcanic system (earthquakes, landslide, volcanism etc.). For this reason there has been increasing interest in these large-scale caldera systems, their behavior, and deformation, in an effort to provide both accurate and useful information for better hazard assessment, management and mitigation.

The Caldera Cycle

Previous studies have demonstrated that large caldera systems progress through stages of a cycle. It is through the identification of these stages of a caldera cycle that resurgence was first recognized. van Bemmelen (1939) was the first to recognize the process of resurgence during his study on Toba, and through this recognition, developed the first idea of stages in a caldera cycle. Based on petrology of the rocks and the structural features seen in and around Toba caldera, van Bemmelen categorized the cycle into three stages: the first being a "paroxysmal outburst" (the discharges of widespread pyroclastic flows), followed by the collapse of the batholith roof (caldera collapse), and finally the upheaval and tilting of the floor, forming the resurgent dome. Using this initial idea, Smith and Bailey (1968) built on the caldera cycle by further breaking it into six stages (Figure 2.1). They denoted the first stage of the cycle to be the pre-eruption tumescence of the region, as the magma reservoir of the system developed (Figure 2.1A). This was followed by the climactic eruption phase

(Figure 2.1B) and finally caldera collapse (Figure 2.1C), where the roof of the magma reservoir drops to form the floor of the caldera. Smith and Bailey (1968) noted that a renewal in volcanic activity (small explosive or effusive lava dome-forming eruption) typically followed caldera collapse; these eruptions occurred either along faults through the caldera or along the caldera ring faults (Figure 2.1D). This stage was then succeeded by a period of uplift of the caldera floor, known as resurgence (Figure 2.1E), followed by activity along the caldera faults, forming the final surface expression we typically see at calderas today (Figure 2.1F). Not all calderas follow this cycle, however, as some do not undergo any notable magmatic activity or resurgence after caldera collapse (Smith and Bailey, 1968; Cole et al., 2005).

Lipman (1984) supplemented Smith and Bailey's (1968) categorization of the caldera cycle by undertaking detailed studies of caldera eruptive history, structures, and related deposits, including Long Valley, Creede, and Lake City Calderas. His work linked geologic evidence from fieldwork to the caldera cycle stages, providing a better understanding of how each stage would manifest itself in the caldera setting. Pre-eruption volcanism (precursors) is rarely well preserved in the geologic record, although deformation (possibly related to magma migration and the emplacement of silicic magma bodies) is recorded at certain systems, such as at Long Valley (Savage and Clark, 1982; Castle et al., 1984) and Yellowstone (Wicks et al., 2006; Pierce et al., 2007). The caldera eruption and collapse, on the other hand, is well recorded in the ignimbrite deposits (large volume, widespread, sometimes lithic-rich), and the structural ring faults of the caldera. Following roof block collapse, the caldera system undergoes post collapse volcanism, highlighting the fact that shallow magmatic

systems that can continue to be active (through replenishment of magma) intermittently for millions of years after the climactic collapse event. Related to this activity is resurgence, where Lipman (1984) strived to characterize the features of a resurgent dome. Based on characteristics of resurgent domes from different resurgent calderas, he recognized the structural uplift of resurgence as a complex process, with several possible styles of uplift possible: symmetrical uplift, central uplift, asymmetrical uplift, trapdoor, and joint resurgence. In characterizing these styles of uplift, it is important to appreciate that these styles may be reflecting a variety of mechanisms that drive resurgence. These three key pieces of literature form the building blocks of our understanding of the caldera cycle, and signify the first understandings of resurgence and how it is related to the caldera system.

Resurgence: The Last Stage in the Caldera Cycle

Resurgence is the process whereby the caldera floor is structurally uplifted and deformed, forming a resurgent dome or block (Figure 2.1E; Smith and Bailey, 1968; Marsh, 1984; Cole et al., 2005). The process of resurgence can also be expressed through a renewal of magmatic activity at the surface, forming volcanic features along faults running through the caldera or along caldera ring faults (Cole et al., 2005). It is this stage of resurgence and renewed activity that is, unfortunately, least understood; the actual mechanisms that drive resurgence are little understood. In reviewing Smith and Bailey (1968), their stages 4, 5, and 6 (Figures 1D, E, & F respectively) can each by classified as synresurgence volcanism (Orsi et al., 1996), where the observed volcanic activity is tied to the resurgence stage that may span longer than tens of thousands of years, not a separate stage on its own. Despite years of research into caldera systems and the

known potential hazards, associated with earthquakes from deformation (Acocella, 2010; Orsi et al., 1999) and volcanic activity (Orsi et al., 1996), there are still several aspects of resurgence that are not fully understood. Furthermore, questions associated with resurgence fall into two categories: timescales and mechanisms. The timescales of resurgence are not well constrained; when did resurgence start and how long did it continue for? The process of resurgence is also not well understood: is the process a continuous process or episodic, and what is the driving force behind resurgence?

BACKGROUND ON RESURGENCE

One of the first questions raised in understanding resurgence is determining when resurgence starts. The initial thought was that resurgence might occur almost immediately after the caldera eruption and collapse, and in some caldera systems, such as at Toba, this has not yet been resolved (Chesner and Rose, 1991; Chesner, 2012). In other well-known caldera systems, however, there has been a lot of effort put into determining when resurgence starts, by using stratigraphy and geochronology to constrain both the starting age as well as duration of resurgence. Related to the timescale of resurgence is determining the uplift rates for the resurgent domes in these resurgent caldera systems. These uplift rates vary between calderas, and can be used to classify two types of unrest of these resurging calderas.

Before going into the two types of resurgence unrest, it is necessary to first constrain the period of resurgence. For different caldera systems, this has been performed through a variety of measures, such as ^{40}Ar-^{39}Ar dating of resurgent lava domes, or stratigraphic relationships between samples. A good

example of this is at Valles caldera (Table 2.1), where resurgence was constrained between two periods of volcanism (Spell and Harrison, 1993; Phillips et al., 2007). The youngest caldera eruption at Valles occurred 1.25 Myrs ago, forming the Upper Bandelier Tuff. Following this eruption, resurgence occurred, in the form of structural uplift of the resurgent dome, and volcanic activity, forming the Valles Rhyolite Formation. When this period of resurgence ended, where uplift was synchronous with the extruded lava domes (hence deformation of the lava domes), volcanism in the north of the caldera started, and continued until ~0.2 Myrs ago (Spell and Harrison, 1993). The start of this second surge of volcanism, not deformed by the resurgent dome, was in 1.23 Myrs ago, and marked the end of the resurgence period for Valles. Based on this evidence, resurgence at Valles is constrained to a period of ~54 kyrs, which means the uplift could have occurred all at once, or at some point within 54 kyrs before 1.23 Myrs ago. Similar correlations to obtain resurgence periods were done at Long Valley caldera. Within 100 kyrs ago of the caldera collapse, at 0.76 Myrs ago (Table 2.1; Savage and Clark, 1982; Hildreth, 2004), the resurgent dome was structurally uplifted. This period of resurgence ended around 0.6 Myrs ago; the correlation was made between the rhyolitic dome eruptions within the caldera at 0.6 Myrs ago and the structural uplift to obtain a period of resurgence of 100 kyrs ago.

Resurgence Uplift Rates

The average uplift rate of the resurgent dome can be calculated by dividing the total amount of uplift for the resurgent dome over the determined period of resurgence (Chesner and Rose, 1991). By calculating the uplift rate, it provides a basis of comparison between resurgent calderas for understanding

how 'restless' the system is, and how fast resurgence occurred at each particular location. For larger, older caldera systems, the uplift rates are low, averaging a few centimeters a year or less for the period of the resurgence (Table 2.1). Valles Caldera returns an average uplift rate between 1.9 – 3.7 cm/yr, depending on how long resurgence is calculated to last (Phillips et al., 2007). If resurgence occurred even faster than the calculated 54 kyrs, uplift rates could be as high as 100 cm/yr. This is similar to systems such as Long Valley, with rates from 5 -12 cm/yr (Hill et al., 1985; Langbein et al., 1993; Tizzani et al., 2007); recent unrest measured returns higher uplift rates, while an average uplift rate for the entire period of resurgence return lower uplift rates of 0.5 cm/yr (Hill et al., 2003). Yellowstone caldera also returns similar uplift rates between 5-7 cm/yr (Chang et al., 2007; Chang et al., 2010). In comparison to these older, more established caldera systems, younger systems have reflected higher uplift rates; the resurgent dome on Tanna, Vanuatu, has shown rates as high as 15.6 cm/yr (Chen et al., 1995; Merle et al., 2013; Metrich et al., 2011), which is not even as high as uplift rates of 25 cm/yr as seen at Iwo-Jima, Japan (Kaizuka, 1992; Chen et al., 1995). Other young systems such as Campi Flegrei, Italy, and Rabaul, Papua New Guinea, return high uplift rates as well, of an average of 51 cm/yr and 4 cm/yr respectively (Orsi et al., 1999; Archbold et al., 1988). Rabaul may not reflect an uplift rate in the double digits, but the uplift occurred recently, between 1983 and 1985, making it a young and restless system. When comparing these uplift rates, it is important to note that they are just average uplift rates taken over the period of resurgence. Resurgence itself may actually occur much faster, in shorter periods. The lower uplift rates from the older systems reflect longer-term signals of the system returning to isostatic

equilibrium after the caldera eruption and collapse; this represents the first type of resurgence unrest that can be observed. The higher uplift rates, on the other hand, reflect the restlessness and shorter-term signals of activity occurring at the younger systems; this classifies as the second type of resurgent unrest that may be experienced. This means, for example, that a kilometer uplift at Valles caldera may have occurred within a shorter period, such as the suggested 1000 years, instead of over the entire period of resurgence of 54 kyrs. It is necessary to be able to tease out these differences in uplift rates, because it has implications not only for how long resurgence takes, but also whether the resurgence occurs continuously at low uplift rates, or whether it can occur episodically, at high uplift rates, to form the resurgent domes seen in caldera systems today.

Mechanisms of Resurgence

The question of timescales of resurgence has always been linked to the question of identifying what mechanisms would be responsible for the surface expression of resurgent uplift seen on the resurgent domes. Several studies, mostly using analytical modeling, have proposed a few common mechanisms that may be responsible for the uplift seen. Marsh (1984) provides theoretical models, derived from observations of calderas such as Yellowstone and Long Valley, and suggestions from Smith and Bailey (1968), to explain three models that drive resurgence and link them to the timescales of resurgence seen at those caldera systems. The first mechanism that might drive uplift of the caldera floor is viscous rebound, which would occur over a short, immediate time span after caldera collapse (Figure 2.2B). The second mechanism involves regional detumescence; the initially inflated crust will return to isostatic equilibrium over

time (Figure 2.2C). This process of the crust 'deflating' squeezes the magma reservoir system below the caldera, forcing magma up, thus uplifting the surface above it. The time range for the regional area to return to isostatic equilibrium is on the order of 10^3-10^5 years, meaning this mechanism can be considered a longer term signal in the uplift of a resurgent dome. The third mechanism involves pressurization against the base of the caldera floor as a result of vesiculation of the remaining magma, convection in the magma reservoir (Figure 2.2D), or an influx of new magma into the system (Figure 2.2A). This would reflect timescales on the order of 10^3-10^5 years, similar to regional detumescence. Applying this to the timescales we see at resurgent domes, longer periods of resurgence most likely reflect signals from regional detumescence and/or pressurization that drive resurgence. This may apply to systems such as Valles, where a period of 54 kyrs of resurgence may be a result of regional detumescence and/or magmatic activity (Table 2.1). More recently, Kennedy et al. (2012) attempted to apply timescales to different mechanisms of resurgence by assuming the magma reservoir, replenished magma, and residual magma as simple changes of volume of cylinders (Figure 2.3). Through these calculations, Kennedy et al. (2012) provide possible styles of resurgence and their associated uplift rates for the resurgent dome, following caldera collapse (Figure 2.4). Kennedy et al. (2012) divide the styles of uplift based on the amount of uplift seen; it is assumed in this case that there's a relationship between the uplift rate and the amount of uplift seen, where a higher uplift rate over a shorter timescale produces less uplift than a lower uplift rate over a longer timescale. Panels A to D (Figure 2.4) show resurgent uplift styles that only provide uplift from 10^0-10^2 m of uplift. The uplift rate for these resurgence

styles would be higher but occur on shorter durations; these are a result of changes in hydrothermal systems or small, shallow intrusions. Resurgence styles that produce 10^2-10^3 m of uplift are a result of lower uplift rates over longer periods of time, produced by a regional signal or shallow laccoliths intruding into the system, thus bending the roof of the magma reservoir (Figure 2.4E-G). According to Kennedy et al. (2012), lava dome eruptions along faults (Figure 2.4H), as described by Smith and Bailey (1968), or regional extension of the caldera (Figure 2.4I), will not produce resurgence; the resurgence they refer to here is structural uplift and deformation of the caldera floor. The magmatic activity is still part of the resurgence stage of the caldera, but will not produce resurgent domes.

Combining Timescales and Mechanisms

When looking at applying these models to known caldera systems, the faster and higher uplift rates of younger systems such as Iwo-Jima, Tanna, and Campi Flegrei (Table 2.1), can be driven by shallow mechanisms (Figure 2.4). This would also result in the episodic style of resurgence seen; as the shallow mechanisms start and stop, the resurgence expressed at the surface also varies episodically. The longer term uplift rates, such as at Valles and Long Valley, can be attributed to mechanisms from new magma intruding into the magma reservoir, or activation along the faults of the caldera (Figure 2.4). Since these are larger scale mechanisms, the effect on the uplift rates is slower, thus translating as longer-term, lower uplift rates, as seen at the larger caldera systems. The mechanisms outlined in Kennedy et al. (2012) can be recast in terms of amount of uplift and the timescales related with each mechanism to emphasize the two different styles of uplift (Figure 2.5). Faster uplift rates

reflect short-term active processes of shallow mechanisms, such as hydrothermal activity, small-scale intrusions, and gas and fluid circulation. Slower uplift rates, in turn, reflect longer-term larger processes related to large caldera systems re-establishing lithostatic equilibrium and magmatic recharge.

TOBA CALDERA

Toba Caldera is a complex volcano tectonic depression, formed from four overlapping caldera eruptions, the youngest one creating the caldera lake seen today (Figure 2.1; Chesner, 2012; de Silva et al., 2015). The first of these eruptions was the Haranggaol Dacite Tuff (HDT), erupting ~1.2 Myrs ago in the north of the caldera. The next eruption was the Oldest Toba Tuff (OTT), erupting in the southern section of Toba ~0.8 Myrs ago, creating the Porsea Caldera; the remnants of this caldera can still be seen within the outline of the current caldera today (Knight et al., 1986; Chesner, 2012). The eruption that followed, the Middle Toba Tuff (MTT), returned volcanic activity to the northern section of Toba ~0.5 Myrs ago, most likely in the similar location as the HDT (Chesner and Rose, 1991; Chesner, 2012). The final eruption, the Youngest Toba Tuff (YTT) eruption, occurred ~ 75 kyrs ago and produced the final topographic expression of the caldera as seen today. Following the creation of this caldera, the depression was filled in with water from precipitation and run off, within approximately 1500 years, allowing for deposition of lacustrine sediments along the caldera floor (Chesner, 2012). After some downcutting in the outlet to the south of the caldera, the lake level has stabilized at 906 m above sea level (a.s.l.). Sediments deposited would have been sourced from mass wasting and drainage into the caldera. Closer to the walls of the caldera, sedimentation would have been of coarser and larger sediments, and possibly

debris flows, while within the middle of the lake, sedimentation would have been of finer, smaller particles.

Toba's Resurgence

At some point, either immediately after the YTT eruption or some time after, Toba's magmatic system experienced resurgence, the last stage in the caldera cycle following a catastrophic caldera-forming eruption. Reasons for this resurgence have been given as either changes in magmatic pressure or regional detumescence (Smith and Bailey, 1968; Chesner, 2012). As part of this period of resurgence, the floor of the caldera was uplifted and deformed, raising both intracaldera fill and the deposited lake sediments above the lake level, forming a resurgent dome, called Samosir Island, with a total uplift of around 700 m above the lake level. The top 100 m of Samosir Island comprises of deposited lake sediment layers, known as the Samosir Formation (Aldiss and Ghazali, 1984). Underlying this sediment formation is the YTT intracaldera fill. The base of this 600 m thick intracaldera fill has not been easily identified, however in the southern section of the island, basement rock may have been observed protruding through (Chesner, 2012). The resurgence uplift at Toba Caldera is also linked with the uplift of the Uluan block, an eastern half and compliment to Samosir Island. Resurgence uplift of Uluan has been measured, however the amount of uplift would have been less than Samosir's, with an uplift of only around 250-300 m (van Bemmelen, 1939; Chesner and Rose, 1991).

Along with this structural resurgence was volcanic resurgence; lava domes were extruded both along Samosir Fault, the main fault on Samosir Island, and the caldera ring faults (Figure 2.1; de Silva et al., 2015). Lava domes

extruded on the island of Samosir can be found in the north and along the east coast, forming a peninsula known as Tuk Tuk (Figure 2.1; de Silva et al., 2015). Lava domes along the caldera ring faults can be found in the south, west, and north (Figure 2.1; de Silva et a., 2015). In the south, lava domes extruded both along the caldera ring as well as within the lake, forming the island of Pulau Sibandang; collectively these lava domes are known as the Pardepur lava domes (Chesner and Rose, 1991; Chesner, 2012). Along the west of the caldera ring lies Pusuk Buhit, a composite stratovolcano. Lava flows found overlying older tuff from Toba imply Pusuk Buhit predates the YTT eruption but younger looking flows near the summit of the volcano also indicate that it has exhibited volcanism post-YTT eruption as well (Aldiss and Ghazali, 1984; Chesner and Rose, 1991). In the north of the caldera, two prominent lava dome extrusions can be seen: Sipisupisu (also known as Tandukbenua), an andesitic lava dome, and Singgalang, an apparently "partner" to the andesitic lava dome activity seen at Sipisupisu (de Silva et al., 2015).

Scope and Objectives

Toba Caldera provides a young, well-preserved, and detailed record of sediment lake deposition from some time after the YTT eruption to the point where deposition ended, when the resurgent dome was uplifted above the lake level, essentially stopping deposition. Both the well-preserved lake sediments and structures of uplift and faulting on the surface of Samosir Island can help constrain the uplift rate and style of the resurgent dome, defining the period of resurgence experienced at Toba Caldera.

Dating the sediment record with radiocarbon (^{14}C) dating provides ages of deposition, which when combined with the elevation these sediment layers are found at, can provide calculated uplift rates for the resurgent dome. A single ^{14}C age obtained at the top of this stratigraphy at an elevation near 1630 m shows that the resurgent dome was last under water 33,090 ± 570 years ago. This age and elevation returns a minimum uplift rate of 1.8 cm/yr (Chesner, 2012). The actual uplift of Samosir Island has not been well categorized; Aldiss and Ghazali (1984) described uplift as a tilted horst, while van Bemmelen (1939) characterized Samosir Island as a tilted block. A neotectonic analysis of the faulting on Samosir Island will provide insight into the uplift style of the resurgent dome and whether uplift was as one continuous block or if uplift was incremental.

METHODS

Sediment Stratigraphy and Radiocarbon Dating

In order to best characterize the uplift rates experienced on Samosir Island, only the most recent sediments of the Samosir Formation (Aldiss and Ghazali, 1984) can be analyzed, to provide the most recent deposited sediment layer from the most recently experienced uplift. This layer forms the youngest blanket of sediment found on Samosir Island, its elevation of uplift calculated from the current lake level (906 m a.s.l., assumed to be 900 m for simplicity in calculations). The youngest sediment layer is not evenly found across Samosir Island; the sediment layer is more extensive in the north of the island than in the south. The southern section of Samosir Island, in general, is more dissected; sediment cover of both older and younger sediment is not easily found, and as

such, the focus of sediment logging and sampling has been in the northern section of the island.

Stratigraphic logging of the sediment cover in the northern section shows two main types of sediment that are repeatedly deposited. The first type is rhythmically bedded laminated muds and sand, intermittently found with cross cutting and conformable layers of coarse debris flows of conglomerates and fluvial sands (Figure 2.7A; Chesner, 2012; de Silva et al., 2015). This type of sediment also contains layers of organic-rich matter, such as wood and plant debris. The second type is diatomaceous tuff with laminated ashy sediment, most commonly found along the western half of Samosir Island (Figure 2.7B). Seven samples of type 1, the organic-rich sediment layers, were selected from five different locations on Samosir Island and sent to Beta Analytics Inc. for ^{14}C dating; two samples contained wood while the other five contained organic-rich sediment matter. Three organic-rich sediment matter samples were sampled locally on the Tuk Tuk peninsula (Table 2.2; de Silva et al., 2015). The two wood samples were pretreated with an acid-base-acid (ABA; 1 N HCl and 1 N NaOH) wash at 70°C, with repeated base washes until all extract humic acid was removed. The eight organic sediment samples were pretreated with only acid wash (1 N HCl) at 70°C. Samples were analyzed by accelerator mass spectrometry (AMS) and results were corrected using the on-line $\delta^{13}C$ AMS values of the respective graphite aliquots measured, following instrumental analysis described in Santos et al. (2007). Resulting ages are reported both as conventional ^{14}C ages (yr BP) as well as 95.4% (2-standard deviation) probability calendar age ranges (cal yr BP) calibrated by OxCal 4.1 (Ramsey, 2009) using the IntCal09 calibration curve (Reimers et al., 2009).

Neotectonic Analysis

Faulting on the surface of Samosir can be seen both in the field (Figure 2.7C; de Silva et al., 2015) as well as on relief maps of the island. The neotectonic analysis of the faulting observed on Samosir Island was performed on a 90 m Digital Elevation Model (DEM) using the version 10.1 ArcGIS (Geographical Information System) Desktop software. Several shaded reliefs were processed from the DEM, using different sun azimuth values (from 0° to 315° along the horizon) to highlight the fault scarps from different sun angles. Once the fault scarps were visible, they were traced by marking length of the fault scarps, delineating the position of the fault scarp as the mid point between the top and bottom elevations of the fault scarp. The delineated fault scarps were then ranked according to chronological order, by determining which faults splay off a main fault, or which faults offset other faults or linear features (such as drainage channels), thereby determining which fault was formed first and which fault was formed second. Using this ranking of fault systems, the faulting activity across the resurgent dome was grouped according to different regions of localized activity. The chronology of faulting activity and regions do not use any actual ages measured, meaning that fault activity in one region may have occurred at the same time as fault activity in another region, if these two regions are not connected by any fault systems between them. Drainage channels were also delineated based on maps of active rivers on the island and dissected slopes that may have seasonal drainage. The fault and drainage traces were then presented on a 90 m contour map of Samosir Island to remove any biasedness from relief shading or sun azimuth shading of the DEM.

RESULTS

Radiocarbon Ages

Samosir Island's uplift has been described as a tilted block (van Bemmelen, 1939; Aldiss and Ghazali, 1984). Topographically, Samosir's surface starts at lake level along the west coast of the island, gently sloping upwards till the highest elevation (around 1630 m), representing the top of the cliff delineating the Samosir Fault (Figure 2.6; de Silva et al., 2015; Chesner, 2012). The eastern coast of Samosir lies at the bottom of this cliff, near lake level, where protruding from the middle of the eastern coast is the Tuk Tuk peninsula. Sediments collected for radiocarbon dating fall along a transect from the west coast of Samosir up to the highest elevation along the Samosir Fault, and then down the cliff onto the Tuk Tuk peninsula. ^{14}C ages for the samples along the west coast (close to lake level) yielded conventional ages of 28,220 ± 150 years BP and 21,240 ± 90 years BP (Toba 1 at 1035 m and Toba 7 at 1041 m, respectively; Figure 2.8; Table 2.2; de Silva et al., 2015). Further up a slope along the transect, at a localized small lake along the road, organic-rich sediment yielded a conventional age of 28,660 ± 150 years BP (Toba 6 at 1305 m; Figure 2.8; Table 2.2; de Silva et al., 2015). At the top of the Samosir Fault, another small lake within layers of organic-rich sediment returned a conventional age of 33,730 ± 240 years BP (Toba 5 at 1600 m). Proceeding down the cliff of the Samosir Fault, another two samples found on slumped terraces returned conventional ages of 22,570 ± 100 years BP and 22,410 ± 100 years BP (Toba 3 and Toba 4, respectively, both at 970 m; Figure 2.8; Table 2.2; de Silva et al., 2015). The last radiocarbon age from along the transect was from sediment cover on the Tuk Tuk peninsula, providing the youngest 14C age of 8,220 ± 40 years BP (Toba 2 at 955 m; Figure 2.8; Table 2.2; de Silva et al., 2015). The

additional three samples from only the Tuk Tuk peninsula returned young ages (Figure 2.9; Table 2.2; Mucek et al., 2017). The layer at the sediment-lava dome contact below the ca. ~8 kyrs ago sediment package returned an age of 12,770 ± 50 years BP, (Toba 9) while two other sediment-lava dome contact layers in other parts of the Tuk Tuk peninsula returned even younger ages of 4,270 ± 30 years BP and 2,690 ± 30 years BP (Toba 8 and 10, respectively; Figure 2.10 and 2.11).

Faulting across Samosir

Based on the ranking of the chronology of faulting, four regions of faulting activity were identified (Figure 2.12; de Silva et al., 2015). The first region of activity was the initial normal faulting of the Samosir Fault system, as accommodated by the main Samosir Fault and stepping down to the east of the island. Subsequent faulting occurred along the hanging wall of the main fault with hinge faults branching off the main fault, forming slumped terraces. The second stage of faulting activity focused in the north of Samosir, where hinged faults off the north end of the Samosir Fault created normal faulting. Any drainage previously established in this region was offset by the faulting and captured, producing the drainage currently in place. The third stage of faulting activity focused along the western slope of Samosir Island; this activity could have occurred some time after the first two stages of faulting, or concurrently, however no absolute ages can be determined so either timing even is possible. The faults during this third stage formed circumferential faults running parallel to the western coast of Samosir. These faults are mostly shallow normal faults stepping down to the east, with the exception of the Samosir Graben, as previously identified (Aldiss et al., 1982; Aldiss and Ghazali, 1984), which runs

parallel to the main Samosir Fault. The development of these circumferential faults cut across antecedent drainage, capturing previously established drainage channels and migrating them to flow preferentially bounded by the fault scarps. The fourth, and last, stage of faulting would be the youngest, focused on the Tuk Tuk peninsula. The faulting on the peninsula is seen through the lake sediments found on top of the Tuk Tuk lava dome, however the relationship between the timing of the faulting and the eruption of the lava dome is not known.

DISCUSSION

Long Term Rates

The ^{14}C ages of the four sediment samples and the single age from Chesner (2012) on the western slope of Samosir up to the top of the Samosir Fault can essentially be said to fall along the same transect and that four of these five samples characterize an isochronous sediment layer. At Salaon Toba, the older sediment layer of 28,220 ± 150 years BP layer (Toba 1) forms a continuous isochronous layer with the next location, Danau Sidihoni, at 28,660 ± 150 years BP (Toba 6; Figure 2.8; de Silva et al., 2015) and the two locations along the Samosir Fault, both Chesner's (2012) at 33,090 ± 570 years BP and Danau Aek Natonang at 33,730 ± 240 years BP (Toba 5; Figure 2.8; de Silva et al., 2015). The age difference between the samples for this isochronous layer of approximately 5000 years (between c. 28 kyrs ago and 33 kyrs ago) can be explained by the differential amount of uplift experienced as Samosir rose out of the water. The uplift hinge of the resurgent dome pivoting about the western side of the island means that there was maximum uplift along the east side (accommodated by the Samosir Fault) while there was minimum uplift along

the west coast. The circumferential faulting along the western slopes of Samosir (Figure 2.12; de Silva et al., 2015) only further speak to the differential uplift story of the resurgent dome; as the resurgent dome was uplifted, local extension caused the normal faulting along the western slope which would only serve to create differential uplift of certain areas, meaning certain fault scarps would have been raised above lake level sooner than others. These normal faults would explain the age difference of 5000 years across this isochronous layer. The continuous extend of this sediment layer, however, indicates that Samosir was still submerged under the lake c. 28 – 33 kyrs ago to allow for sedimentation and this layer to form.

Using the ages of the locations along this transect and their elevations at which they were sampled, a minimum amount of uplift for these locations can be calculated. These uplift rates are minimum calculations because there may have been younger sediment layers deposited on top of the sampled layers that have since been eroded away. Calculating this uplift rate would be taking the age of the sediment layer (assumed to be the last time this layer was below water level) divided by the elevation above lake level at which it was sampled (elevation – 900 m; assumed to be the amount of uplift experienced at this location). Chesner (2012) calculated a minimum uplift rate for the sample along the Samosir Fault to be 1.8 cm/yr. The Aek Natonang sample along the Samosir Fault returns a minimum uplift rate of 2.1 cm/yr (Table 2.2). This indicates that maximum amount of uplift was experienced along the east, along the Samosir Fault, while the uplift rates decrease moving away from the Samosir Fault to the west of Samosir. Danau Sidihoni returns an uplift rate of 1.41 cm/yr, while the c. 28 kyrs ago sediment layer at Salaon Toba returns an uplift rate of 0.48 cm/yr

(Table 2.2). To the east, however, down the Samosir Fault and along the hinged faults (Figure 2.12; de Silva et al., 2015), the Tomok samples return ages c. 22 kyrs ago and uplift rates of 0.31 cm/yr (Figure 2.8; Table 2.2; de Silva et al., 2015). This implies that these hinged faults were only uplifted above the lake level c. 22 kyrs ago, and at a rate slower than the main Samosir Fault of 2.1 cm/yr. Uplift rates along the main Samosir Fault, therefore, decreased substantially. This can also be seen at the Tuk Tuk peninsula, where sediment cover on the Tuk Tuk lava dome returned a calculated uplift rate of 0.67 cm/yr. It should be noted, however, that uplift and faulting on the Tuk Tuk peninsula may be a result of magmatic extrusion and eruption and may not be related to the uplift forces of the resurgent dome. However in this context, the uplift rate of Tuk Tuk is assumed to be connected to the overall uplift of Samosir, so as to provide a continuous uplift story until present day for the resurgent dome.

The main uplift of Samosir Island accommodated along the Samosir Fault resulted in a relief of 700 m (above lake level). The differential uplift across the resurgent dome shows that maximum uplift rates were experienced on the east, while uplift rates decreased towards the west, supporting the idea of a hinged resurgent uplift (Figure 2.13; de Silva et al., 2015). In order to better characterize Samosir's uplift in the context of resurgent timescales and mechanisms (as seen in Figure 2.5), it is necessary to first determine if the amount of uplift seen started at from lake level or from a lower elevation, indicating the amount of uplift is actually higher. The first scenario is if actual uplift started at lake level, at ~900 m. The highest elevation on Samosir is ~1600 m, meaning the total amount of uplift of the resurgent dome is ~700 m, 100 m of that being lake sediment and the other 600 m being intracaldera YTT

(Figure 2.13). This would mean that 700 m of uplift occurred in c. 33 kyrs (^{14}C age for Chesner (2012) and Aek Natonang at this elevation). However, based on bathymetry data, the deepest depth of Lake Toba is ~400 m (500 m a.s.l.). If this was the depth of the caldera floor after the YTT eruption when resurgence began, and uplift actually started at this depth, the amount of uplift would have been 1100 m, which would be the maximum amount of uplift feasibly calculated for Samosir Island (Figure 2.13; de Silva et al., 2015).

Using these two potential uplift scenarios and the ^{14}C ages and uplift rates for the sediments sampled (Figure 2.8), it is possible to construct an uplift history for Samosir Island that better constrains the uplift process of the resurgent dome. Since total amount of uplift on Samosir Island is 700 m for c. 33.7 kyrs, and the last c. 8.2 kyrs at Tuk Tuk has 55 m of uplift (Table 2.2), uplift for the time between Tomok and Tuk Tuk, 22.5 kyrs ago to 8.2 kyrs ago, is approximately 15 m, and the remaining 630 m is uplift between 22.5 kyrs ago and 33.7 kyrs ago (Table 2.3; de Silva et al., 2015). Assuming the given interval of time between the sediments and the amount of uplift recorded for those sediments, the first 11.2 kyrs of uplift of Samosir was at an average rate of 5.6 cm/yr. This then decreased to an average uplift rate of 0.7 cm/yr between 22.5 kyrs ago and 8.2 kyrs ago, and stayed at this low uplift rate of 0.7 cm/yr until the present day. The average uplift rate for the resurgent dome is the same as for calculating uplift rate of the total 700 m over a period of 33.7 kyrs, which is 2.1 cm/yr (Table 2.3; Figure 2.14; de Silva et al., 2015). If the scenario for maximum amount of uplift was used instead, this would only change the start of resurgence, where the period between the YTT eruption and when the lake sediments are first uplifted above lake level at 33.7 kyrs ago involves uplift of

500 m over a period of 40.3 kyrs. The uplift rates of the dome after 33.7 kyrs ago would still remain the same (Figure 2.14; de Silva et al., 2015).

Short Term Rates

The sample locations on the Tuk Tuk peninsula (Toba 2, 8, 9, 10; Table 2.2; Figure 2.9; Mucek et al., 2017) tell another story of resurgence experienced at Toba. The main uplift accommodated by the resurgent dome show long term, slow uplift rates, associated with a caldera system returning to lithostatic equilibrium. On the Tuk Tuk peninsula, however, the young sediment ages found on the surface and at the sediment-lava dome contact boundary return uplift rates that vary and increase over time (Figure 2.15). These uplift rates increase from 0.3 cm/yr to 1.9 cm/yr, with the youngest sediment age at 2,690 ± 30 years BP. This is reflective of shorter term, high uplift rates that is commonly linked to local, small intrusions (Figure 2.5), of a "restless" system at equilibrium. This is further supported by the fact that the elevations of the young sediment layers are similar, yet represent an age span of ~6 kyrs (between Toba 2 and Toba 10; Figure 2.10), meaning that the uplift was also accompanied by down dropping of the lava dome, common activity during a "restless" period. As a result, the uplift calculated from each sampled location does not contribute to a cumulative uplift (Figure 2.15), but instead an explanation that there must have been periods of time where the lava dome was down dropped.

Resurgence Mechanisms

There have been several mechanisms used to explain the driving force behind resurgence (Marsh, 1984; Kennedy et al., 2012) and most of them are

related to the rise of magma pushing up on the collapsed roof of the remnant magma reservoir (caldera floor) and forming the resurgent dome. The question that usually arises with respect to this mechanism is whether the rising magma is new magma or remobilized remnant magma. Regardless of the source, rising magma has been accredited to being one of the main potential mechanisms for resurgence. At Toba Caldera, the uplift of the resurgent dome, Samosir Island, has also been attributed to rising magma (de Silva et al., 2015). By using the radiocarbon ages of the sediments and the amount of uplift experienced (Table 2.2), a continuous influx of magma into the remnant magma reservoir would achieve uplift rates experienced at the sediment sampled locations. Numerical modeling of Toba's magma reservoir shows that a continuous pulse of magma, starting at ca. ~33.7 kyrs ago into a temperature dependent system would generate the amount of uplift at the sediment locations at the age of the sampled sediments (see Figure 9 from de Silva et al., 2015). This does not discount the fact that the radiocarbon ages and uplift rates would match both a scenario of a single continuous pulse of magma or a scenario where there are several pulses of magma, each occurring around the time of the sediment age. As part of an exploration of other mechanisms of resurgence, this numerical model also disproved that detumescence of the Toba Caldera system is responsible for the uplift generated on Samosir Island. By applying detumescence of the system, it is not possible to reach the maximum uplift height of 700 m above lake lavel. In fact, detumescence would only be able to generate an uplift of 5-10 m (de Silva et al., 2015)

CONCLUSIONS

Radiocarbon ages from the uppermost organic-rich lake sediments across Samosir Island return calculated uplift rates that decrease from an average of 2.1 cm/yr to as low as 0.7 cm/yr. Lower uplift rates for locations found along the western slope of the island can be explained by differential uplift, where the hinged axis of the uplifting resurgent dome along the western side resulted in lower uplift rates in comparison to the unhinged east side, which experienced maximum uplift rates for the resurging system. Uplift rates of Samosir Island as a resurgent dome of an average of 2.1 cm/yr fall within the lower spectrum of uplift rates (as seen in Table 2.1). When recast to look at it from the perspective of uplift rates for a resurgent system, decreasing uplift rates from 5.6 cm/yr to 0.7 cm/yr show low uplift rates over a long term for the main resurgent dome, which is common of large caldera systems returning to lithostatic equilibrium (Figure 2.5). These long-term, low uplift rates experienced at Samosir indicate that the resurgent system at Toba is most likely a result of the driving forces of either magmatic recharge or the system returning to lithostatic equilibrium. The uplift rates experienced at the Tuk Tuk peninsula, however, show variable and increasing uplift rates, from 0.3 cm/yr to 1.9 cm/yr. This is more reflective of short-term, high uplift rates related to small-scale activity and "restlessness" associated with intrusions of magma. In this case, the intrusions of magma are also related to the emplacement of the Tuk Tuk peninsula lava dome on the surface. This supports the theory and modeling of rising magma causing uplift (de Silva et al., 2015) and the appearance of the Tuk Tuk lava dome may be one of the "leaks" from this rising magma. This also raises the possibility that remnant magma recharge is involved, which agrees with the uplift rates related to this resurgence mechanism (Figure 2.5) and previous work (Chesner and

Rose, 1991; Chesner, 2012) stating that magmatic recharge plays a key role in Toba's resurgence.

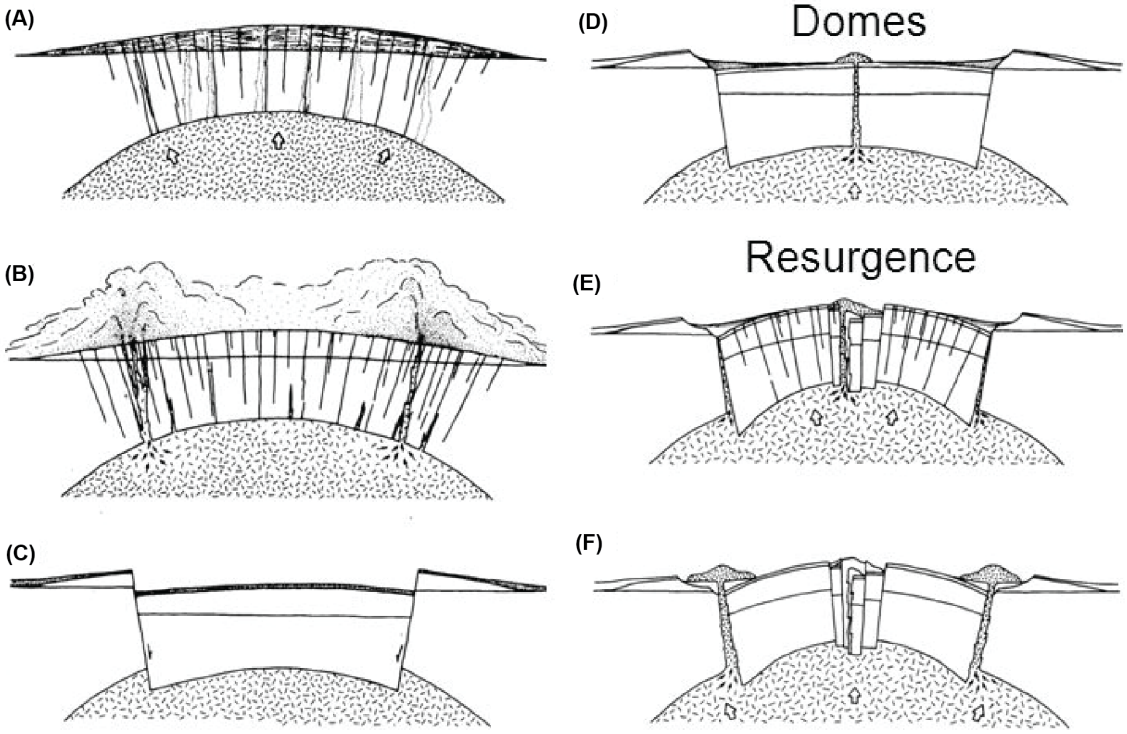


Figure 2.1: The six stages of the caldera cycle

(From Smith and Bailey, 1964)
(A) Stage 1: regional tumescence of the regional area as magma reservoir is inflating below
(B) Stage 2: caldera eruption, where material is erupted along caldera ring faults.
(C) Stage 3: caldera collapse, shown here as a piston collapse, movement downward along the ring faults
(D) Stage 4: pre-resurgence volcanism occurring along faults, forming lava domes.
(E) Stage 5: resurgence causing structural uplift and deformation of the caldera floor, forming resurgent dome
(F) Stage 6: volcanism along faults and final caldera expression

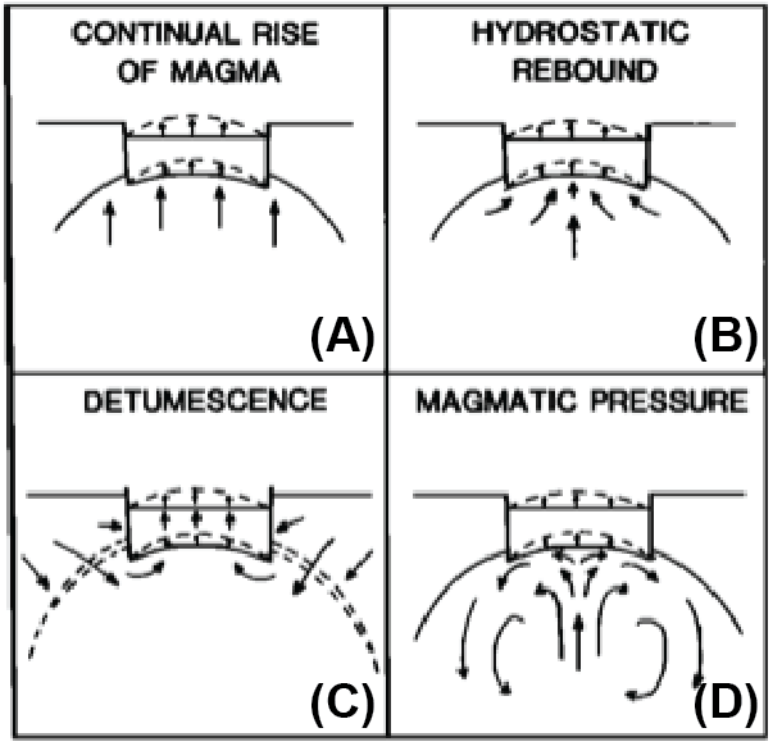


Figure 2.2: Mechanisms of resurgence

(From Marsh, 1984)
(A) Influx of new magma into chamber
(B) Magmatic rebound of the system after eruption
(C) Regional detumescence squeezing magma up
(D) Magmatic pressure against the base of the caldera floor, from latent vesiculation or convection within the chamber

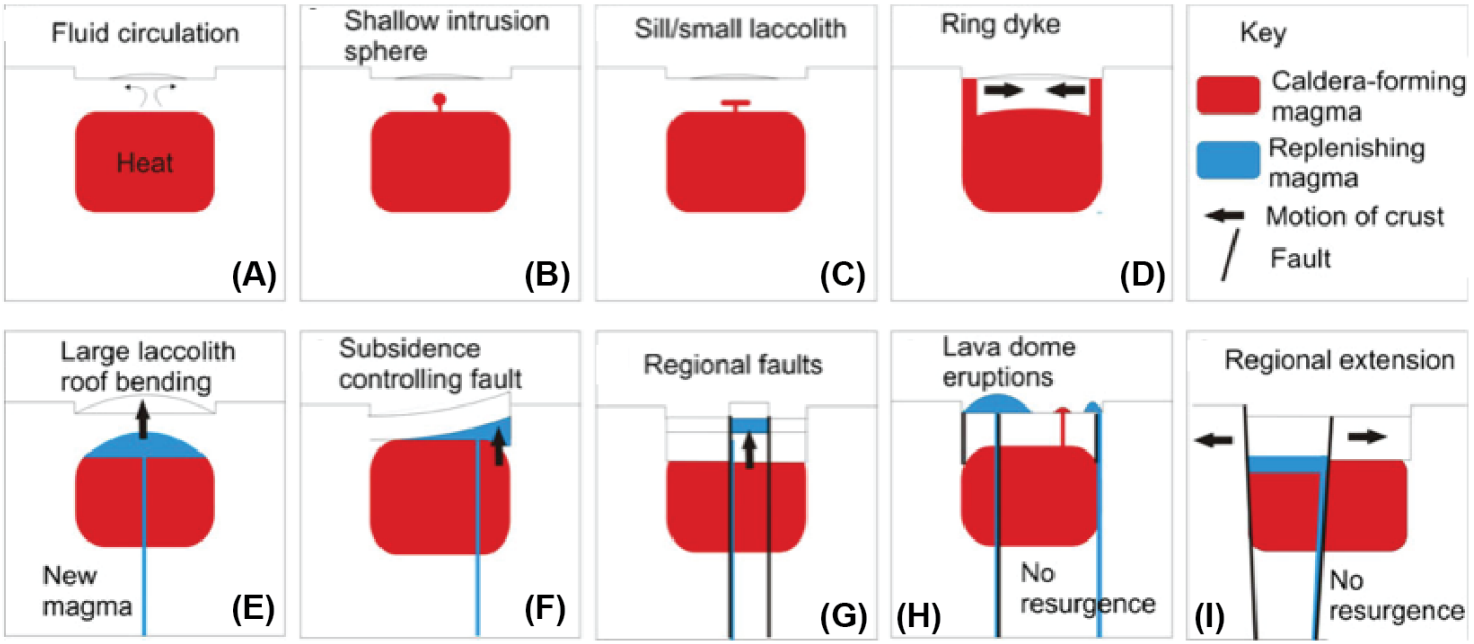


Figure 2.3: Styles of uplift during resurgence

(From Kennedy et al., 2012) Panels A - D reflect smaller amounts of uplift, while panels E - G accommodate larger amounts of uplift.
(A) Hydrothermal activity above magma reservoir (B) Shallow intrusion of a spherical point source (C) Shallow intrusion of a sill like source (D) Magmatic inflation of ring dyke (E) Large shallow laccolith bending roof of magma reservoir (F) Large shallow asymmetrical laccolith intruding along ring faults (G) Shallow laccolith intruding along regional faults (H) New magma intrudes through ring and regional faults, forming lava domes but no structural resurgence (I) Regional extension of the caldera accommodates for new magma, no structural resurgence.

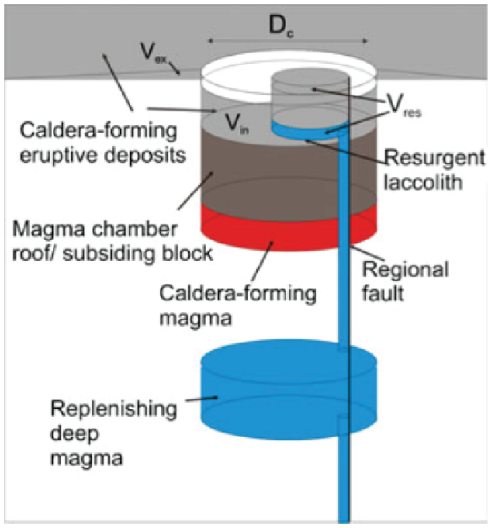


Figure 2.4: Simplified idea of resurgence as a change in volumes

(From Kennedy et al., 2012) Simplified idea of magma reservoir and how resurgence occurs, allowing for the modeling and simplification of possible resurgence styles. Shallow magma reservoir (red) is linked and replenished by deeper magma reservoir (blue). Deeper magma reservoir is also linked to the resurgent laccolith between the caldera floor (dark grey) and the deposited caldera eruption deposits (light grey). D_c: Diameter of caldera; V_{res}: volume of resurgence; V_{in}: volume of intracaldera deposits; V_{ex}: volume of extracaldera deposits. As replenishing magma from the deeper magma reservoir enters the shallower magma reservoir, the change in volume is accommodated by V_{res} changing.

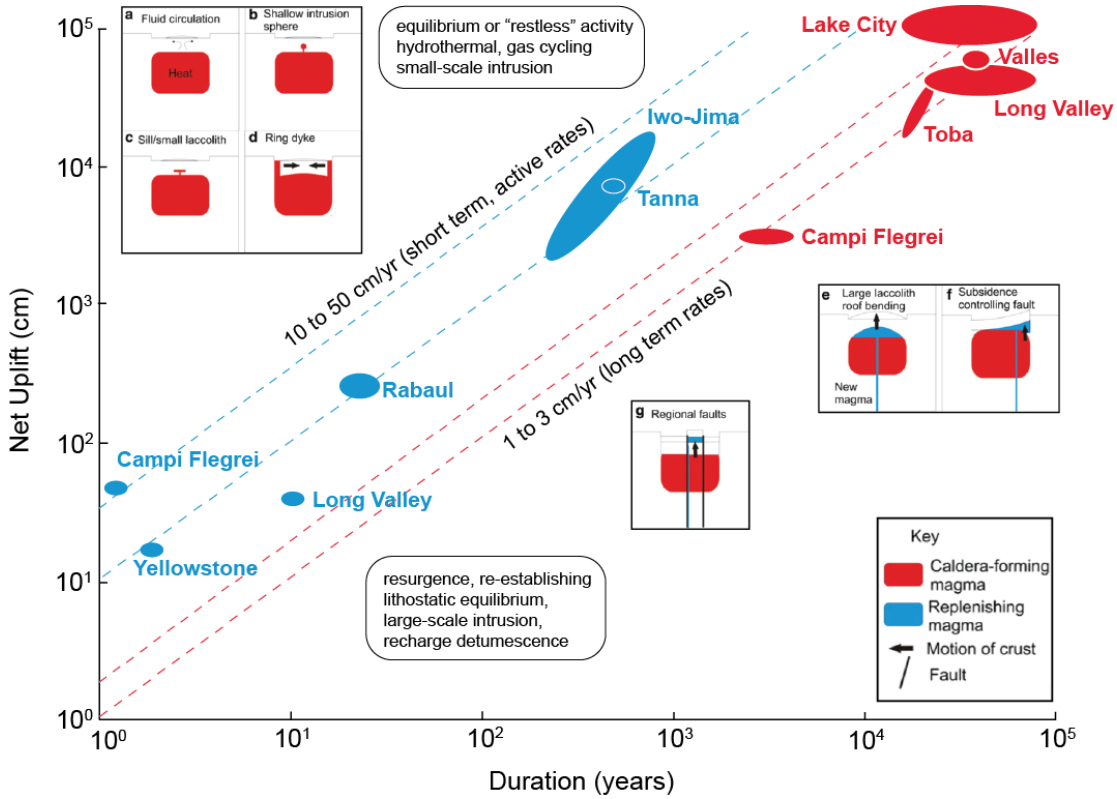


Figure 2.5: Relationship between uplift rates and resurgence mechanisms

(Adapting information from Figure 2.4; Kennedy et al., 2012). Two different uplift rates are driven by different processes. Faster uplift rates (10 to 50 cm/yr) occur over a short term in active processes, driven by small-scaled intrusions (sill intrusion in (c); dyke intrusion in (d); shallow sphere intrusion in (b) or hydrothermal/ geothermal processes and latent pressure vesiculation within magma intrusion in (a)). Slower uplift rates (1 to 3 cm/yr) occur over longer terms in larger systems trying to return to lithostatic equilibrium after caldera eruption and collapse. Processes that drive these slower rates include recharge of new magma into the system (causing roof bending and uplift in (e), (f) and (g) or detumescence of the caldera system, allowing the crust to return to equilibrium.

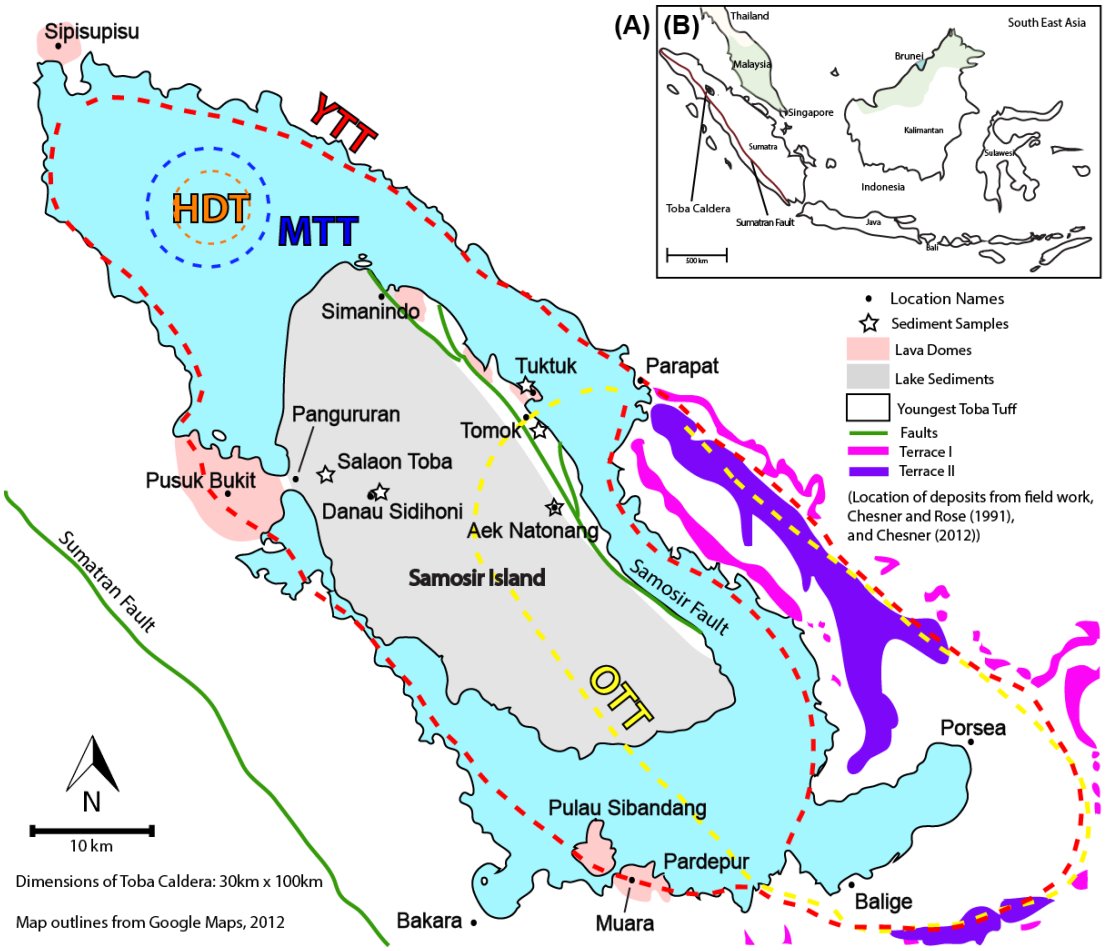


Figure 2.6: Map of Toba Caldera, eruption outlines, and geological deposits

(Modified from de Silva et al., 2015)
(A) Eruption outlines of Toba's four eruptions shown in colored dashed lines. Orange: Haranggaol Dacite Tuff (HDT). Yellow: Oldest Toba Tuff (OTT). Blue: Middle Toba Tuff (MTT). Red: Youngest Toba Tuff (YTT). Lake sediment found on resurgent dome shown in grey. Lava domes related to resurgence shown in red. Samosir and Sumatran faults shown in thick green line. Two lake terraces from previous high lake stands shown in purple and pink: Terrace 1 at an elevation of 1160 m and Terrace 2 at an elevation of 1050 m. Location of sediments sampled for radiocarbon dating marked by white stars. Inset shows location of Toba Caldera in relation to South East Asia.
(B) Inset of South East Asia, with Toba Caldera outlined in red box and Sumatran Fault in red line.

Figure 2.7: Sediment stratigraphy and logging on Samosir Island

(From de Silva et al., 2015)
(A) First type of sediment found on Samosir Island: rhythmically bedded laminated muds and sand, intermittently found with cross cutting and conformable layers of coarse debris flows of conglomerates and fluvial sands
(B) Second type of sediment: diatomaceous tuff with laminated ashy sediment
(C) Extensional, normal faulting found through layers of sediment, found mostly on the west side of Samosir Island

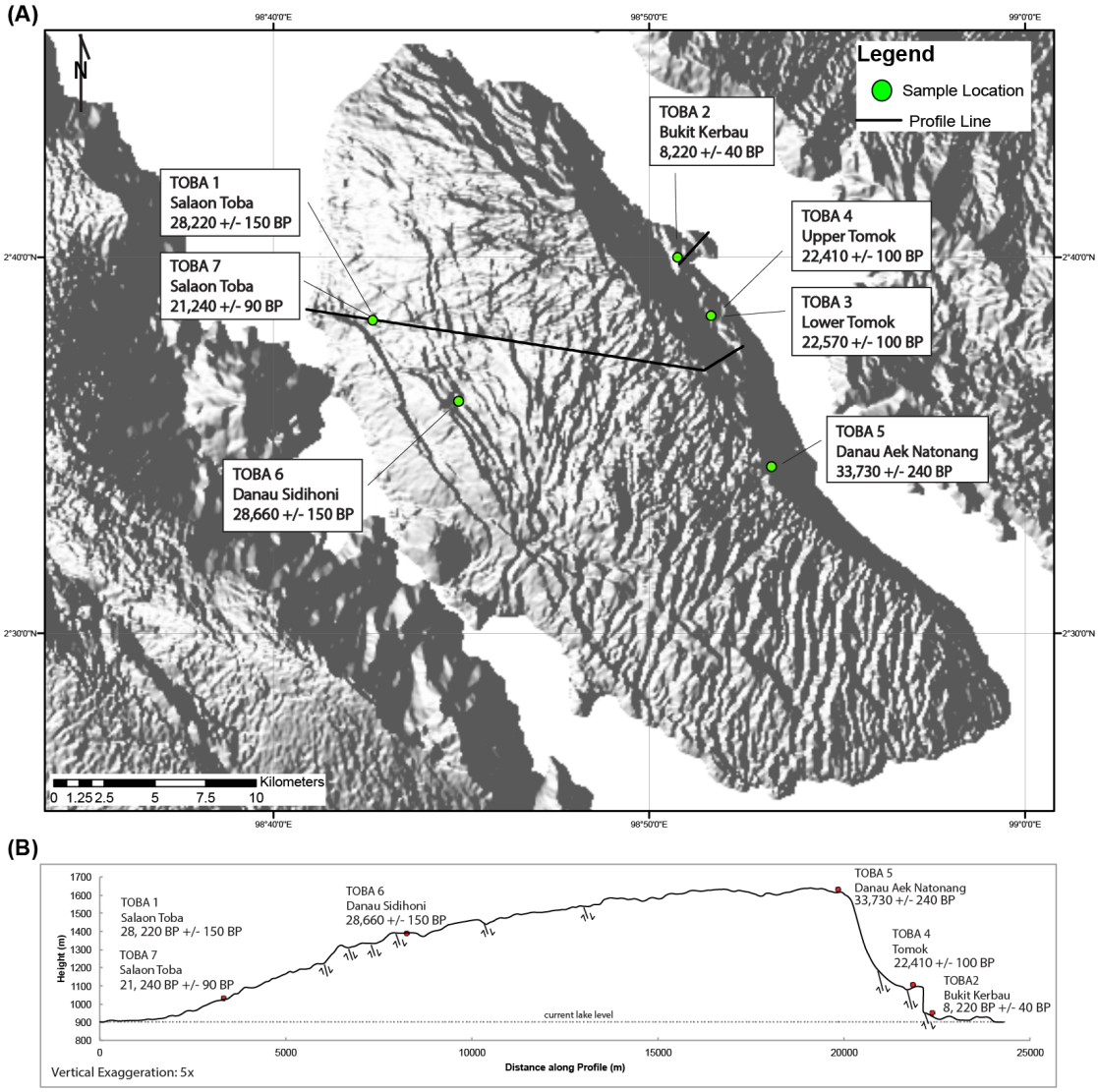


Figure 2.8: Radiocarbon ages along transect across Samosir Island

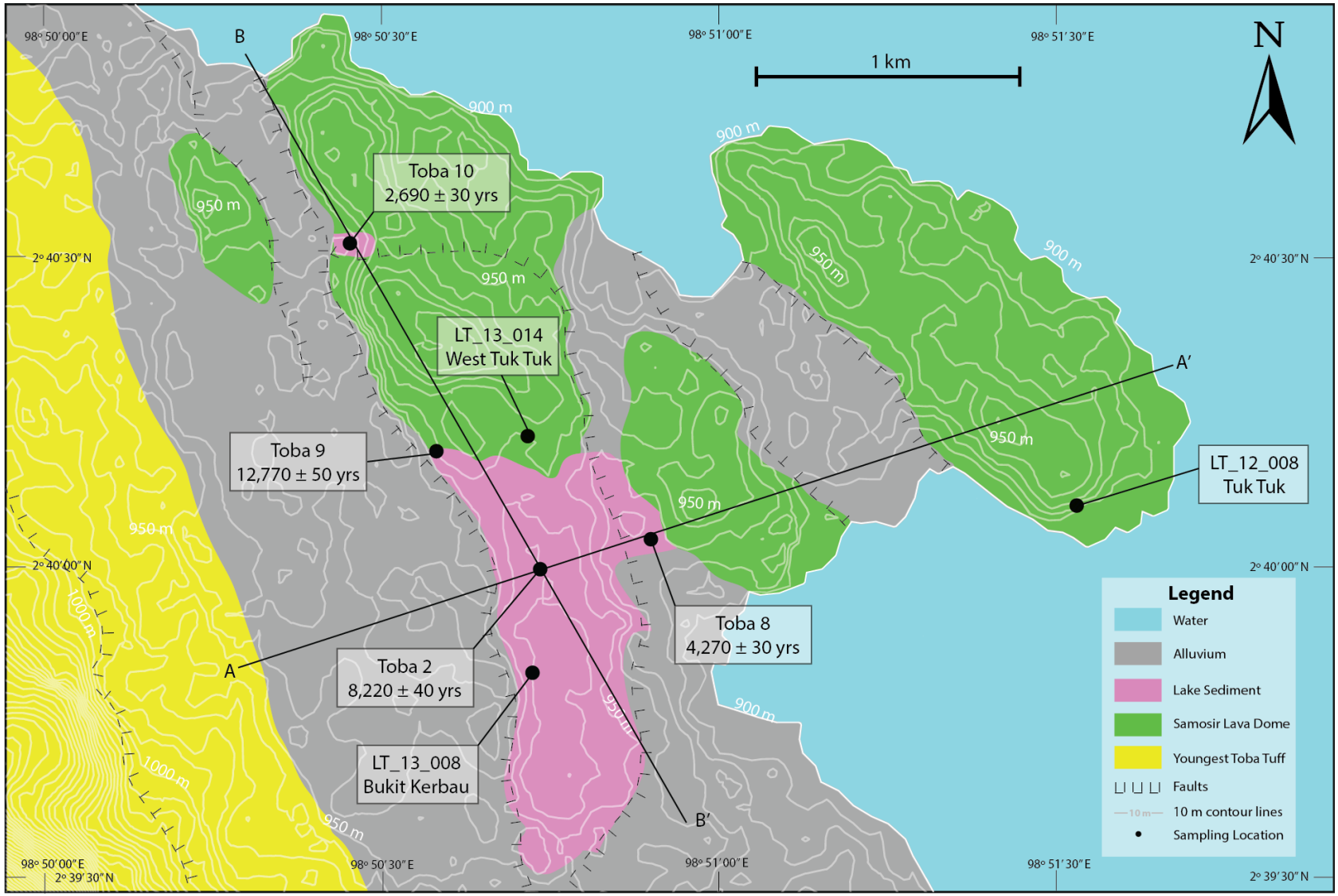
(From de Silva et al., 2015)

(A) Upper figure of relief map of Samosir Island on 90 m DEM, with sun azimuth from 270°. Transect for lower profile shown by black line. Location of samples on relief map shown in green circles; location of samples on profile shown in red circles.

(B) Profile of transect shown with 5x vertical exaggeration.

Figure 2.9: Radiocarbon ages on the Tuk Tuk peninsula

The Tuk Tuk peninsula is made up of several lobes of lava domes that have faulted to form three sections (Tuk Tuk, West Tuk Tuk, Bukit Kerbau). The lake sediments deposited on top of these lava domes were sampled to constrain the minimum age for the emplacement of the Tuk Tuk lava dome. Sampling locations are indicated by black dots; sediment samples are labeled as found in Table 2.2. Faults are inferred from the surrounding geology; any evidence of fault scarps have either been destroyed through construction or are obstructed by forests growing along the edge of the lava domes.


98° 50′ 00″ E
98° 50′ 30″ E
98° 51′ 00″ E
98° 51′ 30″ E
2° 40′ 30″ N
2° 40′ 00″ N
2° 39′ 30″ N
1 km
N
B
B′
A
A′
900 m
950 m
1000 m
Toba 10
2,690 ± 30 yrs
LT_13_014
West Tuk Tuk
Toba 9
12,770 ± 50 yrs
Toba 8
4,270 ± 30 yrs
Toba 2
8,220 ± 40 yrs
LT_13_008
Bukit Kerbau
LT_12_008
Tuk Tuk
Legend
Water
Alluvium
Lake Sediment
Samosir Lava Dome
Youngest Toba Tuff
Faults
10 m contour lines
Sampling Location

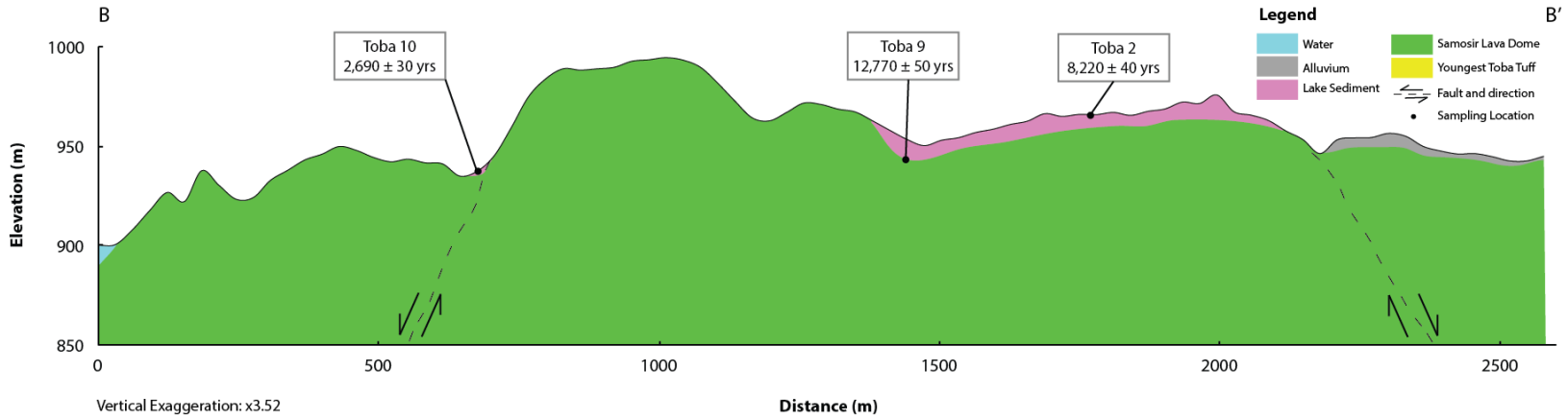


Figure 2.10: A-A' cross section across Tuk Tuk peninsula

(A-A') East-west cross-section of the Tuk Tuk peninsula showing the geology, faulting, and sediment locations from the Samosir Fault through the Youngest Toba Tuff to the Tuk Tuk coast (lake level at 900 m).

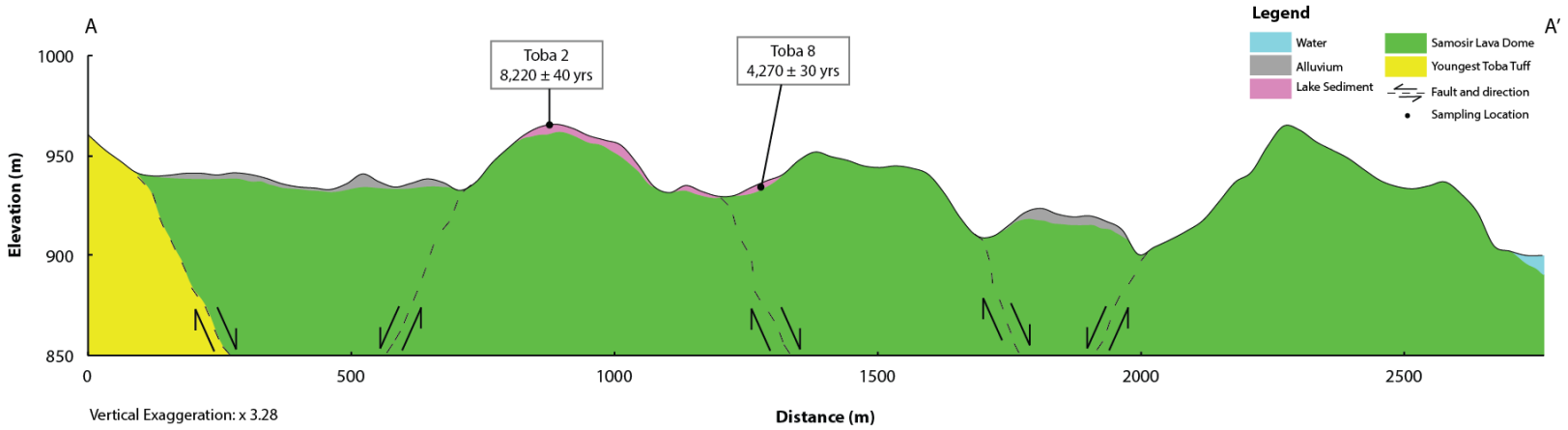


Figure 2.11: B-B' cross section across Tuk Tuk peninsula

(B-B') North-south cross-section of the Tuk Tuk peninsula showing the geology, faulting and sediment locations along the length of the lava dome, starting at the northern Tuk Tuk coast (lake level at 900 m).

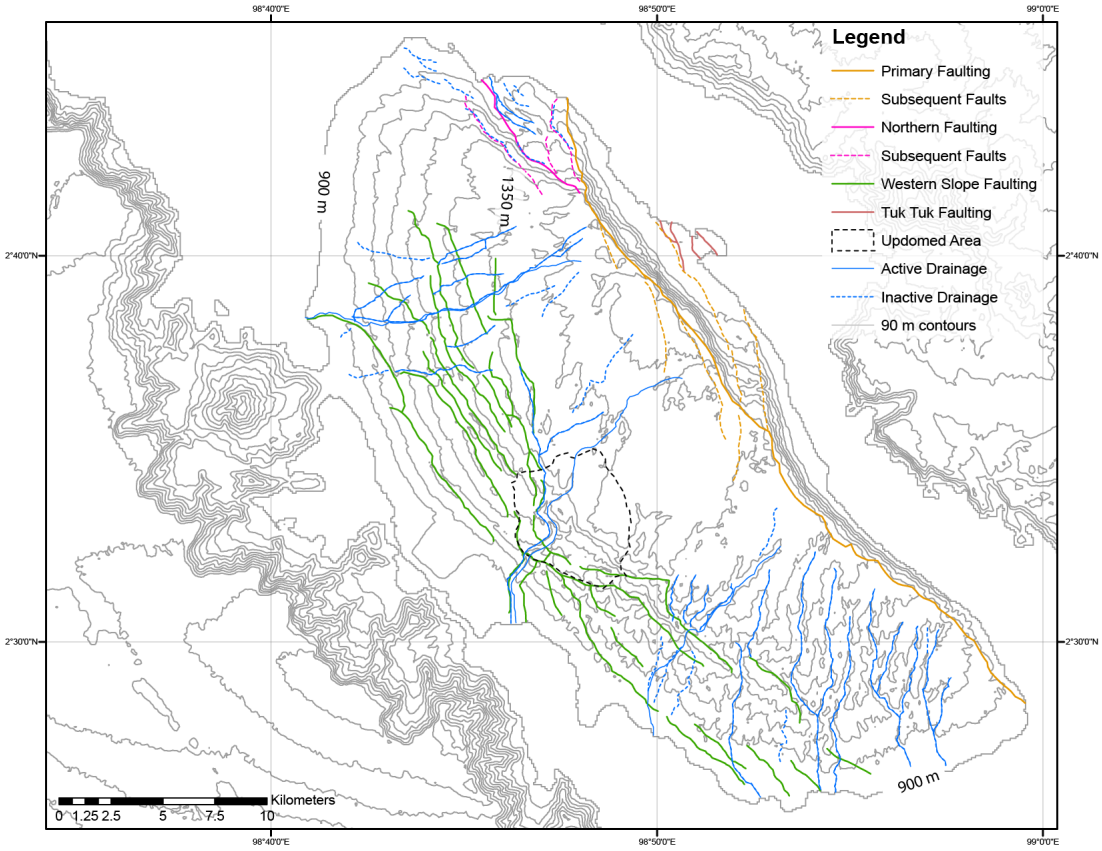


Figure 2.12: Neotectonic fault analysis of Samosir Island

(From de Silva et al., 2015) Faults shown in colored lines on 90 m contour map of Samosir Island. Drainage channels shown in blue lines (continuous lines: active drainage, dashed lines: inactive drainage). First stage of faulting activity shown in orange, followed by faulting in pink, then faulting in green. Faults shown in dashed lines show hinged faults off the main fault. Final stage of faulting shown in red.

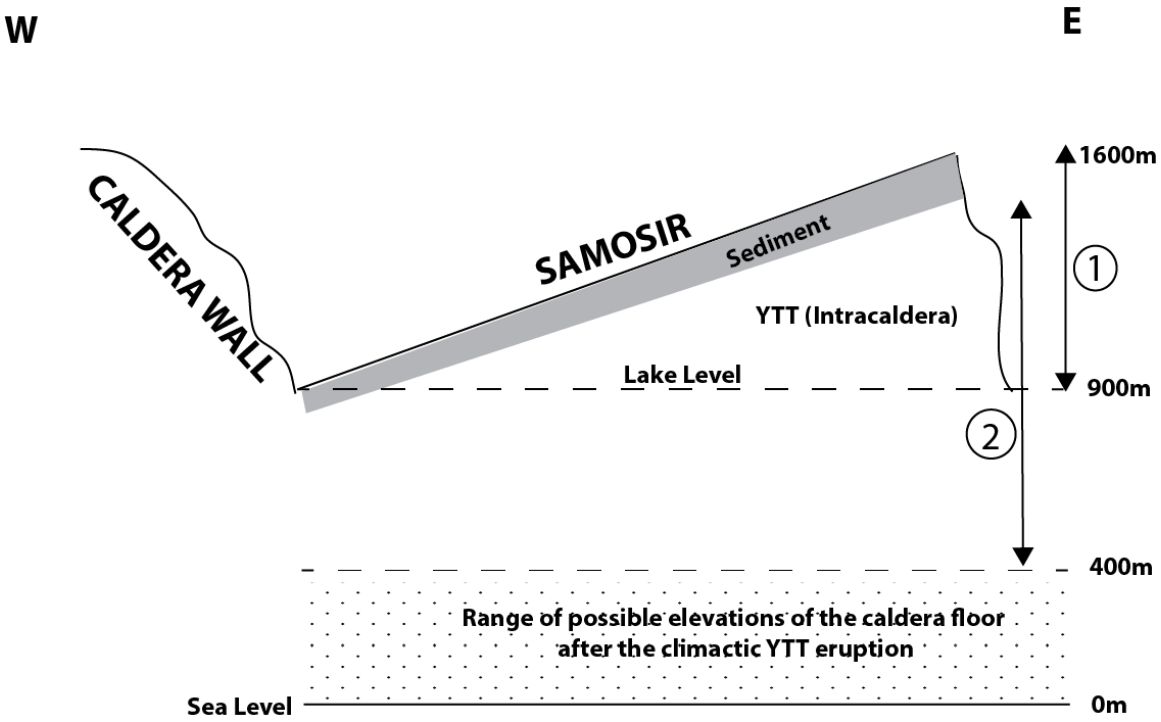


Figure 2.13: Different uplift scenarios for Samosir Island

(From de Silva et al., 2015) Two scenarios can be used to calculate the amount of uplift of Samosir Island. Scenario 1 (labeled 1) is if uplift is only 700 m, when uplift of Samosir Island is from lake level (at 900 m) to max elevation of 1600 m. Scenario 2 (labeled 2) is if uplift starts from the caldera floor (assumed to be the deepest depth at 500 m above sea level) up to maximum elevation of 1600 m. This provides a maximum uplift amount of 1100 m. Grey bar represents 100 m of lake sediment. Stippled texture represents caldera floor. Horizontal is not to scale; vertical is to scale.

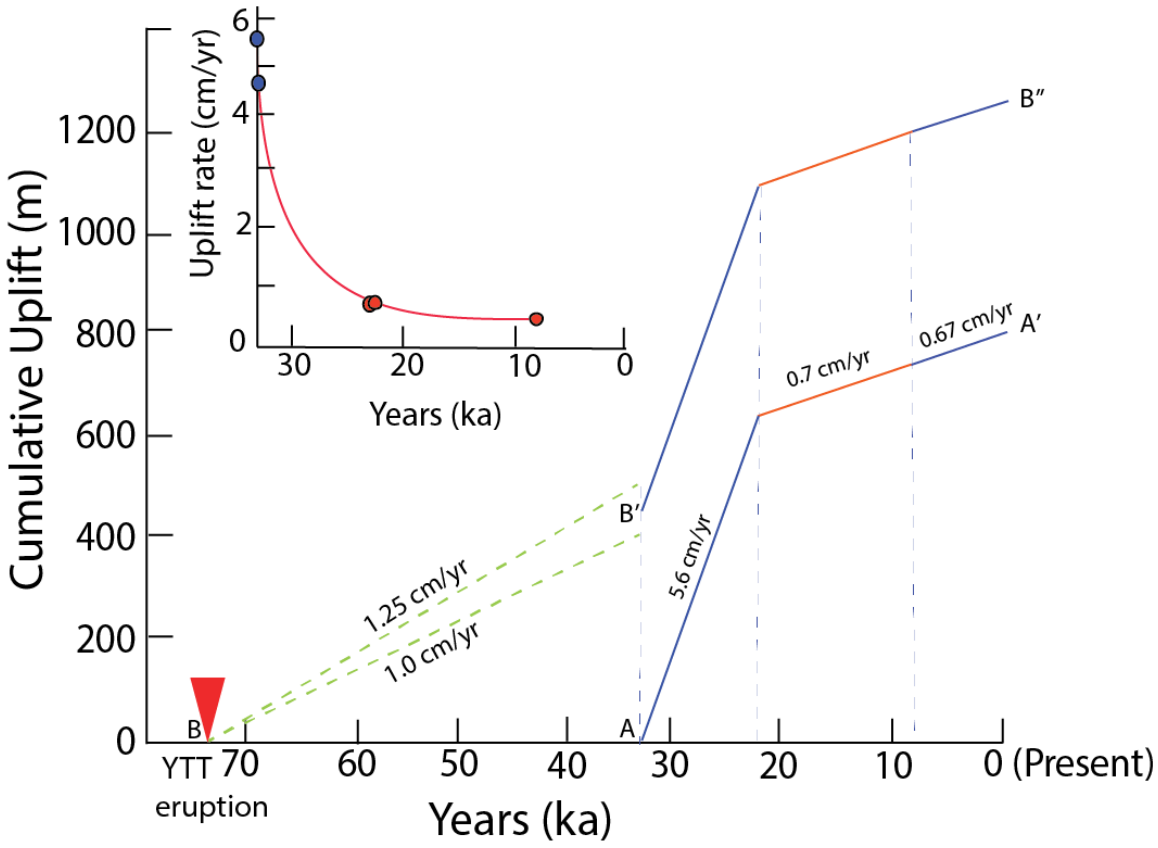


Figure 2.14: Uplift rates over time for the uplift of Samosir Island

(From de Silva et al., 2015) Main figure shows cumulative uplift over time. Slope of the lines represent uplift rate. Radiocarbon ages obtained from sediment samples (Table 2.3) calculate uplift rate A-A', assuming scenario 1 from Figure 2.13. Toba eruption at 74 kyrs ago is marked by red triangle. B-B' show uplift from base of caldera to current lake level (900 m above sea level) including or excluding the 100 m of lake sediment (Table 2.3). B'-B" is the same uplift rates from the radiocarbon ages, but using maximum cumulative uplift rate from scenario 2. Inset shows uplift rates (as calculated from Table 2.3) from the Samosir Fault, down to Tomok, down to Tuk Tuk, with uplift rates decreasing over time.

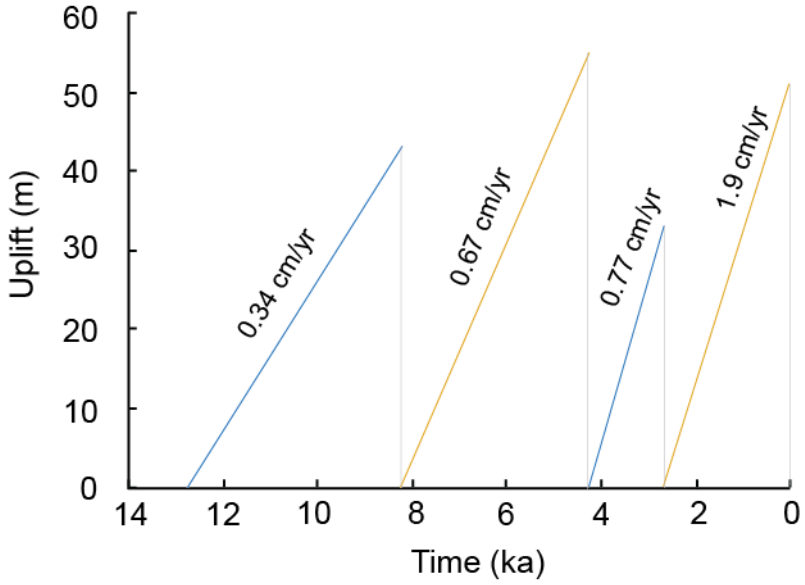


Figure 2.15: Uplift rates on Tuk Tuk peninsula

Uplift rates for the four different sediment samples (as seen in Table 2.2). Uplift rates appear to be increasing over time, which is representative of short-term, 'restlessness' rates at active caldera systems.

Table 2.1: Uplift rates at different active calderas across the world.

Caldera	Caldera Eruption	Duration of Structural Resurgence	Amount of Uplift	Rates of Uplift	Classification	Mechanism of Resurgence	Reference
Valles, New Mexico, USA	1.256 Ma	54 ka	1000 m	1.9 cm/yr	Long term	Magmatic Recharge	Phillips et al. (2007)
		27 +/- 27 ka		3.7 cm/yr			
		1000 yr		100 cm/yr			
Long Valley, California, USA	760 ka	100 ka	500 m	0.5 cm/yr	Long Term	Magma intrusion into shallow crust	Hill et al. (2003)
		1979-1981	20 cm	6.5 cm/yr			Hill et al. (1985)
		1981-1983	10 cm	5 cm/yr			
		1983-1984	12 cm	12 cm/yr			
		1984-1985	1 cm	1 cm/yr			
		1988-1990	11 cm	5.5 cm/yr			Langbein et al. (1993)
		1997-1998	10 cm	10 cm/yr			Tizzani et al. (2007)
Yellowstone, WY, USA	640 ka	2004-2006	via InSAR	7 cm/yr	Long Term	Magmatic intrusions	Chang et al. (2007)
		2006-2008		5 cm/yr			Chang et al. (2010)
Yenkahe block, Tanna, Vanuatu	< 20 ka	1000 yr	155 m	15.6 cm/yr	Short Term	Intrusion of ascending magma laterally	Chen et al. (1995); Merle et al. (2013); Metrich et al. (2011)
Campi Flegrei, Naples, Italy	15 ka	1969 - 1972	1.7 m	51 cm/yr	Short Term	shallow hydrothermal fluid movement and/or shallow magmatic intrusion	Dvorak and Mastrolorenzo (1991); Orsi et al. (1999); Lanari et al. (2004)
		1984 - 1985	1.8 m	51 cm/yr			
		1988	few mm	-			Lanari et al. (2004); Acocella (2010)
		2000 - 2001	5 cm	5 cm/yr			
Iwo-Jima, Japan	7.3 ka	420 yr	120 m	25 cm/yr	Short Term	Magmatic intrusion and/or geothermal fluids	Ukawa et al. (2003)
		500-800 yrs BP	110 m	15-20 cm/yr			Kaizuka (1992); Chen et al. (1995)
Rabaul, Papua New Guinea	3500 yrs BP	1983-1985	8 cm	4 cm/yr	Short Term	Dyke intrusion	Archbold et al. (1988); McKee et al. (1984)

Table 2.2: Radiocarbon ages of sediments sampled on Samosir Island.

Sample	Lab No.	Material: Pretreatment	^{14}C Age	± 1s yr BP	^{13}C/^{12}C ‰	Conventional Age ± 1s yr BP	Calibrated age range (95.4% probability) Cal yrs BP	Location	Lat (N)	Long (E)	Elevation (m)	Uplift Rate (cm/yr)
TOBA 1	347762	organic sediment: acid washes	28160	± 150	-21.4	28220 ± 150	32980-31940	Salaon Toba	02° 38' 20.0"	098° 42' 39.0"	1035	0.48
TOBA 2	347763	organic sediment: acid washes	8220	± 40	-24.9	8220 ± 40	9300-9030	Bukit Kerbau	02° 39' 59.99"	098° 50' 45.0"	955	0.67
TOBA 3	347764	wood: acid/alkali/acid	22630	± 100	-28.9	22570 ± 100	27710-26870	Tomok Lower	02° 38' 46.84"	098° 52' 00.61"	970	0.31
TOBA 4	347765	wood: acid/alkali/acid	22430	± 100	-26.2	22410 ± 100	27580-26740	Tomok Upper	02° 38' 46.84"	098° 52' 00.61"	970	0.31
TOBA 5	351723	organic sediment: acid washes	33720	± 240	-24.5	33730 ± 240	38960-38370	Aek Natonang	02° 34' 03.96"	098° 53' 17.29"	1600	2.08
TOBA 6	351724	organic sediment: acid washes	28560	± 150	-22.3	28660 ± 150	33560-33180	Sidihoni	02° 36' 09.79"	098° 44' 55.95"	1305	1.41
TOBA 7	351725	organic sediment: acid washes	21250	± 90	-25.9	21240 ± 90	25660-25060	Salaon Toba	02° 38' 20.0"	098° 42' 39.0"	1041	0.66
TOBA 8	361811	organic sediment: acid washes	4190	± 30	-20.1	4270 ± 30	4860-4830	Bukit Kerbau (Peak 1)	02° 40' 03.5"	098° 50' 55.8"	933	0.77
TOBA 9	361812	organic sediment: acid washes	12740	± 50	-23.1	12770 ± 50	15190-15060	Bukit Kerbau (Peak 2)	02° 40' 11.3"	098° 50' 35.9"	943	0.34
TOBA 10	361813	organic sediment: acid washes	2620	± 30	-20.6	2690 ± 30	2850-2750	Bukit Kerbau (Peak 3 and 4)	02° 40' 30.7"	098° 50' 27.4"	951	1.90

Table 2.3: Summary of uplift rates calculated for Samosir sediment samples.

Age Range	Time Interval (kyrs)	Uplift (m)	Uplift Rate (cm/yr)
33.7 - 22.5 ka	11.2	630	5.63
22.5 - 8.2 ka	14.3	15	0.10
8.2 ka to present	8.2	55	0.67
33.7 ka to present	33.7	700	2.1
74 ka to 33.7 ka (including sediment layer)	40.3	500	1.25
74 ka to 33.7 ka (excluding sediment layer)	40.3	400	1

CHAPTER 3: POST-SUPERERUPTION RECOVERY AT TOBA CALDERA

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ABSTRACT

Large calderas, or supervolcanoes, are sites of the most catastrophic and hazardous events on Earth, yet the temporal details of post-supereruption activity, or resurgence, remain largely unknown, limiting our ability to understand how supervolcanoes work and address their hazards. Toba Caldera, Indonesia, caused the greatest volcanic catastrophe of the last 100 kyrs, climactically erupting ~74 kyrs ago. Since the supereruption, Toba has been in a state of resurgence but its magmatic and uplift history has remained unclear. New ^{14}C, zircon U-Th crystallization, and (U-Th)/He ages reveal resurgence commenced at 69.7 ± 4.5 kyrs ago and continued until at least ~2.7 kyrs ago, progressing westward across the caldera, as reflected by post-caldera effusive lava eruptions and uplifted lake sediment.

INTRODUCTION

Many of Earth's largest calderas, or supervolcanoes, like Yellowstone (Wyoming, USA) and the Valles Caldera (New Mexico, USA), record multi-million year histories punctuated by geologically instantaneous and catastrophic supereruptions (Rampino et al., 1988; Self, 2006; Costa et al., 2014). During the intervening periods of relative quiescence, the caldera re-establishes magmastatic, isostatic and lithostatic equilibrium after the catastrophic disruption of the caldera-forming (climactic) eruption. Referred to as resurgence, this period of post-climactic recovery is recognized as one of the most dynamic phases of a caldera cycle during which uplift of the caldera floor is accompanied by further eruptions, establishment of hydrothermal and geothermal systems, and ore formation (Smith and Bailey, 1968; Lipman, 1984; Kennedy et al., 2012). However, despite the recognition that all currently active

large calderas are in resurgence with the potential for significant further hazard (Newhall and Dzurisin, 1988), precise timing of events during resurgence at large calderas are unknown, impeding our ability to fully assess any accompanying hazard. One of the main challenges is to unravel how activity varies in space and time, but to date, efforts have been hindered by the limitations of the available techniques (Marsh, 1984; Phillips et al., 2007; Chesner, 2012).

Eruptions and Resurgence at Toba

Eruptive activity at Toba began ~1.2 Myrs ago with the production of the Haranggaol Dacite Tuff, followed by caldera-forming eruptions at ~0.8 Myrs ago (the Oldest Toba Tuff), and ~0.5 Myrs ago (the Middle Toba Tuff; Chesner, 2012). Toba's third and last caldera-forming eruption, that of the climactic Youngest Toba Tuff (YTT), occurred ~74 kyrs ago (ages range from 73.9 ± 0.6 to 75.0 ± 1.8 kyrs ago; Storey et al., 2012 and Mark et al., 2014, respectively) and created the present lake basin by the collapse of the roof of the magma reservoir (Chesner, 2012). The lake formed within ~1500 years (Chesner, 2012) and over the next 66 kyrs at least, episodic trapdoor-style uplift of the caldera floor formed Samosir Island (de Silva et al., 2015). Several lava effusions accompanied resurgent uplift and faulting (Aldiss and Ghazali, 1984) on the margins of Samosir and the caldera (Figure 3.1), but to date, $^{40}Ar/^{39}Ar$ age determinations have not been able to differentiate their ages from the age of the climactic eruption despite clear stratigraphic evidence of their relative youth (Chesner, 2012).

This study shows how the application of combined ^{238}U-^{230}Th disequilibrium and (U-Th)/He dating of zircon crystals (Farley, 2002; Farley et al., 2002; Schmitt et al., 2006; Danišík et al., 2016) from eruptions at Toba Caldera and ^{14}C ages of lake sediment deposits found on lava extrusions reveal for the first time details of the post-caldera eruption and uplift history that informs the potential hazards of the largest young supervolcano on Earth, which remain heavily debated (Rampino and Self, 1992; Ambrose, 1998; Oppenheimer, 2002; Gathorne-Hardy and Harcourt-Smith, 2003). This study confirms that Toba Caldera formed during the climactic eruption ~74 kyrs ago but find that resurgence started within a few 1000 years after caldera formation, and continued until at least ~2.7 kyrs ago.

METHODS

Sampling

Ten samples from the Toba Caldera complex were collected from four different groups (eight samples from three distinct lava dome/flow regions around Toba Caldera and two YTT samples) in order to determine the eruption age by the combined zircon ^{238}U-^{230}Th disequilibrium and (U-Th)/He method (Schmitt et al, 2006). Along the western rim of the caldera, two samples were collected from Pusuk Buhit. Pusuk Buhit is a composite lava dome with noticeable morphological features of lava flows from the summit. The two samples were from two of the stratigraphically youngest lava flows; LT_14_002 (Pusuk Buhit South) from near the summit of Pusuk Buhit, and LT_14_007 (Pusuk Buhit North) from another stratigraphically young lava flow collected at a lower elevation (Table 3.1).

In the south of the caldera, two samples were collected from the Pardepur lava domes. The Pardepur domes consist of a lava dome extruded along the southern margin of the caldera rim and the small lava dome island, Pulau Sibandang. One sample (LT_12_015; Pardepur South) was collected from near the summit of the caldera rim lava dome, while the second sample (LT_12_016; Pardepur North) was collected from the shoreline of Pulau Sibandang (Table 3.1).

The third group of lava domes sampled is from Samosir; this includes one sample from the north of Samosir Island, and three samples from the Tuk Tuk peninsula region. The north Samosir Island sample, LT_12_003 (Samosir North), was collected from a road cut around the edge of the lava dome. On the Tuk Tuk peninsula, one sample was collected from the main Tuk Tuk lava dome (LT_12_008; Samosir Tuk Tuk), while the other two (LT_13_014 and LT_13_008; Samosir West Tuk Tuk and Samosir Bukit Kerbau, respectively) were collected from the surrounding peaks.

Three sediment samples from lava dome-sediment contact zones on the Tuk Tuk peninsula on Samosir Island were analyzed by ^{14}C dating to obtain the age of sediment deposition and provide the minimum age at which the lava dome must have already been extruded.

Mineral Separation

Samples of pumice and lavas from Toba ignimbrite and lava domes were crushed and sieved to the <250 μm fraction, rinsed, and magnetically separated at currents of 0.25, 0.75, and 1.25 A on a Frantz Isodynamic Separator. The non-magnetic fraction from 1.25 A was run through heavy liquid separation

(Methylene Iodide, 3.33 gcm^{-3}) and zircons were hand selected from the denser fraction. Approximately 50 zircon crystals were picked for each Toba sample and then rinsed in cold 48% HF for 1 minute to remove adhered glass from zircon surfaces.

^{238}U-^{230}Th Analysis

Subsets of 25 zircons for each sample were selected, mounted, and pressed into a pre-mounted indium (In) mount, exposing the unpolished surfaces of the zircons. Unknown grains were mounted along with secular equilibrium (>350 kyrs ago) zircon standards AS3 (Duluth Gabbro) for mounts prepared at the University of California – Los Angeles (UCLA). The surfaces of AS3 were polished to 3 µm prior to mounting unknown zircons samples. Following the sample mounting, the In mount was coated with a layer of conductive gold and analyzed on a CAMECA ims 1270 Secondary Ion-Mass Spectrometer (SIMS or ion microprobe) at UCLA. ^{238}U-^{230}Th zircon analyses followed protocols outlined in Schmitt et al. (2006; 2010; 2011).

Analyses performed at the UCLA CAMECA ims 1270 used a $^{16}O^-$ beam with a primary current of 40-80 nA, with a spot size varying from 35×40 to 55×60 µm on the zircon surface. Measurements were performed using multicollection, and electron-multiplier and Faraday cup detector gains were calibrated by comparing the background-corrected $(^{238}UO^+)/(^{235}UO^+)$ normalized to $(^{238}U)/(^{235}U) = 137.88$ (Rosman and Taylor, 1998). U/Th relative sensitivities were calibrated from analyses of zircon standard 91500 with 81.2 ppm U and 28.61 ppm Th (Wiedenbeck et al., 1995). The accuracy of the relative sensitivity calibration and background corrections was verified on the

AS3 secular equilibrium standard (1099.1 Ma; Paces and Miller, 1993). The (^{230}Th)/(^{238}U) weighted averages of AS3 analyses distributed between unknowns was 0.996 ± 0.007 (1 s.d., Mean Square of Weighted Deviates (MSWD) = 1.5; n = 17), consistent with secular equilibrium of AS3. The zircon ^{238}U-^{230}Th ages were calculated using a two-point isochron through each zircon analysis and a model melt from the published whole rock compositions of Toba rocks of (^{230}Th/^{232}Th) = 0.465 ± 0.002 and (^{238}U/^{232}Th) = 0.517 ± 0.001 (Vasquez and Reid, 2004).

^{238}U-^{206}Pb Analysis

Zircons found to be in secular equilibrium after initial ^{238}U-^{230}Th analysis were reanalyzed for ^{238}U-^{206}Pb on the CAMECA ims 1270 ion probe SIMS at UCLA; the grains were re-polished and adjacent spots were reanalyzed. Analytical conditions (e.g., primary current and spot size) were similar to those used for ^{238}U-^{230}Th analyses. ^{238}U-^{206}Pb ages were calculated following the approach of Compston et al. (1984). U-Pb relative sensitivities were calibrated using AS3 reference zircon (1099.1 Ma; Paces and Miller, 1993), which was analyzed repeatedly throughout the duration of the analytical session. All reported ages were corrected for common Pb and disequilibrium using $D_{Th/U}$ = 0.2. Ages >10 Ma used ^{204}Pb correction while ages <10 Ma used ^{207}Pb correction (Rosman and Taylor, 1998). Uranium concentrations were measured using (UO^+)/($Zr_2O_4^+$), calibrated to 91500 (81.2 ppm U, 28.61 ppm Th; Wiedenbeck et al., 1995) yielding a relative sensitivity factor of 0.12. Th concentration was calculated based on Th^+/U^+ relative sensitivity of 0.666, determined on reference zircon AS3 (Schmitt et al., 2003).

(U-Th)/He Analysis

(U-Th)/He zircon analyses followed protocols outlined in Danišík et al. (2012). Zircon crystals were plucked out from the In mounts previously used for SIMS analysis, photographed and measured for dimensions in order to calculate alpha-ejection correction factor (Farley et al., 1996), and individually transferred into niobium micro-tubes. Radiogenic ^{4}He was extracted at ~1250°C under ultra-high vacuum using a diode laser and analyzed on identical helium extraction lines at the University of Waikato (New Zealand) or at the John de Laeter Centre in Perth (Australia) on a Pfeiffer Prisma QMS-200 mass spectrometer. Released gas was purified using a hot (~350°C) Ti-Zr getter, spiked with 99.9% pure ^{3}He and introduced into the mass spectrometer next to a cold Ti-Zr getter. $^{4}He/^{3}He$ ratios were measured using a Channeltron detector operated in static mode and corrected for HD and ^{3}H interferences by monitoring mass/charge = 1 amu. A "re-extract" was run after each sample to verify complete outgassing of the crystals. He gas results were blank corrected by heating empty Nb tubes using the same procedure. Typically 10 to 15 blank analyzes were measured before and after each set of crystal measurements.

After the ^{4}He measurements, micro-tubes containing the crystals were retrieved from the laser cell. Following the dissolution procedure of Evans et al. (2005), the samples were spiked with ^{235}U and ^{230}Th and dissolved in Parr bombs using HF, HNO_3 and HCl. Sample, blank, and spiked standard solutions were analyzed for ^{238}U, ^{232}Th and ^{147}Sm on a Perkin Elmer SCIEX ELAN DRC II ICP-MS (at the University of Waikato) or on an Agilent 7500 ICP-MS at TSW Analytical Ltd (Perth). Total analytical uncertainty of uncorrected (U-Th)/He ages was calculated by propagating uncertainties of U, Th, Sm, and He

measurements. The uncorrected (U-Th)/He ages were Ft-corrected after Farley et al. (1996) assuming a homogeneous distribution of U and Th, verified by the CL images taken on several zircon crystals (Figure 3.2). Anisotropic diffusion of He in zircon (Reich et al., 2007) is not an issue in young and quickly cooled volcanic rocks, as in this case for the Toba samples, which essentially have zero residence time in the zircon He partial retention zone (Meesters and Dunai, 2002). The observed over dispersion of single grain zircon (U-Th)/He ages indicated by elevated MSWD values (Table 3.1) is interpreted as resulting from the simplified assumptions regarding zircon crystal geometry and the presence of undetected inclusions that can affect the accuracy of (U-Th)/He ages (Danišík et al., 2017). Furthermore, nanocracks within the crystals may also affect the accuracy by creating pathways for the escape of ^{4}He. The accuracy of zircon (U-Th)/He dating procedure was monitored by replicate analyses of Fish Canyon Tuff zircon (n = 20) measured over the period of this study as internal standard, yielding mean (U–Th)/He age of 28.2 ± 0.8 Myrs ago (1σ), consistent with the reference (U–Th)/He age of 28.3 ± 1.3 Myrs ago (Reiners, 2005).

The Ft-corrected (U-Th)/He ages were then corrected for disequilibrium and pre-eruptive crystal residence by using the MCHeCalc software (Schmitt et al., 2011) that requires as input parameters the Ft-corrected zircon (U–Th)/He ages and uncertainties, the zircon crystallization ages and uncertainties, and D_{230} and D_{231} parameters describing zircon-melt fractionation of Th and Pa relative to U. The D_{230} was calculated by dividing measured Th/U ratios of zircons by measured whole-rock Th/U; for D_{231} the published Pa/U zircon-rhyolite melt partitioning ratio of 3 was adopted (Schmitt, 2007). From resulting distributions of single grain ages, outliers were rejected based on statistical

criteria (IQR test; Upton and Cook, 1996). The resulting distribution was tested for normality (with a positive outcome) by using Q-Q-plots and Shapiro-Wilk W test and used to calculate the final eruption age for each sample as error-weighted average and ± 2 sigma (σ) standard error uncertainty. For single grain ages that were found to be in secular equilibrium, the age used to represent these grains were the average value of ages for each sample. The maximum 2σ uncertainty from the sample set was used as the 2σ uncertainty for the secular equilibrium single grains. To be conservative on the errors associated with the error-weighted average eruption age, the eruption ages were recalculated in Isoplot 4.15 (Ludwig, 2008), using the weighted by assigned/internal errors option. Each eruption age is weighted by the inverse-square of their assigned errors, where the 'probability of fit' is greater than the minimum value defined as 0.15. The 95% confidence is equal to the internal 2σ propagated error multiplied by MSWD and Student's-t for N-1 degrees of freedom, 95%= $\tau\sigma\sqrt{MSWD}$, (Isoplot 4.15; Ludwig, 2008).

^{14}C analysis

The organic-rich sediment samples were analyzed by accelerator mass spectrometry (AMS) at Beta Analytic (Table 3.2). Organic sediments were processed in acid wash and results were corrected using the on-line $\delta^{13}C$ AMS values of the respective graphite aliquots measured, following instrumental analysis described in Santos et al. (2007). Resulting ages are reported both as conventional ^{14}C ages (yr BP) as well as 95.4% (2-standard deviation) probability calendar age ranges (cal yr BP) calibrated by OxCal 4.1 (Ramsey, 2009) using the IntCal09 calibration curve (Reimer et al., 2009).

RESULTS

Zircon Eruption Ages

In this work, eruption ages for ten samples from Toba Caldera have been determined using the combined ^{238}U-^{230}Th disequilibrium and (U-Th)/He zircon dating method (Table 3.1; Appendix Table 3.1). The eruption ages for the Youngest Toba Tuff (79.5 ± 5.5 and 78.1 ± 5.8 kyrs ago; Figure 3.3A and B) determined by this approach overlap within 2 standard error (σ) uncertainty with the recent $^{40}Ar/^{39}Ar$ ages of 73.9 ± 0.6 and 75.0 ± 1.8 kyrs ago (Figure 3.3K; Storey et al., 2012 and Mark et al., 2014, respectively), indicating concordance of the results and providing a cross check for the (U-Th)/He eruption ages. In contrast, ages for the post-caldera lava domes along the eastern coast of Samosir Island range from 69.7 ± 4.5 to 65.3 ± 4.6 kyrs ago (Figure 3.3E-H). Younger eruption ages have been determined for centers along the western rim of Toba Caldera where the Pardepur lava domes, at 56.9 ± 3.9 and 63.4 ± 5.6 kyrs ago (Figure 3.3I and J), and the Pusuk Buhit lava flows, at 62.2 ± 7.1 and 54.5 ± 8.0 kyrs ago (Figure 3.3C and D), are located. These data suggest that post-YTT eruptive activity started immediately after the climactic eruption and continued episodically for at least 15.2 ± 9.2 kyrs thereafter (Figure 3.3K).

Zircon Crystallization Ages

^{238}U-^{230}Th disequilibrium ages of the outermost rims from ten samples from Toba (YTT and post-caldera domes) were obtained (Figure 3.4; Appendix Table 3.2). In addition, ^{238}U-^{206}Pb ages of zircon interiors were obtained for zircons found to be in secular equilibrium. Outermost rim ages, measured with

the ^{238}U-^{230}Th method, record the last stage of zircon crystallization. For YTT, zircon rim ages range to within few 10,000 years prior to eruption. Previous work shows that some YTT zircon interiors are between 100 and 300 kyrs ago (Reid and Vasquez, 2016). ^{238}U-^{230}Th outermost zircon rim crystallization ages (2σ) for the post-caldera domes define a population that overlaps YTT outermost zircon rim ages dating back to ~350 kyrs ago (Figure 3.5). The YTT zircons yield a weighted average rim age of 95.0 ± 6.0 kyrs ago (MSWD = 3.6), while the weighted average rim ages for the Pardepur, Samosir, and Pusuk Buhit lava domes are 85.6 ± 9.5, 104 ± 5, and 105 ± 19 kyrs ago respectively (MSWD = 3.3; 2.7; 1.4 respectively; Figure 3.4; Appendix Table 3.2).

Sediment Ages

Previous dating of sediments on Samosir Island have shown that the isochronous sediment cover over the main uplift of the island was deposited c.a. ~33.7 kyrs ago (de Silva et al., 2015). This age also represents the last moment in time the resurgent dome was under the lake. The youngest age is from sediment found on the Tuk Tuk peninsula, c.a. ~8.2 kyrs ago, assumed to be the age at which the lava dome was last under water. Newer radiocarbon ages from other sediment samples found on the Tuk Tuk peninsula have extended the story of uplift at Tuk Tuk, reflecting younger ages than previously sampled (Figure 3.6; Table 3.2). Sediment layers at the lava dome-sediment layer contact have returned ages of 12.77 ± 0.05 kyrs ago, 4.27 ± 0.03 kyrs ago, and 2.69 ± 0.03 kyrs ago (Figure 3.7; Figure 3.8), implying that the history of uplift at Tuk Tuk is more complex than previously thought.

DISCUSSION

Age and stratigraphic relationships indicate that the first Samosir lava domes were emplaced to form what today is the Tuk Tuk peninsula and then progressed south along the Samosir Fault (Figure 3.1). Activity then migrated to the western and southern margin of the caldera. On the western margin at Pusuk Buhit, two lava flows were erupted separately, one at ~62 kyrs ago, followed by a younger lava flow ~54 kyrs ago. In the southern Pardepur region, the lava dome erupted on the caldera rim (~63 kyrs ago) was emplaced on top of older lava flows related to the Oldest Toba Tuff caldera ~0.8 Myrs ago, whereas the island lava dome (~57 kyrs ago) extruded after the YTT eruption (~74 kyrs ago). These data indicate the Pardepur lava domes are polygenetic. Each spatiotemporal grouping of lava domes is therefore interpreted as a separate pulse of eruptions from the post-climactic magma system.

Recent Resurgent Activity

The eruption of the Samosir lava domes along the Samosir Fault, where uplift of at least 700 m is recorded (Figure 3.1; Chesner, 2012; de Silva et al., 2015), clearly demonstrates the link between the resurgent volcanism and structural uplift of Samosir and suggests that the contribution of magmatism to the uplift of the resurgent dome would have been greatest during the emplacement of the Samosir lava domes. While previous work (de Silva et al., 2015) presented a model where a single pulse of magmatism at 30 kyrs ago could have accounted for the temporal pattern of uplift of Samosir, it now appears that episodic magmatism and uplift beginning immediately after the climactic eruption must be considered. Moreover, radiocarbon dating of sediments found overlying the Tuk Tuk peninsula domes (Figure 3.6) placed the youngest lake sediments at 8.22 ± 0.04 kyrs ago (Figure 3.7; de Silva et al.,

2015), while the lava dome-lake sediment contact yields an age of 12.77 ± 0.05 kyrs ago (Figure 3.8; Table 3.2). Since zircon eruption ages suggest the extrusion of the Samosir lava domes continued for 4.4 ± 6.4 kyrs after the climactic eruption (Figure 3.3k) and these ages are distinct from the ages of sediment cover on the domes (Figure 3.6), we propose the following sequence of events for the development of the Tuk Tuk peninsula.

Soon after the climactic eruption, several polygenetic lobes of lava domes extruded in close proximity, starting with the North Samosir lava dome (~70 kyrs ago) and the Tuk Tuk dome (~69 kyrs ago), followed by a lobe of the West Tuk Tuk lava dome (~68 kyrs ago), and ending with the Bukit Kerbau lava dome (~65 kyrs ago). The West Tuk Tuk and Bukit Kerbau lava domes are significantly younger than the YTT (Figure 3.3K), therefore these eruptions define a separate episode after the climactic eruption. The earliest sediments on the Tuk Tuk peninsula are dated to 12.77 ± 0.05 kyrs ago. This suggests that the Tuk Tuk peninsula was down faulted, causing it to drop below lake level. Lake sediment was then deposited on the Tuk Tuk peninsula from 12.77 ± 0.05 kyrs ago to 8.22 ± 0.04 kyrs ago (de Silva et al., 2015), producing a thick lake sediment package seen on top of Bukit Kerbau (Figure 3.7). At ~8 kyrs ago, the Tuk Tuk peninsula was again uplifted above lake level, terminating lake sediment deposition with the youngest lake sediment age of 8.22 ± 0.04 kyrs ago (de Silva et al., 2015).

Following this event, further subsidence of the eastern portion of the Bukit Kerbau lava dome occurred at 4.27 ± 0.03 kyrs ago, based on the age of sediment on top of the lava (Figure 3.7). An even younger faulting event

occurred in the northern section of the Tuk Tuk peninsula, on the West Tuk Tuk lava dome (Figure 3.8), producing a lava dome-lake sediment contact age of 2.69 ± 0.03 kyrs ago. Subsequently, this area was again uplifted above lake level, terminating lake sediment deposition and leaving lake sediments of different ages at a similar elevation height of ~950 m (Figure 3.8). These constraints indicate that magmatic resurgence at Toba, driving episodic submergence and uplift of the Tuk Tuk peninsula, continued episodically until at least 2.7 kyrs ago, much more recently than previously known.

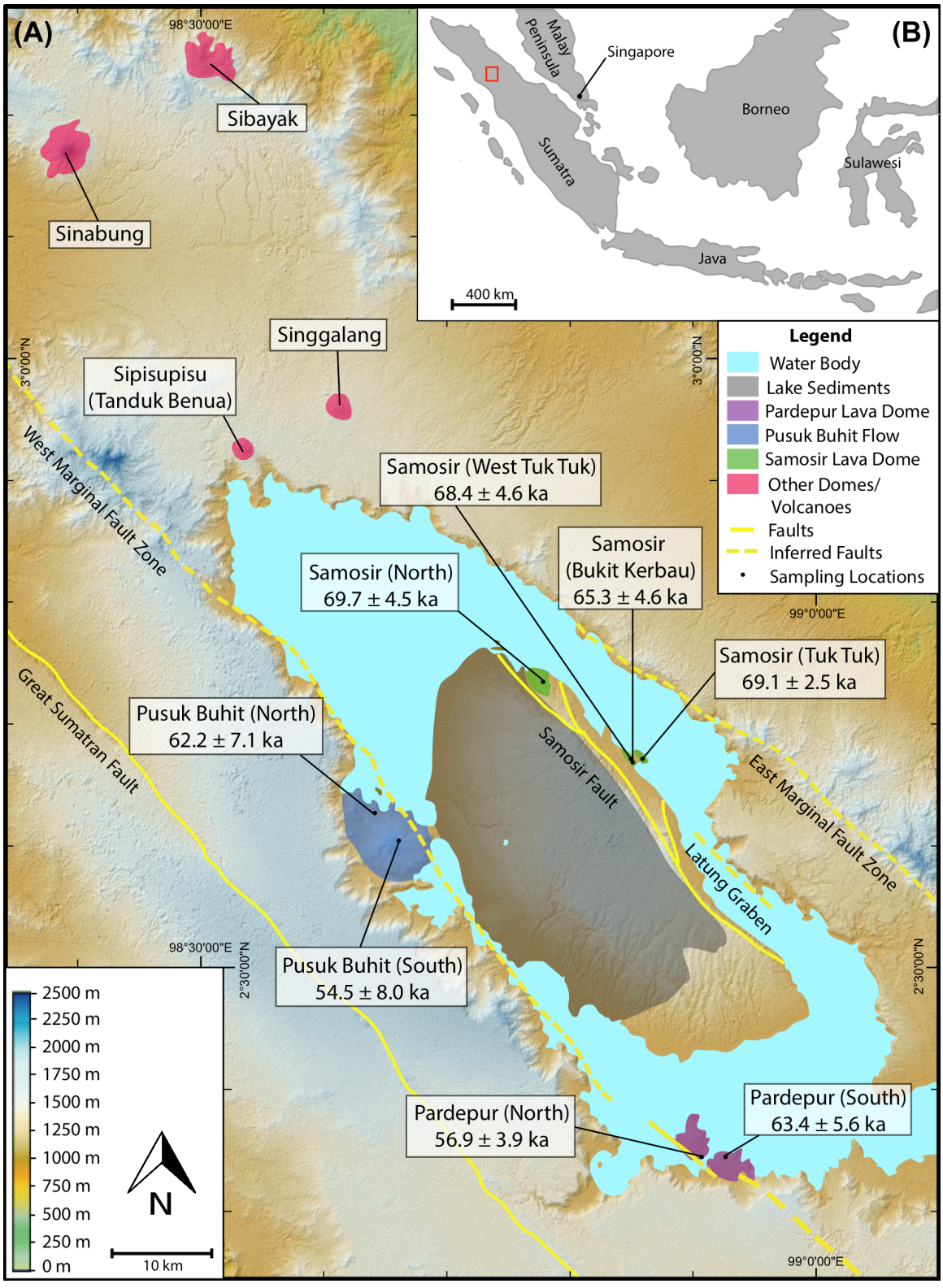
CONCLUSION

A significant record of structural and magmatic resurgence of Toba Caldera since the climactic eruption of the YTT, ~74 kyrs ago, is being revealed through new geochronological data. The new eruption and outermost zircon rim crystallization ages from the post-caldera lava domes reveal that extrusions of lava domes began immediately after the climactic eruption. Combined with the ^{14}C ages of sediments on post-caldera lava domes, these data indicate that resurgence at Toba started immediately after the YTT eruption, and eruptions continued episodically for another 6 to 24 kyrs (Figure 3.3K). The spatiotemporal pattern of the post-caldera lava domes records spatially discrete pulses of volcanism moving from along the Samosir Fault to the southern and western parts of the caldera. The spatial and temporal link between the Samosir lava domes and uplift of Samosir strongly indicates that magmatism associated with the volcanic episodes motivated uplift of the resurgent dome. The high-resolution temporal and spatial record of resurgence at Toba provides hitherto unknown details of post-supereruption recovery at supervolcanoes (Barker et al., 2014; Barker et al., 2015; Till et al., 2015). Toba's ~1 million year lifetime is

similar to that of other active large resurgent calderas worldwide such as Long Valley, Yellowstone, and the Valles Caldera. These systems, like Toba, all have geophysical and petrological evidence of active magmatic systems beneath them (Wolff and Gardner, 1995; Masturyono et al., 2001; Lowernstern and Hurwitz, 2008; Koulakov et al., 2009; Seccia et al., 2011; Jaxybulatov et al., 2014; Huang et al., 2015;), but are "older" in that the last supereruptions were at least 630 kyrs ago (Matthews et al., 2015). This has proved challenging for current geochronological techniques to provide insights into the immediate post-supereruption history. At older calderas, much of this evidence of post-supereruption history is probably destroyed or buried by subsequent activity. These findings at Toba indicate that magmatism beneath large calderas continues vigorously between supereruptions, motivating structural uplift and feeding hazardous eruptions within and around the caldera almost immediately after the climactic eruption.

Figure 3.1: Digital elevation map of Toba Caldera and locations of sampled and analyzed lava domes

(A) Sample locations and (U-Th)/He eruption ages of analyzed lava domes are indicated (green: Samosir domes; blue: Pusuk Buhit flows; purple: Pardepur domes; red: other volcanic extrusions). Inferred fault lines taken from Aldiss and Ghazali (1984). Base map is an Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) 30 m Digital Elevation Model (DEM).
(B) Overview of Southeast Asia; red rectangle outlines study area of Toba Caldera on the island of Sumatra, Indonesia, as shown in (A).


(A)
98°30'00"E
Sibayak
Sinabung
Singgalang
Sipisupisu
(Tanduk Benua)
West Marginal Fault Zone
Great Sumatran Fault
3°0'0"N
2°30'0"N
Samosir (West Tuk Tuk)
68.4 ± 4.6 ka
Samosir (North)
69.7 ± 4.5 ka
Samosir
(Bukit Kerbau)
65.3 ± 4.6 ka
Samosir (Tuk Tuk)
69.1 ± 2.5 ka
Pusuk Buhit (North)
62.2 ± 7.1 ka
Pusuk Buhit (South)
54.5 ± 8.0 ka
Samosir Fault
Latung Graben
East Marginal Fault Zone
Pardepur (North)
56.9 ± 3.9 ka
Pardepur (South)
63.4 ± 5.6 ka
99°0'0"E
(B)
Malay Peninsula
Singapore
Borneo
Sumatra
Sulawesi
Java
400 km
Legend
Water Body
Lake Sediments
Pardepur Lava Dome
Pusuk Buhit Flow
Samosir Lava Dome
Other Domes/ Volcanoes
Faults
Inferred Faults
Sampling Locations
2500 m
2250 m
2000 m
1750 m
1500 m
1250 m
1000 m
750 m
500 m
250 m
0 m
N
10 km

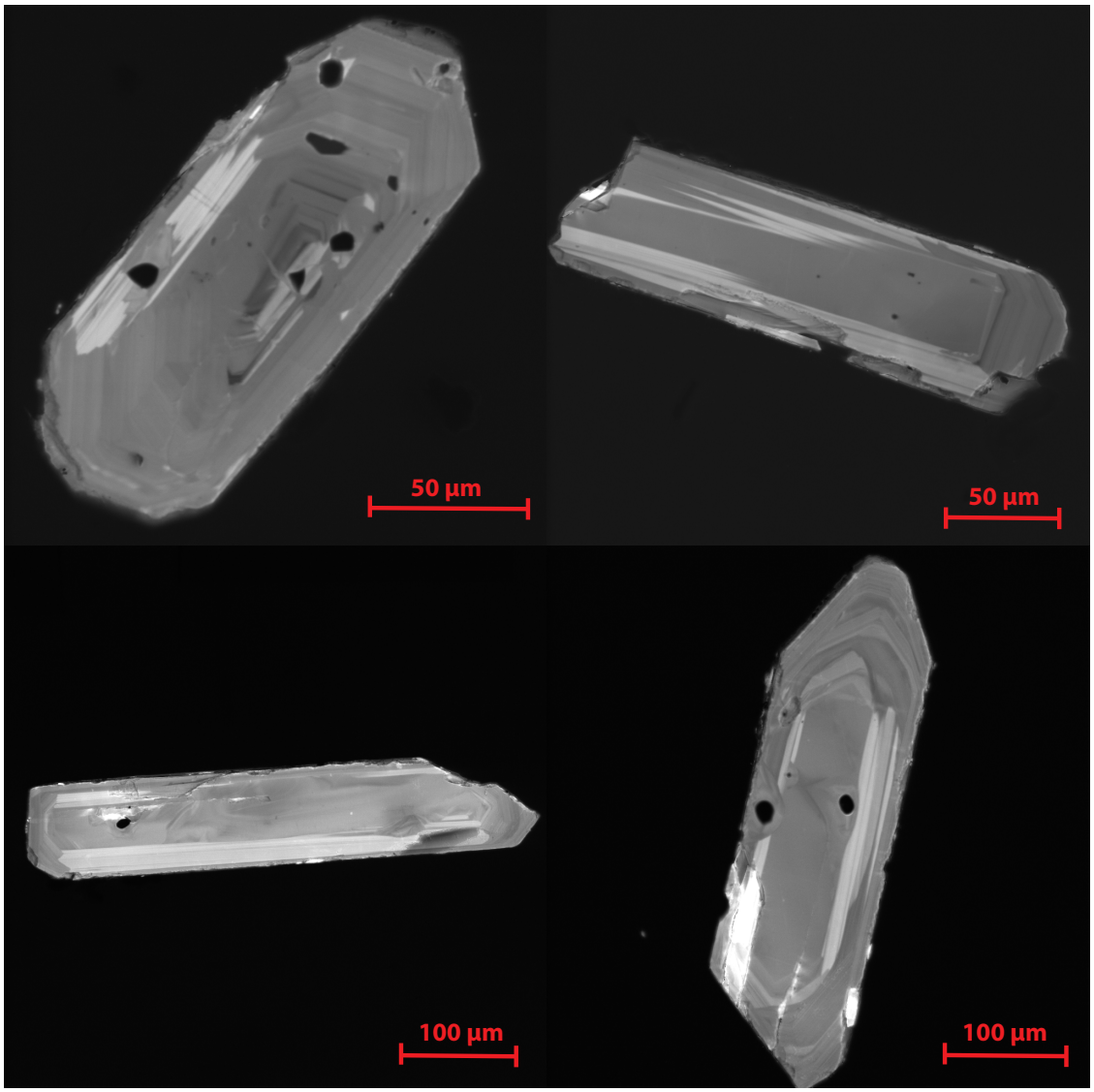


Figure 3.2: Cathodeluminescence (CL) images of representative zircon crystals from Toba samples

Top row (left to right): YTT zircon (LT_12_001), Samosir lava dome zircon (LT_12_003)
Bottom row (left to right): Pardepur lava dome zircon (LT_12_016) and Pusuk Buhit lava flow zircon (LT_14_007).
Darker regions are relatively enriched in uranium, whereas lighter regions are poor in uranium.

Figure 3.3: Rank-ordered disequilibrium corrected (U-Th)/He zircon ages and evolution of Toba samples

(A) – (J): Rank-ordered disequilibrium corrected (U-Th)/He zircon ages with Gaussian curve of best-fit error-weighted eruption ages for individual Youngest Toba Tuff (YTT) and Toba lava dome samples. Individual crystal eruption ages (as points) plotted with ± 2 standard error (σ) bars. Error weighted average eruption ages with ± 2σ (as shown by Gaussian curve for each sample) are calculated using MCHeCalc (Schmitt et al., 2006). MSWD refers to the Mean Square of Weighted Deviates. Plotted data can be found in Appendix Table 3.1.
(K): Evolution of Toba lava domes after YTT eruption, ranked according to (U-Th)/He error weighted average eruption ages. Grey bar represents range of YTT eruption ages from most recent $^{40}Ar/^{39}Ar$ analysis of YTT samples (Storey et al., 2012; Mark et al., 2014).

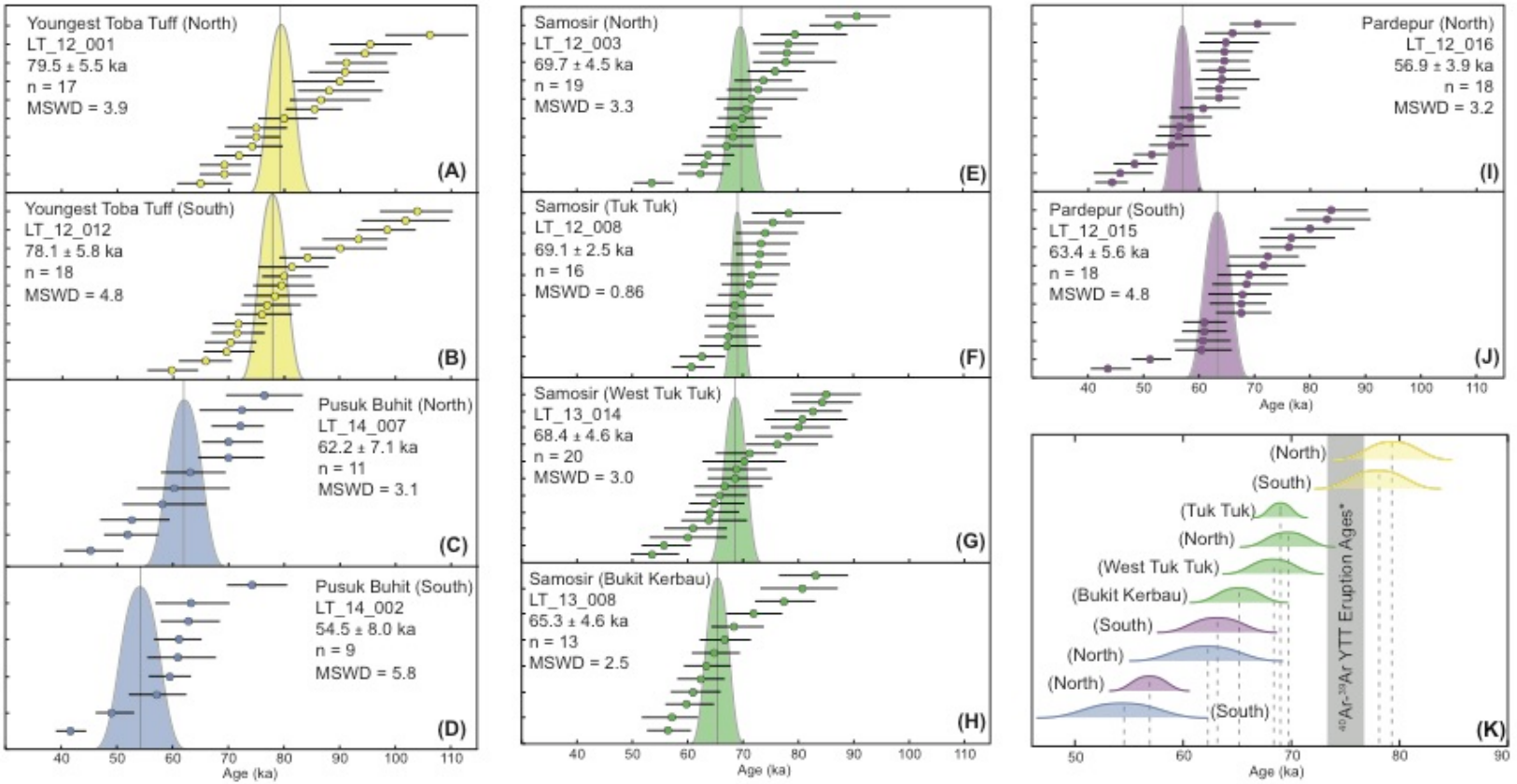
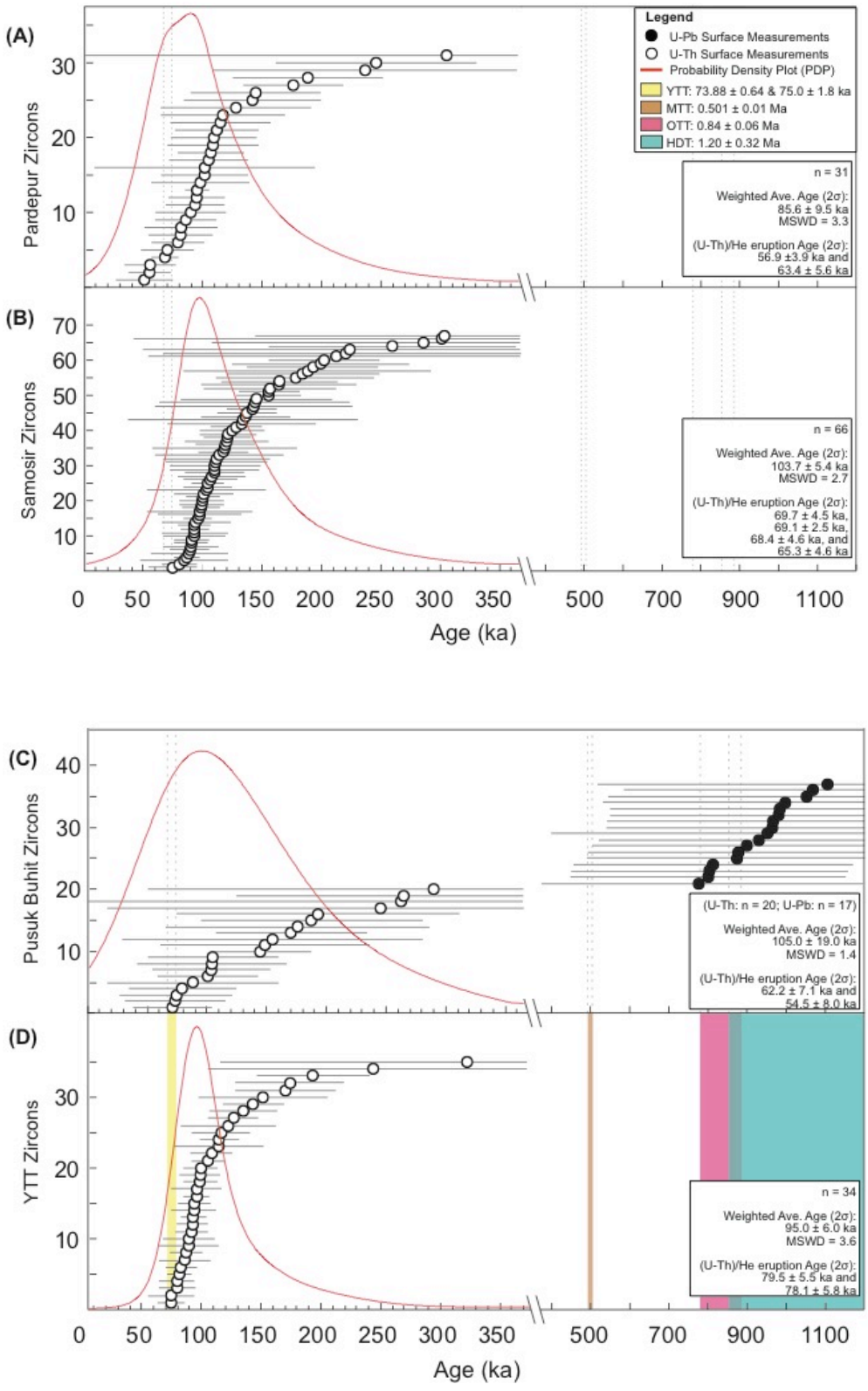

Youngest Toba Tuff (North)
LT_12_001
79.5 ± 5.5 ka
n = 17
MSWD = 3.9
(A)
Youngest Toba Tuff (South)
LT_12_012
78.1 ± 5.8 ka
n = 18
MSWD = 4.8
(B)
Pusuk Buhit (North)
LT_14_007
62.2 ± 7.1 ka
n = 11
MSWD = 3.1
(C)
Pusuk Buhit (South)
LT_14_002
54.5 ± 8.0 ka
n = 9
MSWD = 5.8
(D)
40 50 60 70 80 90 100 110
Age (ka)
Samosir (North)
LT_12_003
69.7 ± 4.5 ka
n = 19
MSWD = 3.3
(E)
Samosir (Tuk Tuk)
LT_12_008
69.1 ± 2.5 ka
n = 16
MSWD = 0.86
(F)
Samosir (West Tuk Tuk)
LT_13_014
68.4 ± 4.6 ka
n = 20
MSWD = 3.0
(G)
Samosir (Bukit Kerbau)
LT_13_008
65.3 ± 4.6 ka
n = 13
MSWD = 2.5
(H)
40 50 60 70 80 90 100 110
Age (ka)
Pardepur (North)
LT_12_016
56.9 ± 3.9 ka
n = 18
MSWD = 3.2
(I)
Pardepur (South)
LT_12_015
63.4 ± 5.6 ka
n = 18
MSWD = 4.8
(J)
40 50 60 70 80 90 100 110
Age (ka)
(North)
(South)
(Tuk Tuk)
(North)
(West Tuk Tuk)
(Bukit Kerbau)
(South)
(North)
(North)
(South)
40Ar-39Ar YTT Eruption Ages*
(K)
50 60 70 80 90
Age (ka)

Figure 3.4: ^{238}U-^{230}Th and ^{238}U-^{206}Pb ages of surfaces of zircon crystals from Toba

(A) – (D): ^{238}U-^{230}Th and ^{238}U-^{206}Pb ages of surfaces of zircon crystals plotted for Toba. Panels (B) - (C) show post-YTT lava dome zircons from Toba, and panel (D) shows YTT zircons. All zircon ages younger than 350 kyrs ago are dated with ^{238}U-^{230}Th. Ages older than 350 kyrs ago are dated with ^{238}U-^{206}Pb. $^{40}Ar/^{39}Ar$ age range (Storey et al., 2012; Mark et al., 2014) for the Youngest Toba Tuff (YTT) eruption with ± 2 standard error (σ) shown by vertical yellow lines. Eruption ages (Chesner, 2012) with ± 2σ of Haranggaol Dacite Tuff (HDT), Oldest Toba Tuff (OTT), Middle Toba Tuff (MTT) shown in aqua, pink, and brown vertical lines, respectively. All errors shown are ± 2σ; n refers to the number of grains analyzed for each sample; y-axes show numbers of zircons for ranked-order plot; MSWD refers to Mean Square of Weighted Deviates; see Appendix Table 3.2 for complete dataset.


(A)
Pardepur Zircons
(B)
Samosir Zircons
(C)
Pusuk Buhit Zircons
(D)
YTT Zircons
Legend
U-Pb Surface Measurements
U-Th Surface Measurements
Probability Density Plot (PDP)
YTT: 73.88 ± 0.64 & 75.0 ± 1.8 ka
MTT: 0.501 ± 0.01 Ma
OTT: 0.84 ± 0.06 Ma
HDT: 1.20 ± 0.32 Ma
n = 31
Weighted Ave. Age (2σ):
85.6 ± 9.5 ka
MSWD = 3.3
(U-Th)/He eruption Age (2σ):
56.9 ±3.9 ka and
63.4 ± 5.6 ka
n = 66
Weighted Ave. Age (2σ):
103.7 ± 5.4 ka
MSWD = 2.7
(U-Th)/He eruption Age (2σ):
69.7 ± 4.5 ka,
69.1 ± 2.5 ka,
68.4 ± 4.6 ka, and
65.3 ± 4.6 ka
(U-Th: n = 20; U-Pb: n = 17)
Weighted Ave. Age (2σ):
105.0 ± 19.0 ka
MSWD = 1.4
(U-Th)/He eruption Age (2σ):
62.2 ± 7.1 ka and
54.5 ± 8.0 ka
n = 34
Weighted Ave. Age (2σ):
95.0 ± 6.0 ka
MSWD = 3.6
(U-Th)/He eruption Age (2σ):
79.5 ± 5.5 ka and
78.1 ± 5.8 ka
Age (ka)

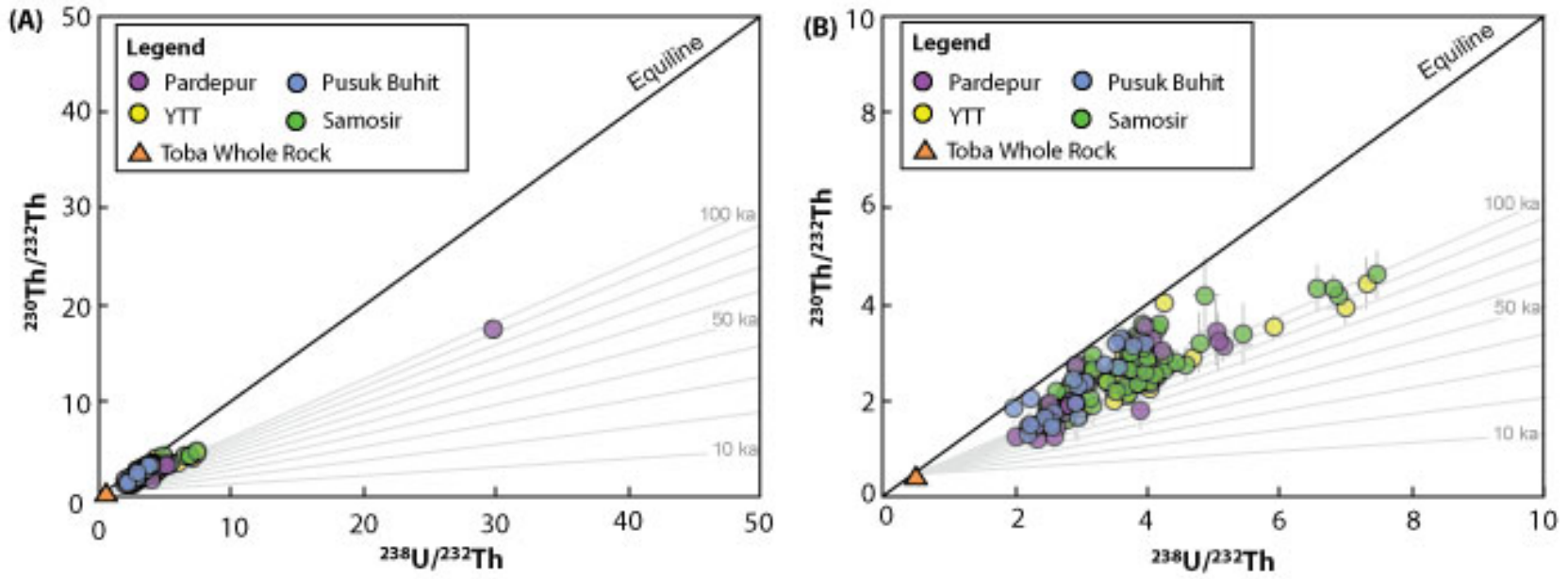
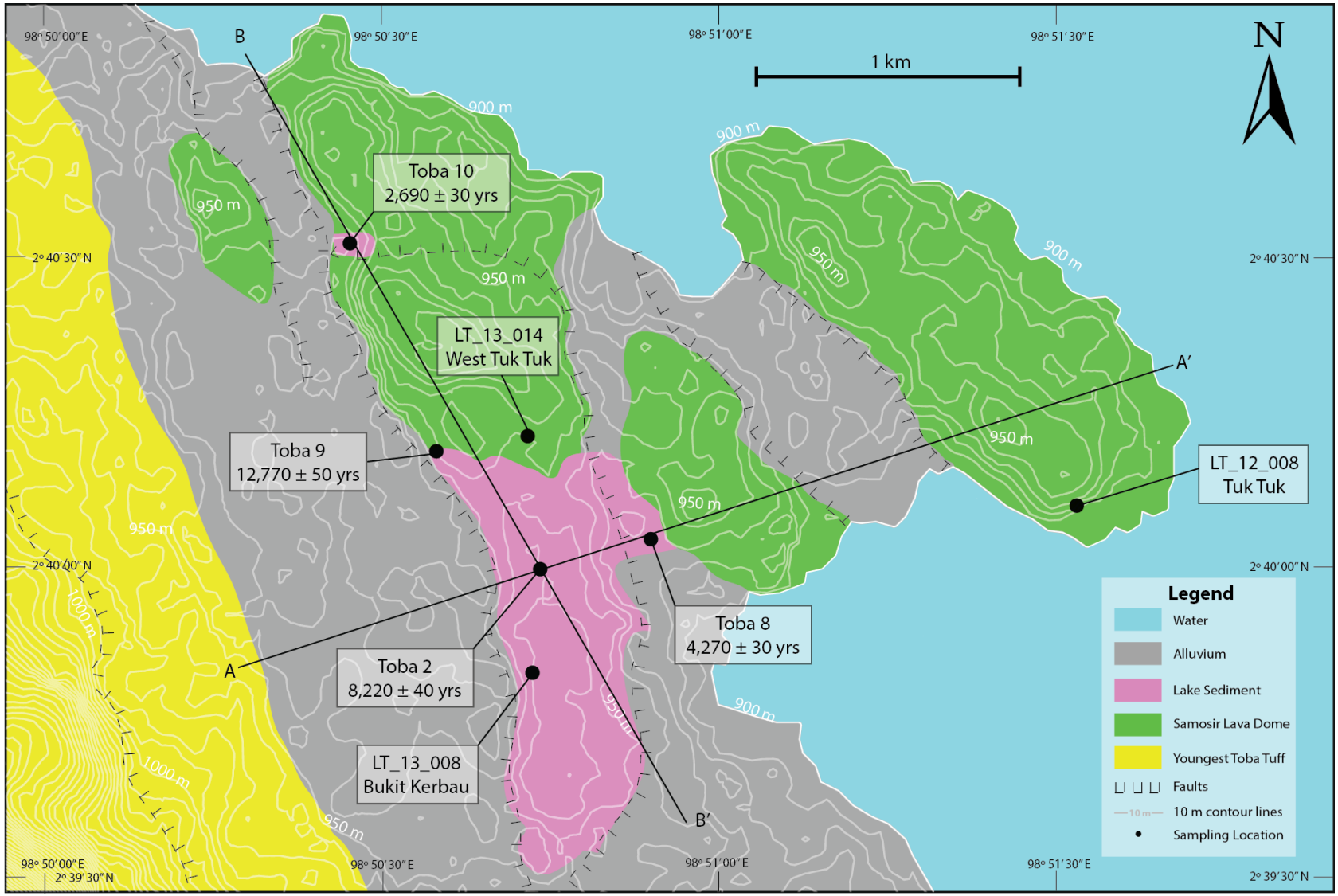


Figure 3.5: ^{238}U-^{230}Th and ^{232}Th-^{230}Th disequilibrium plot of Toba samples

^{238}U-^{230}Th and ^{232}Th-^{230}Th disequilibrium plot of Youngest Toba Tuff, Samosir lava domes, Pardepur lava domes, and Pusuk Buhit lava flows. Toba whole rock isotopic compositions are (^{232}Th-^{230}Th) = 0.465 ± 0.004 and (^{238}U-^{230}Th) = 0.517 ± 0.002 (2 standard error (σ); Vasquez and Reid, 2004). Faint grey lines are calculated isochrons in 10 kyr increments, spanning the ages of the surface peak ages from 10 kyrs ago to 100 kyrs ago. Panel (A) shows entire data set, while panel (B) is a close up, showing the data plotted between values of 0 – 10 for both (^{238}U-^{230}Th) and (^{232}Th-^{230}Th). Error bars are ± 2σ; plotted data is found in Appendix Table 3.2.

Figure 3.6: Overview location map of lake sediments on Tuk Tuk Peninsula

The Tuk Tuk peninsula is made up of several lobes of lava domes that have faulted to form three sections (Tuk Tuk, West Tuk Tuk, Bukit Kerbau). The lake sediments deposited on top of these lava domes were sampled to constrain the minimum age for the emplacement of the Tuk Tuk lava dome. Sampling locations are indicated by black dots; sediment samples are labeled as found in Table 3.2; lava dome samples are labeled as found in Table 3.1. Faults are inferred from the surrounding geology; any evidence of fault scarps have either been destroyed through construction or are obstructed by forests growing along the edge of the lava domes.


98° 50′ 00″ E
98° 50′ 30″ E
98° 51′ 00″ E
98° 51′ 30″ E
2° 40′ 30″ N
2° 40′ 00″ N
2° 39′ 30″ N
1 km
N
B
B′
A
A′
900 m
950 m
1000 m
Toba 10
2,690 ± 30 yrs
LT_13_014
West Tuk Tuk
Toba 9
12,770 ± 50 yrs
Toba 8
4,270 ± 30 yrs
Toba 2
8,220 ± 40 yrs
LT_13_008
Bukit Kerbau
LT_12_008
Tuk Tuk
Legend
Water
Alluvium
Lake Sediment
Samosir Lava Dome
Youngest Toba Tuff
Faults
10 m contour lines
Sampling Location

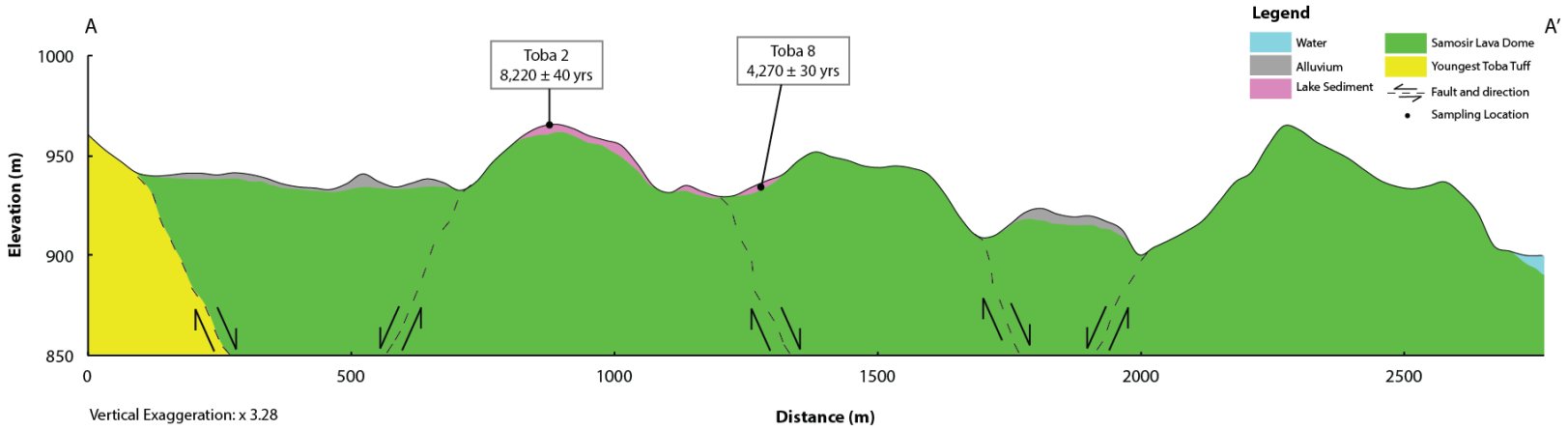


Figure 3.7: A-A' cross-section across Tuk Tuk peninsula

(A-A') East-west cross-section of the Tuk Tuk peninsula showing the geology, faulting, and sediment locations from the Samosir Fault through the Youngest Toba Tuff to the Tuk Tuk coast (lake level at 900 m).

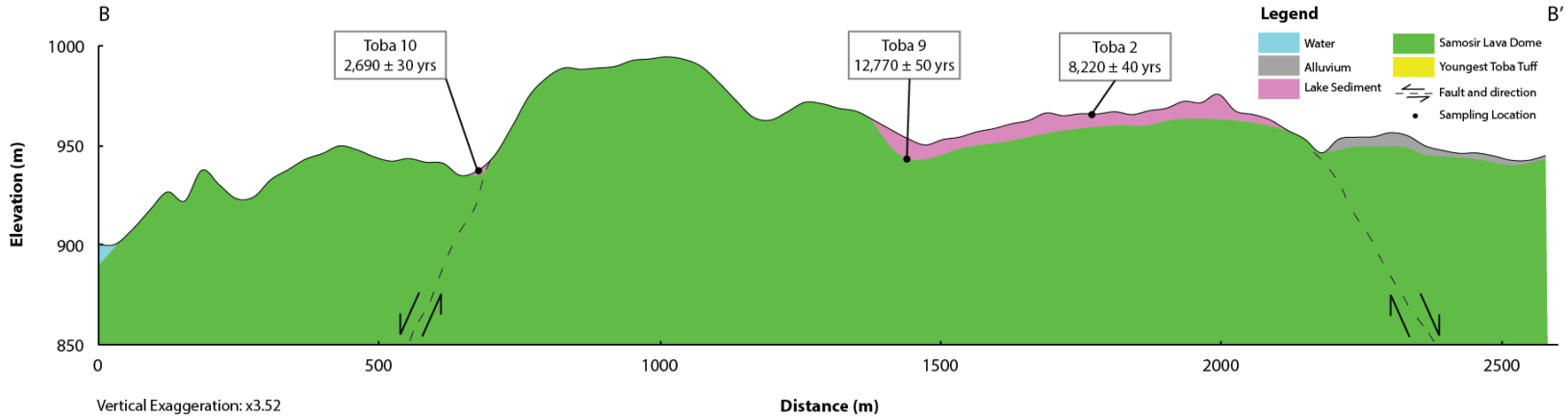


Figure 3.8: B-B' cross-section across Tuk Tuk peninsula

(B-B') North-south cross-section of the Tuk Tuk peninsula showing the geology, faulting and sediment locations along the length of the lava dome, starting at the northern Tuk Tuk coast (lake level at 900 m).

Table 3.1: (U-Th)/He eruption ages for Samosir resurgent lava domes.

Sample Name	Sample ID	Rock Type	Latitude (N)*	Longitude (E)*	Elevation (m)	Eruption Age^ (ka)	± 2σ (ka)	MSWD
Youngest Toba Tuff (North)	LT_12_001	Rhyolitic Tuff	02°59.63	098°32.64	1361	79.5	5.5	3.9
Youngest Toba Tuff (South)	LT_12_012	Rhyolitic Tuff	02°39.12	098°57.52	1041	78.1	5.8	4.8
Samosir (North)	LT_12_003	Rhyolitic Lava	02°44.46	098°46.86	925	69.7	4.5	3.3
Samosir (Tuk Tuk)	LT_12_008	Rhyolitic Lava	02°40.21	098°51.42	919	69.1	2.5	0.86
Samosir (West Tuk Tuk)	LT_13_014	Rhyolitic Lava	02°40.20	098°50.72	964	68.4	4.6	3
Samosir (Bukit Kerbau)	LT_13_008	Rhyolitic Lava	02°39.84	098°50.72	965	65.3	4.6	2.5
Pusuk Buhit (North)	LT_14_007	Andesitic Lava	02°37.76	098°38.14	1025	62.2	7.1	3.1
Pusuk Buhit (South)	LT_14_002	Dacitic Lava	02°35.91	098°38.58	1613	54.5	8.0	5.8
Pardepur (North)	LT_12_016	Dacitic Lava	02°20.88	098°54.08	917	56.9	3.9	3.2
Pardepur (South)	LT_12_015	Dacitic Lava	02°20.82	098°55.68	1038	63.4	5.6	4.8

* Lat/Lon in WGS 84 geographical coordinate system
^ Ages based on combined U-Th and (U-Th)/He data
Note: σ represents standard error
Full data set provided in Appendix Table 1

Table 3.2: Radiocarbon ages of sediments on Samosir Island.

Sample	Lab No.	Material: Pretreatment	^{14}C Age	± 1 s.d. yr BP	^{13}C/^{12}C ‰	Conventional Age ± 1s yr BP	Calibrated age range (95.4% probability) Cal yrs BP	Location	Lat (N)*	Lon (E)*	Elevation	Source
TOBA 2	347763	organic sediment: acid washes	8220	40	-24.9	8220 ± 40	9300-9030	Bukit Kerbau	02° 39.999	098° 50.757	955m	de Silva et al. 2015
TOBA 8	361811	organic sediment: acid washes	4190	30	-20.1	4270 ± 30	4860 - 4830	Bukit Kerbau (Peak 1)	02° 40.058	098° 50.933	933m	This Study
TOBA 9	361812	organic sediment: acid washes	12740	50	-23.1	12770 ± 50	13240 - 13110	Bukit Kerbau (Peak 2)	02° 40.188	098° 50.598	943m	This Study
TOBA 10	361813	organic sediment: acid washes	2620	30	-20.6	2690 ± 30	900 - 800	Bukit Kerbau (Peak 3 and 4)	02° 40.512	098° 50.457	951m	This Study

* Lat/Lon in WGS 84 geographical coordinate system
Note: Error s.d. used is standard deviation

CHAPTER 4: PERSPECTIVES OF RESURGENT MAGMATIC ACTIVITY AT TOBA CALDERA FROM SINGLE CRYSTAL $^{40}AR/^{39}AR$ AGES

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ABSTRACT

The Toba Caldera, located in Indonesia, is the youngest resurgent caldera found worldwide, entering its current cycle of resurgence after the last caldera eruption at 74 kyrs ago and producing the Youngest Toba Tuff (YTT). Accompanying the period of resurgence was the uplift and formation of the resurgent dome, Samosir Island, and several lava domes along ring fractures and faults that cut through the caldera. Previous geochronology for four of these lava dome localities (North Samosir, Tuk Tuk Samosir, North Pardepur, South Pardepur) by combined U-Th-disequilibrium/(U-Th)/He zircon geochronology yielded eruption ages ranging from 69.7 ± 4.5 kyrs ago to 56.9 ± 3.9 kyrs ago, implying resurgent volcanic activity started almost immediately after the climactic eruption and continued for ~20,000 years. $^{40}Ar/^{39}Ar$ ages from sanidine and plagioclase feldspar crystals from the same lava domes have returned ages that are contemporaneous with the climactic eruption, between 74.3 ± 0.4 and 71.4 ± 8.2 kyrs ago for North Samosir, Tuk Tuk Samosir, and South Pardepur, with only North Pardepur showing a substantially younger $^{40}Ar/^{39}Ar$ crystallization age of 23.6 ± 9.8 kyrs ago. These ages overlap with the (U-Th)/He ages, but the younger error weighted average (U-Th)/He eruption ages imply that the process of resurgence is more complex. Using eruption temperatures and a simple argon diffusion model, the difference between the weighted mean (U-Th)/He age and stacked plateau $^{40}Ar/^{39}Ar$ ages can be explained by a difference in closure temperatures between argon and helium. Sanidine and plagioclase feldspar crystals from three lava domes record the YTT eruption age and are interpreted to be antecrysts that remained in the remnant magma system below argon closure temperature (T_c) in sanidine/plagioclase

(350°C). In contrast, the younger North Pardepur lava dome $^{40}Ar/^{39}Ar$ inverse isochron plagioclase age of 47.9 ± 11.1 kyrs ago overlaps with the (U-Th)/He age, implying that plagioclase crystals are either autocrysts, formed during the eruption of the North Pardepur dome, or YTT antecrysts that have been reset due to their host magma remaining above argon T_c for >700 yrs.

INTRODUCTION

Large silicic calderas are found all over the world, such as at the Yellowstone and Long Valley calderas (in the USA), Aira Caldera (in Japan), and Taupo Caldera (in New Zealand), are the result of large catastrophic eruptions that release hundreds of thousands of cubic meters of ash and pumice into the stratosphere, potentially affecting regional environments and global climate (Rampino and Self, 1992; Zielinski et al., 1996; Oppenheimer, 2002; Williams et al., 2009). Hazards posed by eruptions from these systems are unimaginable and unquantifiable, since there has not been such a large-scale eruption in historic times. These caldera systems go through a caldera cycle starting from the initial build up of magma that culminates with the climactic eruption (Smith and Bailey, 1968; Cole et al., 2005). The majority of research on these caldera-forming systems focuses on the climactic eruptions and the impacts from those eruptions. However, no significant research has focused on the final stage of the caldera cycle known as resurgence. Resurgence is defined as the period where the floor of the caldera is structurally deformed and uplifted followed by the extrusion of lava domes (Smith and Bailey, 1968; Marsh, 1984; Kennedy et al., 2012). Associated hazards related to the geologic activity during resurgence may occur, such as earthquakes from structural uplift, and volcanic activity related to the lava dome extrusions. Despite active calderas being in a state of

"restlessness" (Newhall and Dzurisin, 1988), the entire process of resurgence is still not well understood. In order to better constrain these resurgence-related hazards, it is necessary to be able to constrain the parameters associated with resurgence, such as timescales. Two particular aspects of resurgence timescales that need to be constrained are the initial and final stage(s). The beginning of resurgence can be defined as when structural deformation or volcanic activity on the surface initiates. Defining the start of structural deformation would require the dating of faults and organic matter found on the floor of the caldera. Due to the poor preservation and nature of erosion on such features for an uplifted caldera floor, using structural deformation is not a viable option for most calderas. Using the eruption ages of the post caldera lava domes as the start and end ages for resurgence is a method that is both more accessible and precise.

Toba Caldera

The Toba Caldera consists of a caldera complex made of four overlapping caldera-forming eruptions (Chesner and Rose, 1991; Chesner, 2012). The first eruption was the Haranggaol Dacite Tuff (HDT) that erupted at 1.20 ± 0.16 Ma (Nishimura et al., 1977) in the northern part of the Caldera. This first eruption was followed by the Oldest Toba Tuff (OTT) at 0.84 ± 0.03 Ma (Diehl et al., 1987) that produced 2300 km^3 of rhyolitic ignimbrite to the south, forming the Porsea Caldera. The next Toba eruption produced the Middle Toba Tuff (MTT) at 0.501 ± 0.005 Ma (Chesner et al., 1991) in the northern section of Toba and is thought to have originated from a similar source as the HDT. The last eruption produced the Youngest Toba Tuff (YTT) at ~74 kyrs ago (73.88 ± 0.64 kyrs ago and 75.0 ± 1.8 kyrs ago; Storey et al., 2012 and Mark et al., 2014, respectively) that erupted 2800 km^3 of rhyolitic ash and pumice that created the

present caldera. It is unknown whether Toba underwent resurgence in between each caldera eruption. However, since the last eruption, Toba entered a period of resurgence in which the floor of the caldera was structurally uplifted to form a resurgent dome in the middle of the caldera known as Samosir Island.

Volcanic activity coincided with the structural deformation and uplift at Toba. Lava domes were extruded along the caldera fracture rim and along faults intruding across the length of the resurgent dome. On Samosir Island, resurgent lava domes erupted on the north and east coast, forming the Samosir lava domes (Chesner, 2012; Mucek et al., 2017). These domes are geochemically similar to the YTT (rhyolitic). Along the southern end of the caldera rim, lava domes erupted along the rim covering older lava flows (most likely during the OTT) that formed a small island, Pulau Sibandang. Collectively, these southern extrusions are known as the Pardepur lava domes (Chesner, 2012; Mucek et al., 2017). The Pardepur lava domes are unlike the Samosir domes, in that they are more dacitic than rhyolitic. Other resurgent lava domes that erupted include basaltic andesite to andesitic domes in the north (forming Sipisupisu and Singgalang) and andesitic to dacitic lava flows found on a composite stratovolcano along the western rim of the caldera known as Pusuk Buhit. These western and northern caldera ring lavas are compositionally the most mafic of the lava domes found at Toba.

Previous studies at Toba have largely focused on the age of the youngest caldera forming eruption, the YTT. The most recent ages have been from Storey et al. (2012) and Mark et al. (2014) using $^{40}Ar/^{39}Ar$ dating on mineral phases. Storey et al. (2012) looked at total fusion of both single crystal and multigrain

sanidine aliquots from distal YTT tephra which was then astronomically calibrated with the NGRIP ice core; this returned a $^{40}Ar/^{39}Ar$ age of 73.88 ± 0.64 kyrs ago (2 sigma; full errors). Mark et al. (2014), on the other hand, looked at both biotite and sanidine crystals from proximal and distal YTT tephra; single grains of each mineral phase underwent total fusion. The ages resulting from total fusion were then plotted on a global inverse isochron dataset, and run through an optimization model (Renne et al., 2010) to return an age of 75.0 ± 1.8 kyrs ago (2 sigma; full errors). The only published data on the post-caldera eruption volcanic units are $^{40}Ar/^{39}Ar$ ages briefly mentioned in Chesner (2012); the dataset itself is not presented, merely mentioned. Based on $^{40}Ar/^{39}Ar$ incremental heating on sanidine crystals, Chesner (2012) reports that the ages of these post-caldera lava domes are "indistinguishable from the YTT (75-77 ka)". The YTT age that Chesner (2012) identifies is from previously $^{40}Ar/^{39}Ar$ dated sanidine crystals (Chesner et al., 1991). Chesner et al., (1991) looked at single grain total fusion on sanidine crystals from proximal YTT ignimbrite. Based on these previous ages, the eruption of the post-caldera lava domes could have occurred concurrently with the caldera collapse, implying that resurgence at Toba started immediately after (or during) the formation of the YTT caldera.

The Period of Resurgence at Toba Caldera

A recent study by Mucek et al. (2017) dated the post-caldera lava domes using the (U-Th)/He method on zircons that yielded ages that were younger than the YTT eruption. In this study, we dated the post-caldera lava domes again using $^{40}Ar/^{39}Ar$ geochronology on sanidine crystals and compared those results with the (U-Th)/He ages from the same samples (Figure 4.1). A comparison of the $^{40}Ar/^{39}Ar$ and (U-Th)/He ages will provide a better constraint of the lava

dome ages, thus constraining the timing of resurgence at Toba. If the lava domes erupted and crystallized in a short amount of time soon after the YTT eruption as suggested by Chesner et al. (1991) and Chesner (2012), then the $^{40}Ar/^{39}Ar$ and (U-Th)/He ages should be concordant.

Toba Caldera is the youngest documented resurgent caldera within the last 100,000 years (Chesner, 2012). The young age of caldera formation and resurgent dome, combined with young erupted volcanics presents a sample set of higher resolution associated with temporal details of the process of resurgence. Resurgence at Toba has been constrained using (U-Th)/He dating on zircon crystals (Mucek et al., 2017), which in itself may have limitations due to the longevity of zircon crystals and the protracted history found within each zircon crystal. Analyzing sanidine and plagioclase crystals from these lava domes using $^{40}Ar/^{39}Ar$ geochronology will better constrain the start and end of resurgence at Toba. Incremental heating of single-crystal sanidine and plagioclase crystals provides a resurgence timeline. Combining both the (U-Th)/He and $^{40}Ar/^{39}Ar$ techniques will help constrain the temporal history associated with resurgent magmatic activity at Toba.

METHODS

Four post-caldera lava domes were sampled; two from the Samosir lava domes and two from the Pardepur lava domes (Figure 4.1). Additionally, two YTT locations were sampled to provide a cross-reference to previously dated YTT samples. These samples were also previously used in the sampling of zircon crystals and dated by (U-Th)/He by Mucek et al. (2017). From one of the YTT samples, vapor phase sanidine crystals were picked out of vesicles from within

pumice pieces. The samples were crushed and sieved; material from the fraction size 355-500 μm was separated and cleaned thoroughly in deionized water before drying overnight at 55°C. Magnetic crystals and groundmass such as magnetite, biotite, and amphibole were separated from the non-magnetic minerals (sanidine, plagioclase, and quartz) using a Frantz Isodynamic Separator. Lithium Heteropolytungstate (LST) heavy liquid was used to separate sanidine from plagioclase and quartz. Individual sanidine crystals were handpicked from the YTT and Samosir dome samples to select euhedral and unfractured crystals with few to no inclusions. It must be noted that no sanidine crystals were found in the Pardepur dome samples so plagioclase crystals were selected for dating instead. The samples were then leached in 15% Hydrofluoric Acid (HF) for eight minutes to remove adhered glass before being ultrasonically cleaned in triple distilled water and dried overnight at 55°C. Each sample was sieved again to remove any fine-grained particles produced during the acid leaching process. Sanidine and plagioclase crystals were then handpicked under a binocular microscope to a purity of >99.9%. Furthermore, vapor phase sanidine crystals were hand-picked out of vesicles from one of the YTT samples for analysis, however they were only cleaned in triple distilled water, not leached in HF. Approximately 20 handpicked crystals (>10mg) for each sample were packed into aluminum capsules and subsequently vacuum-sealed in quartz vials. Standard crystals of a known age (FCT-NM; Fish Canyon Tuff sanidine standards produced from the New Mexico Geochronology Research Laboratory in Socorro, New Mexico) were packed into copper capsules and loaded in the quartz vials to measure the neutron flux in the reactor to ultimately obtain a J-curve needed for the age calculations. The heights of each packed sample were

recorded and determined using vernier calipers before being irradiated. The quartz vials were irradiated at the TRIGA (Cadminum-Lined In-Core Irradiation Tube (CLICIT)-position) nuclear reactor at Oregon State University for 30 minutes (16-OSU-02). After the two week cool down period, all the capsules were unpacked and the standards (flux monitors) were separated from the samples. Individual crystals for both the flux monitors (FCT-NM) and the samples were individually loaded into copper (Cu) plachettes for analysis on the ARGUS-VI multicollector mass spectrometer outfitted with four Faraday collectors (each outfitted with 1012 W ohm resistors) and an ion-counting CuBe electron multiplier (CDD), located next to the lowest mass Faraday collector. This set up allows for all argon isotopes (mass 36 on the multiplier; mass 37, 38, 39, 40 on the four Faradays) to be measured simultaneously. The Cu-planchettes were then loaded in an ultra-high vacuum sample chamber. Furthermore, the ARGUS-VI can be run in full multi-collector mode, while the highly sensitive electron multiplier measures the lowest mass peak (mass 36). This multiplier has a high peak/noise ratio and low dark/noise ratio.

The flux monitors were analyzed first by the total fusion method on individual crystals to create a J-curve for the age calculation. Individual J-values for each sample were calculated by parabolic extrapolation of the measured flux gradient against the irradiation height and typically give 0.1-0.15% uncertainties (1σ). The unknown samples were analyzed by incrementally heating single crystals of sanidine, while the plagioclase crystals were analyzed as single crystal total fusion. Both incremental heating and total fusion of the crystals used a defocused 25 W CO_2 laser beam, scanning across the crystal in preset patterns to heat each sample evenly. After heating, reactive gases within the laser

chamber and extraction line were cleaned using a SAES Zr-Al ST101 getter operated at 400°C for 90 seconds then exposed to two SAES Fe-V-Zr ST172 getters for 30 seconds; One getter is operated at 200°C and the other is operated at room temperature. The ages were calculated using the ArArCALC v2.7.0 software (Koppers, 2002) and analyzed against the flux monitors, the Fish Canyon Tuff standard (28.201 ± 0.046 Ma; 2σ; calibrated to Kuiper et al. 2008). Ages within the ArArCALC software (available from http://earthref.org/ArArCALC/) were calculated as both a weighted mean age (with $1/\sigma^2$ weighting factor; Taylor, 1997) and as a YORK2 least-squares fits (with correlated errors; York, 1969). Ages were calculated using the corrected decay constant 5.530 ± 0.097 $x10^{-10}$ yr^{-1} (at 2σ) (Steiger and Jäger, 1977; Min et al., 2000). Other constants used in the age calculations can be found in Koppers et al. (2003; Table 2 within). Calculated ages and error estimates include the corrections for blanks, baselines, irradiation production ratios, mass fractionation, and radioactive decay.

Ages measured and calculated include plateau ages (Table 4.1), calculated from incremental heating data (Appendix Table 4.1), and total fusion ages. The "plateau ages" are calculated from two or more contiguous temperature steps with apparent dates that are indistinguishable at the 95% confidence interval and represent ≥50% of the total $^{39}Ar_k$ released (Fleck et al., 1977). Steps were selected to minimize Mean Square Weighted Deviates (MSWD) of plateau age to fall within calculated 2σ confidence limit for full external errors. K/Ca ratios for all analyses are calculated weighted on the highest precision, not overall K/Ca values. Isochron analyses were used to assess any trapped non-atmospheric argon in any of the samples (York, 1969); in some cases, isochron

analyses were used to confirm the plateau ages for the sample. Total fusion ages (a total gas age) were calculated for each sample by weighting the averages of all the ages of all the gas fractions for each sample; this age is comparable to a conventional K-Ar age.

To obtain eruption temperatures of the lava domes, four thin sections were prepared from the same samples: one of the YTT (LT_12_001), one of the North Samosir lava dome (LT_12_003), and one of each of the Pardepur lava domes (LT_12_015 and LT_12_016). Ilmenite-magnetite pairs were identified in only two of the samples using a petrographic microscope. The two Pardepur lava domes contained pairs of ilmenite and magnetite, both touching and non-touching pairs (Appendix Figure 4.1). The YTT and Samosir lava dome thin sections, unfortunately, did not show any ilmenite crystals; only magnetite crystals were observed. To complete the data set, eruption temperatures from ilmenine-magnetite pairs presented in Chesner (2012) were used for these two samples. The two thin sections (LT_12_015 and LT_12_016) were coated with carbon before being placed into the electron microprobe for analysis. The electron microprobe used for analysis was the Oregon State University (OSU) Cameca SX-100 electron microprobe (EMP). Backscatted electron (BSE) images were taken of the pairs and used to pick points on each crystal for analysis. Analytical procedure and standards used for the analysis can be found in Appendix Table 4.1 and 4.2. Analysis data from ilmenite-magnetite pairs, and calculated temperatures using Ghiorso and Evans (2008) can be found in Appendix Table 4.3. Example of two types of ilmenite-magnetite pair measurements made can be seen in Appendix Figure 4.1.

Data was then plotted on a log-log magnesium/manganese plot (Appendix Table 4; Appendix Figure 4.2), following the steps outlined in Bacon and Hirschmann (1988) to test the equilibrium between the ilmenite and magnetite pairs. Analyses that fell outside of the 2 sigma error bars were discarded as these pairs would not be in equilibrium. Using the ILMAT spreadsheet (LePage, 2003), geothermometry for the data was calculated assuming geothermometer calculations by Stormer (1983) for oxygen fugacities (Appendix Table 4.5). The final log oxygen fugacity vs temperature plot (Appendix Figure 4.3) shows all three geothermometer calculations for Ghiorso and Evans (2008), Andersen and Lindsley (1985), and Spencer and Lindsley (1981).

RESULTS

All plateau, isochron and total fusion ages calculated are at 2σ errors. $^{40}Ar/^{39}Ar$ sample and age information can be found in Table 4.1 and the full argon data analysis can be found in Appendix Table 4.6.

Vapor Phase Age

Ten vapor phase sanidine crystals hand-picked from vesicles from the northern YTT sample were analyzed. Each individual crystal was incrementally heated to produce an age spectrum and observe how the argon was released from the sample until the crystal was completely melted. All ten plateau ages were combined to form a "stacked plateau age". They yielded a stacked plateau age of 74.3 ± 0.4 kyrs ago (Figure 4.2A), returning an age that is similar to the sanidine crystals from the bulk YTT sample (Storey et al., 2012; Mark et al.,

2014). The stacked inverse isochron age of 74.3 ± 0.4 kyrs ago for these crystals agrees with the stacked plateau age. This age overlaps with both the northern and southern YTT samples collected in this study.

Youngest Toba Tuff Ages

Four individual sanidine crystals from the northern YTT sample and fifteen individual sanidine crystals from the southern YTT sample were incrementally heated. The northern YTT sample returned a stacked plateau age of 74.5 ± 0.9 kyrs ago (Figure 4.2B), while the southern YTT sample measured a stacked plateau age of 74.1 ± 0.5 kyrs ago (Figure 4.2C). Their corresponding stacked inverse isochron ages of 74.6 ± 1.1 kyrs ago and 74.3 ± 0.5 kyrs ago agree with the stacked plateau ages. All of these ages correspond with published $^{40}Ar/^{39}Ar$ sanidine age of the YTT by Storey et al. (2012) at 73.88 ± 0.64 kyrs ago.

Post Caldera Lava Dome Ages

Ten sanidine crystals from each of the Samosir lava domes (collectively known as the Samosir lava dome) were analyzed. The North Samosir lava dome yielded a stacked plateau age of 73.9 ± 1.0 kyrs ago (Figure 4.2D) while the Tuk Tuk Samosir lava dome yielded a stacked plateau age of 74.3 ± 0.4 kyrs ago (Figure 4.2E). Their corresponding stacked inverse isochron ages were 73.4 ± 1.2 kyrs ago and 74.4 ± 0.4 kyrs ago, respectively. The Pardepur lava domes contained only a few plagioclase crystals for dating and these crystals were also smaller than 400 µm, which in turn created higher uncertainties than those from the sanidine analyses. Six crystals from the North Pardepur lava dome yielded a stacked plateau age of 23.6 ± 9.8 kyrs ago, but a stacked inverse isochron age of

47.9 ± 11.1 kyrs ago (Figure 4.2F), while eleven plagioclase crystals from the South Pardepur lava dome yielded a stacked plateau age of 71.4 ± 8.2 kyrs ago (Figure 4.2G), with an agreeing stacked inverse isochron age of 75.4 ± 7.0 kyrs ago.

DISCUSSION

(U-Th)/He ages from Mucek et al. (2017) indicate error weighted average eruption ages that are younger for the Samosir lava domes, older for the YTT, and similar for the Pardepur lava domes versus their sanidine $^{40}Ar/^{39}Ar$ ages. The error weighted average eruption ages represent the average age of the population of zircon crystals analyzed, with the average age calculated as weighted to include all errors (Mucek et al., 2017). The term "Δage" is given for the difference between the error weighted average age of the (U-Th)/He technique and the stacked $^{40}Ar/^{39}Ar$ plateau age for each sample. (U-Th)/He eruption ages place the YTT eruption at 79.5 ± 5.5 kyrs ago and 78.1 ± 5.8 kyrs ago, which overlaps within error of the $^{40}Ar/^{39}Ar$ age, giving a Δage of 5 and 4 kyr (Figure 4.3A and B, respectively). The two Samosir domes give (U-Th)/He error weighted average ages of 69.7 ± 4.5 kyrs ago and 69.1 ± 2.5 kyrs ago for Samosir (North) and Samosir (Tuk Tuk) domes. The corresponding $^{40}Ar/^{39}Ar$ ages were 73.9 ± 1.0 kyrs ago and 74.3 ± 0.4 kyrs ago, yielding a Δage of 4.2 and 5.2 kyr, respectively (Figures 4.3C and D), between the (U-Th)/He and $^{40}Ar/^{39}Ar$ ages. The South Pardepur lava dome yielded a $^{40}Ar/^{39}Ar$ crystallization age of 71.4 ± 8.2 kyrs ago, which is similar to the YTT (U-Th)/He eruption ages of 74.5 ± 5.7 kyrs ago, giving an Δage of 8 kyr (Figure 4.3F). In contrast, the North Pardepur lava dome gives a $^{40}Ar/^{39}Ar$ age of 23.6 ± 9.8kyrs ago, which is younger than the (U-Th)/He age; Δage is 33.3 kyrs (Figure 4.3E). While the

errors overlap between the ages from the two techniques, the difference between the (U-Th)/He age and $^{40}Ar/^{39}Ar$ age imply there is more to the eruption history. This is especially true when the Pardepur (North) is the only sample that is distinguishable from the YTT eruption age (even when including errors) in either technique.

The (U-Th)/He eruption ages from zircon crystals presented in Mucek et al. (2017) show magmatic resurgence starting at 69.7 ± 4.5 kyrs ago and ending at 56.9 ± 3.9 kyrs ago, moving west across the caldera. Sanidine and plagioclase $^{40}Ar/^{39}Ar$ ages from the same samples show that magmatic resurgence started almost immediately after the 74 kyrs ago eruption and continued until 23.6 ± 9.8kyrs ago. The similarity and overlap in $^{40}Ar/^{39}Ar$ ages of the Samosir domes and the South Pardepur lava dome with the YTT eruption age raise the possibility of a few scenarios. The lava domes could have erupted contemporaneously during the YTT eruption, however in the geologic stratigraphy, the lava domes are clearly emplaced on top of the YTT intracaldera ignimbrite. Furthermore, there are several individual zircons from these lava domes that return (U-Th)/He eruption ages that are younger than the YTT eruption (Figure 4.3C-F). (U-Th)/He dating measures the amount of trapped He within a zircon crystal after temperatures have cooled below helium closure temperature (T_c = 190°C; Reiners, 2005). It is unlikely that these young ages would be recorded within individual zircons if the eruptions occurred during the time of the YTT eruption. A second scenario would be one where new magma entered the system, picking up xenocrystic YTT sanidine and plagioclase crystals from the remnant YTT magma, thus returning $^{40}Ar/^{39}Ar$ ages on the sanidine and plagioclase crystals that are of YTT age. The issue with this scenario is that

if there was new magmatic influx, during the eruption and cooling of the dome from the new magma, autocrystic sanidine and plagioclase crystals should have also formed, returning younger $^{40}Ar/^{39}Ar$ ages reflective of the (U-Th)/He error weighted average eruption ages. The third scenario is that the magma that erupted to form the post-caldera lava domes on the surface is remobilized remnant magma. The remnant magmatic system would have remained cool enough to retain the YTT argon signature within the sanidine/plagioclase crystals until remobilization, while the He within the zircon would record the (U-Th)/He eruption age. This third scenario is most likely for two reasons. The first is that the compositions of the Samosir lava domes and the Pardepur lava domes are similar to the YTT composition (Chesner, 2012); this suggests that remnant magma is the main component of the lava domes as opposed to newer, more mafic magma. The compositions of lava domes from Samosir are similar to the YTT composition, both rhyolitic at >72 wt. % SiO_2. The Pardepur lava domes are rhyodacitic in composition, falling along a mixing line between the northern andesitic lavas and the rhyolitic YTT magmas (Chesner, 2012). Compositionally, the Samosir and Pardepur lava domes are likely remnant YTT magma. If the sanidine and plagioclase crystals are from remobilized remnant YTT magma, the magma system would have remained below argon closure temperature (T_c = 350°C; McDougall and Harrison, 1999) since the YTT eruption until right before the lava dome erupted. For the crystal-rich cooler magma to erupt as a lava dome, it must have been reheated just prior by a hot intrusion to trigger an eruption. The eruption of the remnant YTT magma would produce YTT sanidine/plagioclase crystals found within the remobilized remnant melt. The second reason is that the ^{238}U-^{230}Th surface analyses of the

zircon crystals show that the zircons crystallized around the time of the YTT eruption (and even pre-YTT; Mucek et al., 2017). This means that the crystallization of the zircons also date to older, YTT ages, but the He trapped within the zircons reflect the time of the eruption of these crystals. The resulting geochronological techniques thus produce sanidine and plagioclase crystals reflecting $^{40}Ar/^{39}Ar$ ages of the YTT and zircon crystals reflecting younger (U-Th)/He eruption ages.

Argon Diffusion

For the sanidine and plagioclase crystals to retain the YTT argon signature, yet the remnant magmatic system be hot enough to erupt, the length of time for the reheating of the magmatic system must have been quick. The closure temperature for argon within a sanidine/plagioclase crystal range between 255-350°C (McDougall and Harrison, 1999; Cassata et al., 2009; Hora et al., 2010; Cassata and Renne, 2013), and the diffusion of argon out of the crystal is dependent on this temperature. Based on experimental studies, argon diffusion out of an argon bearing crystal is faster at higher temperatures (Foland, 1994). Assuming a given crystal size and a diffusion coefficient, the time taken for complete argon loss from an argon bearing crystal can be calculated. The determination of this diffusion coefficient, however, is based on experimental data and can vary based on the amount of argon within the crystal and the structure of the mineral, among other parameters. A general formula for calculating this diffusion coefficient is as follows: $D = D_0 \exp(-Q/RT)$, where $D_0 = 4.6 \times 10\text{-}5\ m^2s^{-1}$; $Q = 217.4\ kJmol^{-1}$; $R = 8.314\ JK^{-1}mol^{-1}$. D_0 is the "measure of conductance", or "frequency factor" of all diffusion paths within the lattice of the crystal. Q is the heat capacity within the crystal, and R is the gas constant

(Freer, 1981). For this study, experimental data from Evernden et al. (1960) were used as the argon bearing crystals analysed were of similar size (250 - 420 μm) to the crystals in this study's dataset. The given temperatures and measured diffusion coefficients (Table 4.2) were plotted to obtain an exponential equation equating temperature to diffusion coefficient (Figure 4.4A). This equation was then used to extrapolate the diffusion coefficients at different temperatures (Table 4.2; Figure 4.4B). The temperatures used were based on the measured and calculated Fe-Ti oxide eruption temperatures of the lava domes (see Appendix material). Based on these diffusion coefficients and the simple approximation for diffusion length, time = (radius of crystal)^2 / diffusion coefficient, the minimum amount of time required for all argon to completely diffuse out of different sized crystals can be calculated (Table 4.3).

Magma dynamics

The reheating of the cool remnant magma system must have occurred in less than 1415 yrs at T_c of argon in sanidine and plagioclase, but as the temperature of the system increases, the maximum amount of time the system can stay at hotter temperatures decreases substantially (Table 4.2). At maximum eruption temperatures for the Samosir domes (max eruption temperature same as YTT = 780°C), the time taken from recharge heating to triggering the eruption would be less than 2 years in order for the sanidine crystals in the Samosir domes to retain the YTT argon signature (Table 4.3; Figure 4.5). For the plagioclase crystals in Pardepur (South) at a maximum eruption temperatures of 837°C, the time taken from heating to triggering the lava dome eruption would be less than a year (Table 4.3; Figure 4.5). If the magmatic systems for these lava domes remained at these temperatures for

longer than the calculated time, the YTT argon signature would diffuse out while atmospheric argon would diffuse in, thereby resetting the argon signal. Once these lava domes erupted and cooled below 190°C (T_c = 190°C for He in zircon), the He signature in the zircons of these lava domes would be retained, thus providing (U-Th)/He eruption ages for the zircons that are younger than the $^{40}Ar/^{39}Ar$ sanidine/plagioclase crystallization ages.

In the case of the North Pardepur lava dome, a different eruption scenario must be used to explain the similarity in $^{40}Ar/^{39}Ar$ and (U-Th)/He ages between the plagioclase and zircon crystals. For the plagioclase crystals to display a much younger age than the YTT eruption, this would indicate two possible scenarios. The first scenario is that the plagioclase crystals are autocrysts; the plagioclase crystals formed in the Pardepur (North) magma as the lava dome was erupted and cooled, thus cooling below T_c and retaining the age of eruption at 57 kyrs ago. In this scenario, the autocryst zircons also formed in the magma during eruption and cooled below He T_c, producing the same eruption age at 57 kyrs ago. The second scenario is that the plagioclase crystals are also YTT antecrysts, just like the sanidine/plagioclase crystals in the Samosir and Pardepur (South) lava domes. However, the Pardepur (North) magma would have been reheated to trigger an eruption, but this reheating event would have taken place over a longer period of time, bringing the system above T_c for plagioclase long enough for the YTT argon signal to diffuse out and the crystals to reset. If the magmatic system was held just above plagioclase T_c, this complete argon diffusion would have occurred within ~700 years (Table 4.2; Figure 4.5). If the magmatic system was heated to higher temperatures, this reset would have occurred faster (Table 4.2; Figure 4.4B; 4.5).

Remobilizing Viscous Melt

When remobilizing remnant magma, the concern that arises is that the viscosity of the remnant magma is too high (from solidifying), meaning that the volume of magma may not be eruptible. When looking at the thermal diffusivity of the remnant magma, there are two parts to it: the thermal diffusivity of the crystals suspended within the magma and the thermal diffusivity of the glass matrix (the melt between the crystals). The thermal diffusivity of the crystals, in this instance the minerals sanidine and plagioclase, is lower than the thermal diffusivity of the rhyolitic glass matrix (Figure 4.6; Table 4.5; Evernden et al., 1960; Doremus, 2000). Reheating a viscous volume of remnant magma will lead to the glass matrix melting first, while the crystals are suspended within the melt. This is enough to decrease the viscosity of the volume of remnant magma and allow it to erupt. Experiments by Doremus (2000) show that reheating rhyolitic glass from 400°C to 750°C (and above) can occur as quickly as within a few hours (Figure 4.6). In comparison, the same temperature change, as calculated through argon diffusion, is not enough to reset the argon signature in sanidine or plagioclase crystals; these two minerals require a minimum of 700 years (at lower temperatures) to completely reset their argon signature. This means that the remnant magma can be remobilized by reheating and melting the glass matrix and erupted within a few hours while still containing antecryst YTT sanidine and plagioclase that retain the YTT argon signature.

Vapor Phase Sanidine

Vapor phase crystallization is associated with the second pulse of outgassing released during the cooling of an ignimbrite flow after it has been deposited (Reihle, 2015). During this outgassing, minerals precipitate within

vesicles and cavities, lining the walls of the cavity, and in some cases growing outwards from the walls of the cavity (Streck and Grunder, 1995; Reihle, 2015). Some of the more common mineral phases to crystallize within the vapor phase are silica minerals and alkali feldspars, including sanidine (Heiken, 2006). Within the YTT ignimbrite deposit, vapor phase sanidine crystals were collected from the northern YTT sample, hand-picked from the walls of cavities within pumices from the top 50 m of the partially welded YTT ignimbrite deposit. The analysis of these ten crystals returned a $^{40}Ar/^{39}Ar$ age of 74.3 ± 0.4 kyrs ago, almost identical (overlapping with 2σ error) to the age of the bulk sanidine crystals from the same sample (74.5 ± 0.9 kyrs ago; Table 4.1; Figure 4.2A).

As vapor phase minerals are considered to be part of the post-depositional process, it would be expected that the $^{40}Ar/^{39}Ar$ crystallization age of the vapor phase minerals reflect a younger age than the $^{40}Ar/^{39}Ar$ crystallization age of the minerals crystallizing within the magma. The argon trapped within the crystallization of the vapor phase minerals, however, can be affected by the cooling rate of the ignimbrite flow and the volatiles exsolving as part of the vapor phase (Freundt et al., 2000; Heiken, 2006). As the ignimbrite flow cools overtime, the second outgassing of hot vapor over a short period of time (faster cooling rate) will result in minerals crystallizing soon after deposition, reflecting a crystallization age close to the age of the autocryst minerals formed within the magma. In most cases, however, the second outgassing of hot vapor is a slow process (slower cooling rate), with the ignimbrite flow trapping heat, allowing for compaction and devitrification of the ignimbrite over time (Streck and Grunder, 1995). This would result in vapor phase minerals crystallizing a while after ignimbrite emplacement, reflecting an

age that is younger than the autocryst minerals (found within the main ignimbrite unit).

As the hot vapor outgasses, mobilized elements, such as sodium, calcium, potassium, aluminum, and argon, are transported and deposited within the ignimbrite, accumulating within cavities to form vapor phase minerals (Freundt et al., 2000; Heiken, 2006). In the case of the diffusion of argon, argon released during outgassing will preferentially partition into vapor phase due to its higher solubility in this state (Kelley, 2002; Hora et al., 2010). This implies that vapor phase minerals crystallizing from trapped vapor phase pockets (within cavities of the ignimbrite) will have a higher source of argon to crystallize from. In the case of vapor phase sanidine, this could mean that the crystallization of vapor phase sanidine will preferentially include this excess argon, thus offsetting the original younger $^{40}Ar/^{39}Ar$ crystallization age of the actual sanidine crystal.

In the case of the YTT deposit, the ignimbrite outflow, which was sampled for vapor phase sanidine, was near the top of the ignimbrite. This could mean that the upper half experienced quick cooling after emplacement, thus reflecting $^{40}Ar/^{39}Ar$ ages of vapor phase sanidine that overlap with the $^{40}Ar/^{39}Ar$ autocryst ages (as we see in this case). It is also possible that despite being sampled from the top of the ignimbrite flow, the secondary outgassing associated with the vapor phase continued over time, resulting in keeping this top layer hot for a longer period of time. This could have resulted in younger vapor phase sanidines crystallizing, but the trapped argon within the cavities meant the sanidines crystallized with excess argon, thus returning the same age as the YTT autocrysts.

CONCLUSION

$^{40}Ar/^{39}Ar$ dating on Toba's resurgent lava domes has confirmed past geochronology data and has yielded new information regarding the eruption history of the Toba Caldera. The Samosir lava domes (North and Tuk Tuk) produce $^{40}Ar/^{39}Ar$ ages on single, incrementally heated sanidine crystals that overlap with the YTT $^{40}Ar/^{39}Ar$ eruption age of Storey et al. (2012), Mark et al. (2014), and this study (74.5 ± 0.9 kyrs ago; 2σ; MSWD = 1.18 and 74.1± 0.5 kyrs ago; 2σ; MSWD = 3.62). Pardepur (South) also provides a $^{40}Ar/^{39}Ar$ age on plagioclase crystals that overlap with the YTT eruption. In comparison to previously obtained (U-Th)/He ages on zircon crystals, these ages overlap with error, but are not in agreement when comparing the error weighted average (U-Th)/He age and the stacked $^{40}Ar/^{39}Ar$ plateau age. This can be explained by a magmatic situation where these domes are of remnant YTT magma, and the crystals still retain the YTT argon signature as the magmatic system stays below argon closure temperature of sanidine/plagioclase at 350°C. In this situation, the eruption of these YTT antecrysts of sanidine/plagioclase crystals occur in less than 1400 years, and at maximum eruption temperatures, in less than two years. The (U-Th)/He ages, therefore, record the zircon eruption age of the lava domes, when they have cooled below helium closure temperature at 190°C. Pardepur (North), on the other hand, tells a different story, where the $^{40}Ar/^{39}Ar$ age is similar to the (U-Th)/He age, both ages being younger than the YTT eruption, at 57 kyrs ago. Either the plagioclase crystals are autocrysts, having formed during the lava dome eruption, or they are YTT antecrysts that have remained above plagioclase closure temperature for more than 700 years, thereby resetting the argon signal within the crystal.

Timing of resurgence at Toba has long been confined to a period during or directly after the YTT eruption. $^{40}Ar/^{39}Ar$ dating of crystals from these resurgent lava domes in past studies confirmed this, by providing $^{40}Ar/^{39}Ar$ ages identical to the YTT eruption age. The comparison of precise, single crystal incrementally heated $^{40}Ar/^{39}Ar$ ages with (U-Th)/He eruption ages shows that resurgence could have continued for some time after the YTT eruption, despite $^{40}Ar/^{39}Ar$ ages still overlapping with the YTT eruption age. Furthermore, Pardepur (North) has produced the youngest resurgent $^{40}Ar/^{39}Ar$ age to date, with a stacked inverse isochron age that overlaps with (U-Th)/He eruption age. This implies resurgence at Toba has continued until at least 57 kyrs ago, which is supported by two different methods of geochronology.

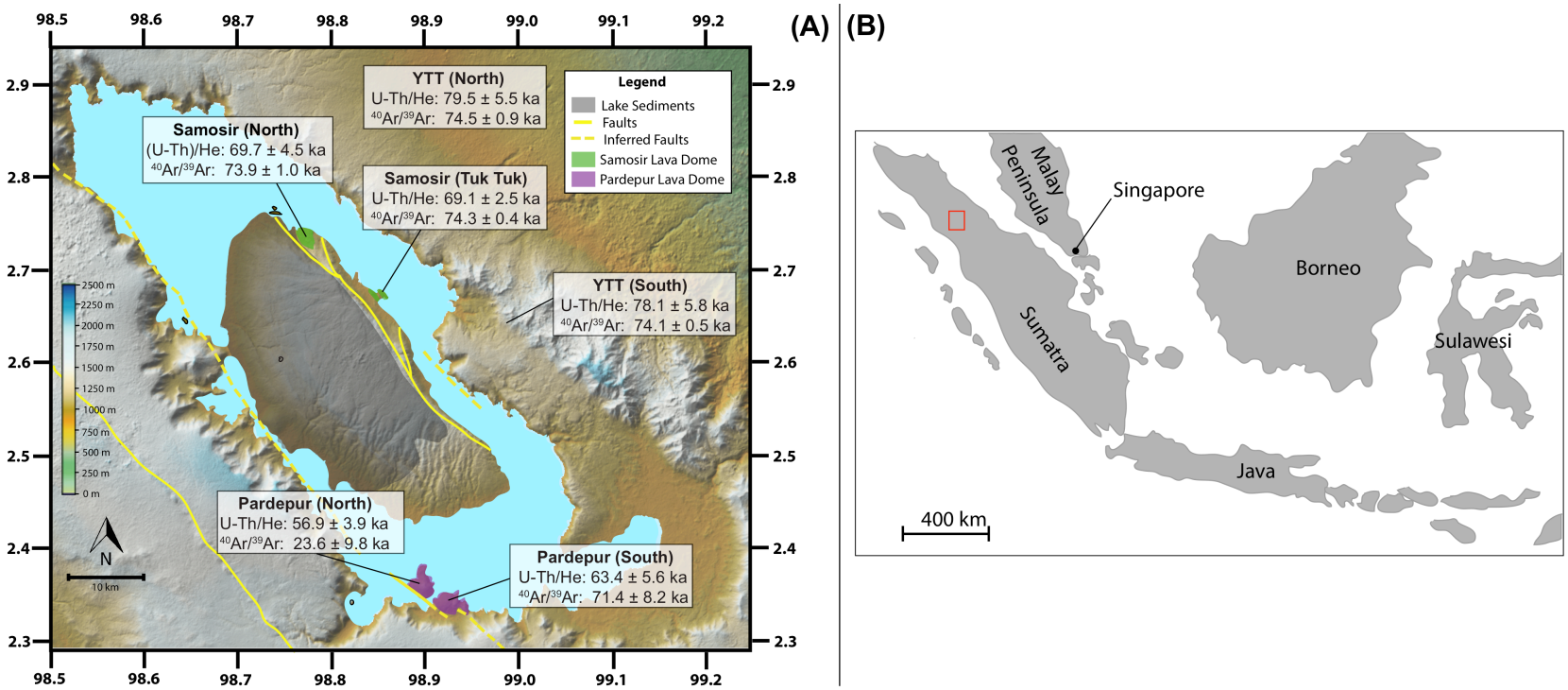


Figure 4.1: Toba Caldera and post-Youngest Toba Tuff (YTT) resurgent lava domes.

(A) Two resurgent lava domes found on the resurgent dome, Samosir Island (Samosir (North) and Samosir (Tuk Tuk) in green). Two resurgent lava domes found along the southern caldera ring fracture (Pardepur (North) and Pardepur (South) in purple). Comparative YTT sample location also indicated. Compared $^{40}Ar/^{39}Ar$ and (U-Th)/He ages are shown in boxes.
(B) Geographical location of Toba Caldera in South East Asia shown outlined in red box.

Figure 4.2: Stacked Ideogram, $^{40}Ar/^{39}Ar$ Plateau Ages, K/Ca ratio, Inverse Isochron, and Normal Isochron measurements for all samples.

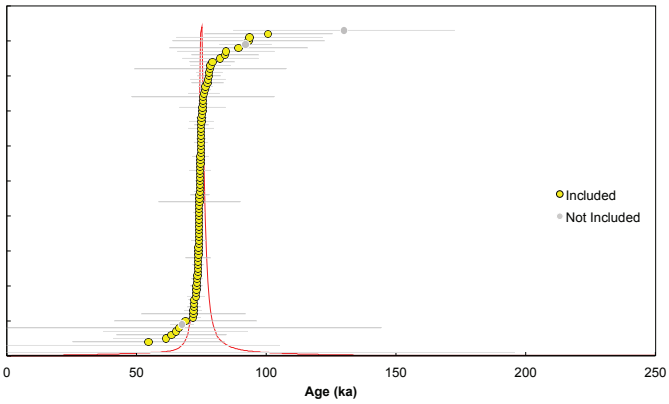
For each figure, subfigure (A) gives Stacked Incremental Heating Steps Ideogram, (B) gives Stacked $^{40}Ar/^{39}Ar$ plateau ages, (C) shows Stacked K/Ca measurements, (D) shows Stacked $^{40}Ar/^{36}Ar$ inverse isochron ages, and (E) gives Stacked $^{40}Ar/^{36}Ar$ normal isochron ages for the following samples (errors on ages are 2σ; mean square weighted deviate (MSWD) and number of crystals per sample analyzed are indicated).

(A) YTT vapor phase
(B) North YTT
(C) South YTT
(D) North Samosir
(E) Tuk Tuk Samosir
(F) North Pardepur
(G) South Pardepur

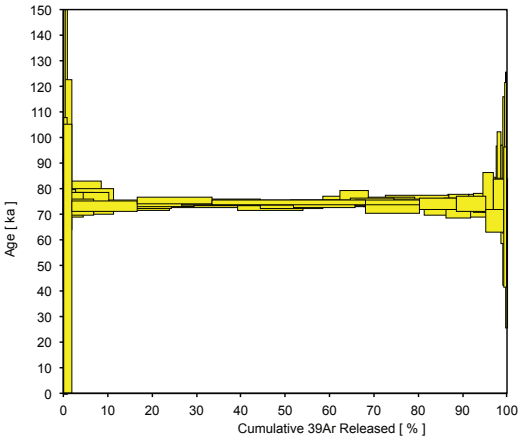
(A)

Youngest Toba Tuff (North) vapor phase
LT_12_001 vapor phase
no. of crystals: 10
Material: sanidine
Total no. of stacked steps in Ideogram: 93
Included steps: 88
Stacked Weighted Plateau Age: 74.3 ± 0.4 ka
MSWD: 1.53
Inverse Isochron Age: 74.3 ± 0.4 ka
MSWD: 1.48
$^{40}Ar/^{36}Ar$ Intercept: 294.4 ± 1.23
Normal Isochron Age: 77.2 ± 0.7 ka
Total Fusion Age: 73.4 ± 0.9 ka

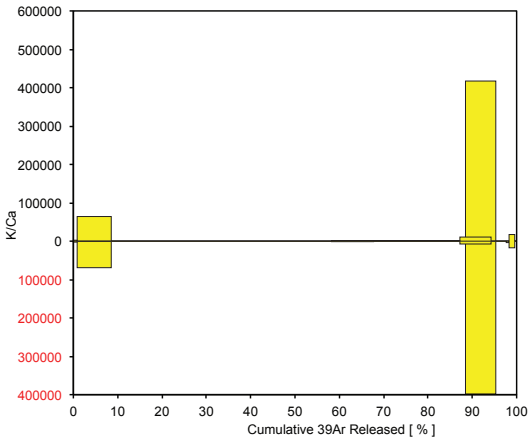
(A) Stacked Incremental Heating Steps Ideogram



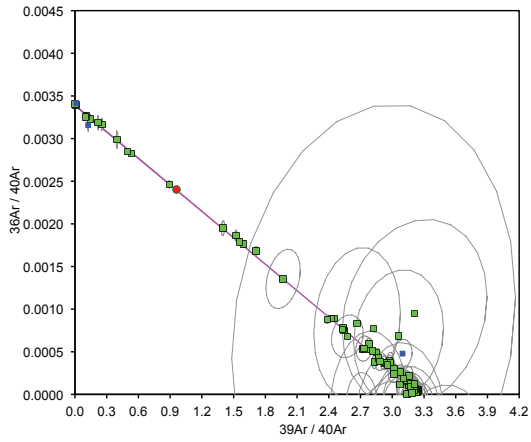
(B) Stacked $^{40}Ar/^{39}Ar$ Plateau Age



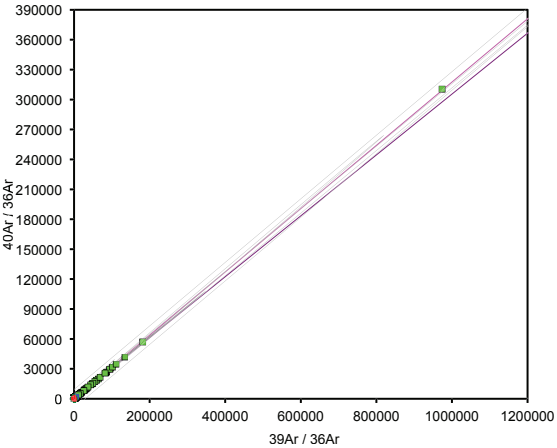
(C) Stacked K/Ca ratios



(D) Stacked $^{40}Ar/^{36}Ar$ Inverse Isochron

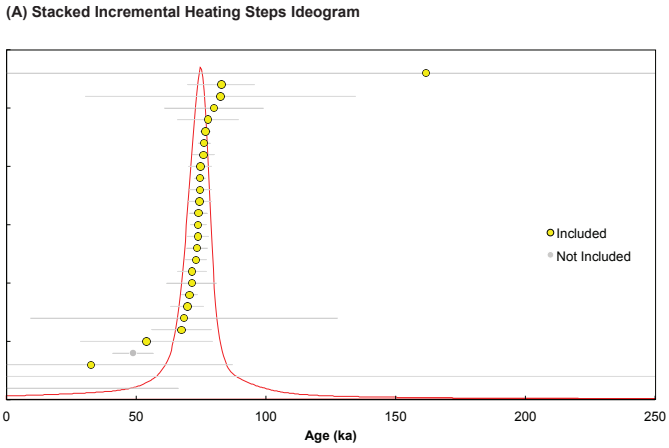


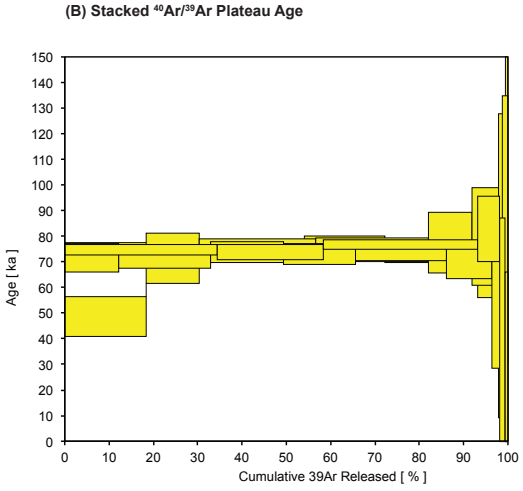
(E) Stacked $^{40}Ar/^{36}Ar$ Normal Isochron

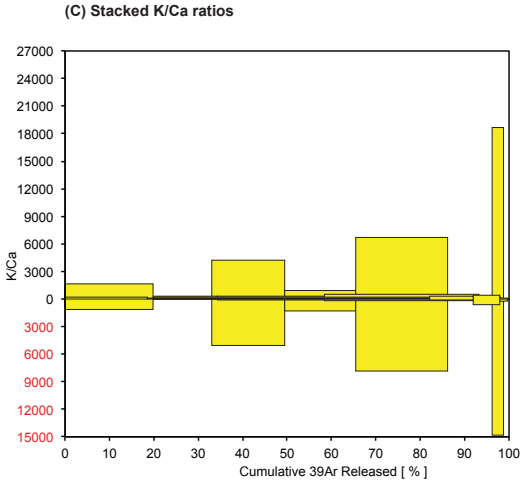


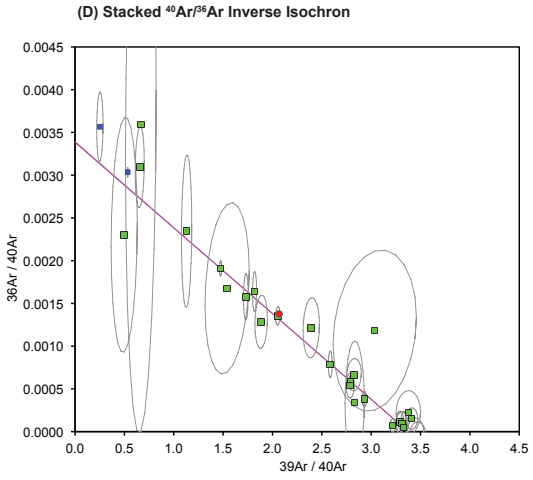
(B)

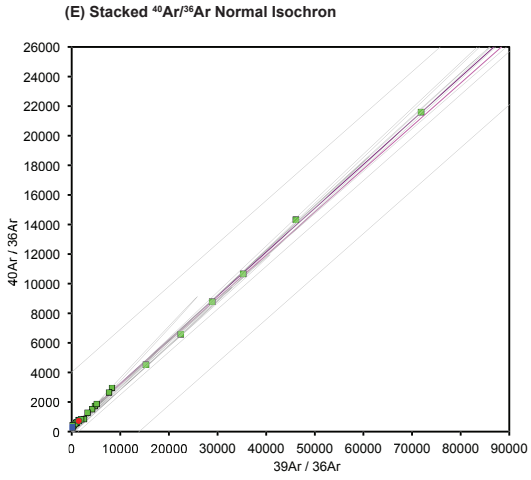
Youngest Toba Tuff (North)
LT_12_001
no. of crystals: 4
Material: sanidine
Total no. of stacked steps in Ideogram: 28
Included steps: 26
Stacked Weighted Plateau Age: 74.5 ± 0.9 ka
MSWD: 1.18
Inverse Isochron Age: 74.6 ± 1.1 ka
MSWD: 1.2
$^{40}Ar/^{36}Ar$ Intercept: 294.91 ± 12.88
Normal Isochron Age: 73.2 ± 1.3 ka
Total Fusion Age: 72.3 ± 1.4 ka





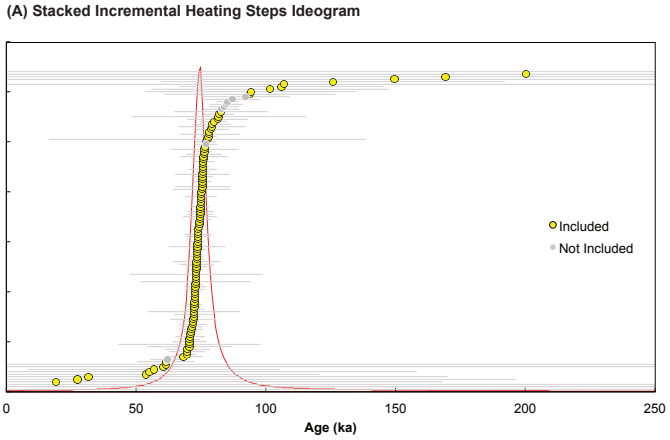


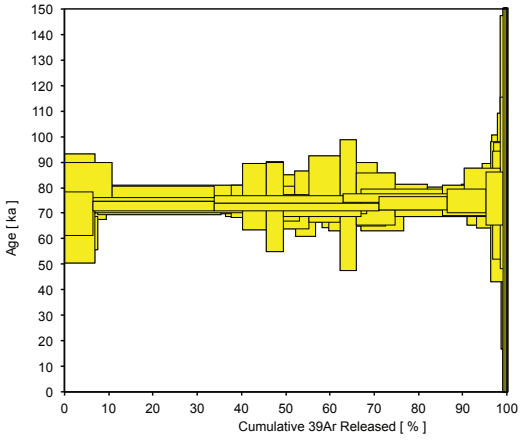


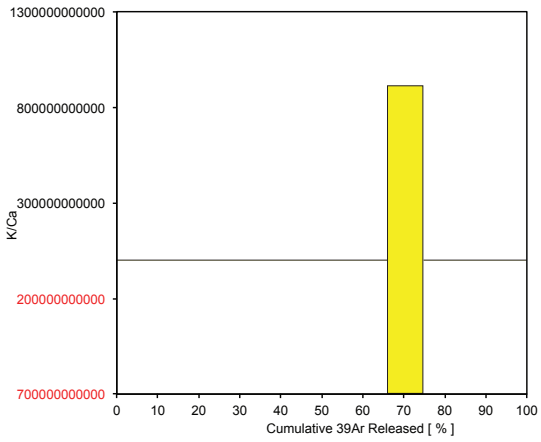


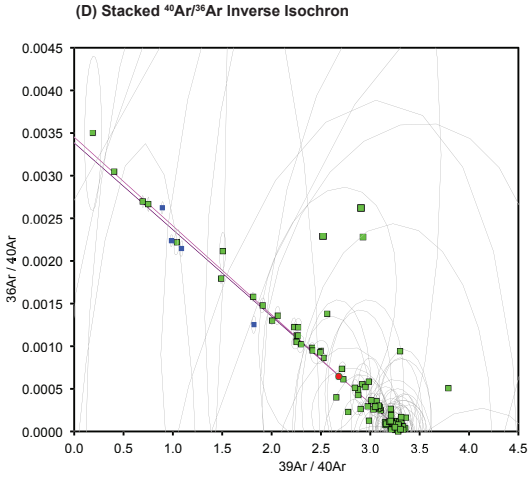
(C)

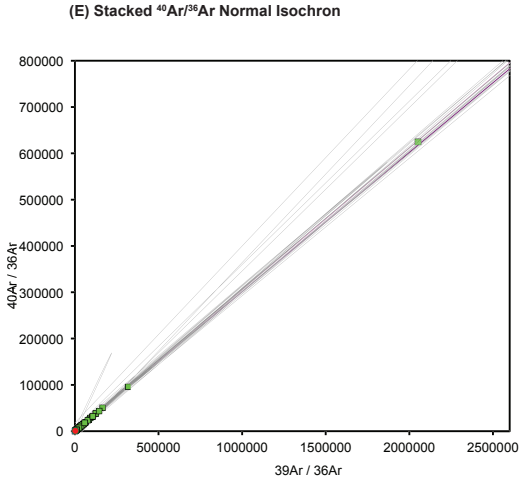
Youngest Toba Tuff (South)
LT_12_012
no. of crystals: 15
Material: sanidine
Total no. of stacked steps in Ideogram: 128
Included steps: 120
Stacked Weighted Plateau Age: 74.1 ± 0.5 ka
MSWD: 1.64
Inverse Isochron Age: 74.3 ± 0.5 ka
MSWD: 1.56
$^{40}Ar/^{36}Ar$ Intercept: 289.77 ± 4.71
Normal Isochron Age: 75.3 ± 0.6 ka
Total Fusion Age: 74.3 ± 0.5 ka





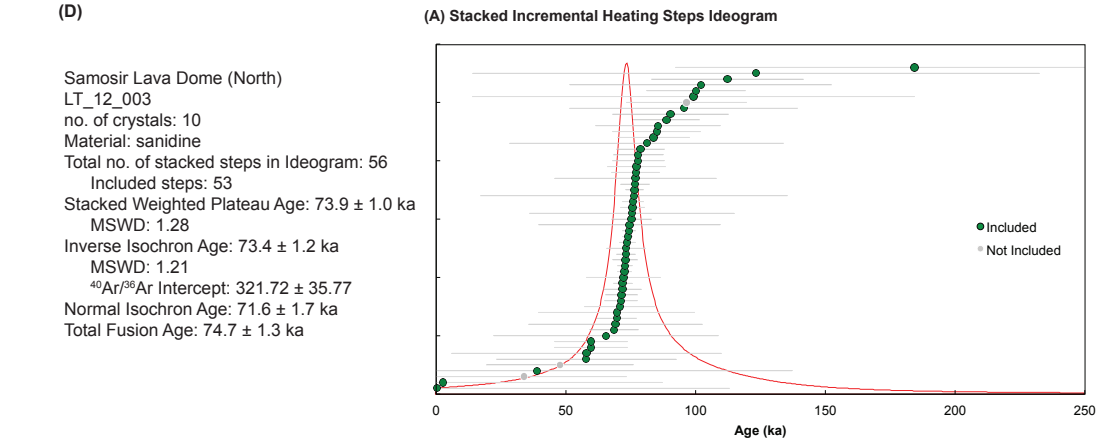


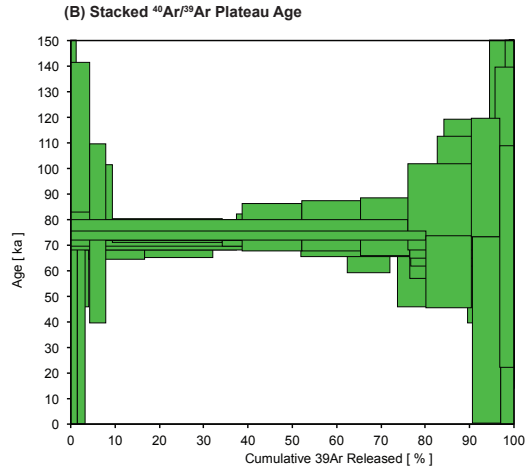


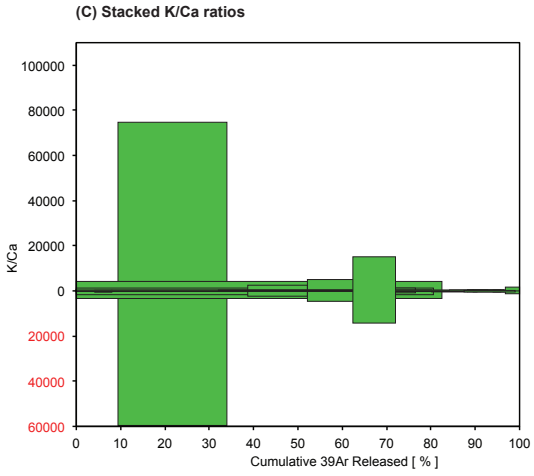


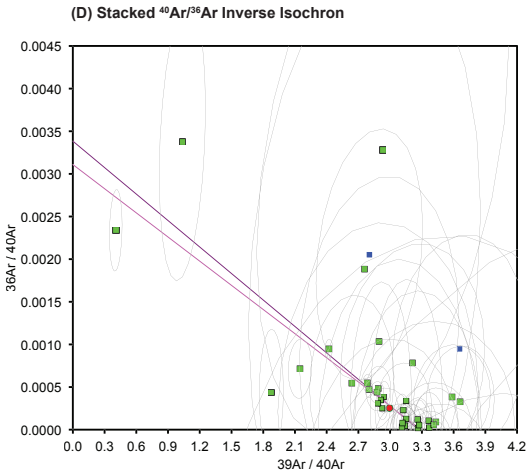
(D)

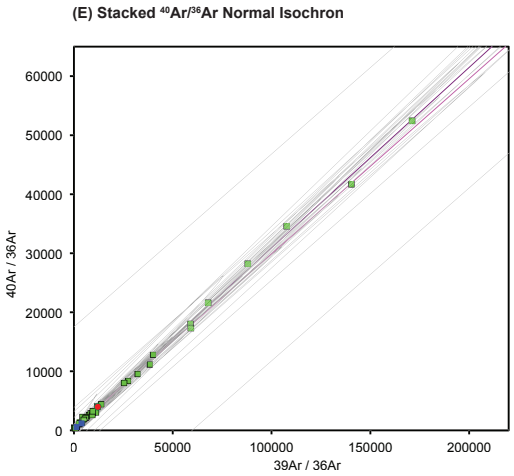
Samosir Lava Dome (North)
LT_12_003
no. of crystals: 10
Material: sanidine
Total no. of stacked steps in Ideogram: 56
Included steps: 53
Stacked Weighted Plateau Age: 73.9 ± 1.0 ka
MSWD: 1.28
Inverse Isochron Age: 73.4 ± 1.2 ka
MSWD: 1.21
$^{40}Ar/^{36}Ar$ Intercept: 321.72 ± 35.77
Normal Isochron Age: 71.6 ± 1.7 ka
Total Fusion Age: 74.7 ± 1.3 ka







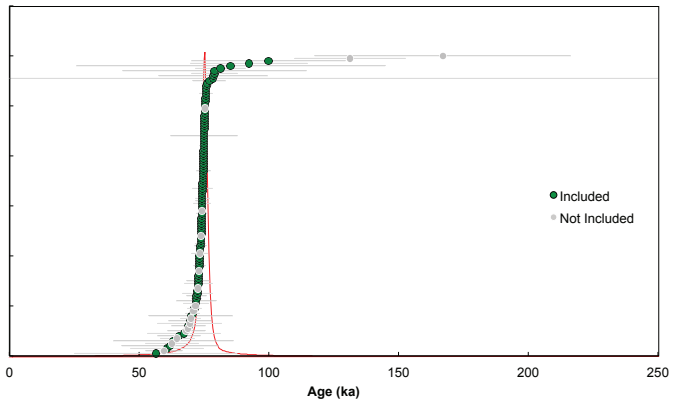




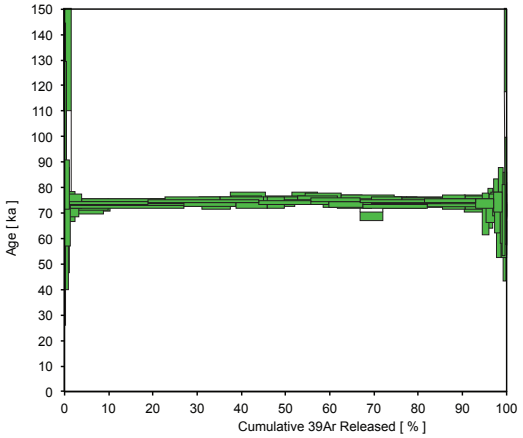
(E)

Samosir Lava Dome (Tuk Tuk)
LT_12_008
no. of crystals: 10
Material: sanidine
Total no. of stacked steps in Ideogram: 120
Included steps: 103
Stacked Weighted Plateau Age: 74.3 ± 0.4 ka
MSWD: 3.62
Inverse Isochron Age: 74.4 ± 0.4 ka
MSWD: 3.48
$^{40}Ar/^{36}Ar$ Intercept: 289.95 ± 4.98
Normal Isochron Age: 74.5 ± 0.4 ka
Total Fusion Age: 74.3 ± 0.4 ka

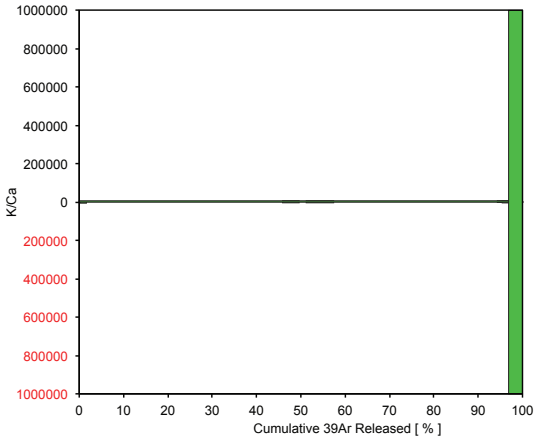
(A) Stacked Incremental Heating Steps Ideogram



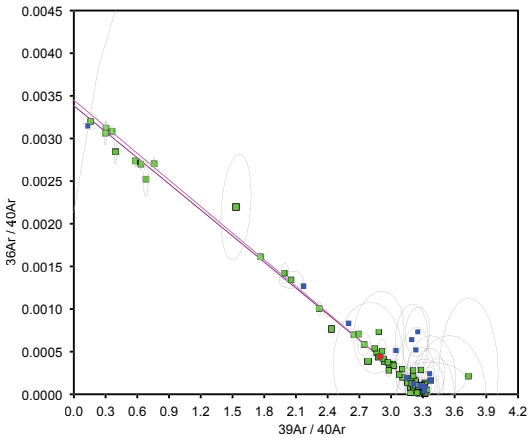
(B) Stacked $^{40}Ar/^{39}Ar$ Plateau Age



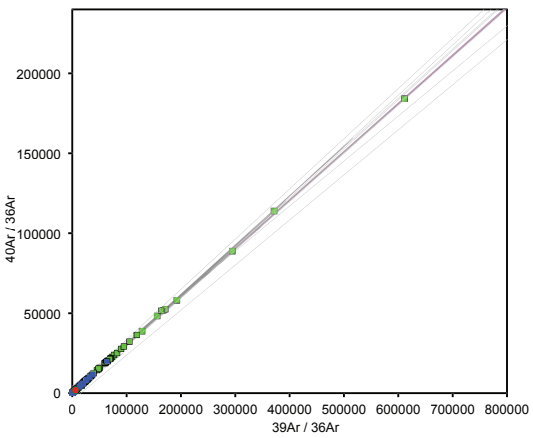
(C) Stacked K/Ca ratios



(D) Stacked $^{40}Ar/^{36}Ar$ Inverse Isochron



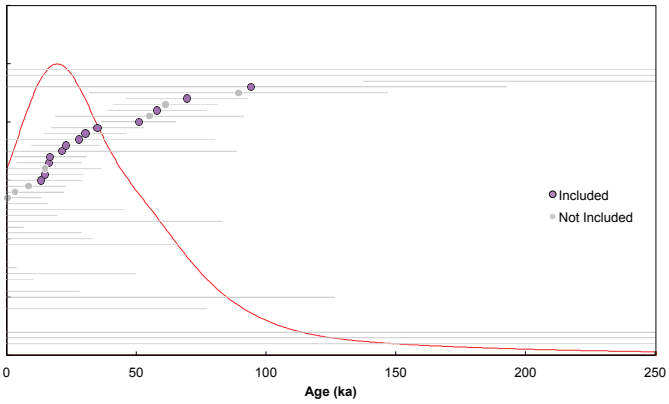
(E) Stacked $^{40}Ar/^{36}Ar$ Normal Isochron



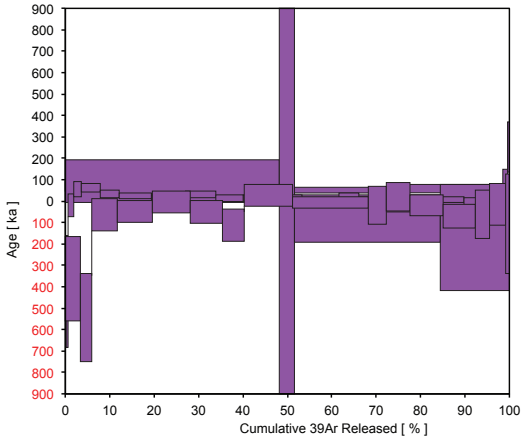
(F)

Pardepur Lava Dome (North)
LT_12_016
no. of crystals: 6
Material: plagioclase
Total no. of stacked steps in Ideogram: 50
Included steps: 27
Stacked Weighted Plateau Age: 23.6 ± 9.8 ka
MSWD: 4.48
Inverse Isochron Age: 47.9 ± 11.1 ka
MSWD: 2.78
$^{40}Ar/^{36}Ar$ Intercept: 289.00 ± 3.14
Normal Isochron Age: 44.7 ± 15.6 ka
Total Fusion Age: -14.4 ± 5.7 ka

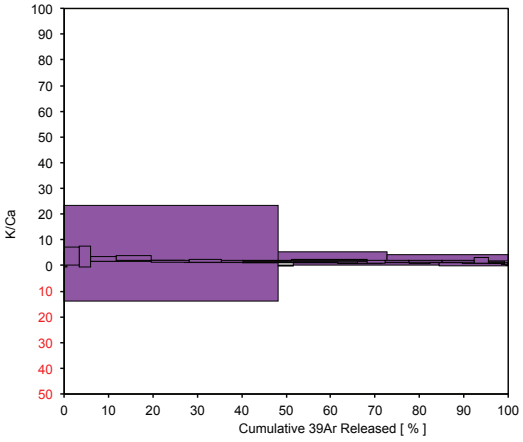
(A) Stacked Incremental Heating Steps Ideogram



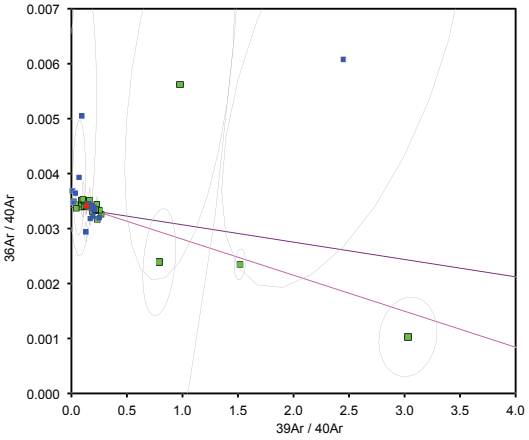
(B) Stacked $^{40}Ar/^{39}Ar$ Plateau Age



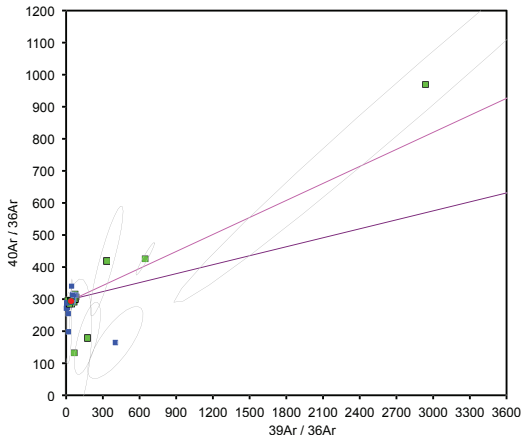
(C) Stacked K/Ca ratios



(D) Stacked $^{40}Ar/^{36}Ar$ Inverse Isochron



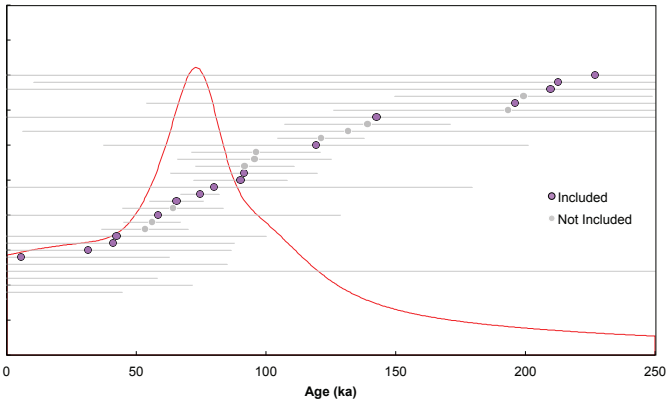
(E) Stacked $^{40}Ar/^{36}Ar$ Normal Isochron



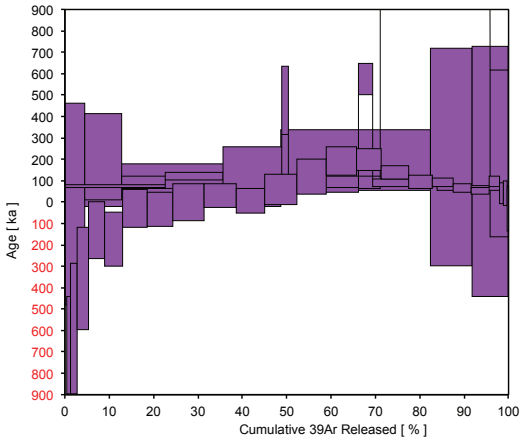
(G)

Pardepur Lava Dome (South)
LT_12_015
no. of crystals: 11
Material: plagioclase
Total no. of stacked steps in Ideogram: 43
Included steps: 21
Stacked Weighted Plateau Age: 71.4 ± 8.2 ka
MSWD: 2.26
Inverse Isochron Age: 75.4 ± 7.0 ka
MSWD: 1.56
$^{40}Ar/^{36}Ar$ Intercept: 294.24 ± 0.74
Normal Isochron Age: 74.6 ± 6.2 ka
Total Fusion Age: 15.3 ± 18.1 ka

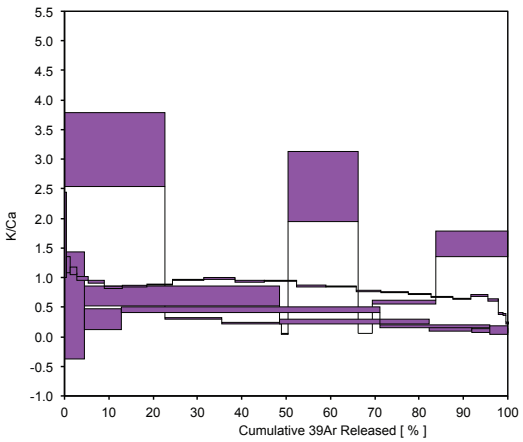
(A) Stacked Incremental Heating Steps Ideogram



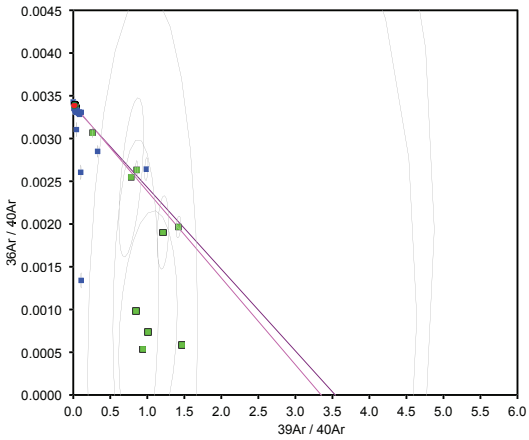
(B) Stacked $^{40}Ar/^{39}Ar$ Plateau Age



(C) Stacked K/Ca ratios



(D) Stacked $^{40}Ar/^{36}Ar$ Inverse Isochron



(E) Stacked $^{40}Ar/^{36}Ar$ Normal Isochron

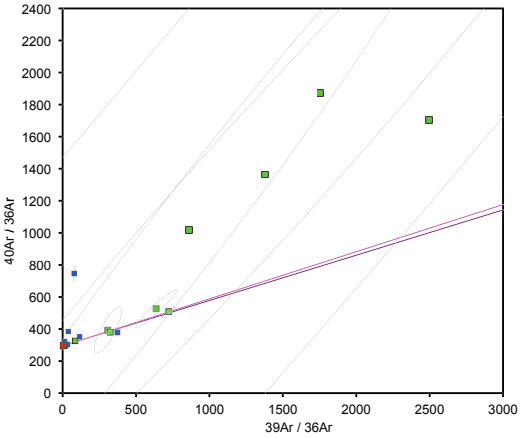
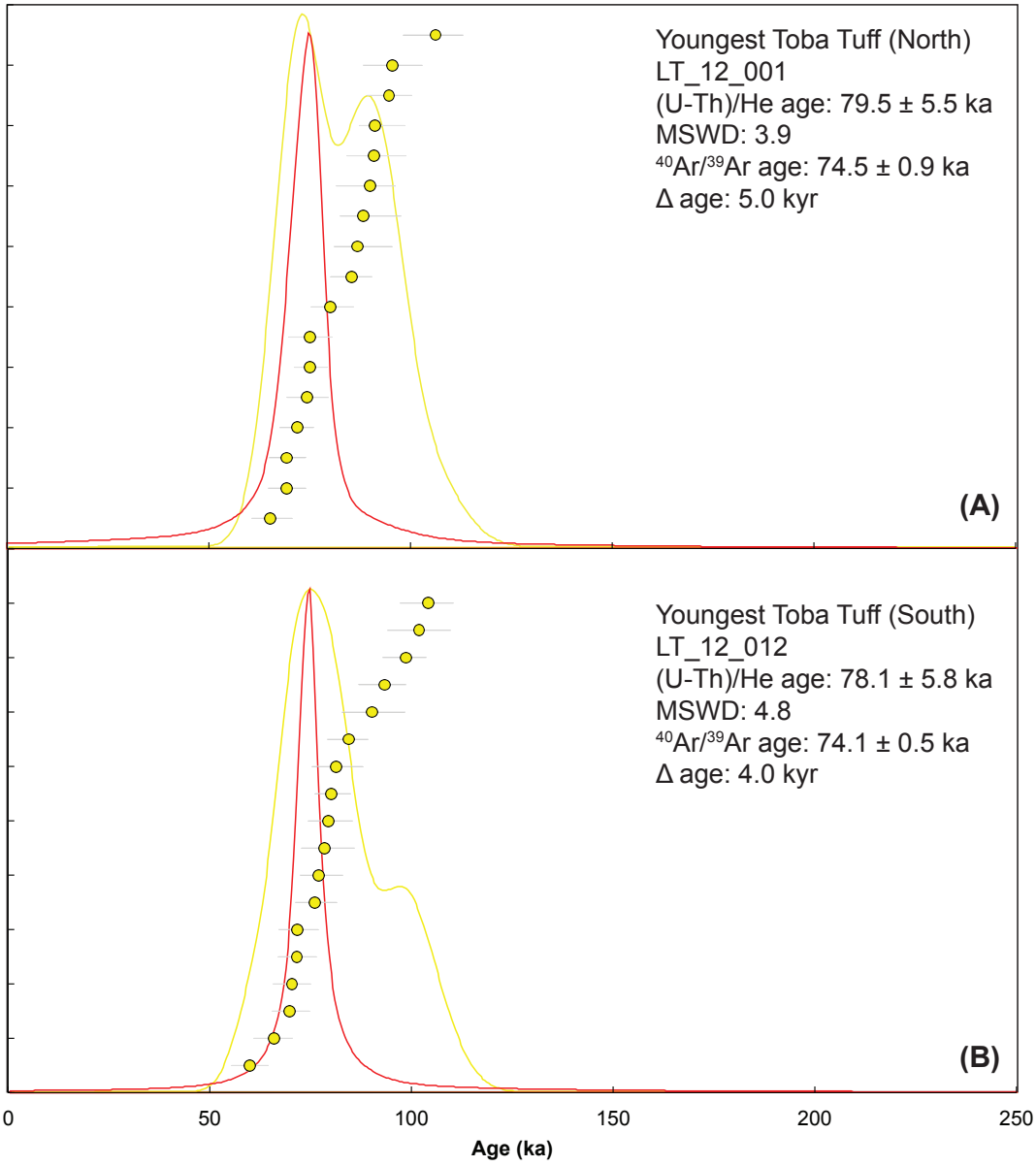
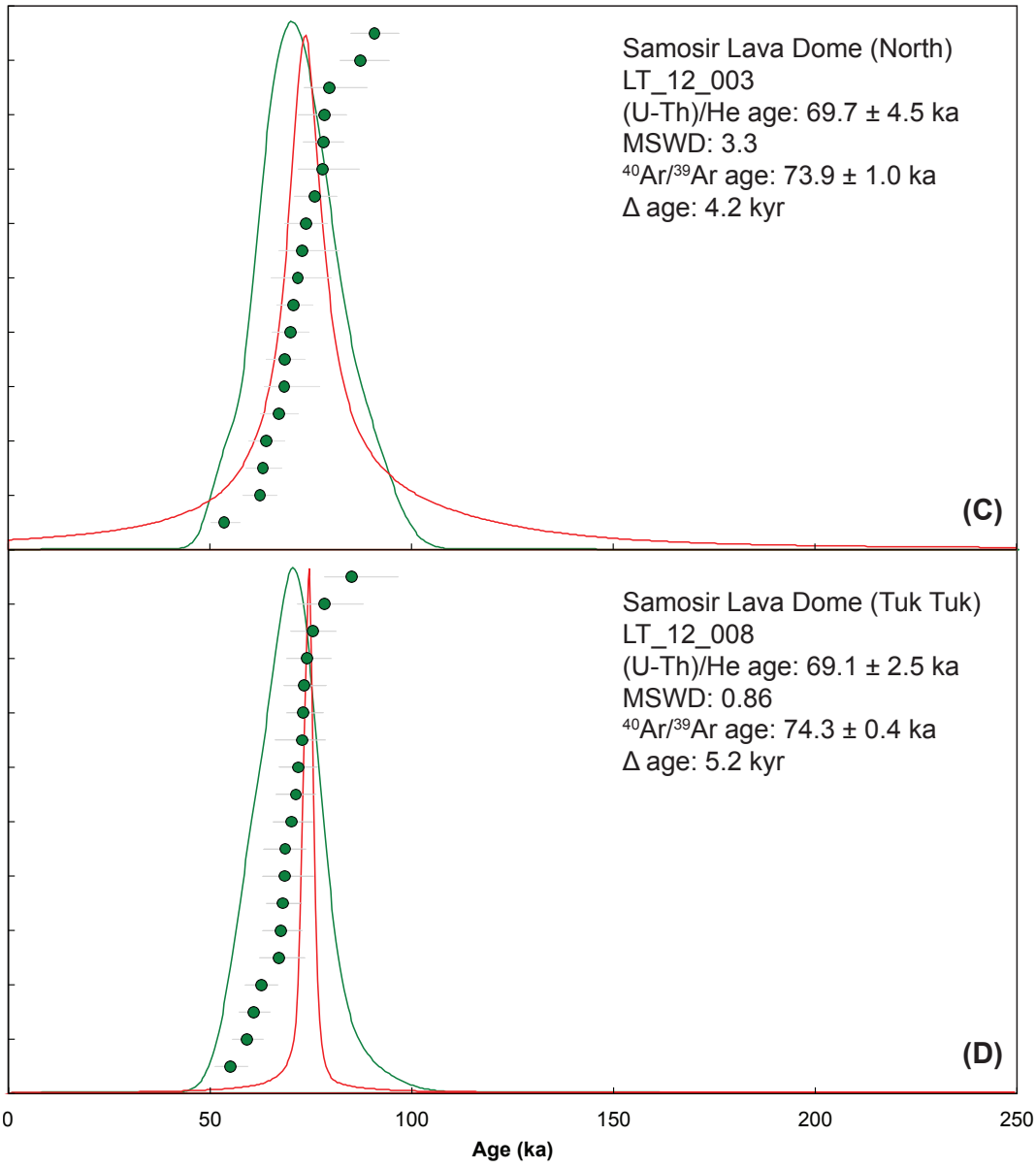


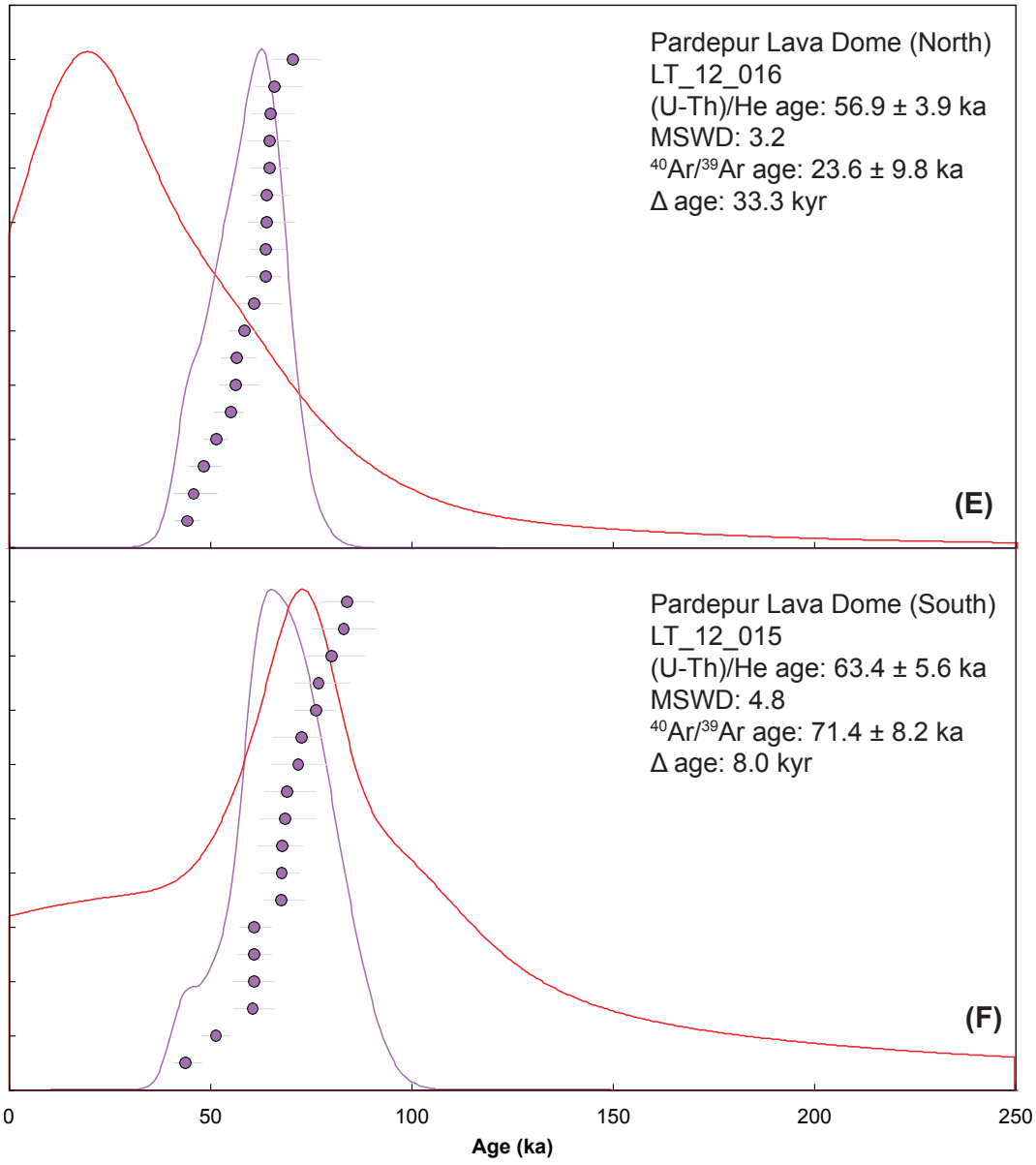
Figure 4.3: (U-Th)/He ranked order probability density plot vs $^{40}Ar/^{39}Ar$ probability density plot.

(U-Th)/He ranked order data (from Mucek et al., 2017) shown with calculated probability density plot compared to $^{40}Ar/^{39}Ar$ probability density plot for
(A) North YTT
(B) South YTT
(C) North Samosir lava dome
(D) Tuk Tuk Samosir lava dome
(E) North Pardepur lava dome
(F) South Pardepur lava dome

Errors for both (U-Th)/He and $^{40}Ar/^{39}Ar$ ages are 2σ; Δage calculation in respective boxes shows difference between error weighted mean age for (U-Th)/He and stacked $^{40}Ar/^{39}Ar$ plateau age.


Youngest Toba Tuff (North)
LT_12_001
(U-Th)/He age: 79.5 ± 5.5 ka
MSWD: 3.9
40Ar/39Ar age: 74.5 ± 0.9 ka
Δ age: 5.0 kyr
(A)
Youngest Toba Tuff (South)
LT_12_012
(U-Th)/He age: 78.1 ± 5.8 ka
MSWD: 4.8
40Ar/39Ar age: 74.1 ± 0.5 ka
Δ age: 4.0 kyr
(B)
0
50
100
150
200
250
Age (ka)


Samosir Lava Dome (North)
LT_12_003
(U-Th)/He age: 69.7 ± 4.5 ka
MSWD: 3.3
40Ar/39Ar age: 73.9 ± 1.0 ka
Δ age: 4.2 kyr
(C)
Samosir Lava Dome (Tuk Tuk)
LT_12_008
(U-Th)/He age: 69.1 ± 2.5 ka
MSWD: 0.86
40Ar/39Ar age: 74.3 ± 0.4 ka
Δ age: 5.2 kyr
(D)
0
50
100
150
200
250
Age (ka)


Pardepur Lava Dome (North)
LT_12_016
(U-Th)/He age: 56.9 ± 3.9 ka
MSWD: 3.2
40Ar/39Ar age: 23.6 ± 9.8 ka
Δ age: 33.3 kyr
(E)
Pardepur Lava Dome (South)
LT_12_015
(U-Th)/He age: 63.4 ± 5.6 ka
MSWD: 4.8
40Ar/39Ar age: 71.4 ± 8.2 ka
Δ age: 8.0 kyr
(F)
0
50
100
150
200
250
Age (ka)

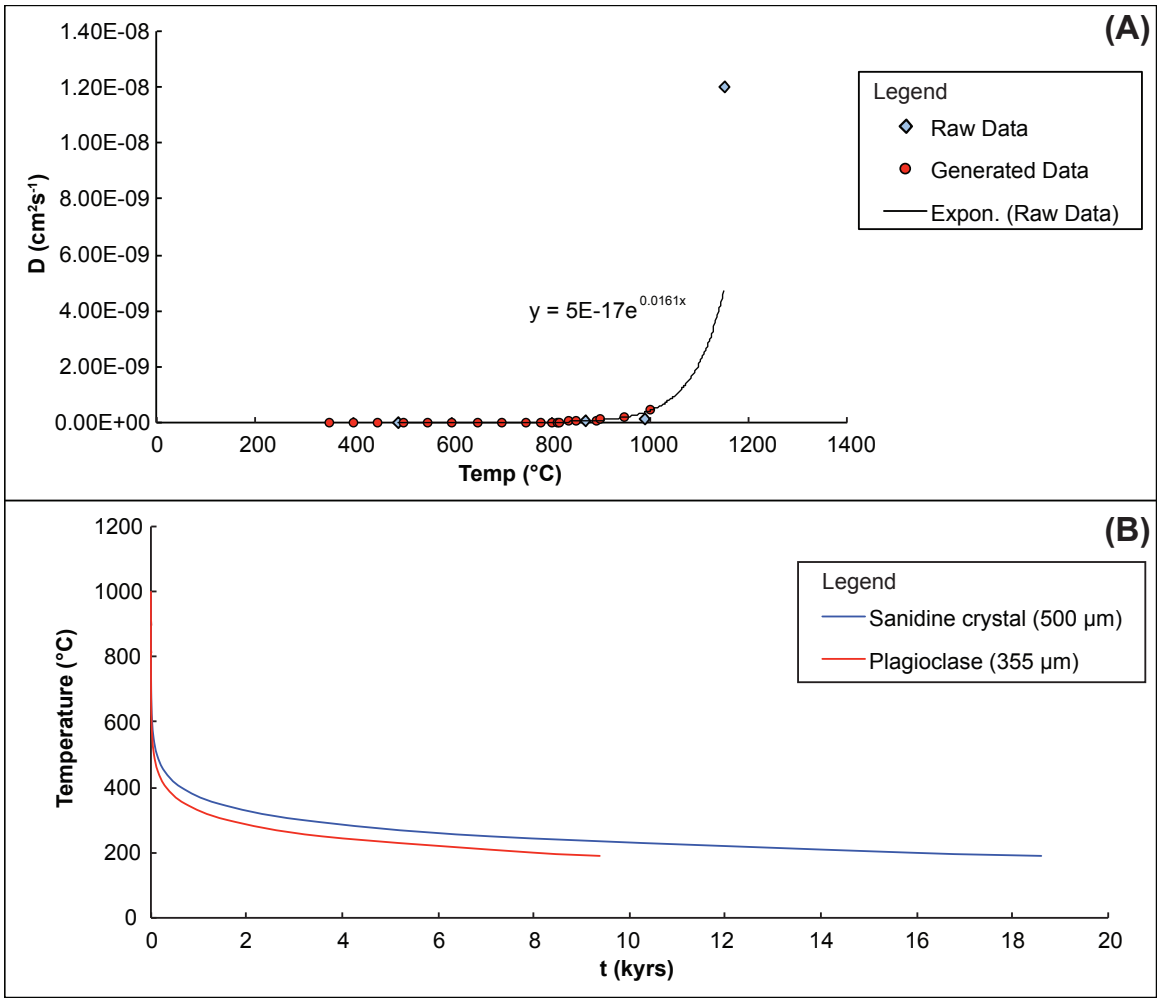


Figure 4.4: Extrapolated data and calculated modeling time for complete Ar diffusion.

(A) Raw data (in blue diamonds) of diffusion coefficients vs. temperature from Evernden et al. (1960) used to calculate exponential equation for diffusion of argon. Using the exponential equation (as indicated on graph), diffusion coefficients are calculated for different temperatures (in red circles).
(B) Using calculated diffusion coefficients from (A) in simple approximation equation for diffusion length, time for complete argon diffusion out of crystal is calculated for sanidine (at 500 µm diameter) and plagioclase (at 355 µm) at increasing temperatures.

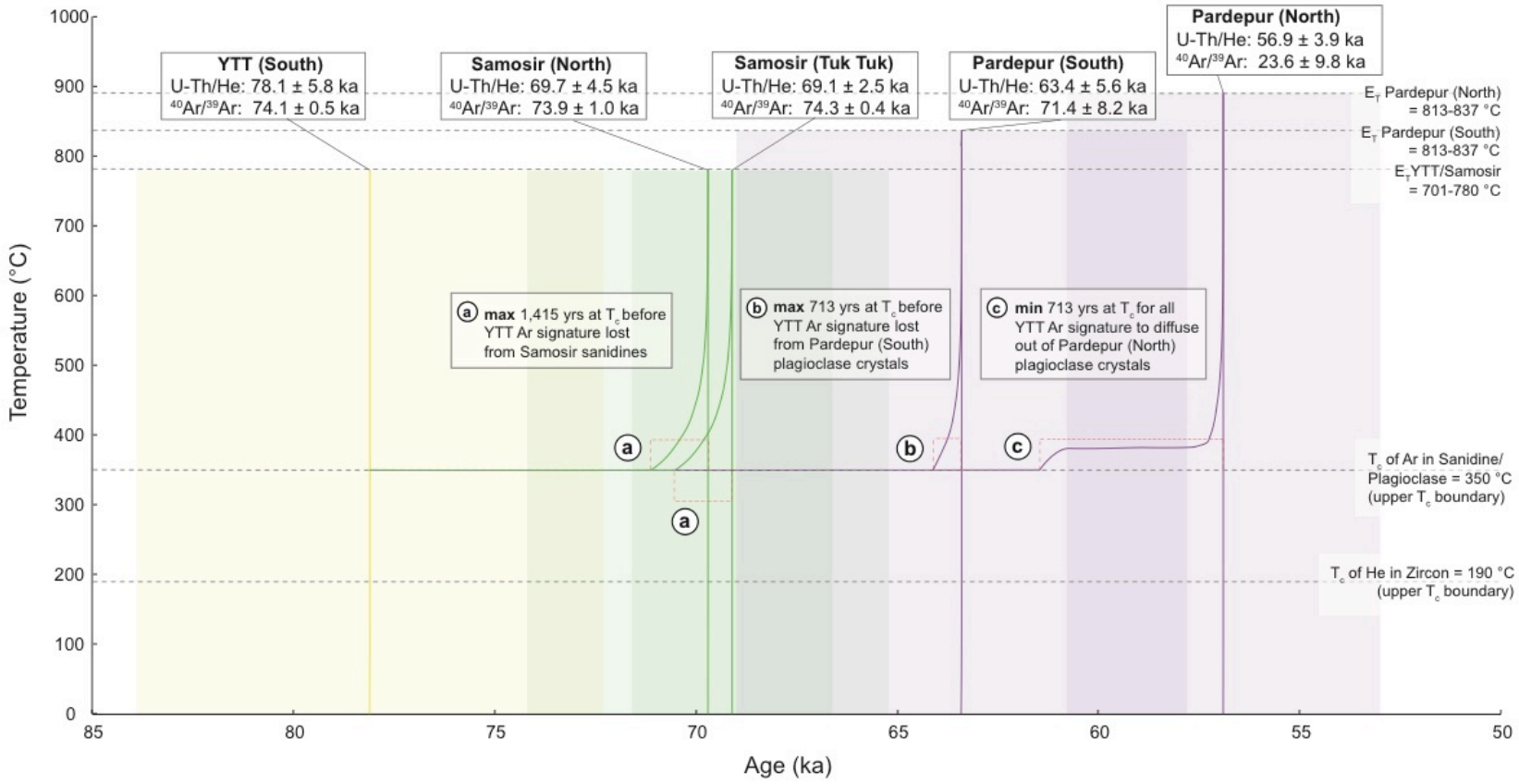


Figure 4.5: Overview of temperature changes over time during eruptions of post-YTT resurgent lava domes.

Each line shows maximum temperature path of respective magmatic system in order for sanidine/plagioclase crystals to retain YTT Ar signature. If crystals remain at longer time intervals at each temperature than what is shown by the line, the crystal argon signature will reset. (a) shows maximum amount of time allowed for Samosir sanidine crystals to sit at closure temperature (T_c) before YTT Ar signature diffuses out completely. (b) shows maximum amount of

allowed time for Pardepur (South) plagioclase crystal at T_c. (c) shows minimum amount of time needed at T_c for Pardepur (North) plagioclase crystals in order for YTT Ar signature to be reset, if plagioclase crystals are YTT antecrysts from a remnant YTT magma. T_c (closure temperatures) for argon and helium are shown in dashed grey lines. Maximum eruption temperatures for samples are shown in dashed grey lines. Transparent colored boxes show 2σ error for given (U-Th)/He eruption ages as taken from Mucek et al. (2017).

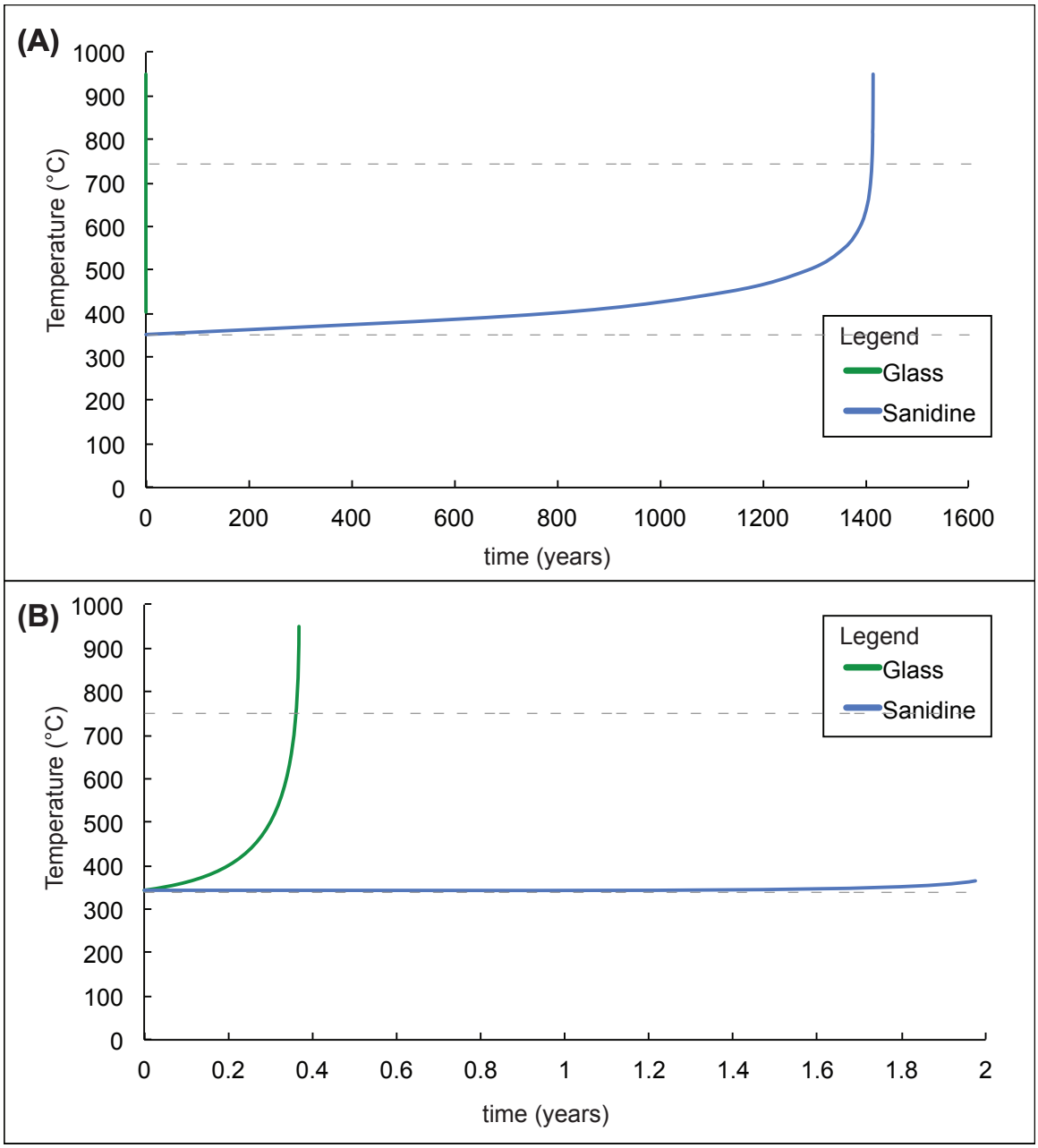


Figure 4.6: Thermal Diffusivity of glass vs. melt

(A) Plot of thermal diffusivity of rhyolite glass vs sanidine using diffusion coefficients determined experimentally from Doremus (2000) for rhyolite glass and from Evernden et al. (1960) (as seen in Figure 4.4) for sanidine crystals (showing at least ~700 years needed for sanidine to initiate partial Ar reset). (B) Zoomed in plot of (A), showing detail for rhyolitic glass. Maximum of ~0.5 years needed for rhyolitic glass to completely melt whereas sanidine crystals have not been affected (in terms of reheating) during this amount of time.

Table 4.1: Summary of Samples and measured $^{40}Ar/^{39}Ar$ ages.

Sample ID	Sample Name	Location	Latitude (N)*	Longitude (E)*	Material Type	Mineral Analyzed	Type of Age Apparent	Age (ka)	error 2σ	MSWD	$^{40}Ar/^{36}Ar$	error 2σ
LT_12_001	Youngest Toba Tuff (vapor phase)	North of Toba Caldera (north sample)	02° 59.630	098° 32.643	Rhyolitic Tuff	Sanidine	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	74.3 74.3 73.4	± 0.4 ± 0.4 ± 0.9	1.53 1.48	294.4	± 1.23
LT_12_001	Youngest Toba Tuff	North of Toba Caldera (north sample)	02° 59.630	098° 32.643	Rhyolitic Tuff	Sanidine	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	74.5 74.6 72.3	± 0.9 ± 1.1 ± 1.4	1.18 1.2	294.91	± 12.88
LT_12_012	Youngest Toba Tuff	East of Parapat (south sample)	02° 39.118	098° 57.523	Rhyolitic Tuff	Sanidine	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	74.1 74.3 74.3	± 0.5 ± 0.5 ± 0.5	1.64 1.56	289.77	± 4.71
LT_12_003	Samosir	North Samosir	02° 44.464	098° 46.861	Rhyolitic Lava Dome	Sanidine	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	73.9 73.4 74.7	± 1.0 ± 1.2 ± 1.3	1.28 1.21	321.72	± 35.77
LT_12_008	Samosir	Tuk Tuk Peninsula	02° 40.214	098° 51.417	Rhyolitic Lava Dome	Sanidine	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	74.3 74.4 74.3	± 0.4 ± 0.4 ± 0.4	3.62 3.48	289.95	± 4.98
LT_12_016	Pardepur	North Pardepur	02° 20.883	098° 54.083	Dacitic Lava Dome	Plagioclase	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	23.6 47.9 -14.4	± 9.8 ± 11.1 ± 5.7	4.48 2.78	289.00	± 3.14
LT_12_015	Pardepur	South Pardepur	02° 20.815	098° 55.676	Dacitic Lava Dome	Plagioclase	Stacked Plateau Age Inverse Isochron Age Total Fusion Age	71.4 75.4 15.3	± 8.2 ± 7.0 ± 18.1	2.26 1.56	294.24	± 0.74

* Lat/Lon in WGS 84 geographical coordinate system

Table 4.2: Experimental data from Evernden et al. (1960) and extrapolated data.

Data from Evernden et al. (1960) for 250 - 420 µm sanidine crystals

Temp (°C)	D (cm^2s^{-1})
490	1.70E-13
870	4.00E-11
990	1.30E-10
1150	1.20E-08

Exponential equation extrapolated from given diffusion coefficients:

$D = 5 \times 10^{-17} \exp(0.0161 \times T)$

where T = temperature (°C)

Simple approximation for diffusion length:

$t = x^2/D$

where x = diffusion length (1/2 of diameter for simple sphere approx.) cm; D = diffusivity cm^2s^{-1}

x = 0.025 cm for 500 µm sanidines and 0.01775 cm for 355 µm plagioclase feldspars

Extrapolated data based on exponential formula from		*t for 500 µm sanidine crystals (x=250 µm)*			*t for 355 µm plagioclase crystals (x=177.5 µm)*		
Temp (°C)	**D (cm^2s^{-1})**	**t (s)**	**t (yrs)**	**t (kyr)**	**t (s)**	**t (yrs)**	**t (kyr)**
190	1.0653E-15	5.87E+11	18601.22	1.86E+01	2.96E+11	9376.88	9.38E+00
200	1.2514E-15	4.99E+11	15835.07	1.58E+01	2.52E+11	7982.46	7.98E+00
250	2.799E-15	2.23E+11	7079.67	7.08E+00	1.13E+11	3568.86	3.57E+00
300	6.2605E-15	9.98E+10	3165.24	3.17E+00	5.03E+10	1595.60	1.60E+00
350	1.4003E-14	4.46E+10	1415.14	1.42E+00	2.25E+10	713.37	7.13E-01
400	3.132E-14	2.00E+10	632.69	6.33E-01	1.01E+10	318.94	3.19E-01
450	7.0054E-14	8.92E+09	282.87	2.83E-01	4.50E+09	142.59	1.43E-01
500	1.5669E-13	3.99E+09	126.47	1.26E-01	2.01E+09	63.75	6.38E-02
550	3.5047E-13	1.78E+09	56.54	5.65E-02	8.99E+08	28.50	2.85E-02
600	7.8389E-13	7.97E+08	25.28	2.53E-02	4.02E+08	12.74	1.27E-02
650	1.7533E-12	3.56E+08	11.30	1.13E-02	1.80E+08	5.70	5.70E-03
700	3.9216E-12	1.59E+08	5.05	5.05E-03	8.03E+07	2.55	2.55E-03
750	8.7715E-12	7.13E+07	2.26	2.26E-03	3.59E+07	1.14	1.14E-03
780	1.4218E-11	4.40E+07	1.39	1.39E-03	2.22E+07	0.70	7.03E-04
800	1.9619E-11	3.19E+07	1.01	1.01E-03	1.61E+07	0.51	5.09E-04
813	2.4187E-11	2.58E+07	0.82	8.19E-04	1.30E+07	0.41	4.13E-04
816	2.5384E-11	2.46E+07	0.78	7.81E-04	1.24E+07	0.39	3.94E-04
837	3.5595E-11	1.76E+07	0.56	5.57E-04	8.85E+06	0.28	2.81E-04
850	4.3882E-11	1.42E+07	0.45	4.52E-04	7.18E+06	0.23	2.28E-04
891	8.4912E-11	7.36E+06	0.23	2.33E-04	3.71E+06	0.12	1.18E-04
900	9.8152E-11	6.37E+06	0.20	2.02E-04	3.21E+06	0.10	1.02E-04
950	2.1954E-10	2.85E+06	0.09	9.03E-05	1.44E+06	0.05	4.55E-05
1000	4.9103E-10	1.27E+06	0.04	4.04E-05	6.42E+05	0.02	2.03E-05

Table 4.3: Fe-Ti Oxide temperatures and calculated diffusion coefficients

Sample Name	Method	Reference	Temperature (°C)	Comment	Calculated D (cm^2s^{-1})	t (s)	t (yrs)
YTT pumice	Fe-Ti oxide	Chesner, 2010	701	min	3.99E-12	1.57E+08	4.97
			780	max	1.42E-11	4.40E+07	1.39
YTT Welded	Fe-Ti oxide	Chesner, 2010	713	min	4.83E-12	1.29E+08	4.10
			761	max	1.05E-11	5.97E+07	1.89
Samosir	Fe-Ti oxide	Chesner, 2010	685	-	3.08E-12	2.03E+08	6.43
			748	-	8.49E-12	7.36E+07	2.33
Pardepur	Fe-Ti oxide	Chesner, 2010	861	-	5.24E-11	6.01E+06	0.19
North Pardepur	Fe-Ti oxide	This Study	816	min	2.54E-11	1.24E+07	0.39
			891	max	8.49E-11	3.71E+06	0.12
South Pardepur	Fe-Ti oxide	This Study	813	min	2.42E-11	1.30E+07	0.41
			837	max	3.56E-11	8.85E+06	0.28

Table 4.4: Thermal diffusivity on rhyolitic glass and sanidine crystals determined from experimental data

Data from Doremus, 2000		*Data from Evernden et al. (1960)*	
Temp (°C)	**time (yrs)**	**Temp (°C)**	**time (yrs)**
403	1.09E-01	300	3165
450	1.42E-01	350	1415
490	5.10E-02	400	633
530	3.12E-02	450	283
550	3.78E-02	500	126
650	6.85E-04	550	56.5
750	3.22E-04	600	25.3
850	3.10E-04	650	11.3
950	1.14E-04	700	5.1
		750	2.3
		780	1.4
		800	1.0
		813	0.8
		816	0.8
		837	0.6
		850	0.5
		891	0.2
		900	0.2
		950	0.1

CHAPTER 5: DECIPHERING TIMESCALES OF DRAINAGE BASIN DEVELOPMENT ON SAMOSIR ISLAND, TOBA CALDERA

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(In preparation as findings from preliminary analysis)

ABSTRACT

Toba's last eruption 74 kyrs ago, forming the caldera seen today, was followed by the caldera filling with water to form a lake within <1500 years and then the onset of a period of resurgence. As part of this resurgence, the floor of the caldera was uplifted and deformed, forming a resurgent dome in the middle of the caldera, known as Samosir Island. During this uplift, lake sediments deposited on the caldera floor tracked the age at which the resurgent dome was last lifted above lake level; this lake sediment cover can be found blanketing the top 100 m across the island surface. ^{14}C ages of the uppermost surface of these lake sediments show that the resurgent dome was last under lake level ~33 kyrs ago. Fault and drainage analysis of the resurgent dome shows that the southern half of Samosir Island is much more dissected than the northern half of the island. Drainage basins in the south are much more developed, with very little sediment cover left and basement rock observed to be exposed in some areas. Using drainage basin analysis tools in ArcGIS and the Geomorph Tools program in Matlab, the stream networks were analysed and channel profiles were created. Combining the identified locations of knickpoints along these channel profiles with assumed erodibility paramters, the minimum amount of time needed for the drainage basins to develop was calculated. Based on these calculations, drainage basins in the north and south took the same amount of time to develop. This means that the difference in drainage development is a result of another factor. One possible explanation is that pre-existing faults may underlie the thick intracaldera YTT deposit on the southern half of Samosir. These faults may have been from the previous half of the OTT resurgent dome, Uluan, that Samosir has appeared to have taken the place of. Pre-existing faults could have

resulted in areas of weakness that were exploited during drainage basin development, thus making the southern drainage basins develop faster than the northern drainage basins. A more detailed study is required, however, to fully develop this potential hypothesis.

INTRODUCTION

Large-scale silicic calderas have been the focus of intense research due to the hazards associated with climactic caldera-forming eruptions (Oppenheimer, 2002; Williams, 2012). These caldera-forming eruptions, however, are not the only hazards associated with caldera systems. As part of the caldera cycle, caldera systems undergo resurgence after the caldera-forming eruption (Smith and Bailey, 1968; Marsh, 1984). This period of resurgence is characterized by structural uplift of the caldera floor (associated with earthquakes) and volcanic extrusions (associated with volcanic activity) along faults through and around the caldera. As a result, resurgent caldera systems should be of interest due to the hazards they pose, especially since all current active calderas are in a state of "restlessness", associated with the period of resurgence (Newhall and Dzurisin, 1988). Determining the timescales associated with resurgence is the first step in being able to characterize and mitigate the hazards that occur during this period of time. Timescales can be obtained through geochronological techniques, such as $^{40}Ar/^{39}Ar$ dating of argon bearing minerals in volcanic rocks, or through less straightforward means, such as modelling geological processes.

One geologic process associated with resurgence is the development of the resurgent dome. During resurgence, the structural uplift of the caldera floor is associated with deformation, leading to the caldera floor being raised several

hundreds of meters (Marsh, 1984; Kennedy et al., 2012) to form a resurgent dome in the middle of the caldera. This resurgent dome, over time, is altered and eroded, changing the surface landscape as drainage basins and channel networks develop. As these landscape evolution processes take time, determining how long a certain landscape took to form can constrain the timing of the formation of the resurgent dome. If there are other constraints that can be applied, such as known ages (from geochronological techniques), the data can be combined to constrain the initial timing of uplift, as well as whether any other geological processes have previously taken place (such as antecedent drainage). This study hypothesizes that the development of drainage basins on a resurgent dome, such as Samosir Island in Toba Caldera, Indonesia, can be used to calculate the time at which initial uplift of the resurgent dome started.

Toba Caldera

Toba Caldera, Indonesia, is a complex caldera system, the result of four overlapping caldera-forming eruptions (Figure 5.1). The first eruption, the Haranggaol Dacite Tuff (HDT), erupted ~1.2 Myrs ago in the northern portion of the caldera. The caldera formed during this eruption must not have been big, and any evidence of it has since been wiped out by subsequent eruptions (Chesner, 2012). This eruption was followed by the Oldest Toba Tuff (OTT) eruption, ~0.8 Myrs ago, which formed the Porsea (or Sibolangit) Caldera in the southern section of Toba (Chesner, 2012). Most likely associated with the OTT eruption was the formation of a resurgent dome; it is hypothesized that part of it still remains along the Porsea caldera (and current caldera, since the two calderas overlap) rim in the form of the Uluan Block (Chesner and Rose, 1991). The next eruption was the Middle Toba Tuff (MTT) eruption, where activity

returned to the northern section of Toba ~0.5 Myrs ago (Chesner, 2012). It is likely that the origin for the HDT and MTT are similar and overlap, however, neither caldera is preserved and their locations can only be hypothesized (Figure 5.1). The last and youngest eruption to date was the Youngest Toba Tuff (YTT) eruption, occurring ~74 kyrs ago (Chesner and Rose, 1991), forming the caldera outline seen today. This eruption was the largest to date, producing around 2800 km^3 of material and is thought to have affected both global climate and create a human bottleneck (Rampino and Self, 1992; Ambrose, 2002; Williams et al., 2009). This eruption wiped out any evidence of calderas from the HDT and MTT eruptions, and most likely caused the reactivation of faults in the Porsea Caldera. The caldera itself is 100x30 km, and at the time after the eruption, when it first formed, it was possibly 2 km deep (Chesner, 2012).

Shortly after its formation, the caldera started to fill up with water from drainage runoff and precipitation experienced in the tropical region (Chesner, 2012). Rough calculations put the lake filling up to current lake level of 900 m above sea level (asl) within 1,500 years after the YTT eruption (Chesner, 2012). With the lake in place, sedimentation started within the lake, from mass-wasting and erosion of the caldera walls. Sediments closer to the walls were coarser and larger, reflective of the travel distance of larger landslide sediments, while sediments deposited in the middle of the lake were finer-grained (de Silva et al., 2015). As the caldera started to return to lithostatic equilibrium, the period of resurgence started, with the caldera floor being uplifted to form a resurgent dome in the middle of the caldera lake, known as Samosir Island. Along with the structural uplift and deformation of the resurgent dome was

volcanic activity along faults. Lava domes extruded along faults running through Samosir Island as well as along the caldera ring faults (Figure 5.1).

Samosir Island

The process of uplift of the resurgent dome meant that the lake sediments found on the caldera floor were also uplifted, forming the upper 100 m thickness of the total 700 m uplifted forming Samosir Island. Below the sediment is 600 m of welded YTT intracaldera fill. The sediments on Samosir Island can be classified into two kinds: laminated diatomaceous matter and ashy sediment, and laminated muds, sands, and course particle debris flows (Figure 5.2). The distribution of the sediment layer appears to be uneven. The northern half of Samosir is mostly blanketed in laminated diatomaceous matter and ashy sediment layers. The southern half, however, looks very different. Laminated layers of sand, small sorted pumices, and medium to large boulders from debris flows can be found within the walls of the valleys. The development of the surface, with respect to faulting and drainage channel evolution, is also very different between the northern and southern parts of Samosir. In the north, the drainage channels are not deep, incising into mainly laminated diatomaceous matter, with river channels being captured by circumferential faulting along the length of the resurgent dome (Figure 5.3). In the south, however, drainage basins are much more developed, eroding through any evidence of faulting and incising valleys through both the sediment layer and the underlying YTT. It has been recorded that basement rock has also been observed in the south of Samosir, below the YTT layer (Chesner et al., 1991), however this has not been confirmed in this study.

The top most layer of the sediment layer on Samosir Island has been dated with radiocarbon dating, returning an age of 33,090 +/- 570 years BP and 33,730 +/- 240 years BP at the same elevation (Chesner, 2012 and de Silva et al., 2015, respectively). Assuming an isosynchronous layer, these ages are a minimum age of the uppermost sediment layer. This age of ~33.7 kyrs ago (older age of the two) is representative of the last period of deposition on the resurgent dome; after 33.7 kyrs ago, the resurgent dome had emerged from the caldera lake, thus stopping deposition. This means before 33.7 kyrs ago, the resurgent dome was still under lake level, covered by the lake. This lake sediment age provides a constraint for the initial emergence of the resurgent dome, and should be corroborated by the development of the drainage basins on Samosir's surface. The question arises, therefore, why the drainage basins in the south are so much more developed than the drainage basins in the north. If the resurgent dome rose equally (both north and south rose at the same time), the drainage basins across the entire island should be equally developed. This difference in drainage basin evolution hints at another timing related to the emergence of Toba's resurgent dome. This study will constrain the initial uplift of Toba's resurgent dome by performing a simple calculation of the minimum amount of time required for the development of drainage basins in the north and south, given certain erosion parameters.

METHODS

ArcGIS Analysis

The initial analysis of the drainage basins on Samosir Island required a better characterization of these basins. An ASTER 30 m digital elevation model (DEM) was loaded into ArcGIS 10.5 Desktop software and then cropped to only

include the spatial extent of the resurgent dome (Figure 5.4). This removed any calculation complications related to the lake surrounding the island. The DEM was first filled (Spatial Analyst Tool -> Hydrology -> Fill) so as to remove any sinks within the DEM (such as small lakes on top of Samosir Island). A flow direction for the DEM was then calculated using the 'Flow Direction' tool. This calculates the elevation of a middle cell to a neighboring cell and selects the path of steepest drop (Figure 5.5). Based on the flow direction, flow accumulation was calculated ('Flow Accumulation' tool) to show the path of flow between the cells which would result in the most accumulated flow; this would represent the path of drainage (Figure 5.6). A value of more than 500 cells was used in determining which drainages would show up. A value of 5000 is usually used to represent the highest-flow paths; extending the drainage to include as many of the upper tributaries as possible (by using a minimum amount of 500 cells) allowed for better characterization of the stream networks.

Using the above calculated raster layers, the drainage basins were calculated with the 'Basin' tool to automatically draw drainage basins divides. This tool draws an automatic watershed outline based on assuming where the cells drain at the edges, using the flow accumulation raster (Figure 5.7). The drainage basins were then extracted as basin polygons (Figure 5.8) and numbered from north to south, with the divide between the northern and southern basins determined by basins found north or south of the Tuk Tuk peninsula. The 'Basin' tool generates all possible basins, but the ones selected for this study were ones that appeared more substantial (in area) and where its headwaters were closest to the highest elevation (along the fault running through the resurgent dome). From these potential basins, only the drainage

basins that reached up to the highest elevation were selected for further analysis. These drainage basins selected are as follows: North 1, North 2, North 8, North 12, South 1, South 3, South 5, South 8, South 9, South 11, and South 13.

Geomorphology Tools

For the drainage analysis of each of these basins, the 'Geomorph Tools' scripts developed by Eric Kirby's geomorphology group was used, combining ArcGIS and Matlab (student version 2012b). The cropped raw DEM (prior to Fill via ArcGIS) and the flow accumulation files were converted to ASCII files to be read in Matlab, and then converted to Matlab code through the 'arcdemtxt2matlab' script. During this process, the initial DEM and flow accumulation files needed to be checked to ensure that the spatial extent of both files were exactly the same and overlapping, and that the coordinates for the files were in UTM coordinates (not Projected Geographic coordinates).

Using the flow accumulation layer in ArcGIS, the headwaters of the main streams (the longest streams) for each basin was identified and marked (Figure 5.9). For some basins, there was more than one potential main stream, so the headwaters for each were identified. This resulted in the following streams: North 8a and b (northern and southern), North 12a, b, and c (northern, middle, and southern), and South 11a and b (western and eastern, respectively). The identified headwaters were selected and stored as a location text file through the Geomorph Tools toolbar in ArcGIS, and parameters were set for the processing of the channels downstream of these headwaters. Two parameters needed to be set: a smoothing window filter and a contour interval. The smoothing window

filter smoothens the channel profile, forcing any point downstream that is higher in elevation than the point above it to be either equivalent or less, thus ensuring the rivers flow downstream without any obstacles. This smoothing window filter was set at 100 m, the minimum amount required for a DEM of 30 m resolution (at least 3 times the resolution of the DEM). This also ensured that any small features, such as faults, would not be completely smoothed over. The contour interval discretizes the vertical extent of the channel profile for analysis, and this was also set at the minimum amount of 5 m increments to produce as detailed a channel profile as possible.

These parameters, the selected headwaters for the different drainage basins, and the flow accumulation and raw DEM files were processed through the 'Profile51' Matlab script which generated channel profiles, calculated regressions over horizontal distances, measured the drainage area, length of channel, elevation changes, as well as allowed for selection and storage of potential knickpoints in the channel profile. The produced data from Matlab was then viewed back in ArcGIS to show the generated streams (Figure 5.10) and selected knickpoints (Figure 5.11).

Extra Information

In order to complete the data set for an evaluation of the drainage basins, two more pieces of information were added. Along the generated streams, a cross-section profile was recorded to measure the elevation of the upland area of the rivers (Figure 5.12). This would provide a better comparison of the channel profile to the profile of the walls of the channel (the upland). Secondly, in order for a better evaluation of the knickpoints, faults on the western side of Samosir

was mapped out (Figure 5.13), using information from de Silva et al. (2015) and Aldiss and Ghazali (1984).

Minimum Response Time Calculation

In a detachment-limited model, the development of a channel profile is described as occurring as a kinematic wave profile (Whipple and Tucker, 1999). For the case of drainage development of Samosir, the sediment cover of laminated ash, sand, and diatomaceous matter define channel erosion as following a detachment-limited model. The erosion is assumed to be linear with slope (n=1). The following calculations are derived from Whipple and Tucker (1999). For a kinematic wave, the response time for the propagation of a disturbance in the channel profile is described as

$$T_b = \frac{H}{U_0} T_{*b}$$

where T_b is the minimum response time for the channel development (yrs), T_{*b} is the dimensionless response time, H is the vertical length scale (m), and U_0 is initial uplift rate.

For n=1 (erosion linear with slope), h=2 (basin area is approximately proportional to the square of basin length), and m=1/2 (slope vs contributing area), hm/n = 1. T_{*b} can also be written as

$$T_{*b} = -{N_E}^{1/n} {U_*}^{\frac{1}{n}-1} \ln(x_{*c})$$

where U is dimensionless uplift rate, x_{*_c} is the distance of the river channel to the headwater (m), and N_E is the dimensionless uplift erosion number. N_E is also written as

$$N_E = \frac{U_0}{K}\, {k_a}^{-m}\, L^{n-hm}\, H^{-n}$$

where K is the value for bedrock erosion (yr^{-1}), L is the length of the basin (m), and k_a is a dimensional constant.

Combining the three above equations,

$$T_b = -\frac{H}{U_0}\,(\frac{U_0}{K}\, {k_a}^{-m}\, L^{n-hm}\, H^{-n})^{1/n} {U_*}^{\frac{1}{n}-1} \ln\,(x_{*c})$$

where $U_* = U/U_0$ and $x_{*_c} = x_c/L$. By substituting in n=1, h=2, m=1/2, the above formula can be simplified to

$$T_b = -\frac{\ln(\frac{x_c}{L})}{K\sqrt{k_a}}$$

where $k_a = A/x^2$ for h=2 from Hack's law. A is the drainage area while x is the length of the river. This equation can also be rewritten to find an erodibility value for the given bedrock,

$$K = -\frac{\ln(\frac{x_c}{L})}{T_b\sqrt{k_a}}$$

For areas where the minimum response time is known, such as in the north for the continuous sediment cover of ~33.7 kyrs ago, an erodibility value can be calculated (Table 5.1). Given that the geology in the north and south are

the same, the same erodibility value can be used then in the south to calculate the minimum amount of time needed for drainage basins in the south to develop.

RESULTS

The channel profiles, the upland profiles, and the slope-area log plots of each of the channels are shown in Figure 5.14. As a general comparison, channel profiles of North 8a and South 3 (Figure 5.14 (C) and (I)) can be compared against each other. In general, the channel profiles in the northern drainage basins are flat and gently sloping from ridge to river mouth. Although knickpoints were selected, the change in elevation at these knickpoints are not that distinct, showing vertical changes of less than 10 m. The overall profile itself appears to be more convex than concave, with the middle portion of the channel 'bulging' slightly. In the south, the channel profiles are more distinct, with an upper elevation plateau followed by a sudden decrease in elevation at a knickpoint. The upper plateau is gentle sloping, where as the elevation change below the knickpoint produces a concave-like profile. The knickpoints identified in the southern channel profiles range from small changes in vertical elevation to more distinct knickpoints creating changes in elevation of over 50 m. The overall profile of the souther channels are more reminiscent of a typical channel profile, where the propagating knickpoint generates a sudden change in elevation from the mouth of the river up to the ridge of the drainage basin.

Using the initial selection of knickpoints, the location of these knickpoints were plotted overlain with the map of the faults running across Samosir Island. Knickpoints that corresponded with faults were not included, as

the knickpoint was assumed to be the accommodation of uplift of a fault, as opposed to a change in elevation (a knick) that started at the base of the channel and has been propagated upstream. The data generated from the Matlab script calculations produced the drainage area of each basin (A), the length of the channels (L), and the location of the knickpoints (x_c), as seen in Table 5.1 (complete data available in Appendix Table 5.1). Assuming an initial minimum amount of time, T_b, of 33.7 kyrs for the drainage basins to have evolved, an erodibility value was calculated (using equations previously mentioned in Methods; 'K' column in Table 5.1). These erodibility values varied in numbers, but the averages of the most common ones were identified: 1.5E-04, 2.5E-04, 3.5E-04, 1.5E-05, 2.5E-05, 3.5E-05, 4.5E-05, 5.5E-05, 6.5E-05, 7.5E-05, and 7E-06 yrs^{-1}. Using these different values, a minimum amount of time for development of each drainage basin was calculated, assuming the location of the knickpoints as points of disturbance propagating through the already established drainage basins. These results for the northern and southern drainage basins are shown as T (time in years in Table 5.1).

The time calculated for each knickpoint in each basin range widely, from a maximum calculated time of over 1.7 myrs for a K of 7E-06 yrs^{-1} from stream North 8a, to a minimum amount of time of 304 yrs for a K of 3.5E-04 from stream South 1. The first characteristic that stands out is that the maximum values seen in the northern basin are similar to the maximum values seen in the southern basin for each given K value. This is especially true for the K value that produces the most realistic T_b values: between 3.5E-04 and 2.5E-04 yrs^{-1} produce drainage basins that develop between maximum time ranges of 22 to 47

kyrs. These T_b values correlate the best with the age of the youngest continuous sediment cover on Samosir Island of ~33.7 kyrs ago.

DISCUSSION

This initial T_b calculation performed on the knickpoints found throughout the channel profiles of the Samosir drainage basins results in a few conclusions. The calculation was first performed based on the distinct difference in drainage basin development seen in the DEM and on the island during fieldwork. The initial assumption was that the difference between the more developed drainage basins in the south and the less developed drainage basins in the north were a result of a difference in time. The more developed southern drainage basins must have been a result of the southern half of Samosir Island being uplifted first, before the northern half, thus resulting in developed drainage basins and a dissected topography. However, the T_b calculations show that this is not the case. No matter what K value was used, the time taken for the development of the drainage basins in the north was very similar to the time taken for the southern drainage basins to develop. This implies that another factor is responsible for explaining the difference in drainage development between the northern and southern basins.

The most obvious second explanation for this difference would be a difference in geology. If the southern basins were eroding through rock that was less resistant than the northern basins, this would explain why the southern basins appear to be more developed even if both north and south started development at the same time. Based on the field geology, this is appears unlikely. The geology of Samosir Island appears to be continuous throughout

the island. The upper 100 m of the island is sediment, with interbedded sediment horizons of sand and clay interbedded layers and diatomaceous sequences (de Silva et al., 2015). Below this 100 m of sediment is a thick ~500 m deposit of intracaldera YTT, a relatively welded ignimbrite. Underlying this, based on exposed areas seen in the southern basins, lies basement rock (metasediment) and possibly also OTT (Chesner et al., 1991). In order to determine whether a difference in geology is one of the main reasons for the difference in drainage development, a more detailed study and analysis of the island needs to be done. At the moment, however, this has not been done. It would also be useful to obtain cores across the island in order to catalogue whether the different sediment sequences are actually continuous across the island, or if certain sediments are concentrated deposit in only one region. A detailed sediment deposition study such as suggested would allow erodibility values to be constrained not only across the extent of Samosir Island but also with depth of the deposited layers making up the island of Samosir.

Another explanation is the possibility that the southern drainages have developed along the lines of antecedent drainage. The southern half of Samosir fits almost like a jigsaw puzzle with the cliffs of Uluan Block (Figure 5.1), the remaining half of the resurgent dome formed after the OTT eruption in the Porsea Caldera (Knight et al., 1986; Chesner et al., 1991; Chesner, 2012). If the southern half of Samosir was actually the uplifted half of Uluan that had collapsed during the YTT caldera formation, drainage that was present on that half of Uluan may have remained intact, uplifting with the rise of Samosir Island. This could have given rise to antecedent Uluan drainage influencing and promoting the development of drainage in the south of Samosir as compared to

the north of Samosir. This explanation, however, can be refuted with the geology present on Samosir Island. The intracaldera YTT found on Samosir Island is 500 m thick; if there was antecedent drainage from Uluan, it is likely that the intracaldera YTT filled this up, thus removing any effect it might have on overlying developing drainage.

A similar case, however, may be argued from the point of view of pre-existing faults. The development of the Uluan resurgent dome would have produced faults that are similar to what is seen on Samosir today. The collapse of the western half of Uluan would have produced an underlying layer of Uluan blocks below the intracaldera YTT fill and the 100 m of lake sediment found on Samosir Island. The uplift of Samosir Island could have reactivated pre-existing faults present in the underlying Uluan block, resulting in movement being preferentially accommodated along these pre-existing faults. This would mean that the southern half of Samosir, despite uplifting at the same time as the northern half of Samosir, ~33.7 kyrs ago, would have more movement and faulting, with the resurgent uplift in the south exploiting these older pre-existing and underlying faults. Drainages developing on the surface would exploit the fault zones present, thus producing a more dissected and developed drainage on the surface. This is the most likely scenario and explanation for the southern half of Samosir having drainages that are more developed than the norther half. Further work, however, would be needed in order to verify this hypothesis. Identifying these faults in the south of Samosir, and on the Uluan Block itself, would produce a clearer picture as to the effect of pre-existing faults on the drainage on the surface, if they even exist in the first place.

Limitations and Constraints

There are several limitations and constraints with the preliminary calculations presented here. The first lies in the initial calculation of the flow accumulation and the selection of the headwaters for processing. In the method presented here, the headwaters were selected by using the generated flow accumulation streams, selecting the headwaters of the longest (main) streams present in each drainage basin. A more accurate method might be the selection of the headwaters by using the visible drainages present on the DEM (Figure 5.4). Selecting where the streams appear to start on the DEM instead of through the calculation of flow accumulation might more accurately reflect the true channel development in each drainage basin.

The selection of the knickpoints, thus determining the T_b for each drainage basin, can also be more robust. In the method presented here, the selection of the knickpoints in the river channels was by eye, selecting any evident change in elevation along a channel profile. This could lead to issues of misidentifying knickpoints, or even worse, missing certain crucial yet subtle knickpoints. A more robust method might be to set a minimum required elevation change for a knickpoint over varying horizontal distances, thus providing the ability to classify knickpoints based on the degree of change in vertical elevation and minimizing error in misidentifying a knickpoint compared to an artefact in the processing method.

The generation of these knickpoints in itself raises several issues and questions, the main one being whether the knickpoints correlated with mapped faults and, even more so, unmapped faults. To answer this issue, it would be

necessary to produce a more robust map of the faults on Samosir Island, keeping in mind that the knickpoints themselves might actually be able to resolve faults. This is especially true in the southern half of Samosir, where there are fewer mapped faults, possibly because of the high degree of drainage development, obscuring any fault traces that might exist. A detailed statistical study of the knickpoints in relation to faults, mapped or unmapped, might be able to resolve this issue.

The last issue that appears to be of significance is the produced channel profiles of the streams (Figure 5.14). Both the channel profiles and the upland profiles appear to be convex. It is usually assumed that channel profiles are concave while the upland profiles are convex. This difference shows the degree to which the channel profiles have developed through the erosion of the rivers. In this case, however, a convex channel profile would indicate that uplift rate is increasing going down stream. In order to resolve this difference, it would be necessary to develop a more accurate and precise method of drawing the upland profiles. One possible method is to use a statistical average of the surrounding cells of each cell of the channel to get the average height of the upland along the channel as it goes down stream. With this in place, the upland and channel profiles then be compared again. It is quite possible that the convex profiles are a result of too much interference from fault activity along the western slope of Samosir Island. This ties in again with the need for a better fault map of Samosir's surface, in order to better constrain the faulting activity and its relation to the channel profiles.

CONCLUSION

The similar drainage basin evolution time between the northern and southern drainage basins have raised more questions than answers. The difference in the drainages seen on the surface needs to be explained by something else instead; the assumption that the southern half of the island has had more time for drainage development than the north is incorrect. The most likely scenario is that pre-existing faults underlying Samosir Island from half of the Uluan resurgent dome (from the OTT activity) may be responsible for allowing preferential development of drainages in the south as compared to the north. This hypothesis, however, requires more work, especially a detailed study of the sediments and faults in the region (both on Samosir Island and on Uluan Block). Knickpoints identified in channel profiles may in fact trace faults across southern drainages that are no longer visible due to erosion and river development.

Finer details associated with the faulting and sediment layers can be applied to more rigorous testing in landscape models, where layering of soil and variations in erodibility can be included. The surface features and landscape development of Samosir, however, have provided a different insight into the timing of resurgence and geological processes associated to the development of resurgent domes.

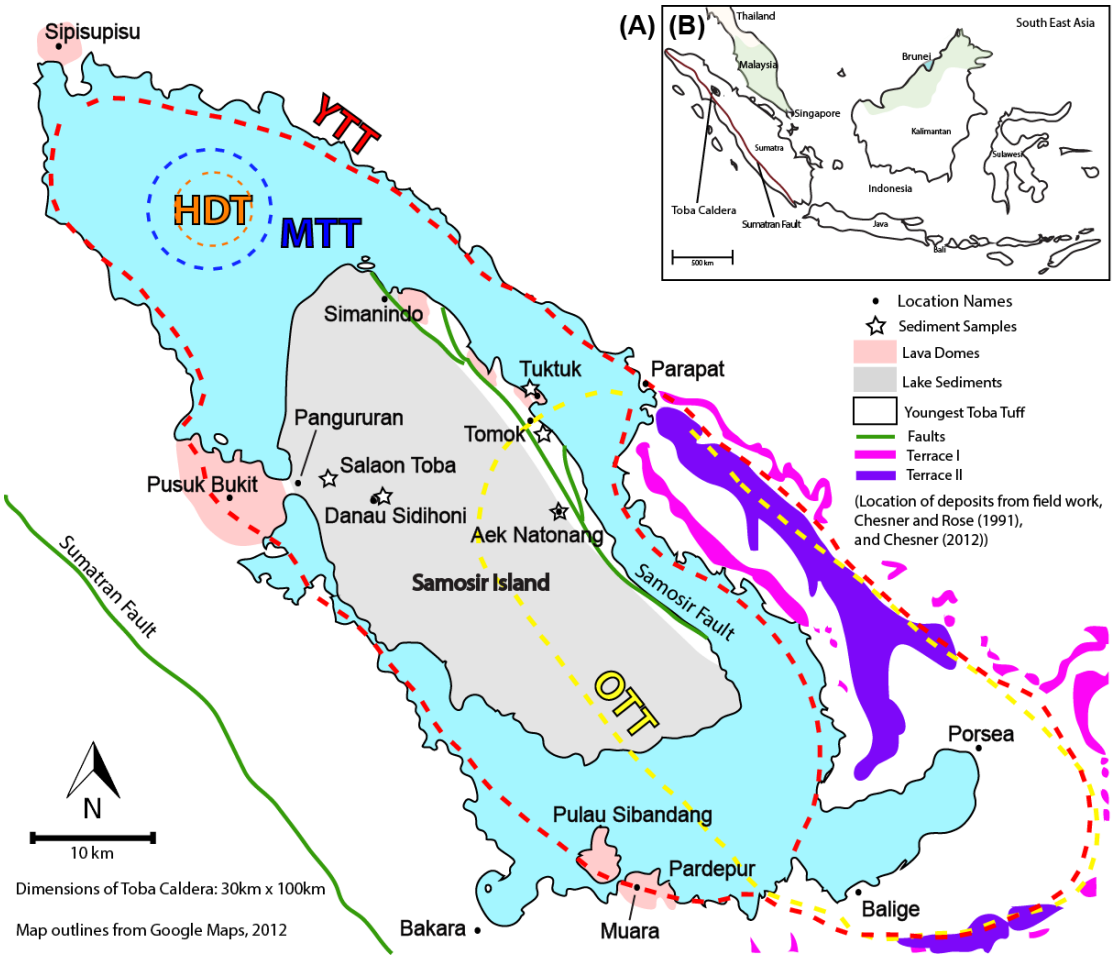


Figure 5.1: Toba Caldera and Map of Toba Caldera, eruption outlines, and geological deposits

(Adapted from de Silva et al., 2015)
(A) Eruption outlines of Toba's four eruptions shown in colored dashed lines. Orange: Haranggaol Dacite Tuff (HDT). Yellow: Oldest Toba Tuff (OTT). Blue: Middle Toba Tuff (MTT). Red: Youngest Toba Tuff (YTT). Lake sediment found on resurgent dome shown in grey. Lava domes related to resurgence shown in red. Samosir and Sumatran faults shown in thick green line. Two lake terraces from previous high lake stands shown in purple and pink: Terrace 1 at an elevation of 1160 m and Terrace 2 at an elevation of 1050 m. Location of sediments sampled for radiocarbon dating marked by white stars.
(B) Inset shows location of Toba Caldera in relation to South East Asia.

Figure 5.2: Sediment stratigraphy and logging on Samosir Island

(From de Silva et al., 2015)
(A) First type of sediment found on Samosir Island: rhythmically bedded laminated muds and sand, intermittently found with cross cutting and conformable layers of coarse debris flows of conglomerates and fluvial sands
(B) Second type of sediment: diatomaceous tuff with laminated ashy sediment
(C) Extensional, normal faulting found through layers of sediment, found mostly on the west side of Samosir Island

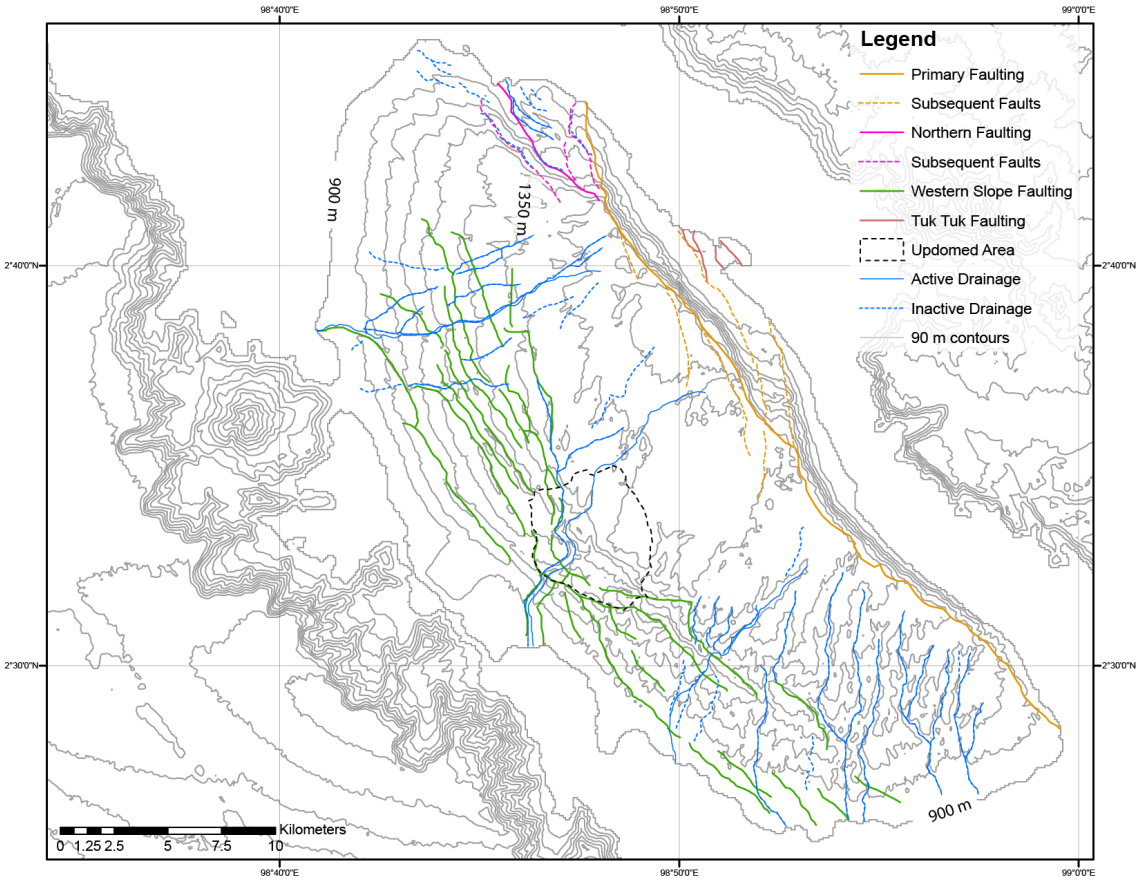


Figure 5.3: Neotectonic fault analysis of Samosir Island

(From de Silva et al., 2015) Faults shown in colored lines on 90 m contour map of Samosir Island. Drainage channels shown in blue lines (continuous lines: active drainage, dashed lines: inactive drainage). First stage of faulting activity shown in orange, followed by faulting in pink, then faulting in green. Faults shown in dashed lines show hinged faults off the main fault. Final stage of faulting shown in red.

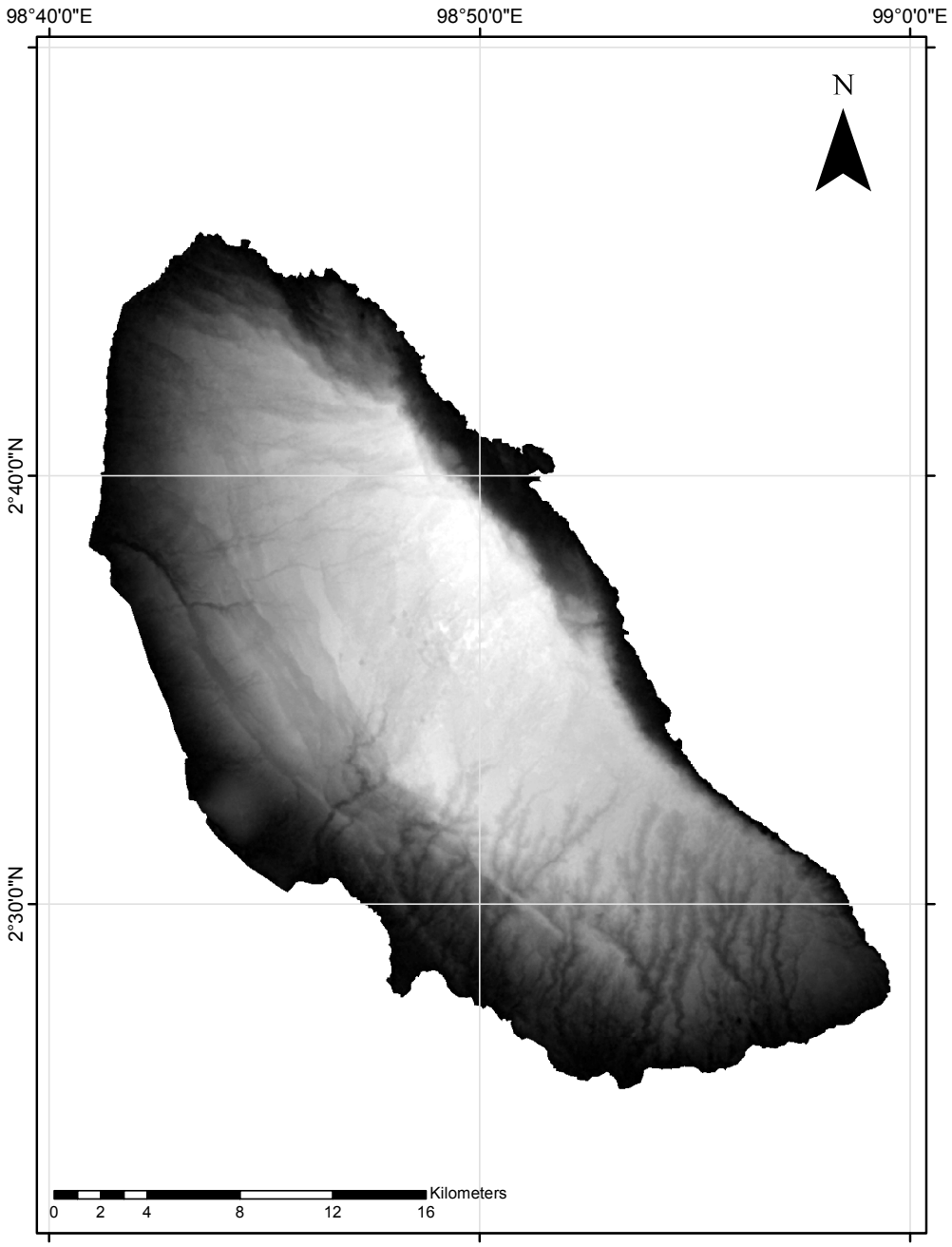


Figure 5.4: Digital Elevation Model of Samosir Island

Digital elevation model (DEM) of Samosir as clipped from ASTER 30 m. ASTER data was obtained from the NASA Reverb dataset. ASTER GDEM is a product of NASA and METI.

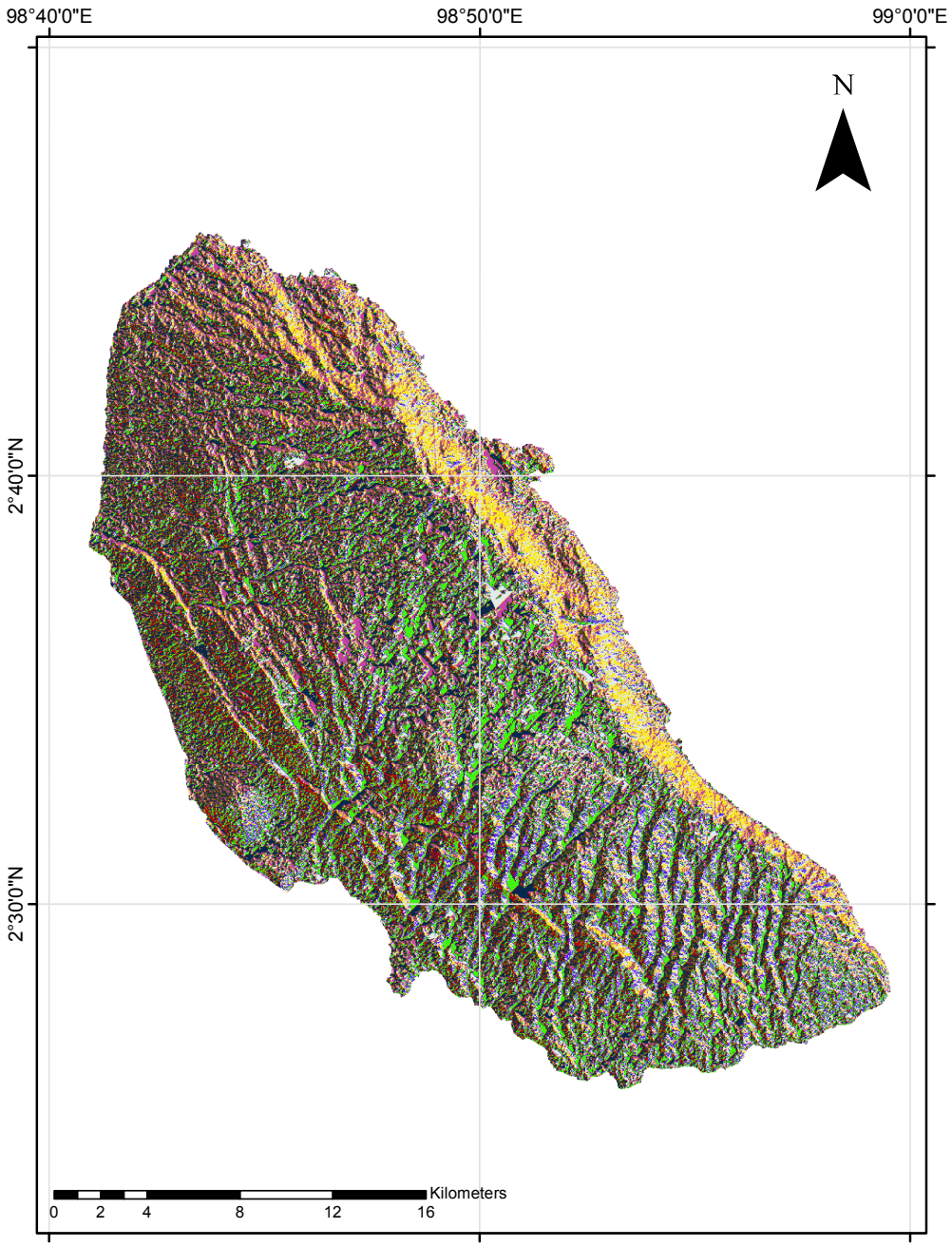


Figure 5.5: Flow direction raster of Samosir Island

Flow direction raster colors show direction of flow of cells. Pink is north, yellow is east, green is south, and red is west.

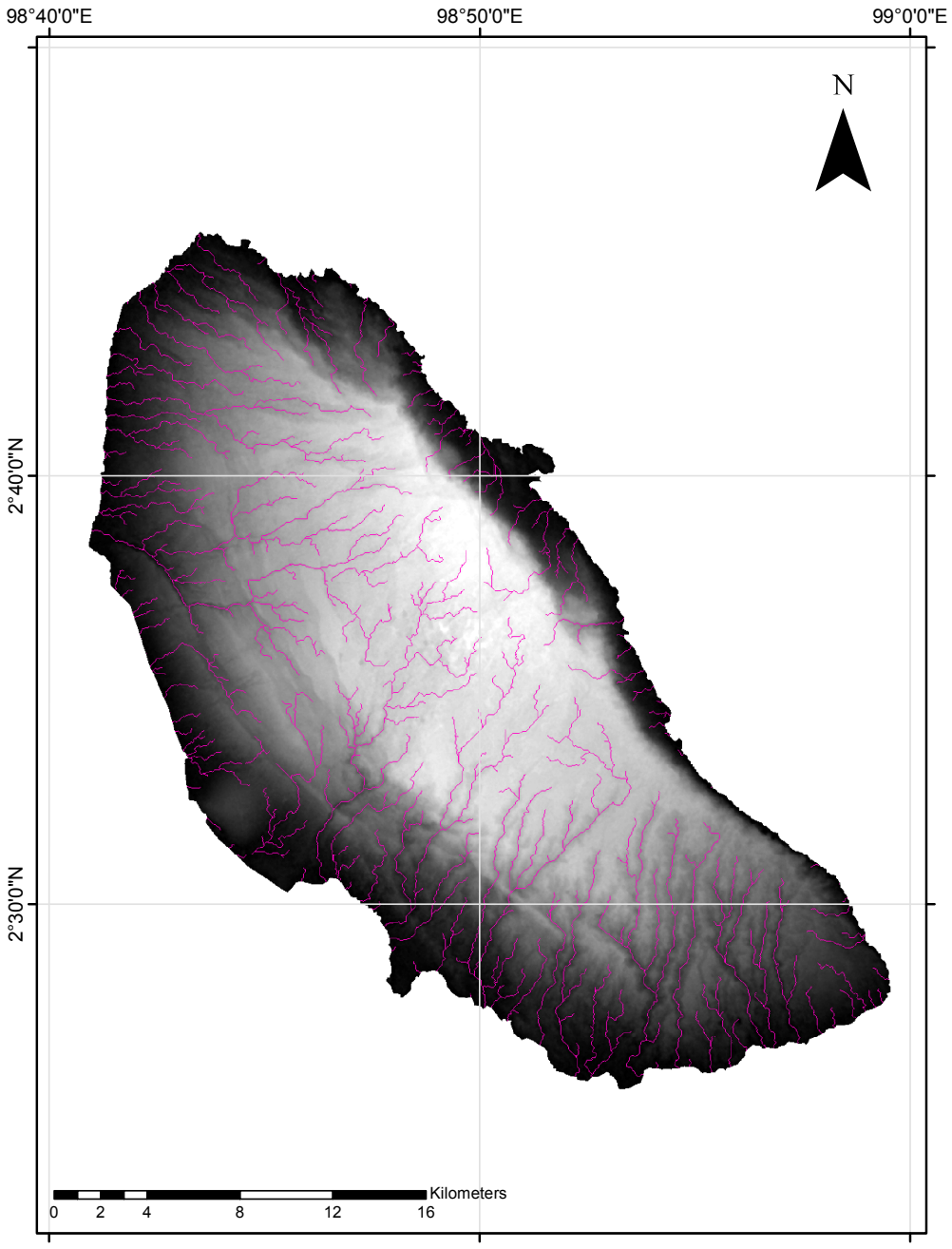


Figure 5.6: Flow accumulation raster of Samosir Island

Flow accumulation (pink lines) shows the drainage calculated on the surface. The outlined drainage also delineates the river channels developed in the drainage basins.

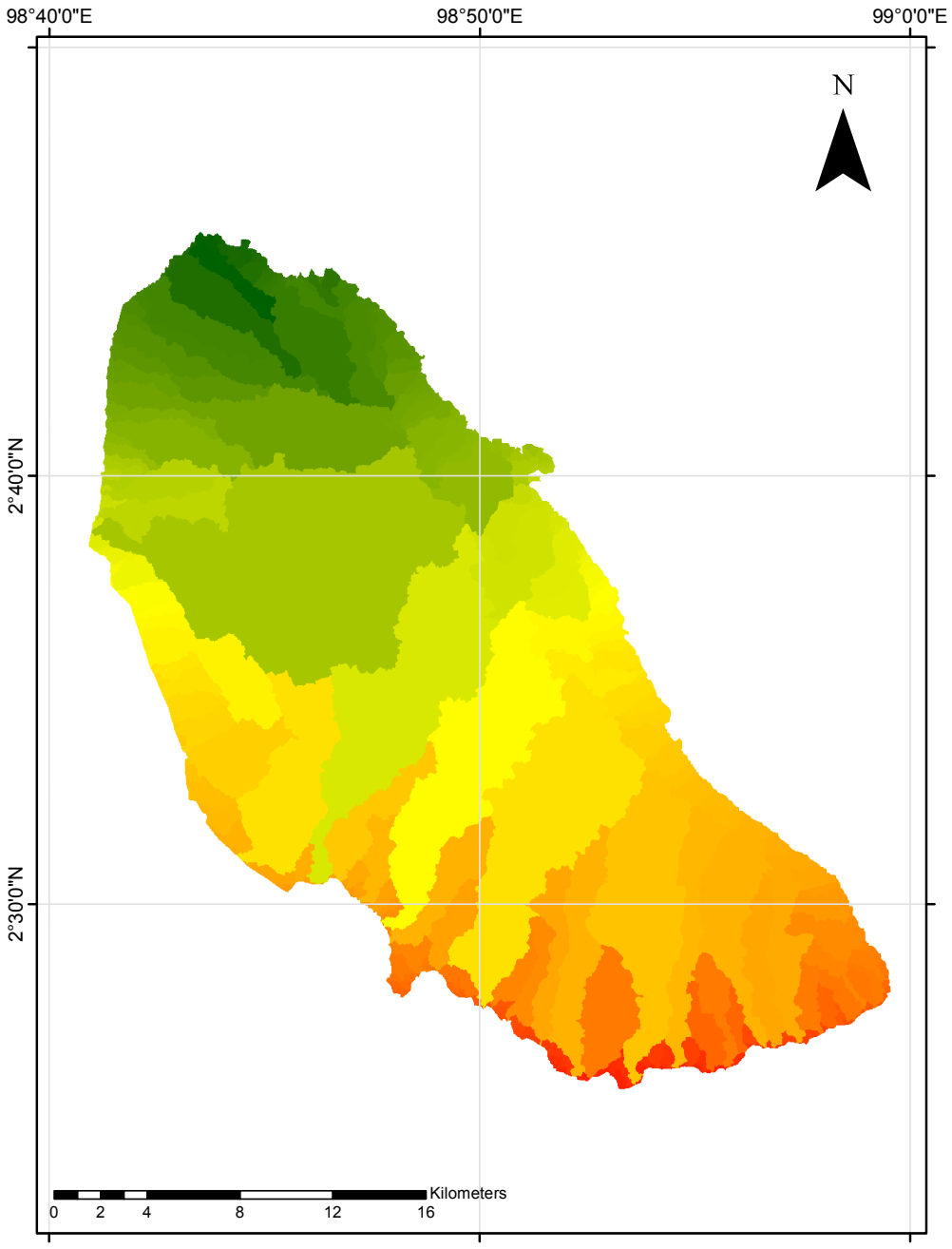


Figure 5.7: Drainage basins on Samosir Island

Drainage basins shown in color; green represents basins with the least drainage, red represents basins with the most drainage. The color range between red and green show the change in drainage over the surface.

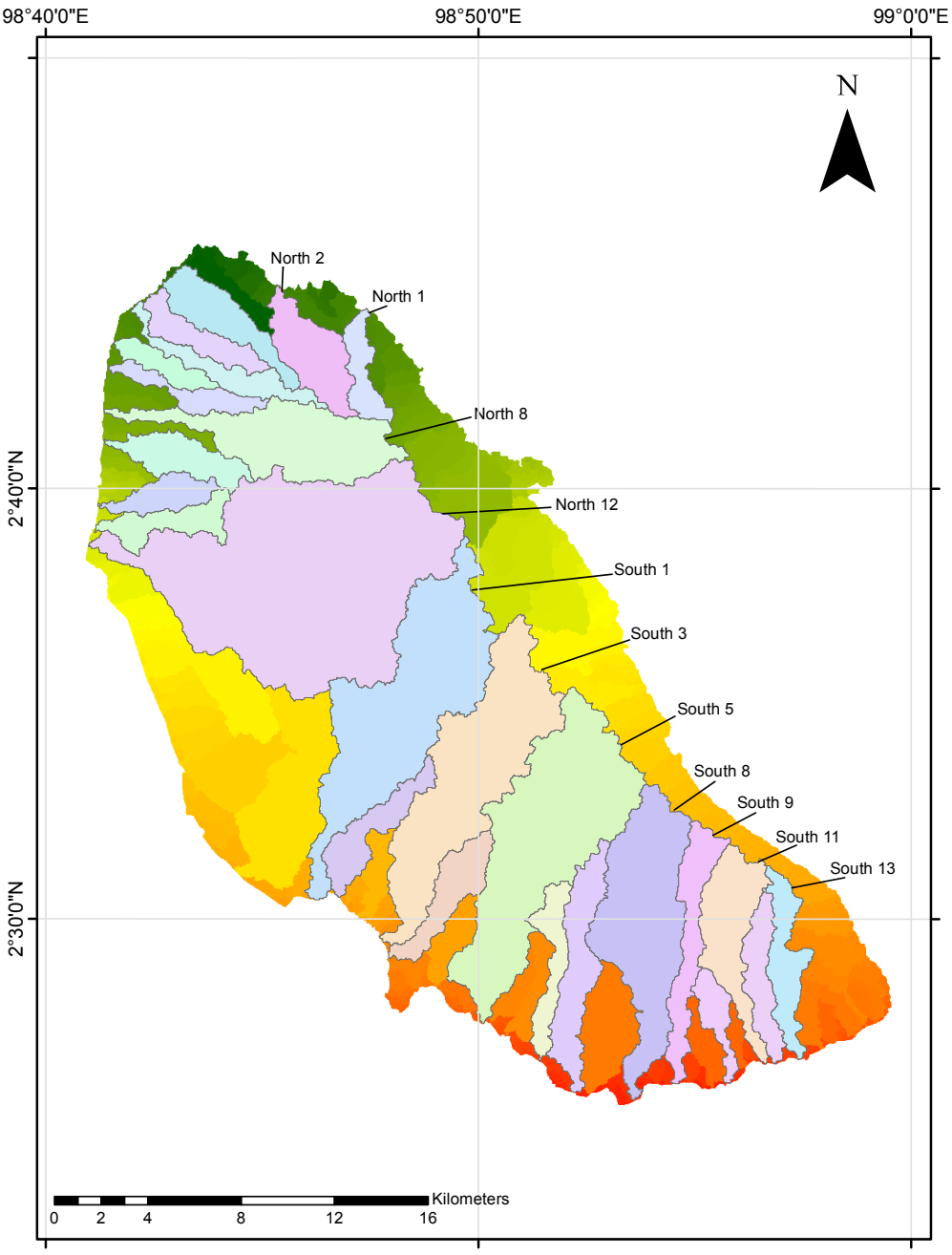


Figure 5.8: Selected drainage basin polygons on Samosir Island

Based on the basins created in Figure 5.6, basins along the main Samosir fault running through the resurgent dome were selected for analysis and numbered. The subset of these basins that start at the main divide (Samosir Fault) were further selected for continued processing.

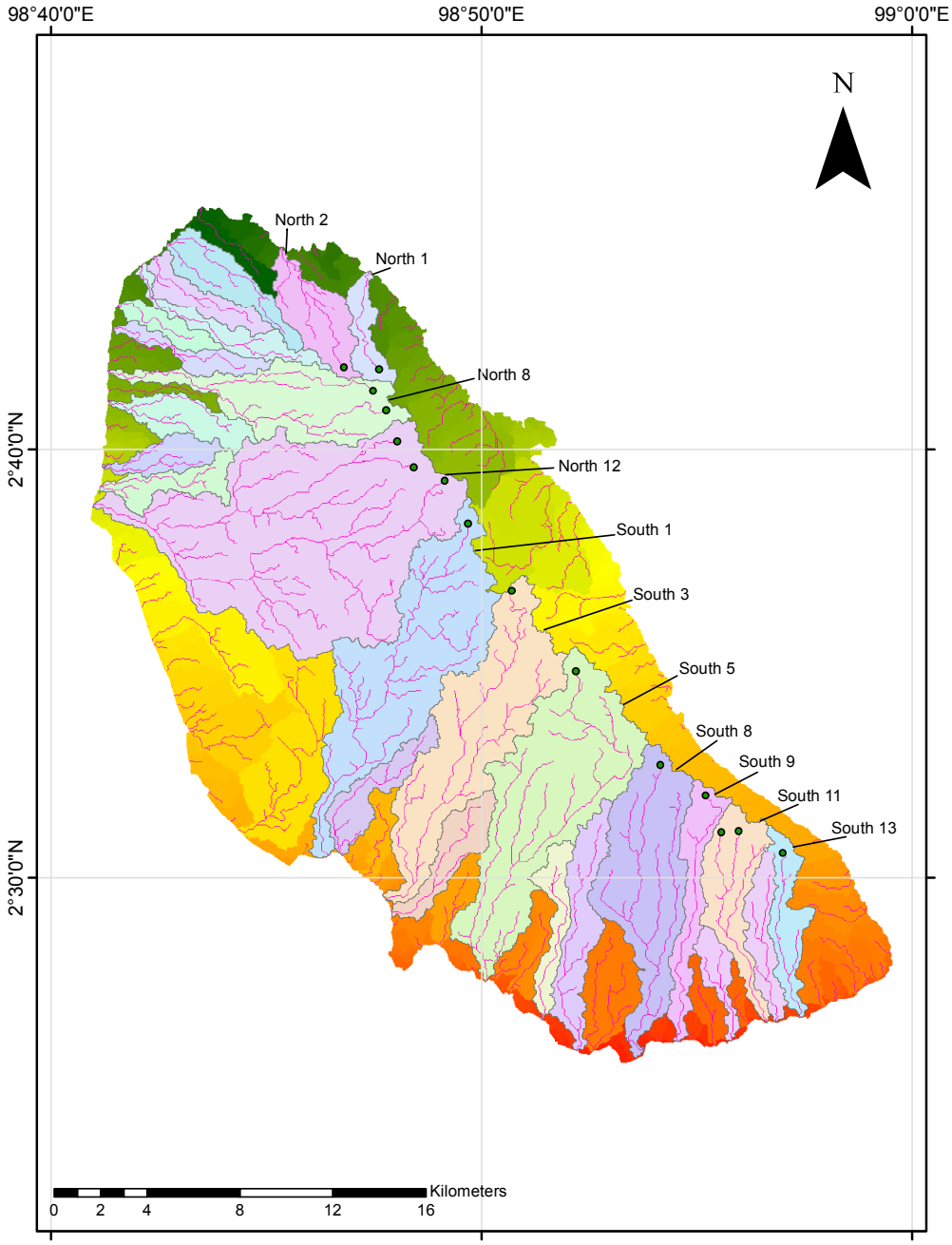


Figure 5.9: Selected headwaters of flow accumulation on Samosir Island

For the selected drainage basins, headwaters of the longest flow accumulation streams were selected to be used as headwaters in the calculations through the Geomorph Tools scripts. These headwaters are shown by green circles, while flow accumulation are shown by pink lines.

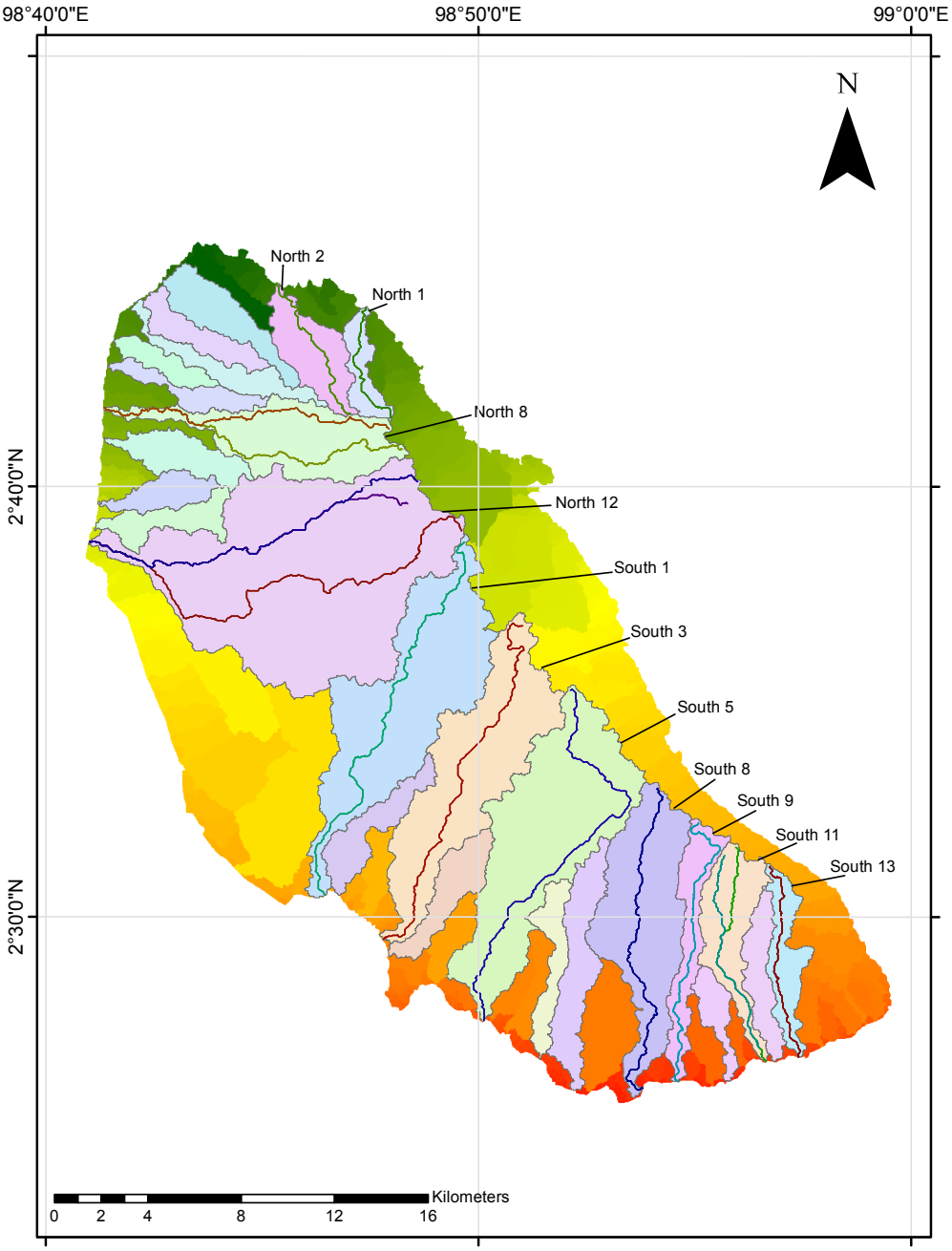


Figure 5.10: Generated stream channels

Based on the processing of the flow direction and headwaters, the stream channels for each basin were generated with the Geomorph Tools scripts and are shown here as lins of different colors for each of the selected drainage basins.

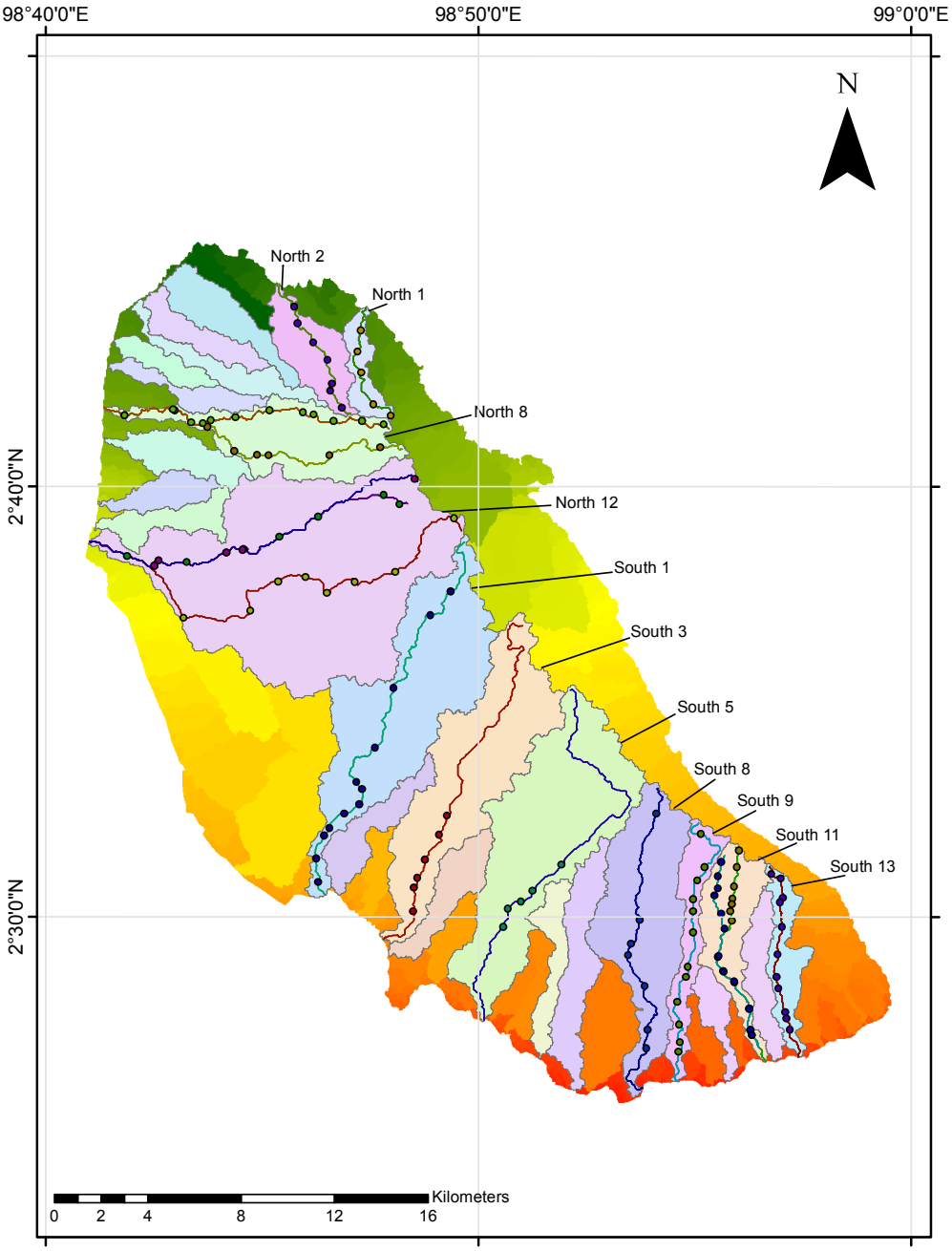


Figure 5.11: Generated knickpoints

Along with the generated stream channels, knickpoints were selected along the channel profiles and the location of these knickpoints are as mapped. The knickpoints are represented by circles of different colours corresponding to each of the selected drainage basins.

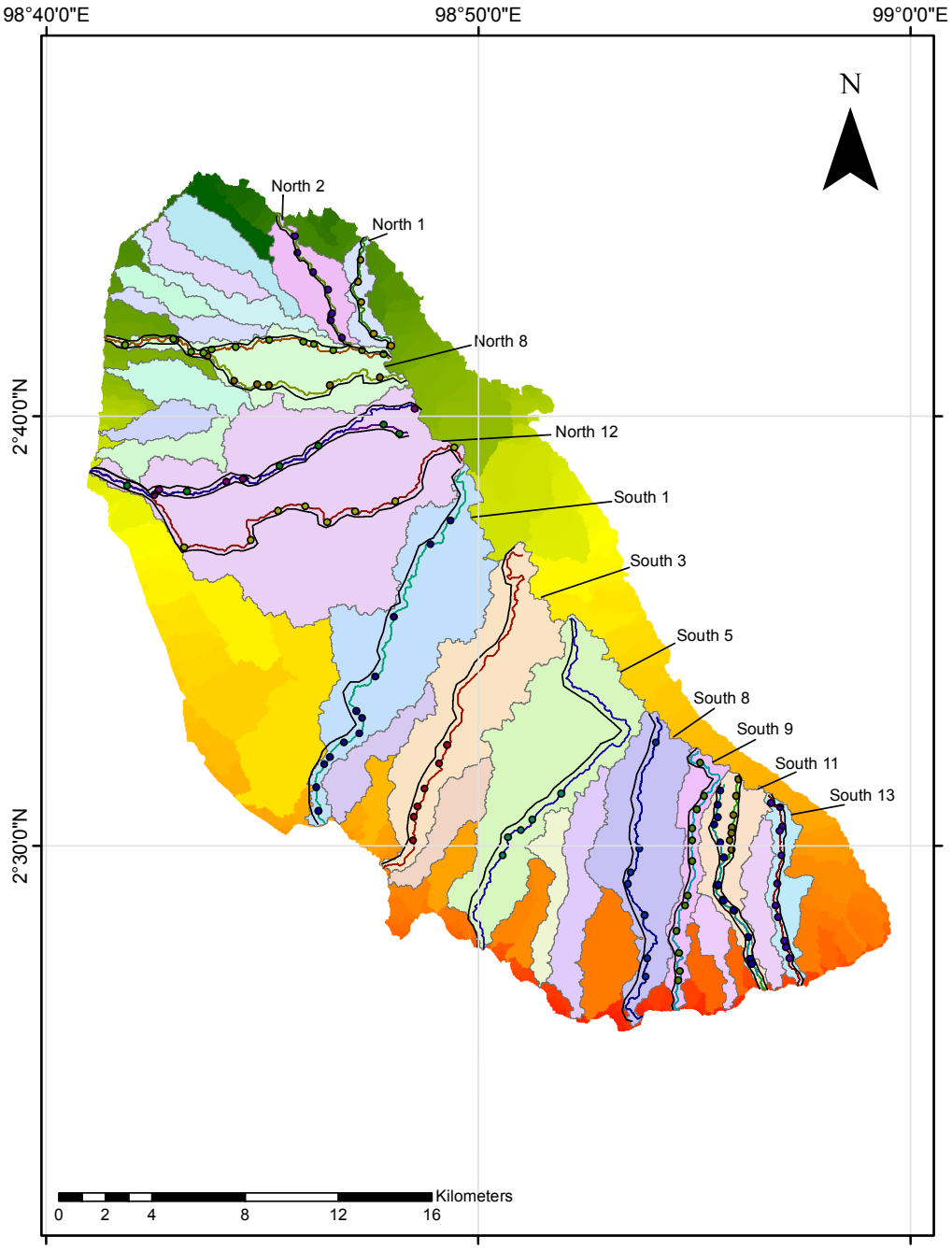


Figure 5.12: Upland profile

To be able to better understand the channel profiles, the upland profile of each stream was generated. The black lines mirroring the different streams are the profile lines used to create the upland profiles for each stream channel

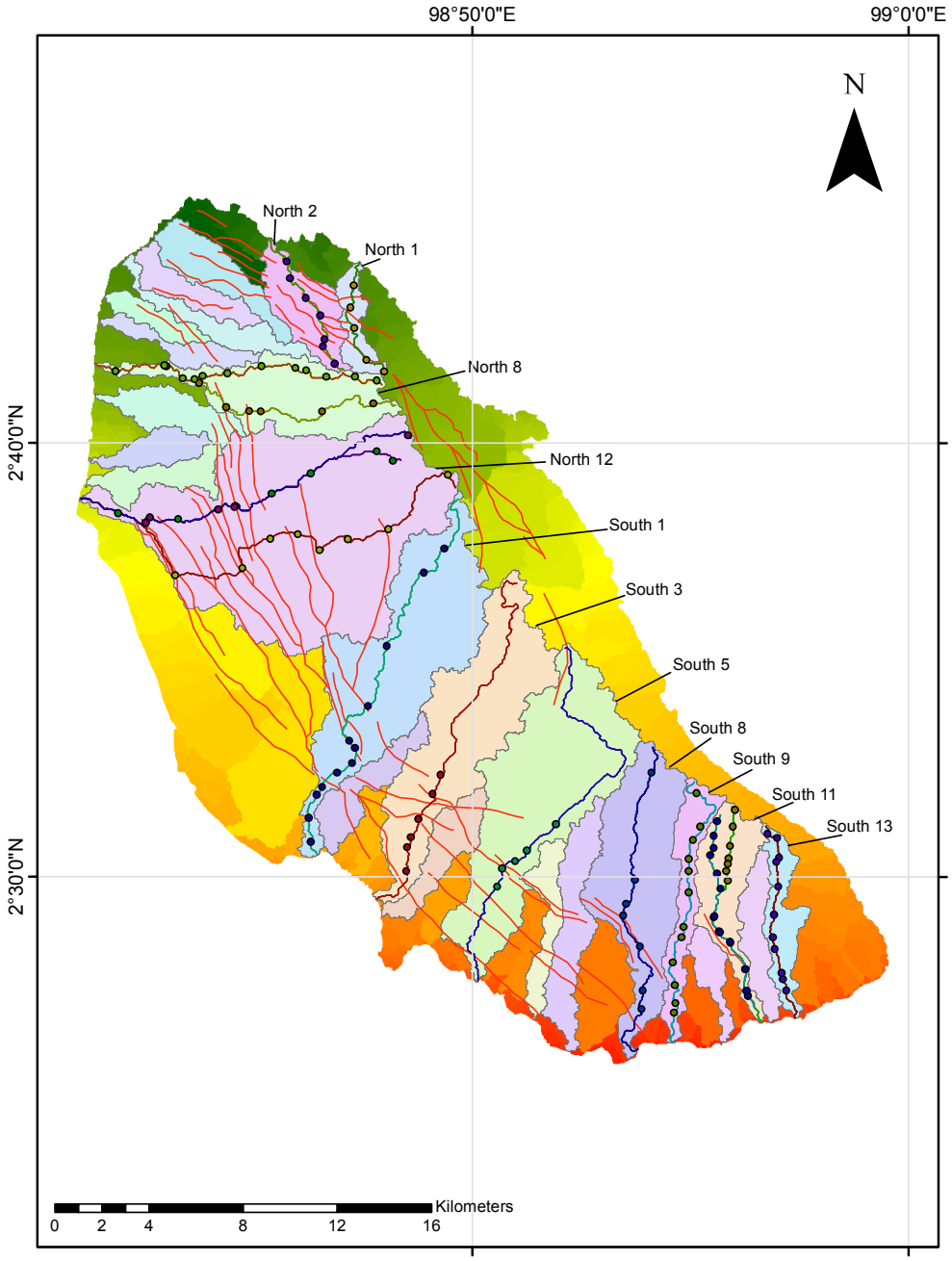


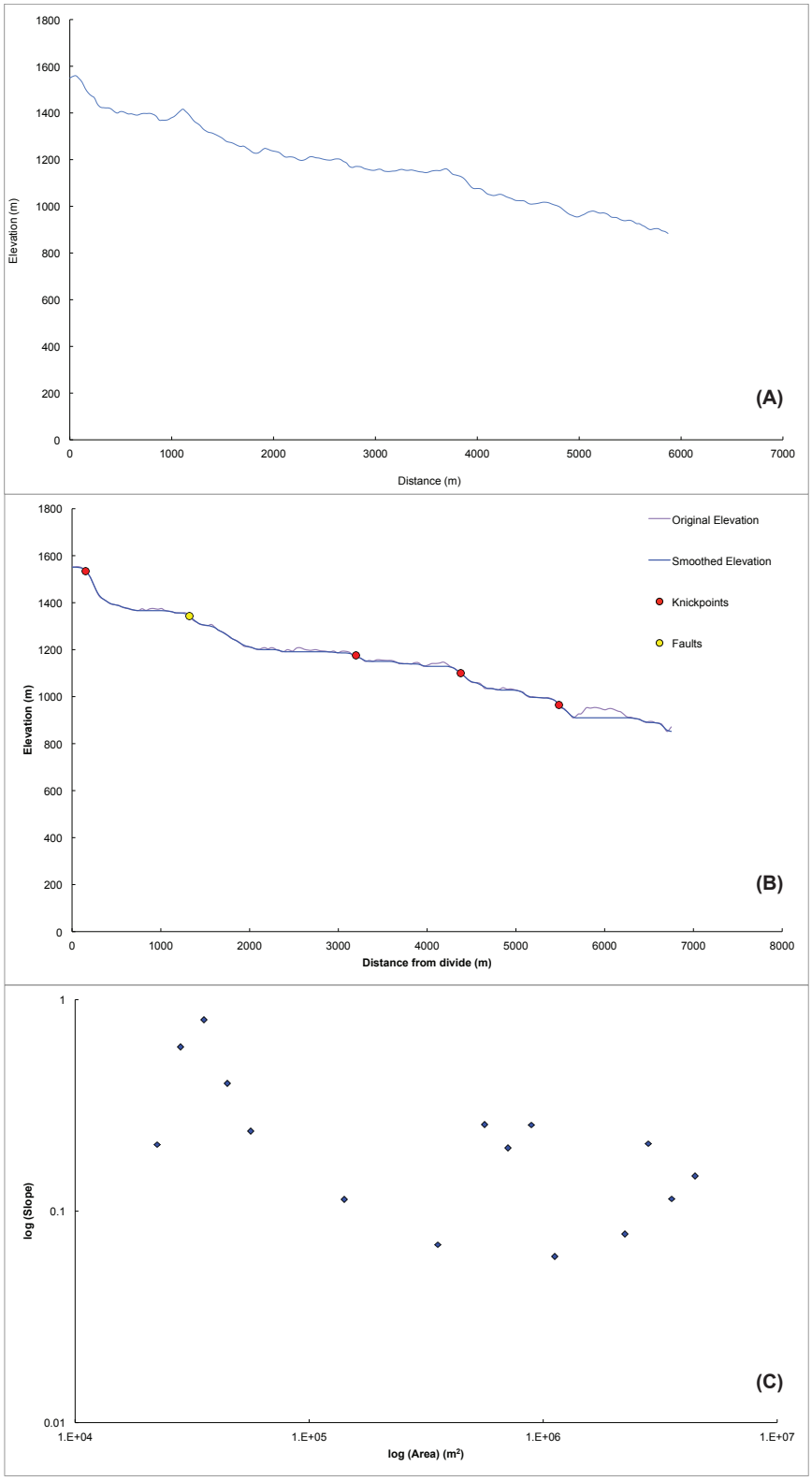
Figure 5.13: Faults on Samosir Island

The location of the knickpoints sometimes corresponded to known faults found along the western flank of Samosir Island. Here, the known faults are mapped as red lines. Only knickpoints that did not intersect with the mapped faults were used in the calculation for the timing of drainage development.

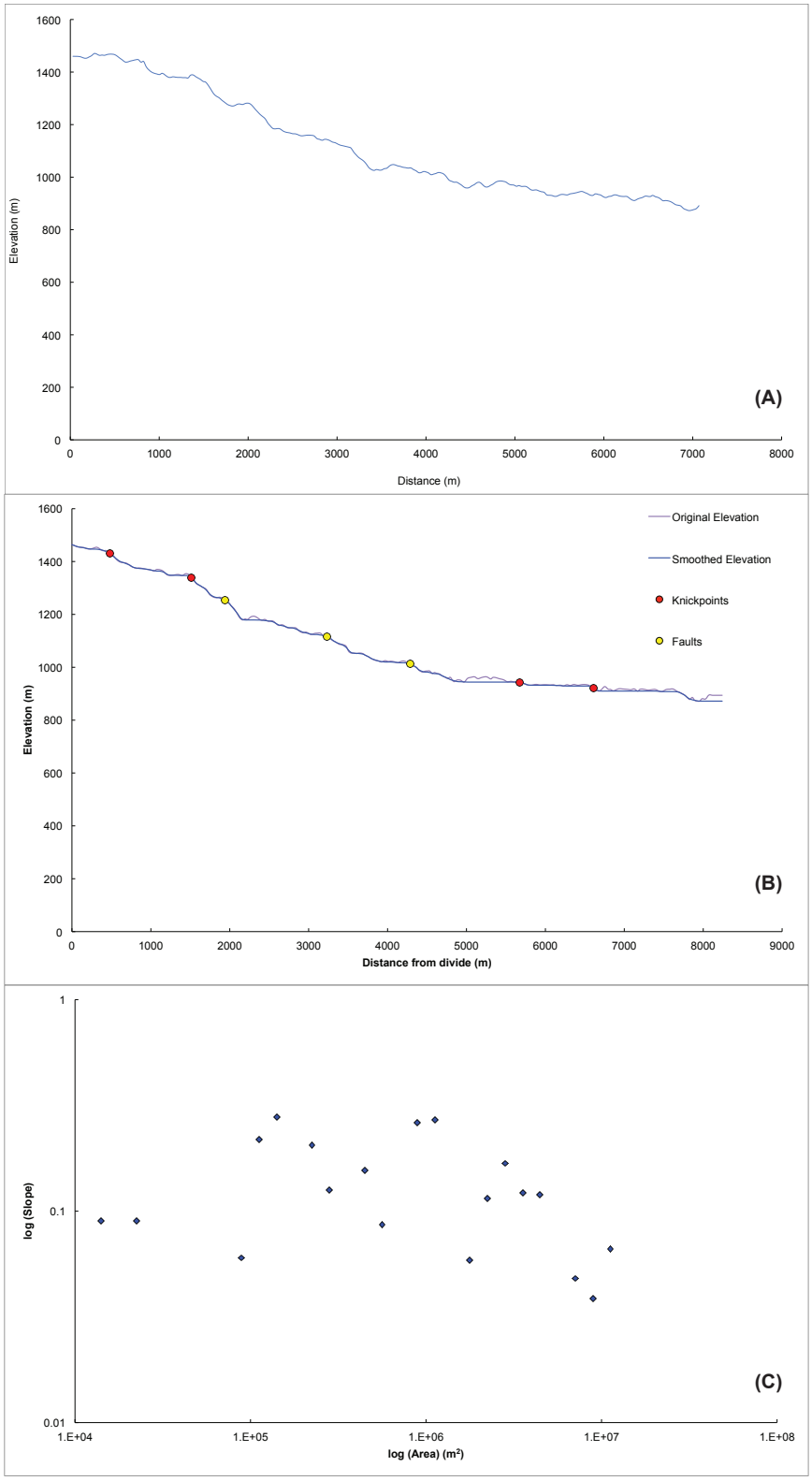
Figure 5.14: River channel profiles

Using the Geomorph Tools, data for each stream channel was created. Here is shown the upland profile (A), the channel profile (including original elevation, smoothed elevation, and knickpoints; (B)), and the calculated binned log slope-log area plots for each of these stream channels. (A) to (G) show the stream channels for the drainage basins in the north, while (H) to (O) show the stream channels for the drainage basins in the south. The complete data generated from the Geomorph Tools can be found in Appendix Table 5.1.

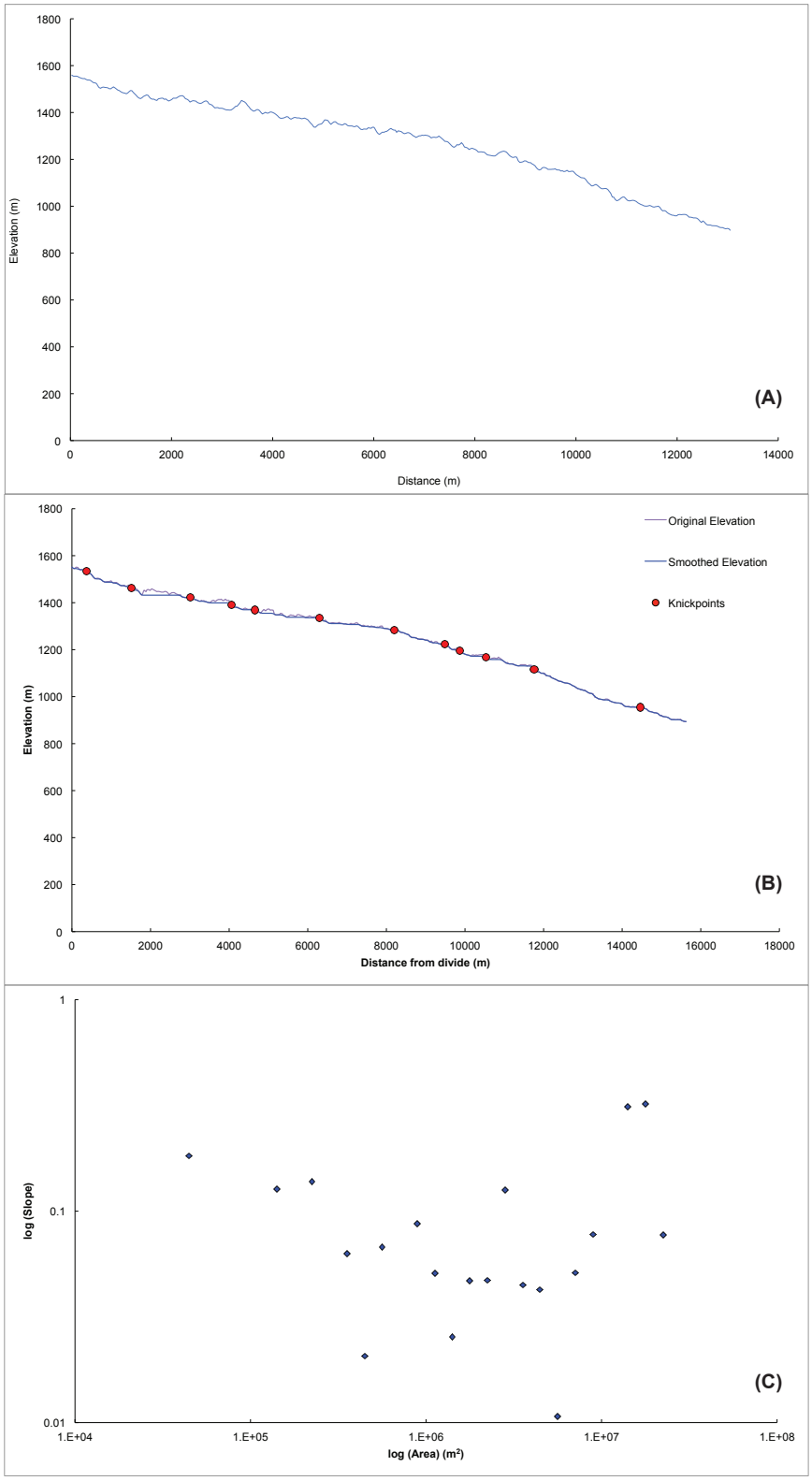
(A) North 1


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

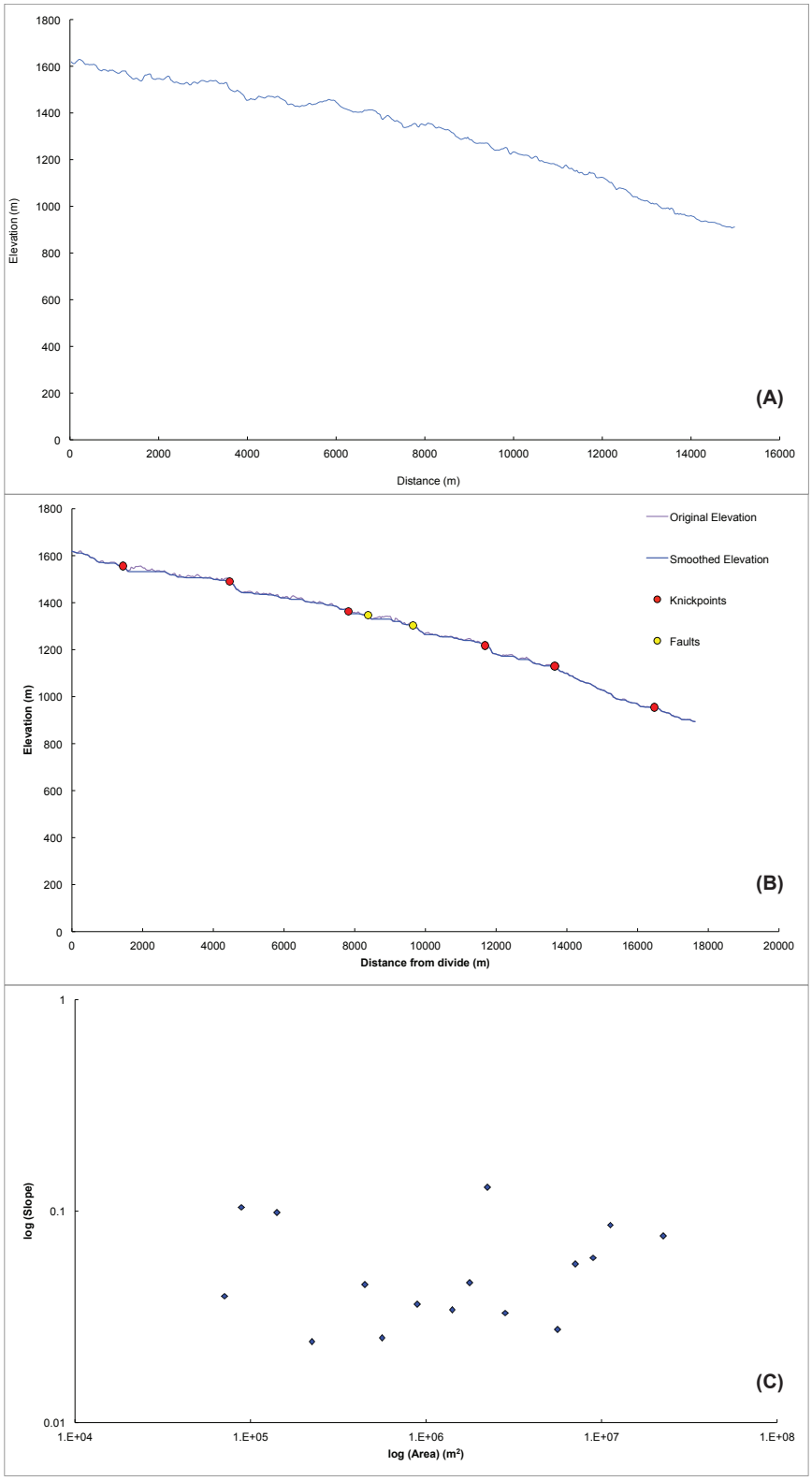
(B) North 2


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

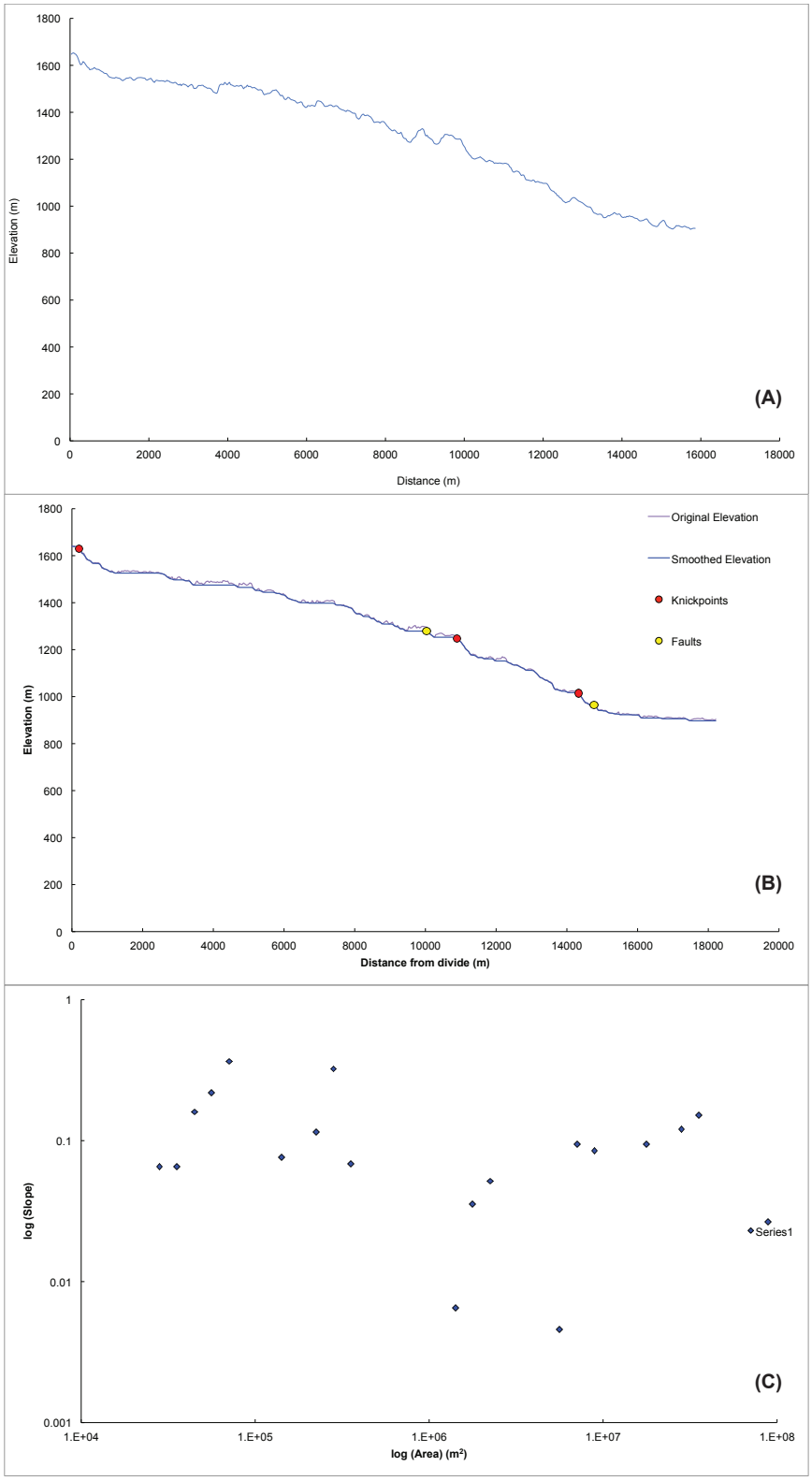
(C) North 8a


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

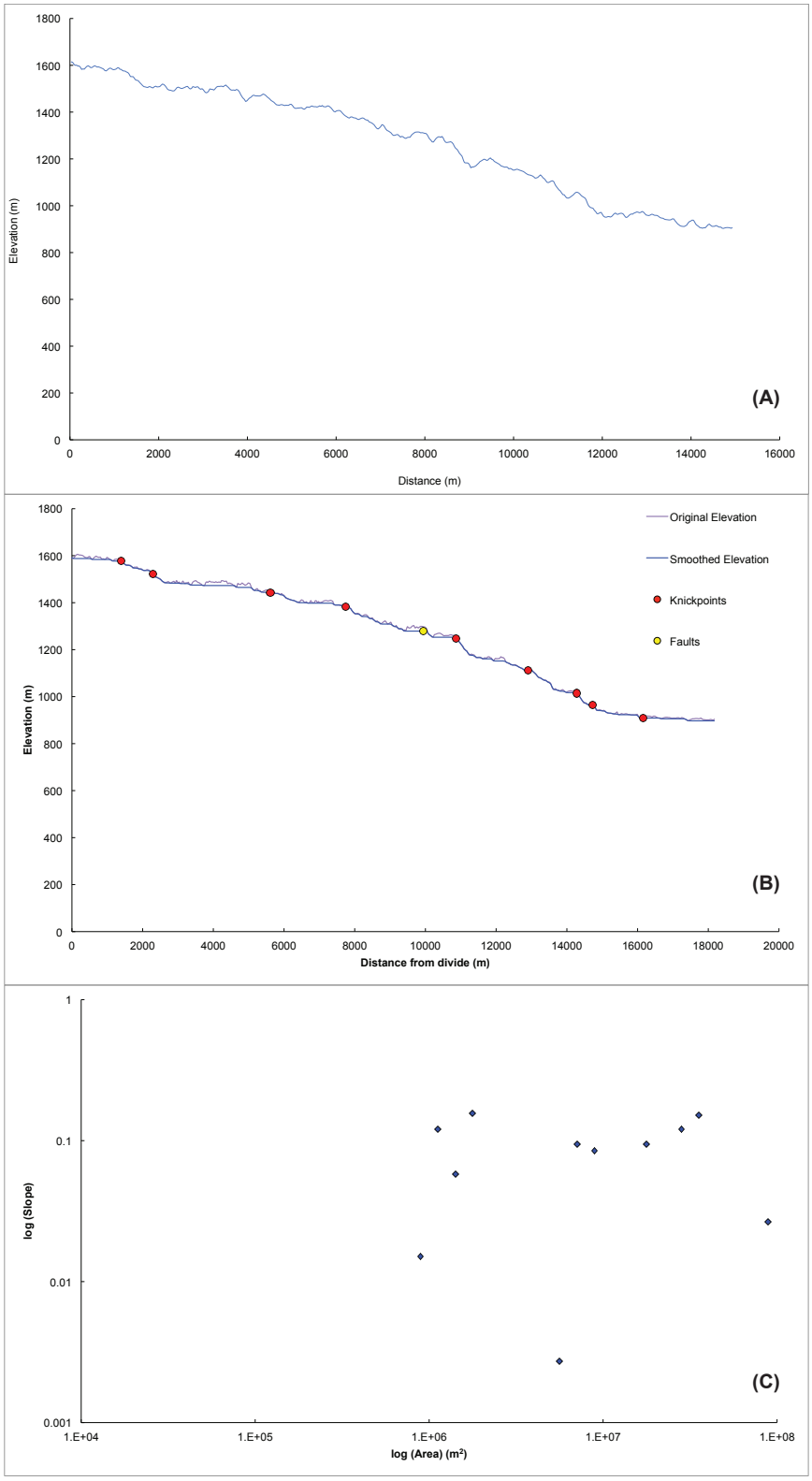
(D) North 8b


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

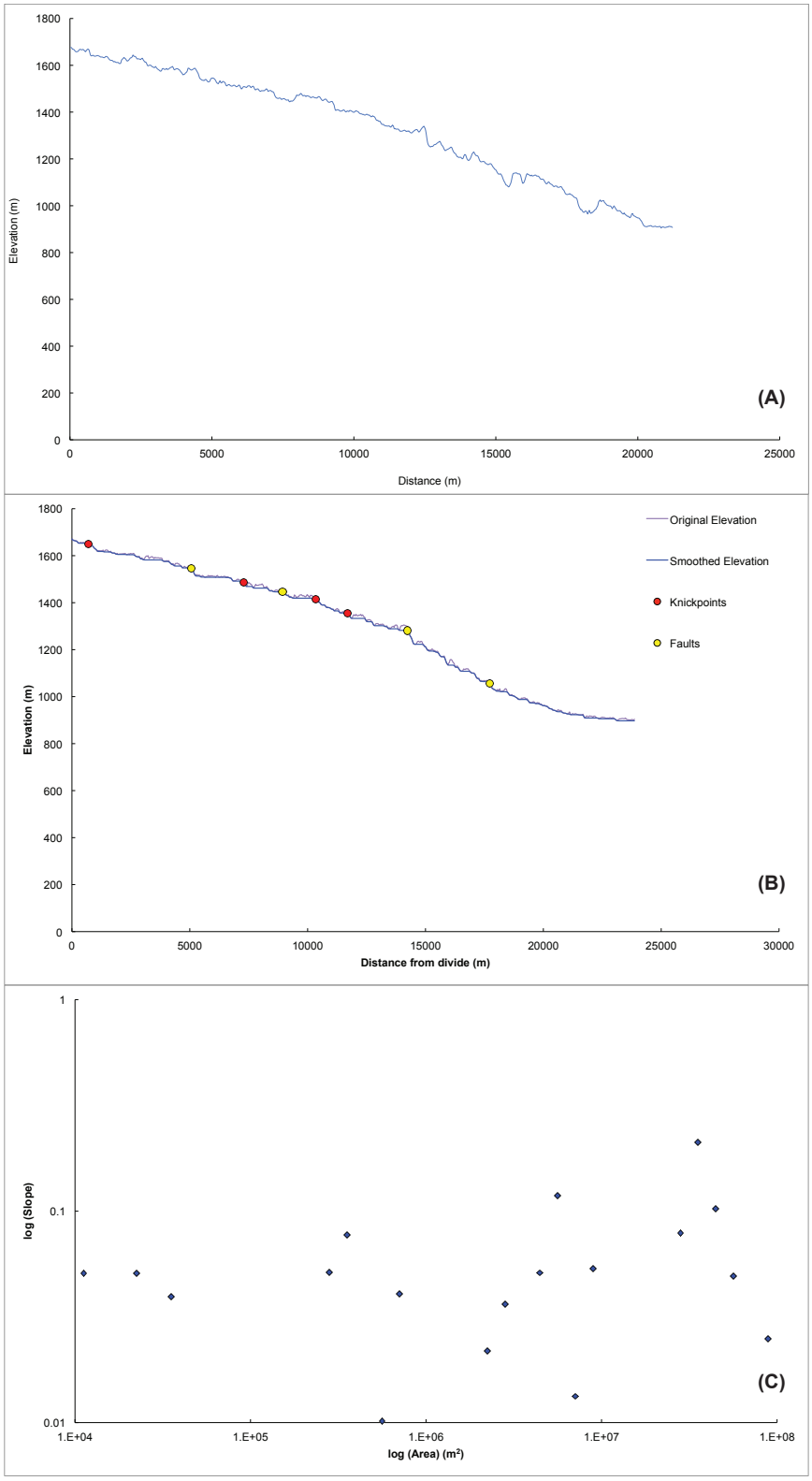
(E) North 12a


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
Series1
(C)
log (Area) (m²)

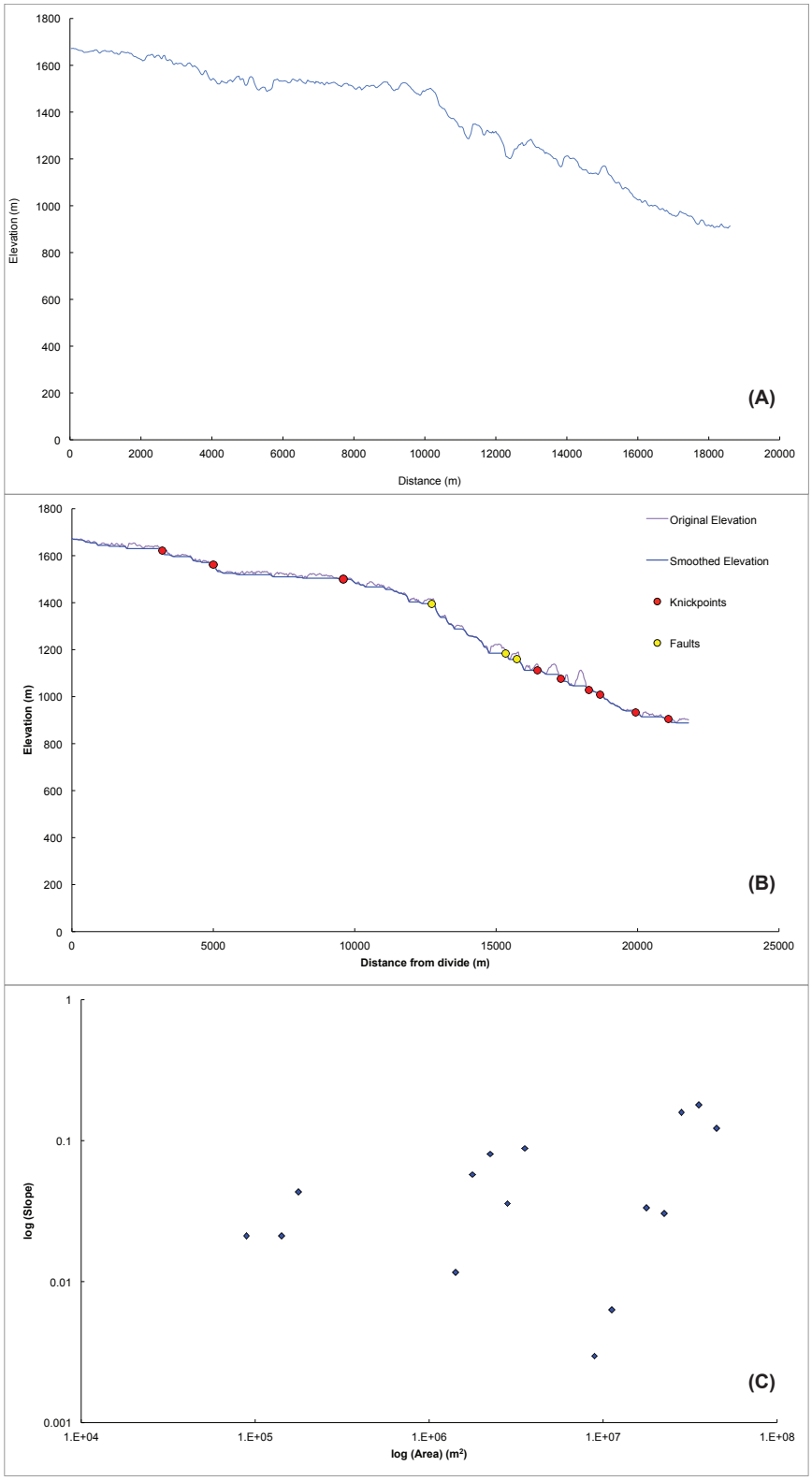
(F) North 12b


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

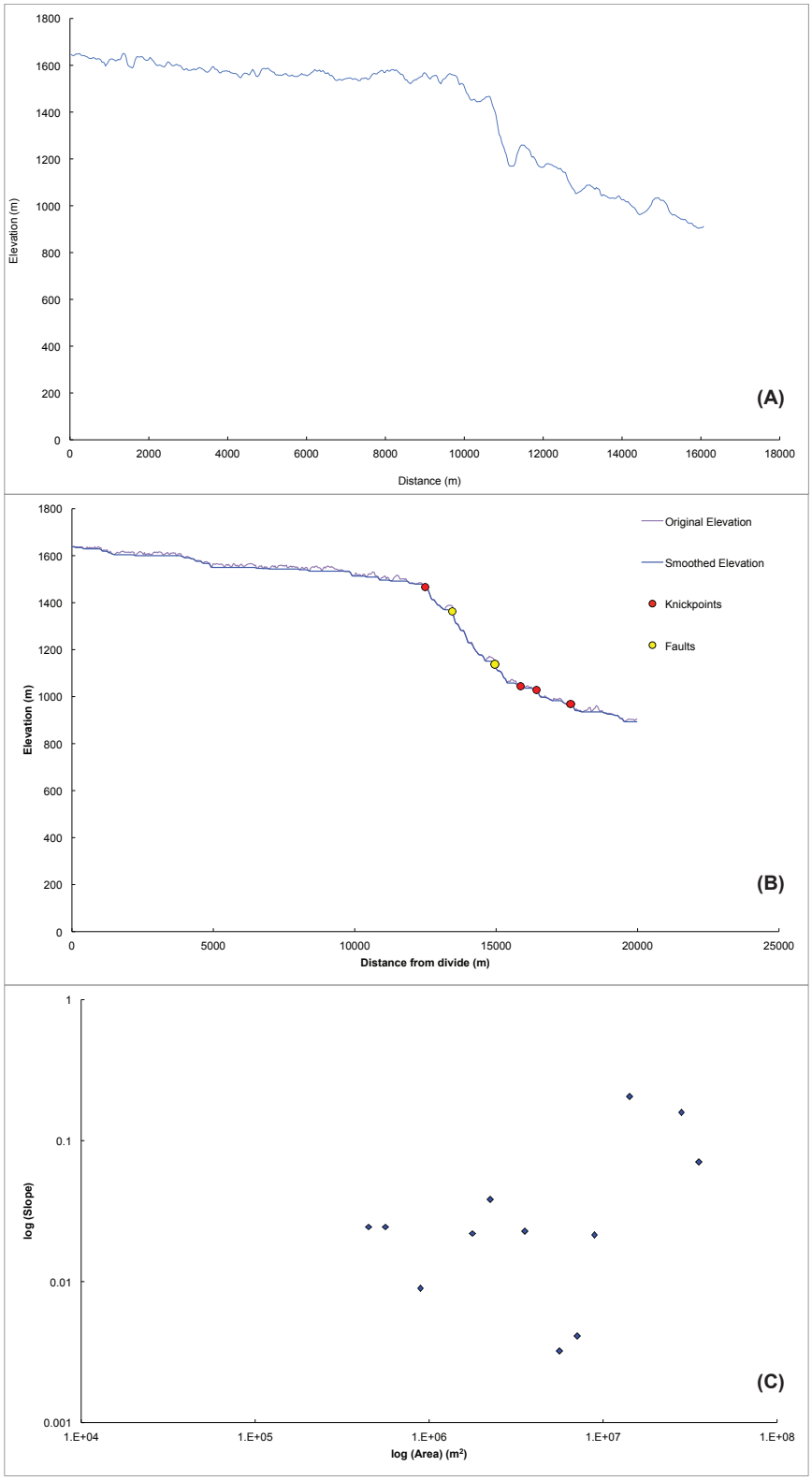
(G) North 12c


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

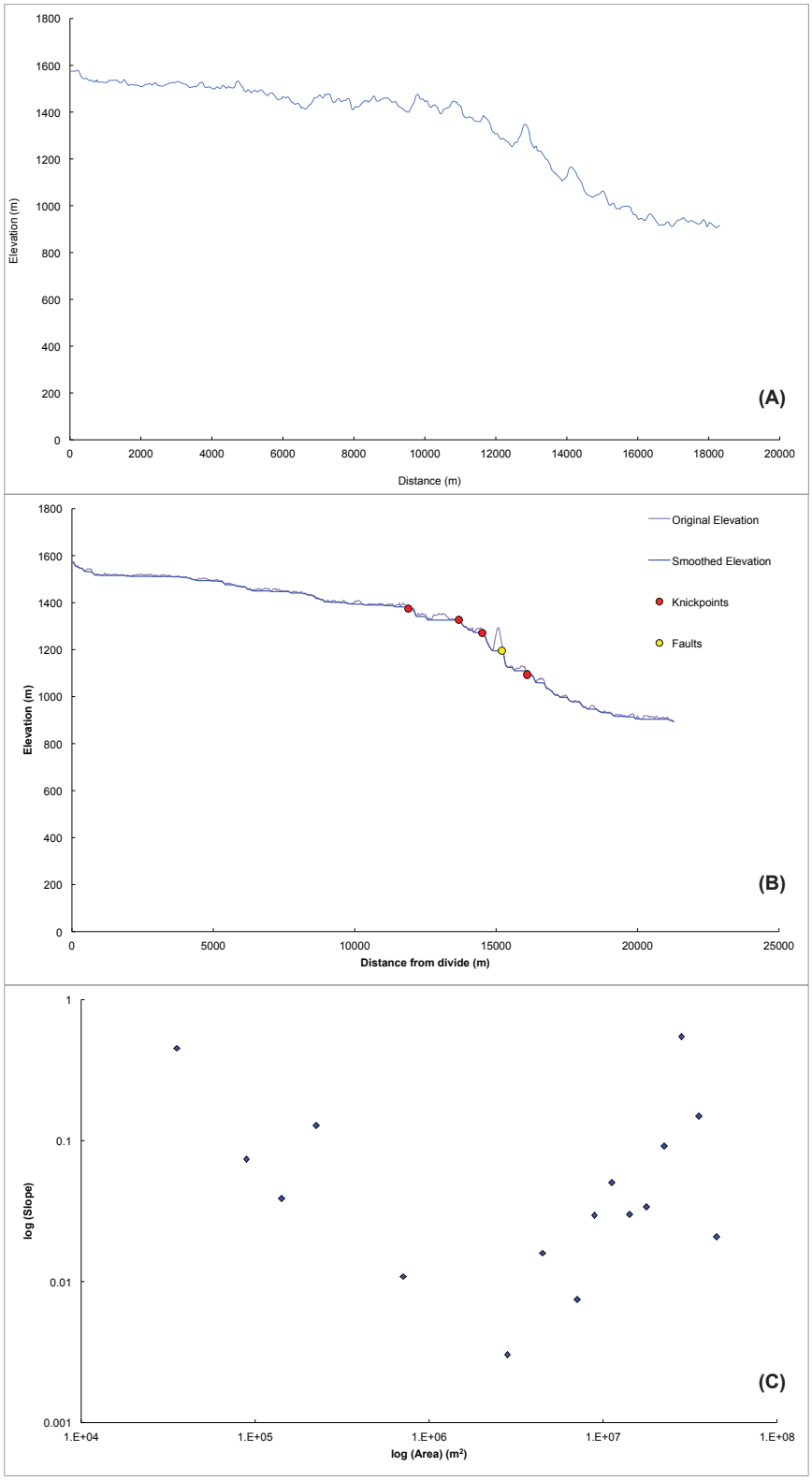
(H) South 1


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

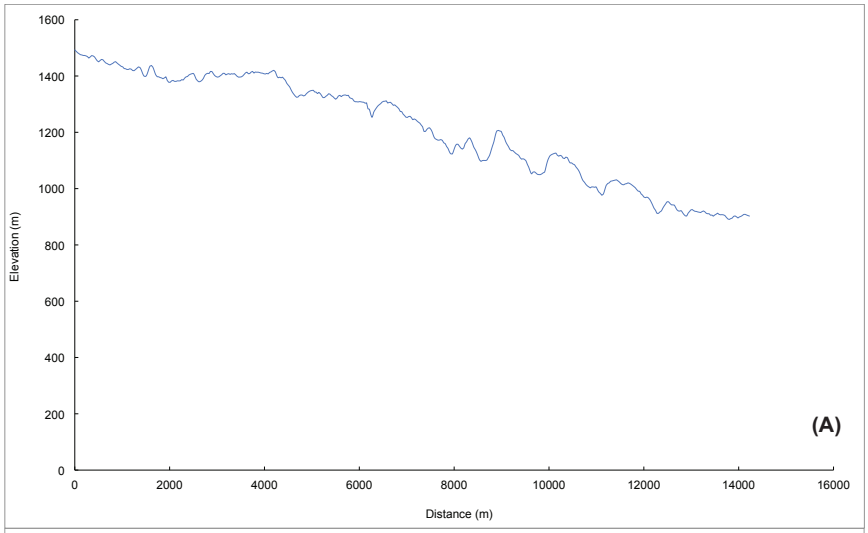
(I) South 3

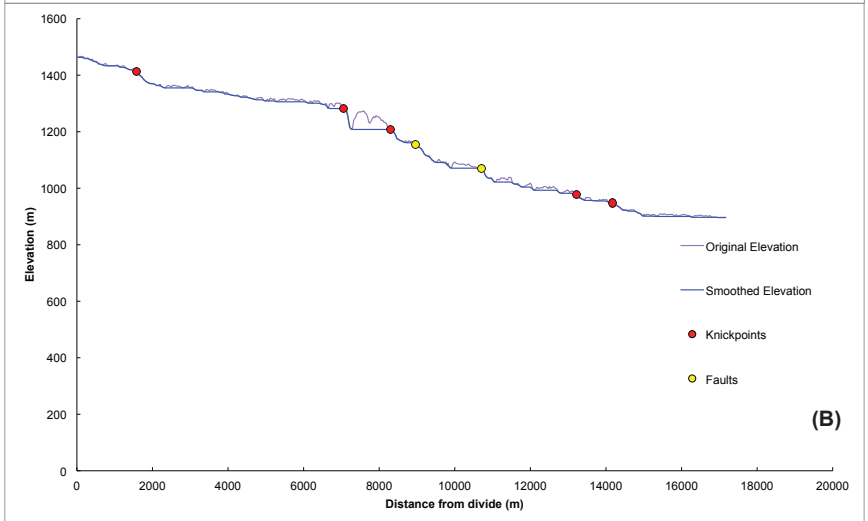

Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

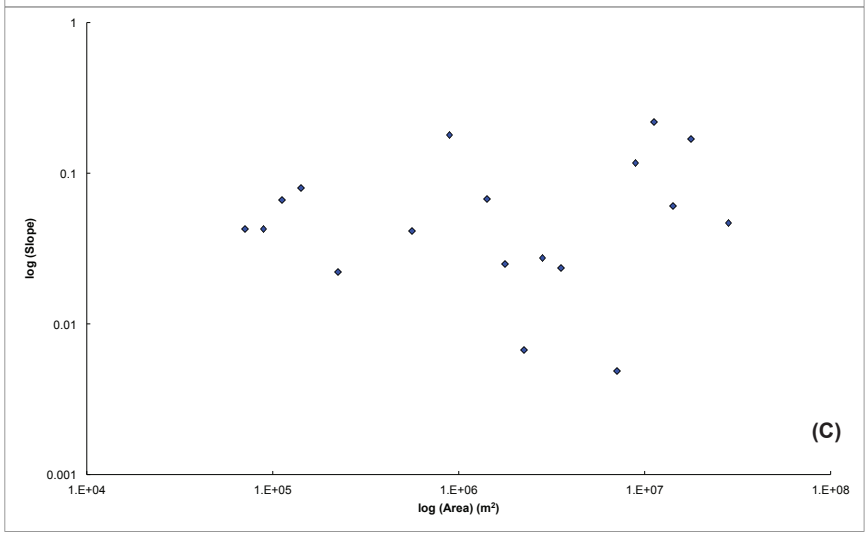
(J) South 5


Elevation (m)
Distance (m)
(A)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
Elevation (m)
Distance from divide (m)
(B)
log (Slope)
log (Area) (m²)
(C)

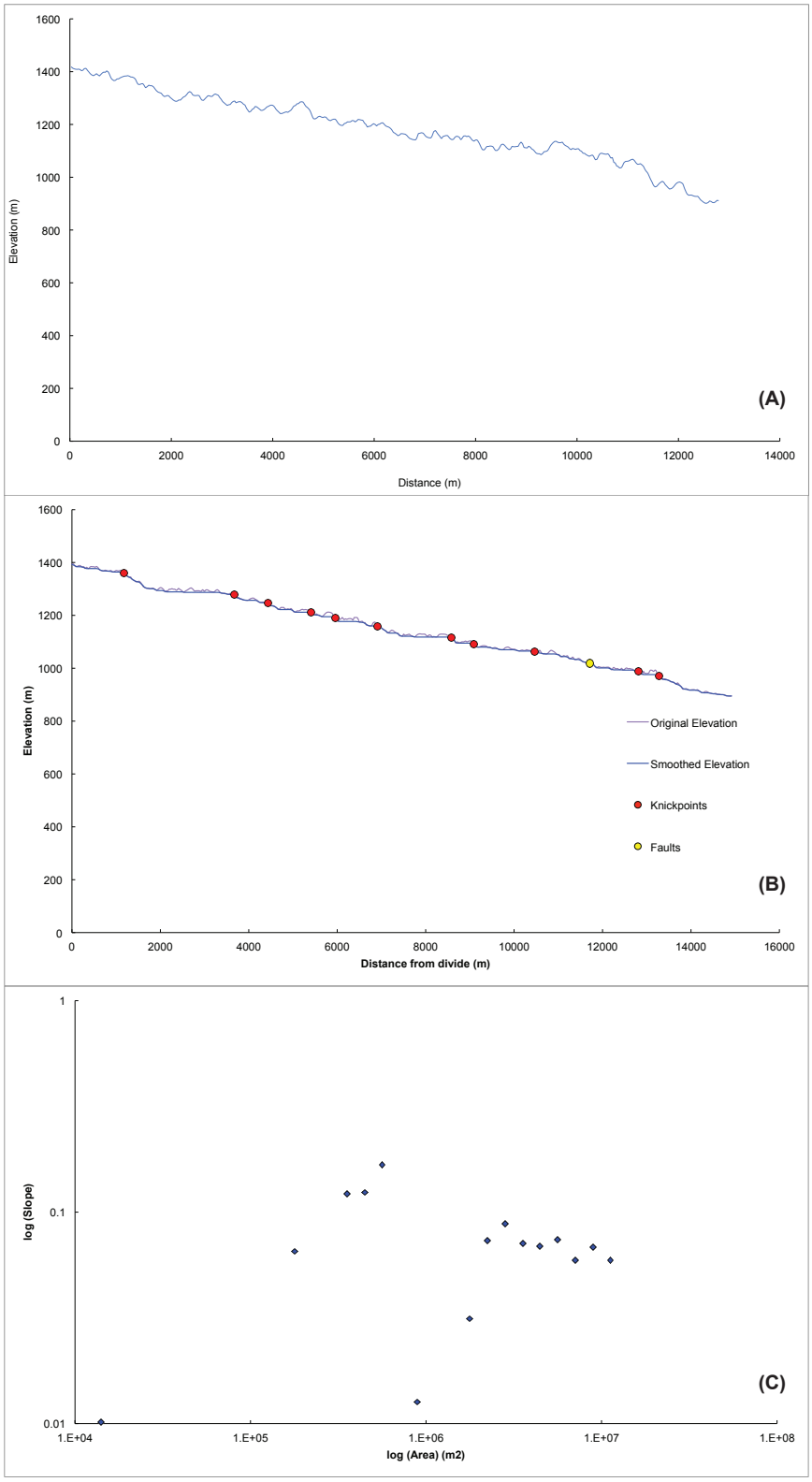
(K) South 8


Elevation (m)
Distance (m)
(A)

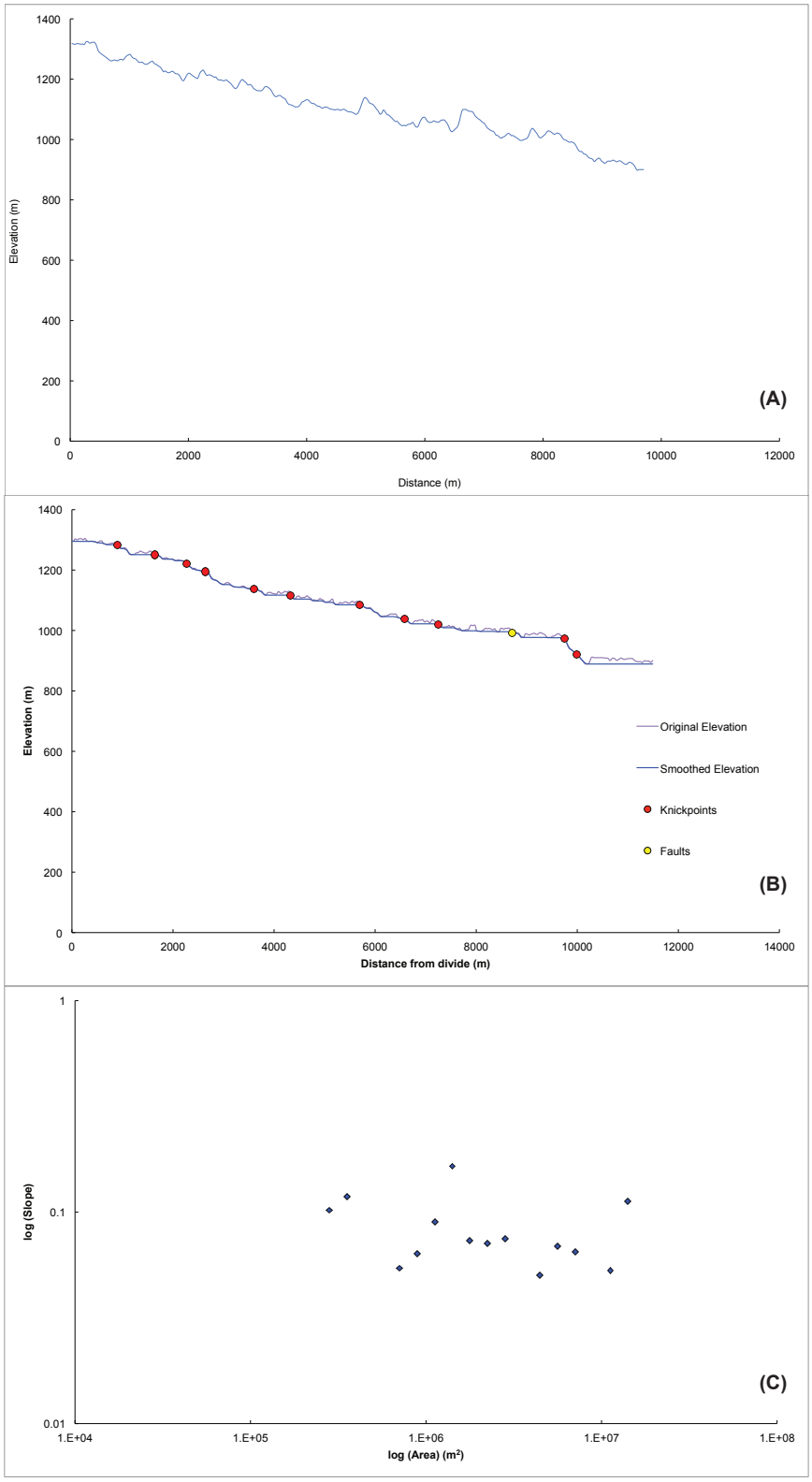

Elevation (m)
Distance from divide (m)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
(B)


log (Slope)
log (Area) (m²)
(C)

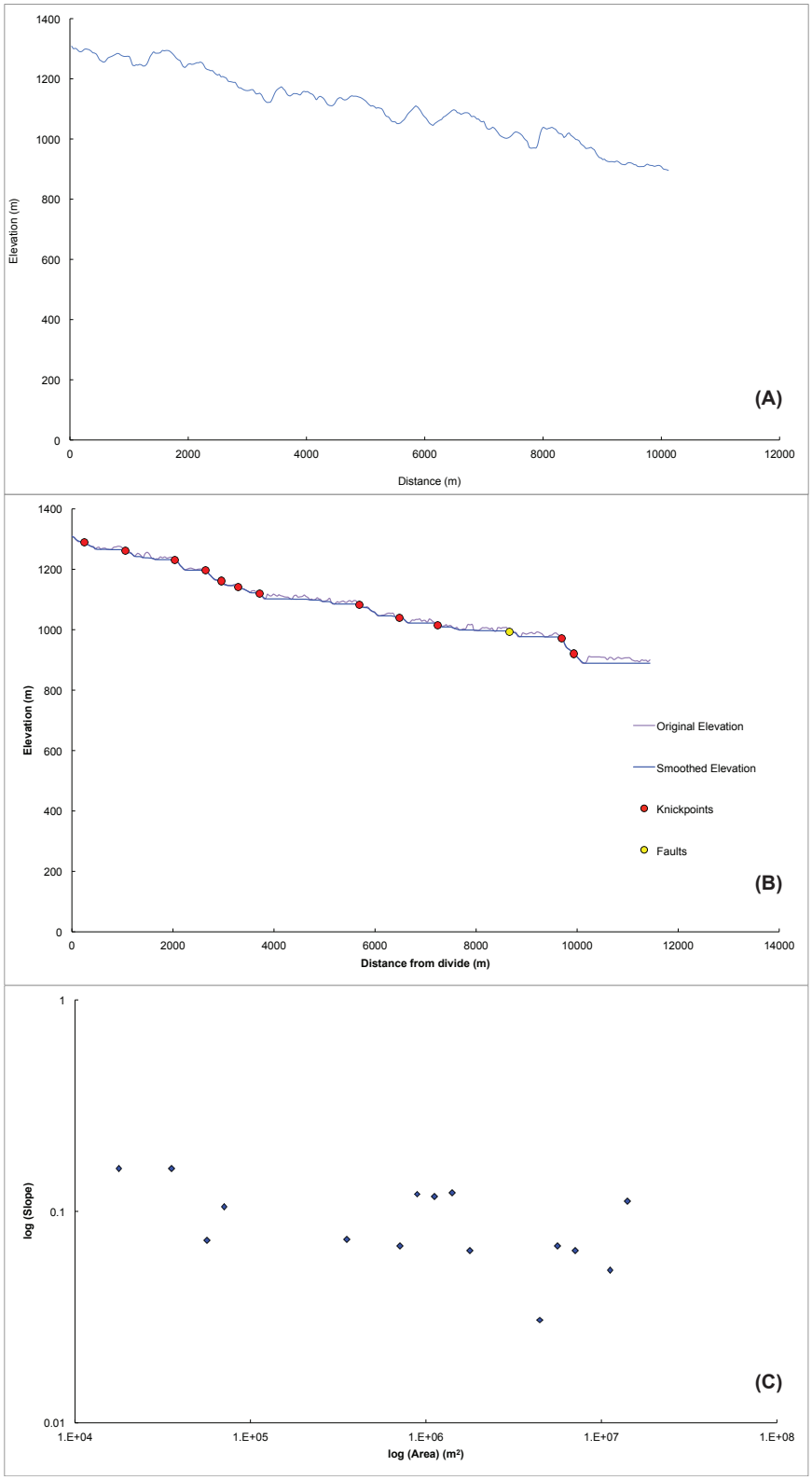
(L) South 9


Elevation (m)
Distance (m)
(A)
Elevation (m)
Distance from divide (m)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
(B)
log (Slope)
log (Area) (m2)
(C)

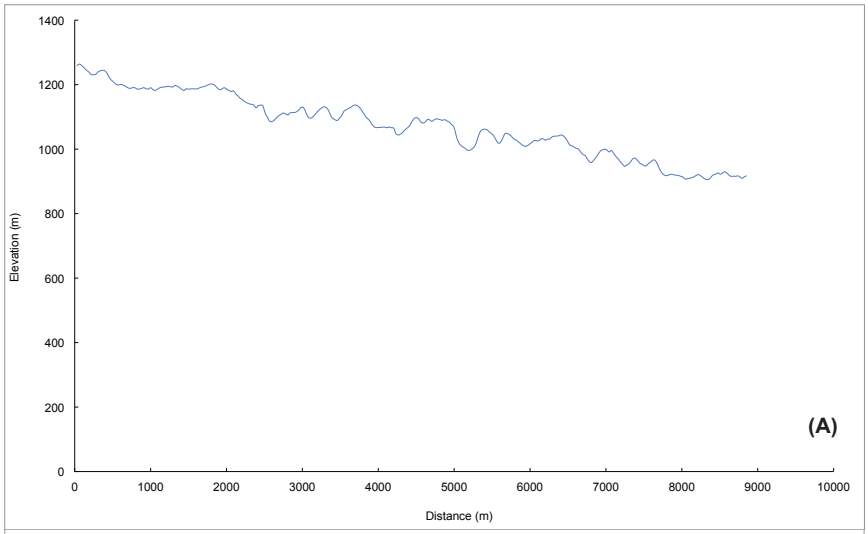
(M) South 11a

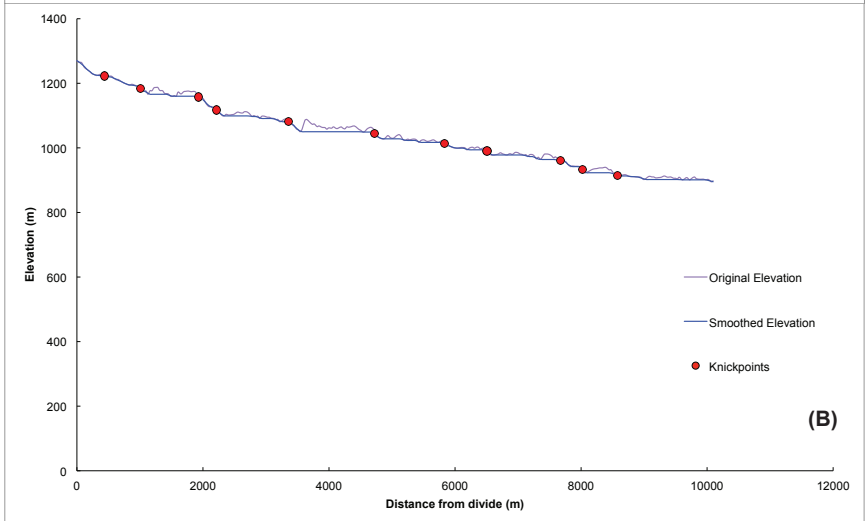

Elevation (m)
Distance (m)
(A)
Elevation (m)
Distance from divide (m)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
(B)
log (Slope)
log (Area) (m²)
(C)

(N) South 11b


Elevation (m)
Distance (m)
(A)
Elevation (m)
Distance from divide (m)
Original Elevation
Smoothed Elevation
Knickpoints
Faults
(B)
log (Slope)
log (Area) (m²)
(C)

(O) South 13


Elevation (m)
Distance (m)
(A)


Elevation (m)
Distance from divide (m)
Original Elevation
Smoothed Elevation
Knickpoints
(B)

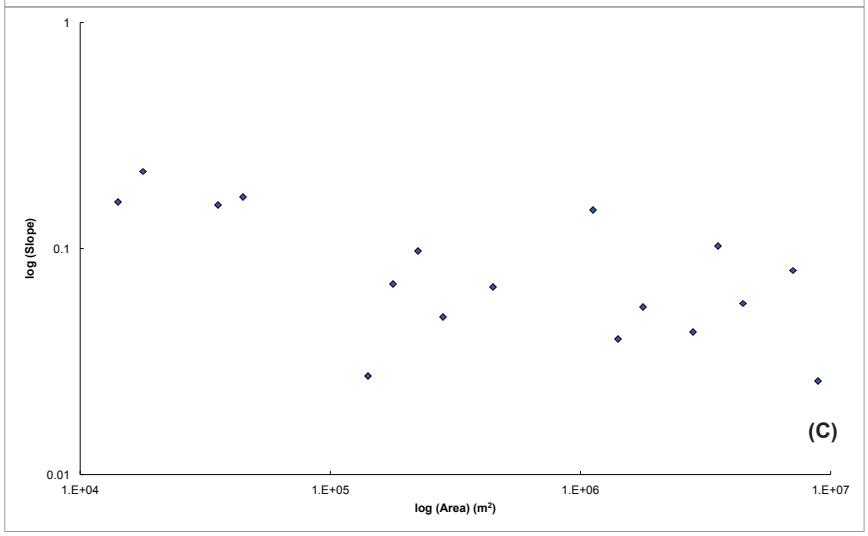

log (Slope)
log (Area) (m²)
(C)

Table 5.1: Analyses of basins, reivers, erodibility, and response time calculations

Watershed No.		Basin Area m^2	Basin Area km^2	x_c (m)	x_c (km)	L (m)	L (km)	k_a	K T = 33.7 ka	T K = 7 E-06	T K = 7.5 E-05	T K = 6.5 E-05
North												
1		4.94E+06	4.94	150	0.15	6750	6.75	0.108	3.43E-04	1,652,989	154,279	178,014
		4.94E+06	4.94	3198	3.20	6750	6.75	0.108	6.73E-05	324,137	30,253	34,907
		4.94E+06	4.94	4377	4.38	6750	6.75	0.108	3.91E-05	188,001	17,547	20,246
		4.94E+06	4.94	5486	5.49	6750	6.75	0.108	1.87E-05	89,985	8,399	9,691
2		1.05E+07	10.51	480	0.48	8241	8.24	0.155	2.14E-04	1,032,645	96,380	111,208
		1.05E+07	10.51	1516	1.52	8241	8.24	0.155	1.28E-04	614,793	57,381	66,208
		1.05E+07	10.51	5669	5.67	8241	8.24	0.155	2.82E-05	135,879	12,682	14,633
		1.05E+07	10.51	6615	6.62	8241	8.24	0.155	1.66E-05	79,786	7,447	8,592
8	**a**	2.36E+07	23.63	374	0.37	15625	15.63	0.097	3.56E-04	1,713,851	159,959	184,569
		2.36E+07	23.63	1514	1.51	15625	15.63	0.097	2.23E-04	1,071,734	100,029	115,418
		2.36E+07	23.63	3003	3.00	15625	15.63	0.097	1.57E-04	757,350	70,686	81,561
		2.36E+07	23.63	4053	4.05	15625	15.63	0.097	1.29E-04	619,590	57,828	66,725
		2.36E+07	23.63	4659	4.66	15625	15.63	0.097	1.15E-04	555,631	51,859	59,837
		2.36E+07	23.63	6308	6.31	15625	15.63	0.097	8.65E-05	416,496	38,873	44,853
		2.36E+07	23.63	8204	8.20	15625	15.63	0.097	6.15E-05	295,846	27,612	31,860
		2.36E+07	23.63	9481	9.48	15625	15.63	0.097	4.77E-05	229,416	21,412	24,706
		2.36E+07	23.63	9873	9.87	15625	15.63	0.097	4.38E-05	210,803	19,675	22,702
		2.36E+07	23.63	10533	10.53	15625	15.63	0.097	3.76E-05	181,072	16,900	19,500
		2.36E+07	23.63	11761	11.76	15625	15.63	0.097	2.71E-05	130,444	12,175	14,048
		2.36E+07	23.63	14467	14.47	15625	15.63	0.097	7.35E-06	35,370	3,301	3,809
	b	2.36E+07	23.63	1452	1.45	17629	17.63	0.076	2.69E-04	1,293,304	120,708	139,279
		2.36E+07	23.63	4457	4.46	17629	17.63	0.076	1.48E-04	712,355	66,486	76,715
		2.36E+07	23.63	7834	7.83	17629	17.63	0.076	8.73E-05	420,184	39,217	45,251
		2.36E+07	23.63	11696	11.70	17629	17.63	0.076	4.42E-05	212,556	19,839	22,891

Watershed No.		T K = 5.5 E-05	K = 4.5 E-05	K = 3.5 E-05	K = 2.5 E-05	K = 1.5 E-05	K = 3.5E-04	K = 2.5E-04	K= 1.5E-04
North									
1		210,380	257,132	330,598	462,837	771,395	33,060	46,284	77,139
		41,254	50,421	64,827	90,758	151,264	6,483	9,076	15,126
		23,927	29,245	37,600	52,640	87,734	3,760	5,264	8,773
		11,453	13,998	17,997	25,196	41,993	1,800	2,520	4,199
2		131,428	160,634	206,529	289,141	481,901	20,653	28,914	48,190
		78,246	95,634	122,959	172,142	286,903	12,296	17,214	28,690
		17,294	21,137	27,176	38,046	63,410	2,718	3,805	6,341
		10,155	12,411	15,957	22,340	37,233	1,596	2,234	3,723
8	**a**	218,126	266,599	342,770	479,878	799,797	34,277	47,988	79,980
		136,403	166,714	214,347	300,086	500,143	21,435	30,009	50,014
		96,390	117,810	151,470	212,058	353,430	15,147	21,206	35,343
		78,857	96,381	123,918	173,485	289,142	12,392	17,349	28,914
		70,717	86,432	111,126	155,577	259,295	11,113	15,558	25,929
		53,009	64,788	83,299	116,619	194,365	8,330	11,662	19,436
		37,653	46,021	59,169	82,837	138,062	5,917	8,284	13,806
		29,198	35,687	45,883	64,236	107,061	4,588	6,424	10,706
		26,829	32,792	42,161	59,025	98,375	4,216	5,902	9,837
		23,045	28,167	36,214	50,700	84,500	3,621	5,070	8,450
		16,602	20,291	26,089	36,524	60,874	2,609	3,652	6,087
		4,502	5,502	7,074	9,904	16,506	707	990	1,651
	b	164,602	201,181	258,661	362,125	603,542	25,866	36,212	60,354
		90,663	110,811	142,471	199,459	332,432	14,247	19,946	33,243
		53,478	65,362	84,037	117,652	196,086	8,404	11,765	19,609
		27,053	33,064	42,511	59,516	99,193	4,251	5,952	9,919

Watershed No.		Basin Area m^2	Basin Area km^2	x_c (m)	x_c (km)	L (m)	L (km)	k_a	K T = 33.7 ka	T K = 7 E-06	T K = 7.5 E-05	T K = 6.5 E-05
North												
8	**b**	2.36E+07	23.63	13659	13.66	17629	17.63	0.076	2.75E-05	132,177	12,336	14,234
		2.36E+07	23.63	16470	16.47	17629	17.63	0.076	7.31E-06	35,212	3,286	3,792
12	**a**	9.11E+07	91.10	206	0.21	18214	18.21	0.275	2.54E-04	1,221,659	114,022	131,563
		9.11E+07	91.10	10901	10.90	18214	18.21	0.275	2.91E-05	139,961	13,063	15,073
		9.11E+07	91.10	14332	14.33	18214	18.21	0.275	1.36E-05	65,350	6,099	7,038
	b	9.11E+07	91.10	1383	1.38	18172	18.17	0.276	1.46E-04	700,580	65,387	75,447
		9.11E+07	91.10	2286	2.29	18172	18.17	0.276	1.17E-04	563,877	52,628	60,725
		9.11E+07	91.10	5611	5.61	18172	18.17	0.276	6.64E-05	319,607	29,830	34,419
		9.11E+07	91.10	7753	7.75	18172	18.17	0.276	4.81E-05	231,678	21,623	24,950
		9.11E+07	91.10	10858	10.86	18172	18.17	0.276	2.91E-05	140,061	13,072	15,084
		9.11E+07	91.10	12901	12.90	18172	18.17	0.276	1.94E-05	93,166	8,695	10,033
		9.11E+07	91.10	14290	14.29	18172	18.17	0.276	1.36E-05	65,370	6,101	7,040
		9.11E+07	91.10	14726	14.73	18172	18.17	0.276	1.19E-05	57,195	5,338	6,159
		9.11E+07	91.10	16147	16.15	18172	18.17	0.276	6.67E-06	32,135	2,999	3,461
	c	9.11E+07	91.10	704	0.70	23866	23.87	0.160	2.61E-04	1,258,534	117,463	135,534
		9.11E+07	91.10	7270	7.27	23866	23.87	0.160	8.82E-05	424,606	39,630	45,727
		9.11E+07	91.10	8934	8.93	23866	23.87	0.160	7.29E-05	350,992	32,759	37,799
		9.11E+07	91.10	10328	10.33	23866	23.87	0.160	6.22E-05	299,212	27,926	32,223
		9.11E+07	91.10	11685	11.69	23866	23.87	0.160	5.30E-05	255,107	23,810	27,473
South												
1		4.59E+07	45.94	3189	3.19	21803	21.80	0.097	1.83E-04	883,362	82,447	95,131
		4.59E+07	45.94	4997	5.00	21803	21.80	0.097	1.41E-04	676,970	63,184	72,904

Watershed No.		T K = 5.5 E-05	K = 4.5 E-05	K = 3.5 E-05	K = 2.5 E-05	K = 1.5 E-05	K = 3.5E-04	K = 2.5E-04	K= 1.5E-04
North									
8	**b**	16,822	20,561	26,435	37,009	61,682	2,644	3,701	6,168
		4,482	5,477	7,042	9,859	16,432	704	986	1,643
12	**a**	155,484	190,036	244,332	342,065	570,108	24,433	34,206	57,011
		17,813	21,772	27,992	39,189	65,315	2,799	3,919	6,532
		8,317	10,166	13,070	18,298	30,497	1,307	1,830	3,050
	b	89,165	108,979	140,116	196,162	326,937	14,012	19,616	32,694
		71,766	87,714	112,775	157,885	263,142	11,278	15,789	26,314
		40,677	49,717	63,921	89,490	149,150	6,392	8,949	14,915
		29,486	36,039	46,336	64,870	108,117	4,634	6,487	10,812
		17,826	21,787	28,012	39,217	65,362	2,801	3,922	6,536
		11,857	14,492	18,633	26,086	43,477	1,863	2,609	4,348
		8,320	10,169	13,074	18,304	30,506	1,307	1,830	3,051
		7,279	8,897	11,439	16,015	26,691	1,144	1,601	2,669
		4,090	4,999	6,427	8,998	14,996	643	900	1,500
	c	160,177	195,772	251,707	352,389	587,316	25,171	35,239	58,732
		54,041	66,050	84,921	118,890	198,149	8,492	11,889	19,815
		44,672	54,599	70,198	98,278	163,796	7,020	9,828	16,380
		38,082	46,544	59,842	83,779	139,632	5,984	8,378	13,963
		32,468	39,683	51,021	71,430	119,050	5,102	7,143	11,905
South									
1		112,428	137,412	176,672	247,341	412,235	17,667	24,734	41,224
		86,160	105,306	135,394	189,552	315,919	13,539	18,955	31,592

Watershed No.	Basin Area m^2	Basin Area km^2	x_c (m)	x_c (km)	L (m)	L (km)	k_a	K T = 33.7 ka	T K = 7 E-06	T K = 7.5 E-05	T K = 6.5 E-05
South											
1	4.59E+07	45.94	9594	9.59	21803	21.80	0.097	7.84E-05	377,211	35,206	40,623
	4.59E+07	45.94	16468	16.47	21803	21.80	0.097	2.68E-05	128,939	12,034	13,886
	4.59E+07	45.94	17286	17.29	21803	21.80	0.097	2.22E-05	106,679	9,957	11,488
	4.59E+07	45.94	18271	18.27	21803	21.80	0.097	1.69E-05	81,208	7,579	8,745
	4.59E+07	45.94	18683	18.68	21803	21.80	0.097	1.47E-05	70,951	6,622	7,641
	4.59E+07	45.94	19929	19.93	21803	21.80	0.097	8.58E-06	41,284	3,853	4,446
	4.59E+07	45.94	21093	21.09	21803	21.80	0.097	3.16E-06	15,204	1,419	1,637
3	3.95E+07	39.53	12484	12.48	19975	19.97	0.099	4.43E-05	213,322	19,910	22,973
	3.95E+07	39.53	15858	15.86	19975	19.97	0.099	2.18E-05	104,766	9,778	11,282
	3.95E+07	39.53	16418	16.42	19975	19.97	0.099	1.85E-05	89,014	8,308	9,586
	3.95E+07	39.53	17633	17.63	19975	19.97	0.099	1.18E-05	56,611	5,284	6,097
5	4.80E+07	48.04	11886	11.89	21280	21.28	0.106	5.31E-05	255,431	23,840	27,508
	4.80E+07	48.04	13678	13.68	21280	21.28	0.106	4.03E-05	193,848	18,093	20,876
	4.80E+07	48.04	14501	14.50	21280	21.28	0.106	3.49E-05	168,228	15,701	18,117
	4.80E+07	48.04	16095	16.10	21280	21.28	0.106	2.54E-05	122,475	11,431	13,190
8	3.18E+07	31.75	1586	1.59	17171	17.17	0.108	2.15E-04	1,037,015	96,788	111,679
	3.18E+07	31.75	7049	7.05	17171	17.17	0.108	8.05E-05	387,545	36,171	41,736
	3.18E+07	31.75	8306	8.31	17171	17.17	0.108	6.57E-05	316,129	29,505	34,045
	3.18E+07	31.75	13221	13.22	17171	17.17	0.108	2.36E-05	113,783	10,620	12,254
	3.18E+07	31.75	14181	14.18	17171	17.17	0.108	1.73E-05	83,283	7,773	8,969
9	1.05E+07	10.55	1179	1.18	14917	14.92	0.047	3.46E-04	1,665,334	155,431	179,344
	1.05E+07	10.55	3665	3.67	14917	14.92	0.047	1.91E-04	920,935	85,954	99,178
	1.05E+07	10.55	4426	4.43	14917	14.92	0.047	1.66E-04	797,183	74,404	85,850
	1.05E+07	10.55	5404	5.40	14917	14.92	0.047	1.38E-04	666,219	62,180	71,747

Watershed No.	T K = 5.5 E-05	K = 4.5 E-05	K = 3.5 E-05	K = 2.5 E-05	K = 1.5 E-05	K = 3.5E-04	K = 2.5E-04	K= 1.5E-04
South								
1	48,009	58,677	75,442	105,619	176,032	7,544	10,562	17,603
	16,410	20,057	25,788	36,103	60,171	2,579	3,610	6,017
	13,577	16,594	21,336	29,870	49,783	2,134	2,987	4,978
	10,336	12,632	16,242	22,738	37,897	1,624	2,274	3,790
	9,030	11,037	14,190	19,866	33,110	1,419	1,987	3,311
	5,254	6,422	8,257	11,560	19,266	826	1,156	1,927
	1,935	2,365	3,041	4,257	7,095	304	426	710
3	27,150	33,183	42,664	59,730	99,550	4,266	5,973	9,955
	13,334	16,297	20,953	29,334	48,891	2,095	2,933	4,889
	11,329	13,847	17,803	24,924	41,540	1,780	2,492	4,154
	7,205	8,806	11,322	15,851	26,418	1,132	1,585	2,642
5	32,509	39,734	51,086	71,521	119,201	5,109	7,152	11,920
	24,672	30,154	38,770	54,278	90,463	3,877	5,428	9,046
	21,411	26,169	33,646	47,104	78,506	3,365	4,710	7,851
	15,588	19,052	24,495	34,293	57,155	2,450	3,429	5,716
8	131,984	161,313	207,403	290,364	483,940	20,740	29,036	48,394
	49,324	60,285	77,509	108,513	180,854	7,751	10,851	18,085
	40,235	49,176	63,226	88,516	147,527	6,323	8,852	14,753
	14,481	17,700	22,757	31,859	53,099	2,276	3,186	5,310
	10,600	12,955	16,657	23,319	38,865	1,666	2,332	3,887
9	211,952	259,052	333,067	466,294	777,156	33,307	46,629	77,716
	117,210	143,257	184,187	257,862	429,770	18,419	25,786	42,977
	101,460	124,006	159,437	223,211	372,019	15,944	22,321	37,202
	84,791	103,634	133,244	186,541	310,902	13,324	18,654	31,090

Watershed No.		Basin Area m^2	Basin Area km^2	x_c (m)	x_c (km)	L (m)	L (km)	k_a	K T = 33.7 ka	T K = 7 E-06	T K = 7.5 E-05	T K = 6.5 E-05
South												
9		1.05E+07	10.55	5956	5.96	14917	14.92	0.047	1.25E-04	602,337	56,218	64,867
		1.05E+07	10.55	6907	6.91	14917	14.92	0.047	1.05E-04	505,224	47,154	54,409
		1.05E+07	10.55	8587	8.59	14917	14.92	0.047	7.53E-05	362,371	33,821	39,025
		1.05E+07	10.55	9085	9.08	14917	14.92	0.047	6.76E-05	325,381	30,369	35,041
		1.05E+07	10.55	10473	10.47	14917	14.92	0.047	4.82E-05	232,081	21,661	24,993
		1.05E+07	10.55	12804	12.80	14917	14.92	0.047	2.08E-05	100,197	9,352	10,790
		1.05E+07	10.55	13284	13.28	14917	14.92	0.047	1.58E-05	76,061	7,099	8,191
11	**a**	1.37E+07	13.72	892	0.89	11494	11.49	0.104	2.35E-04	1,132,840	105,732	121,998
		1.37E+07	13.72	1640	1.64	11494	11.49	0.104	1.79E-04	862,963	80,543	92,934
		1.37E+07	13.72	2270	2.27	11494	11.49	0.104	1.49E-04	719,007	67,107	77,432
		1.37E+07	13.72	2644	2.64	11494	11.49	0.104	1.35E-04	651,397	60,797	70,150
		1.37E+07	13.72	3611	3.61	11494	11.49	0.104	1.07E-04	513,227	47,901	55,271
		1.37E+07	13.72	4326	4.33	11494	11.49	0.104	9.00E-05	433,145	40,427	46,646
		1.37E+07	13.72	5701	5.70	11494	11.49	0.104	6.46E-05	310,772	29,005	33,468
		1.37E+07	13.72	6575	6.58	11494	11.49	0.104	5.14E-05	247,553	23,105	26,660
		1.37E+07	13.72	7248	7.25	11494	11.49	0.104	4.24E-05	204,347	19,072	22,007
		1.37E+07	13.72	9746	9.75	11494	11.49	0.104	1.52E-05	73,122	6,825	7,875
		1.37E+07	13.72	9988	9.99	11494	11.49	0.104	1.29E-05	62,224	5,808	6,701
	b	1.37E+07	13.72	250	0.25	11440	11.44	0.105	3.50E-04	1,686,834	157,438	181,659
		1.37E+07	13.72	1053	1.05	11440	11.44	0.105	2.19E-04	1,052,610	98,244	113,358
		1.37E+07	13.72	2043	2.04	11440	11.44	0.105	1.58E-04	759,994	70,933	81,846
		1.37E+07	13.72	2647	2.65	11440	11.44	0.105	1.34E-04	645,768	60,272	69,544
		1.37E+07	13.72	2959	2.96	11440	11.44	0.105	1.24E-04	596,610	55,684	64,250
		1.37E+07	13.72	3295	3.29	11440	11.44	0.105	1.14E-04	549,212	51,260	59,146
		1.37E+07	13.72	3723	3.72	11440	11.44	0.105	1.03E-04	495,256	46,224	53,335
		1.37E+07	13.72	5692	5.69	11440	11.44	0.105	6.40E-05	308,015	28,748	33,171

Watershed No.		T K = 5.5 E-05	K = 4.5 E-05	K = 3.5 E-05	K = 2.5 E-05	K = 1.5 E-05	K = 3.5E-04	K = 2.5E-04	K= 1.5E-04
South									
9		76,661	93,697	120,467	168,654	281,090	12,047	16,865	28,109
		64,301	78,590	101,045	141,463	235,771	10,104	14,146	23,577
		46,120	56,369	72,474	101,464	169,107	7,247	10,146	16,911
		41,412	50,615	65,076	91,107	151,844	6,508	9,111	15,184
		29,538	36,101	46,416	64,983	108,304	4,642	6,498	10,830
		12,752	15,586	20,039	28,055	46,759	2,004	2,806	4,676
		9,680	11,832	15,212	21,297	35,495	1,521	2,130	3,550
11	**a**	144,180	176,220	226,568	317,195	528,659	22,657	31,720	52,866
		109,832	134,239	172,593	241,630	402,716	17,259	24,163	40,272
		91,510	111,846	143,801	201,322	335,537	14,380	20,132	33,554
		82,905	101,328	130,279	182,391	303,985	13,028	18,239	30,399
		65,320	79,835	102,645	143,704	239,506	10,265	14,370	23,951
		55,128	67,378	86,629	121,281	202,134	8,663	12,128	20,213
		39,553	48,342	62,154	87,016	145,027	6,215	8,702	14,503
		31,507	38,508	49,511	69,315	115,525	4,951	6,931	11,552
		26,008	31,787	40,869	57,217	95,362	4,087	5,722	9,536
		9,306	11,375	14,624	20,474	34,124	1,462	2,047	3,412
		7,919	9,679	12,445	17,423	29,038	1,244	1,742	2,904
	b	214,688	262,396	337,367	472,313	787,189	33,737	47,231	78,719
		133,969	163,739	210,522	294,731	491,218	21,052	29,473	49,122
		96,727	118,221	151,999	212,798	354,664	15,200	21,280	35,466
		82,189	100,453	129,154	180,815	301,358	12,915	18,082	30,136
		75,932	92,806	119,322	167,051	278,418	11,932	16,705	27,842
		69,900	85,433	109,842	153,779	256,299	10,984	15,378	25,630
		63,033	77,040	99,051	138,672	231,120	9,905	13,867	23,112
		39,202	47,913	61,603	86,244	143,740	6,160	8,624	14,374

Watershed No.		Basin Area m^2	Basin Area km^2	x_c (m)	x_c (km)	L (m)	L (km)	k_a	K T = 33.7 ka	T K = 7 E-06	T K = 7.5 E-05	T K = 6.5 E-05
South												
11	**b**	1.37E+07	13.72	6478	6.48	11440	11.44	0.105	5.21E-05	250,917	23,419	27,022
		1.37E+07	13.72	7239	7.24	11440	11.44	0.105	4.19E-05	201,927	18,847	21,746
		1.37E+07	13.72	9692	9.69	11440	11.44	0.105	1.52E-05	73,152	6,828	7,878
		1.37E+07	13.72	9935	9.94	11440	11.44	0.105	1.29E-05	62,245	5,810	6,703
13		8.32E+06	8.32	431	0.43	10095	10.10	0.082	3.28E-04	1,577,273	147,212	169,860
		8.32E+06	8.32	1005	1.01	10095	10.10	0.082	2.40E-04	1,153,307	107,642	124,202
		8.32E+06	8.32	1932	1.93	10095	10.10	0.082	1.72E-04	826,734	77,162	89,033
		8.32E+06	8.32	2213	2.21	10095	10.10	0.082	1.58E-04	758,839	70,825	81,721
		8.32E+06	8.32	3357	3.36	10095	10.10	0.082	1.14E-04	550,557	51,385	59,291
		8.32E+06	8.32	4719	4.72	10095	10.10	0.082	7.90E-05	380,207	35,486	40,945
		8.32E+06	8.32	5834	5.83	10095	10.10	0.082	5.70E-05	274,196	25,592	29,529
		8.32E+06	8.32	6507	6.51	10095	10.10	0.082	4.56E-05	219,593	20,495	23,648
		8.32E+06	8.32	7671	7.67	10095	10.10	0.082	2.85E-05	137,325	12,817	14,789
		8.32E+06	8.32	8027	8.03	10095	10.10	0.082	2.38E-05	114,655	10,701	12,348
		8.32E+06	8.32	8581	8.58	10095	10.10	0.082	1.69E-05	81,250	7,583	8,750

Watershed No.		T K = 5.5 E-05	K = 4.5 E-05	K = 3.5 E-05	K = 2.5 E-05	K = 1.5 E-05	K = 3.5E-04	K = 2.5E-04	K= 1.5E-04
South									
11	**b**	31,935	39,032	50,183	70,257	117,095	5,018	7,026	11,709
		25,700	31,411	40,385	56,540	94,233	4,039	5,654	9,423
		9,310	11,379	14,630	20,483	34,138	1,463	2,048	3,414
		7,922	9,683	12,449	17,429	29,048	1,245	1,743	2,905
13		200,744	245,354	315,455	441,637	736,061	31,545	44,164	73,606
		146,785	179,403	230,661	322,926	538,210	23,066	32,293	53,821
		105,221	128,603	165,347	231,485	385,809	16,535	23,149	38,581
		96,580	118,042	151,768	212,475	354,125	15,177	21,247	35,412
		70,071	85,642	110,111	154,156	256,926	11,011	15,416	25,693
		48,390	59,143	76,041	106,458	177,430	7,604	10,646	17,743
		34,898	42,653	54,839	76,775	127,958	5,484	7,677	12,796
		27,948	34,159	43,919	61,486	102,477	4,392	6,149	10,248
		17,478	21,362	27,465	38,451	64,085	2,746	3,845	6,408
		14,593	17,835	22,931	32,104	53,506	2,293	3,210	5,351
		10,341	12,639	16,250	22,750	37,917	1,625	2,275	3,792

CHAPTER 6: MAGMA DYNAMICS OF POST-74 KA ACTIVITY AT TOBA CALDERA

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ABSTRACT

Toba Caldera's last caldera forming eruption, producing the Youngest Toba Tuff (YTT), occurred 74 kyrs ago, affecting the regional environment and the global climate. Within 1500 years, the formed caldera filled with water, forming a caldera lake. Resurgent activity started at Toba Caldera after the last eruption 74 kyrs ago with the uplifting of the resurgent dome, Samosir Island, and the extrusion of lava domes along the caldera ring faults and faults running through the resurgent dome. (U-Th)/He age dating of these lava domes shows that resurgence started soon after the caldera eruption, 69.7 ± 4.5 kyrs ago with the Samosir lava domes, while $^{40}Ar/^{39}Ar$ age dating of the same domes shows that the continued lava dome effusions were magmatic pulses of remobilized remnant magma activity, which ended 56.9 ± 3.9 kyrs ago at the Pardepur lava domes. Matrix glass analyses represented on the quartz-albite-orthoclase (Qz-Ab-Or) ternary plot indicate that the Samosir dome magmas equilibrated over a deeper range of pressures (200-50 MPa) than the YTT (100-50 MPa), while the Pardepur dome magmas record the lowest pressures (50-0.1 MPa). ^{14}C ages of lake sediment found on the resurgent dome shows that the dome first exited the caldera lake at ~33 kyrs ago and uplift activity continued until as recently as ~2.7 kyrs ago. The period of resurgence recorded at Toba therefore continued until ~2.7 kyrs ago. A major active stratovolcano north of Toba, Sinabung, shows strong geochemical kinship with Toba, through $^{87}Sr/^{86}Sr$ isotopes, whole rock chemistry, and ^{238}U-^{230}Th disequilibrium ages of zircons from recent eruption products. This suggests that Toba's climactic magma reservoir, which was tapped during resurgence, may extend beneath Sinabung and is being

tapped during current Sinabung eruptions. This implies that resurgence at the Toba Caldera system may have continued as eruptions at Sinabung.

INTRODUCTION

Large silicic calderas are the sites of catastrophic eruptions that emit hundreds of thousands of cubic meters of rock, ash, and pumice into the atmosphere. These eruptions are the culmination of hundreds of thousands of years of magmatic activity, all part of a process known as the caldera cycle (Smith and Bailey, 1968). Following the cataclysmic eruptions that can alter both the environment and climate, the caldera system enters the last stage of the caldera cycle, known as resurgence. As part of this process of resurgence, the remnant magmatic system undergoes "restlessness". Driven by remobilized remnant magma or an influx of new magma, the floor of the caldera is pushed up, structurally deforming along pre-existing or new faults and forming a resurgent dome in the middle of the caldera. These resurgent domes can be seen in resurgent caldera systems such as at Long Valley and Valles calderas (USA; Bailey et al., 1976; Spell and Harrison, 1993). Accompanying this structural resurgence is volcanic activity in the form of lava domes that extrude both along faults running through the caldera (and through the resurgent dome) as well as along the caldera ring faults (Smith and Bailey, 1968).

The period of resurgence itself is largely of interest due to its link with potential hazards and the development of systems of economic value. Structural deformation activity, such as the building of the resurgent dome, suggests the possibility of earthquake activity, while the emergence of lava domes along faults throughout the caldera system implies volcanic activity. Both earthquake

and volcanic activity related to resurgence raise the question of hazards for communities living near or on these resurgent caldera systems. The faulting of the caldera floor and potential heat exchange between underground remnant magma and percolating water through the ground has been linked to the development of ore systems and geothermal systems, raising an interest in economic benefits related to the resurgent calderas (Wohletz and Heiken, 1992).

With all the potential hazards and economic value of resurgent calderas, it is surprising that there has not been enough research on these systems, especially considering that all active calderas today are in a state of "restlessness", associated with this period of resurgence (Newhall and Dzurisin, 1988). Resurgence itself has not been well constrained, in particular the understanding of the driving forces and the timescales of resurgence. There have been several mechanisms of resurgence suggested, such as regional detumescence, continuous magma influx, or magmatic rebound, however these need to be properly supported with field-based observations (Marsh, 1984; Kennedy et al., 2012). Determining the timescales related to the period of resurgence would help answer questions related to i) what hazards may occur at what time during resurgence, and ii) how long it takes for systems of economic interest to develop. Specifically, the timescales of resurgence that need to be better constrained in order to answer these questions are deciding when resurgence starts and how long it goes on for.

Toba Caldera

A caldera system that still retains information of the process of resurgence would be the best place for resolving the temporal details of resurgence. Toba Caldera is such a caldera system, having erupted as recently as ~74 kyrs ago and is the youngest resurgent caldera system within the last 100 kyrs (Chesner, 2012). Toba's caldera system is actually a caldera complex, made of four overlapping caldera forming eruptions that form the complex seen today (Figure 6.1). The first eruption at Toba was the Haranggaol Dacite Tuff (HDT), erupting ~1.2 Myrs ago, with the focus of the eruption in the northern section of the complex. The second eruption was the Oldest Toba Tuff (OTT), erupting ~0.8 Myrs ago and producing 800 km^3 of material (ash and ignimbrite; value given is calculated dense rock equivalent; Chesner and Rose, 1991). This eruption took place in the southern part of the Toba Caldera Complex, forming the Porsea Caldera; the outline of the Porsea Caldera can still be seen today. The third eruption was the Middle Toba Tuff (MTT), returning the activity to the northern section of the caldera complex ~0.5 Myrs ago. The fourth and youngest eruption took place ~74 kyrs ago, producing the largest eruption so far, the Youngest Toba Tuff (YTT). This eruption produced 2800 km^3 of material (dense rock equivalent; Chesner, 2012) and created the caldera outline seen today. It is also thought to have reactivated faults along the Porsea Caldera, thus extending its footprint to encompass the entire caldera complex.

Following the last eruption, the caldera was filled with water in <1500 years (Chesner, 2012), creating the caldera lake. Further infilling of this lake was done through deposition of lake sediments from mass wasting and erosion. These lake sediments formed layers along the caldera floor, and as resurgence started, was uplifted along with the caldera floor to form the resurgent dome,

Samosir Island, that now sits above the lake (current lake level at 900 m above sea level, assumed to have been close to this height during resurgent doming; Chesner, 2012; de Silva et al., 2015). As a result, the top 100 m of Samosir Island is deposited lake sediment, overlying 600 m of uplifted intracaldera fill of YTT material. The structural uplift and deformation of the resurgent dome was accompanied by volcanic activity, with the eruption of lava domes both along faults through the resurgent dome and the caldera ring faults (Figure 6.1). These lava extrusions are split into four groups: Samosir lava domes found on Samosir Island, Pardepur lava domes found in the south, the Pusuk Buhit lava flows found on Pusuk Buhit, a composite volcano along the western ring of the caldera, and the two northern lava domes, Sipisupisu and Singgalang.

The youth of Toba Caldera's system sets it up as a natural laboratory to study and constrain the temporal details of resurgence, which can then be applied to other resurgent caldera systems. Well-preserved deposits and sections of both volcanic and sedimentary units provide insight into the timing of resurgence. The volcanic activity and structural uplift of the resurgent dome can offer answers to the question of when resurgence started and how long it has continued for.

Resurgent Uplift at Toba

Previous work (de Silva et al., 2015; Mucek et al., 2017) has looked at constraining the period of resurgence from the lake sediment sequences found on the resurgent dome. The uppermost layer of sediment deposited and assumed to be an isosynchronous layer across the island returned an age of 33,720 ± 240 years BP from radiocarbon dating of organic rich material within

this layer. This means that the surface of the resurgent dome was just below the surface of the lake at ca. ~33.7 kyrs ago, after which it broke the lake level, hence halting further deposition. This period of uplift, with uplift rates of 4.9 cm/yr, was followed by slumping along the main fault through the resurgent dome, which in turn was also uplifted at 22,410 ± 100 years BP, at an uplift rate of 0.7 cm/yr. Uplift of the resurgent dome continued at a localized level around the Tuk Tuk (Samosir) lava dome, with the most recent uplift activity occurring 2,690 ± 30 years BP, at an uplift rate of 1.9 cm/yr (Figure 6.2). The uplift of the main resurgent dome reflects a decreasing uplift rate over time, corresponding with low, long-term uplift rates related to the caldera system returning to lithostatic equilibrium. The uplift activity related to the Tuk Tuk lava dome reflects higher, short-term uplift rates, corresponding to "restless" activity linked to localized, shallow magmatic activity (as described in Kennedy et al., 2012).

Resurgent Volcanism at Toba

Recent work on the resurgent lava domes at Toba (Mucek et al., 2017) has constrained the period of volcanic activity related to resurgence. (U-Th)/He dating of zircon crystals from three of the lava dome groups, Samosir, Pardepur, and Pusuk Buhit, returned eruption ages showing that the start of volcanic resurgence was with the Samosir lava domes, 69.7 ± 4.5 kyrs ago. Volcanism then moved west and south, with lava flows on Pusuk Buhit at 62.2 ± 7.1 kyrs ago and lava domes at Pardepur at 63.4 ± 5.6 kyrs ago. The youngest volcanic activity was the formation of an island, part of the Pardepur lava domes, Pulau Sibandang, at 56.9 ± 3.9 kyrs ago (Figure 6.1).

More work on these lava domes using $^{40}Ar/^{39}Ar$ dating on sanidine and plagioclase crystals have shown that these minerals retain the signature of the YTT eruption; eruption age of the sampled lava domes return the same age as the YTT eruption (Figure 6.1). This implies that the lava domes are remobilized remnant YTT magma. The remnant magma remained under closure temperature for sanidine and plagioclase, allowing the YTT argon signature to remain within the crystal until a reheating event allowed the eruption of these magma bodies. The eruption of the different lava domes were as pulses and occurred quickly (Figure 6.3); as a result the $^{40}Ar/^{39}Ar$ ages for the two Samosir lava domes and one Pardepur dome returned ages coinciding with the YTT $^{40}Ar/^{39}Ar$ age. The second Pardepur dome, forming Pulau Sibandang, returned a younger $^{40}Ar/^{39}Ar$ inverse isochron age of 47.9 ± 11.1 kyrs ago, overlapping with the (U-Th)/He age of the same sample. The implication here is that the magma erupted could have been remnant YTT magma as well, however it was held above closure temperature for plagioclase, thus resetting the argon signal within the plagioclase crystals and losing any previously retained YTT argon signal.

Understanding Magma Dynamics

Despite having constrained the timing of the resurgent volcanic activity at Toba, the link between the different lava domes is still not well constrained. The hypothesis that the magma erupted at these lava domes is remnant magma still needs to be tested. The question arises as to whether the lava dome magmas can be traced back to originating from remnant YTT magma, especially if they originate from similar depths. Furthermore, the resurgent activity experienced at the Toba caldera system may not be only constrained to the volcanics seen within the Toba Caldera. Previous work (Jones, 1989) has shown a possible

geochemical link between volcanics found at Toba Caldera with an actively erupting volcano 30 km north of Toba, Sinabung volcano. If this geochemical link holds true between the Toba volcanic products and recent Sinabung data, it would imply that the resurgent footprint related to Toba's resurgent system extends further north than previously thought, and is being tapped at Sinabung's current volcanic eruptions.

This study looks at answering two questions related to the volcanic activity of resurgence at Toba: 1) are the lava domes erupted at Toba remnant YTT magma and if so, what are the dynamics between the remnant magma and the separate lava domes?, and 2) are current eruptions at Sinabung tapping Toba's magmatic system and does this mean the temporal footprint of resurgence at Toba can be extended until the present? Looking at analyzed matrix glasses from the lava domes and determining whether they originate from similar locations will answer the first question. ^{238}U-^{230}Th disequilibrium ages showing zircon crystallization histories for Sinabung products combined with $^{87}Sr/^{86}Sr$ isotope analyses of the same products offers a two-pronged approach to answering the second question.

METHODS

Sampling

Four samples from the Toba Caldera products were collected; these samples include one from the YTT pumice (LT_12_001), located north of Toba Caldera, one from the North Samosir lava dome (LT_12_003), and one from each Pardepur lava dome (LT_12_015 and LT_12_016). The YTT pumice sample was collected from a road cut; the North Samosir sample was also collected from

a road cut around the edge of the lava dome located at the northern tip of Samosir Island. In the south of the caldera, two samples were collected from the Pardepur lava domes. The Pardepur domes consist of a lava dome extruded along the southern margin of the caldera rim and the small lava dome island, Pulau Sibandang. One sample (LT_12_015; Pardepur South) was collected from near the summit of the caldera rim lava dome, while the second sample (LT_12_016; Pardepur North) was collected from the shoreline of Pulau Sibandang.

Five samples from recent activity at Sinabung were collected from exposed outcrop along river cuts on the southern flank of the volcano for zircon ^{238}U-^{230}Th disequilibrium dating and $^{87}Sr/^{86}Sr$ isotope analysis. The recent two samples were from the 2014 pyroclastic flow, followed by the 2013 lava flow. Two older samples of unknown ages, located lower in the stratigraphic section, were also sampled, one from blocks in a lahar flow and the other from an old lava flow. The fifth sample, material from the 2014 lahar flow, did not yield any zircons but was analyzed for $^{87}Sr/^{86}Sr$ isotopic compositions.

Mineral Separation

Sampled volcanic material from Sinabung was crushed and sieved to the <250 μm fraction, rinsed, and magnetically separated at currents of 0.25, 0.75, and 1.25 A on a Frantz Isodynamic Separator. The non-magnetic fraction from 1.25 A was run through heavy liquid separation (Methylene Iodide, 3.33 gcm^{-3}) and zircons were hand selected from the denser fraction. Sinabung lava flow/pyroclastic material was generally zircon-poor; at least five zircons were

picked for each sample and then rinsed in cold 48% HF for 1 minute to remove adhered glass from zircon surfaces.

Matrix Glass Analysis

The four Toba samples (one YTT pumice, one North Samosir lava dome, two Pardepur lava domes) were cut into billets and sent to Spectrum Petrographics Inc. to be made into 30 μm thick rock slice thin sections with electron microprobe grade polish. The four thin sections were coated with carbon before being placed into the electron microprobe for analysis. The electron microprobe used for analysis was the Oregon State University (OSU) Cameca SX-100 electron microprobe (EMP). Backscatter electron (BSE) scanning was used to pick points on the thin sections for areas of matrix glass that were free of microlites; at least 10 spots were selected on each thin section for analysis. Analytical procedure and standards used for the analysis can be found in Appendix Table 6.1 and 6.2.

^{238}U-^{230}Th Analysis

Zircons from the Sinabung samples were pressed into a pre-mounted indium (In) mount, exposing the unpolished surfaces of the zircons. Unknown grains were mounted along with secular equilibrium early-erupted Bishop Tuff (EBT) for mounts prepared at Stanford University. Following the sample mounting, the In mount was coated with a layer of conductive gold and analyzed on the jointly operated Stanford-USGS Sensitive High Resolution Ion Microprobe-Reverse Geometry (SHRIMP-RG) at Stanford University. ^{238}U-^{230}Th zircon analyses followed protocols outlined in Schmitt et al. (2006; 2010; 2011). ^{238}U-^{230}Th analyses on SHRIMP-RG at Stanford University were performed with

an O^{2-} primary beam with intensities ranging from 13 to 15 nA, focused to a spot size of size of varying from 35×40 to 55×60 μm on the zircon surface. All isotopes were measured on a single EPT® electron multiplier operated in pulse counting mode with 7 scans (peak-hopping) through the mass table. The (^{238}U)/(^{232}Th) was corrected for instrument mass fractionation using early-erupted Bishop Tuff (767.1 ± 0.9 kyrs ago; Crowley et al., 2007), which is in secular equilibrium. For analyses measured in this session (^{238}U)/(^{232}Th) = 0.911 ± 0.007 (1 s.d., MSWD=1.04), and all measured values were corrected to (^{238}U)/(^{232}Th) = 1.0. Finally, the zircon ^{238}U-^{230}Th ages were calculated using a two-point isochron through each zircon analysis and a model melt from the published whole rock compositions of Toba rocks of ($^{230}Th/^{232}Th$) = 0.465 ± 0.002 and ($^{238}U/^{232}Th$) = 0.517 ± 0.001 (Vasquez and Reid, 2004).

$^{87}Sr/^{86}Sr$ isotope analysis

Whole rock material from the five Sinabung samples were sent to New Mexico State University for $^{87}Sr/^{86}Sr$ isotope analysis by Thermal Ionization Mass Spectrometry (TIMS). Powdered material from each sample was dissolved in a mixture of hydrofluoric, nitric, and hydrochloric acid then purified using chromatographic techniques before analysis on the TIMS, following methodology detailed in Ramos and Tepley (2008).

RESULTS

Toba Matrix Glass

The matrix glass analyses for the samples in this study were combined with matrix glass analyses from Chesner and Luhr (2010) on YTT samples and Samosir lava dome samples (Table 6.1). The Samosir lava domes consist of the

northern lava dome at the tip of Samosir Island and the lava dome found along the east coast forming the Tuk Tuk peninsula (Figure 6.1). The samples from Chesner and Luhr (2010) are from the Tuk Tuk peninsula, therefore representing the other half of lava domes found on Samosir. Using the IgPet software to calculate CIPW norm on the given analyses, the values were then plotted on a quartz-albite-orthoclase (Qz-Ab-Or) ternary plot (Figure 6.4). Phase relations in the haplogranitic system were included (as adapted from Blundy and Cashman, 2001). YTT glass is high in SiO_2 (74-75 wt. %) as expected of a rhyolitic magma. YTT glass from this study overlaps with matrix glass analyses from Chesner and Luhr (2010), plotting between 50 MPa and 100 MPa, and going no deeper than 100 MPa.

Whole rock data for the YTT corresponds with the matrix glass data, showing high SiO_2 values of the bulk rock (up to 77 wt. %; Chesner, 2012). Samosir glass from this study shows a wider range in SiO_2 (61-75 wt. %), which in turn reflects the wide range of depths of equilibration for the melt, between 200 and 50 MPa. Chesner and Luhr (2010) Samosir samples overlap, equilibrating at 100 MPa. Whole rock data for both Samosir lava domes show it overlapping with the YTT composition, between 70-77 wt. % SiO_2 (Chesner, 2012). The two Pardepur lava domes overlap in SiO_2, however the North Pardepur glass (from the island) shows less of a range (73-76 wt. %) than the South Pardepur glass (on the caldera rim; 68-77 wt. %). Both samples show the source magma for these lava domes equilibrating at the same depth (between 50-0.1 MPa). Whole rock data for the Pardepur lava domes reflect a different composition to the matrix glass; the Pardepur lava domes plot as more dacite in composition than the matrix glass analyses (65-68 wt. % SiO_2; Chesner, 2012).

The difference between the whole rock and matrix glass analyses can be explained by the accumulation of crystals within the melt; whole rock analyses measures the composition as a mixture between accumulated crystals and melt, while matrix glass analyses only measure the melt composition. The matrix glass analyses, therefore, are a more accurate representation of the composition of the melt of each lava dome, and as such, a more accurate representation of the composition of the remnant magma erupted.

Sinabung Sr Isotopes

The footprint of the Toba magmatic system is extensive, covering the length of lake basins from Pardepur in the south to the northernmost Toba-related centers being Sipisupisu (Tandukbenua) and Singgalang (Chesner, 2012). However, of particular interest here is the active Sinabung volcano, ~30 kilometers to the north of Toba (Figure 6.1). Considered to be part of the Sumatran arc and not related to Toba, Sinabung nevertheless shares chemical characteristics with the Toba magmas in contrast to other arc volcanoes. A compilation of new and published data for Sinabung (Jones, 1989; Gasparon and Varne, 1995; Alloway et al., 2004; Sarbas, 2008) show elevated $^{87}Sr/^{86}Sr$ isotope values from 0.710 to 0.712 overlapping with lithologies related to Toba Caldera (Figure 6.5; Appendix Table 3). Such elevated $^{87}Sr/^{86}Sr$ compositions >0.710 are absent from other regional volcanoes from the Sumatran and Sunda-Bandan Arcs. Thus even the least radiogenic Sinabung samples are exceptional on a regional scale. The Sinabung data fall on a common assimilation – fractional crystallization (AFC) trend with the Toba centers (Figure 6.5), further underscoring consanguinity between Sinabung and Toba. This should be a cause

for some concern because Sinabung has been in explosive eruption since November 2013, and continues to erupt at the time of writing.

Sinabung Zircon Crystallization Ages

To further test a potential link between Toba and Sinabung, ^{238}U-^{230}Th disequilibrium ages of the outermost rims from the five samples from recent eruptions (including 2014) of Sinabung were compared to Toba samples obtained in Mucek et al. (2017) (Figure 6.6; Appendix Table 4). Outermost rim ages, measured with the ^{238}U-^{230}Th method, record the last stage of zircon crystallization. The Sinabung zircons analyzed in this study show outermost rim ages that overlap with YTT and post-YTT dome zircon rim ages, but extend to younger ages with the youngest Sinabung zircon rim weighted average age at 32.0 ± 14.0 kyrs ago (Mean Square of Weighted Deviates (MSWD) = 3.6; Figure 6.6). ^{238}U-^{230}Th outermost zircon rim crystallization ages (2σ) for the Sinabung zircons define a population that overlaps YTT and post-caldera dome outermost zircon rim ages dating back to ~350 kyrs ago (Figure 6.7). The data connote that zircon crystallization under Sinabung overlaps in time with the climactic magma system at Toba as well as the post-climactic domes, but has continued well after any known post-caldera eruptions at Toba. These young zircon model ages and the overlapping crystallization history with Toba indicate a shared magmatic system between Sinabung and Toba, rather than a discrete magma reservoir beneath the former. The zircon crystallization history of a small discrete magma body is unlikely to parallel that of a large system like Toba due to the positive feedbacks that enhance the thermal lifetimes, and zircon crystallization histories in the latter (de Silva and Gregg, 2014). Moreover, the extensive crustal contamination recorded in the Sr-isotope data of Sinabung is

also more consistent with a large shared magma system where assimilation would be more efficient and helps explain the anomalous geochemical character of Sinabung compared to the rest of the arc.

DISCUSSION

Magmatic Activity at Toba

The magmatic resurgent activity at Toba has been dated using (U-Th)/He disequilibrium method on zircon crystals pinpointing the emergence of the lava domes starting with the Samosir lava domes and moving west and south, to Pusuk Buhit and the Pardepur lava domes (Mucek et al., 2017). $^{40}Ar/^{39}Ar$ dating of sanidine and plagioclase crystals on these same domes have shown that they are of YTT eruption age, meaning they retain the YTT argon signature. This implies that the source of the lava domes is remnant YTT magma that has been reheated and remobilized. In order to correlate the data between the matrix glass analyses, (U-Th)/He eruption ages, and $^{40}Ar/^{39}Ar$ ages, the following sequence of geologic processes need to be prescribed.

During the build up of the YTT magma reservoir, eruptible melt equilibrated at the top of the reservoir, at a maximum depth of around 10 km based on the matrix glass analyses (Figure 6.8A). This depth also corresponds with geophysical data showing that the top of the magma chamber for the YTT eruption would have been at around 10 km (Masturyono et al., 2001). The source of this eruptible melt, however, came from a deeper depth, around 30 km, as shown by melt inclusions hosted in quartz crystals within the eruptible melt portion (Chesner and Luhr, 2010). The ground surface would have reflected this large volume build up of magma by tumescing, as is thought to

occur just prior to a caldera forming eruption (Smith and Bailey, 1968). During the caldera forming eruption, eruptible melt would have escaped along fractures circling the caldera, allowing for the roof of the magma chamber to collapse into the vacated space and forming a caldera (Figure 6.8B). At Toba, it is thought that a 2 km deep caldera was formed after the YTT eruption ~74 kyrs ago (Chesner, 2012). This caldera would have been infilled with YTT material and the flanks of the caldera would be covered in YTT outflow. According to stratigraphic sections along the caldera walls, the YTT outflow on the caldera rim was ~400 m, while the intracaldera fill was ~600 m in thickness (Chesner and Rose, 1991; Chesner, 2012). The remnant magma from the YTT eruption would have remained at deeper depths (deeper than ~15 km) until resurgence started. During the beginning of resurgence, heat from a deeper, hotter, and more mafic source, conducted/convected through the overlying remnant magma, remobilizing parts of it to form an eruptible region. The evidence of this more mafic source is seen in the more mafic composition of the matrix glass in the lava domes compared to the YTT (see Results Toba Matrix Glass section). This eruptible region formed and equilibrated between ~20–10 km, before erupting on the surface as the North Samosir dome ~69.7 kyrs ago (Figure 6.8C). The time between the reheating and eruption of the remobilized magma would have been less than 700 years; any period of time longer than this at high eruption temperatures would have resulted in the resetting of the $^{40}Ar/^{39}Ar$ ages of the sanidine crystals from the YTT remnant magma. This geological explanation clarifies why the $^{40}Ar/^{39}Ar$ ages of the sanidines still reflect YTT eruption age while the (U-Th)/He ages of the zircons reflect the eruption age.

The reheating of the remnant magma chamber as part of resurgence caused the magmatic system to start to rise through the crust, resulting in the Tuk Tuk (Samosir) lava dome forming from magma that equilibrated at a shallower depth (10-5 km) than the North Samosir lava domes (Figure 6.8D). The Tuk Tuk lava dome formed ~69 kyrs ago, with sanidine crystals still reflecting YTT eruption age. The explanation for this is the same as for the North Samosir lava dome; the process of heating to remobilization to eruption took less than 700 years at high eruption temperatures, allowing the sanidine crystals to retain the YTT argon signature while the (U-Th)/He ages of the zircons reflect the eruption age.

Over time, as resurgence continued, the magmatic system continued to rise through the crust, with the reheating of the reservoir forming more eruptible regions at shallower depths. One of these magma regions equilibrated at ~5 km depth before erupting as the South Pardepur lava dome ~63 kyrs ago (Figure 6.8E). As was the case with the Samosir lava domes, the South Pardepur lava dome formed within 700 years of the reheating and remobilization of the magma, such that the plagioclase crystals retained the YTT argon signature while the zircon crystals provided a younger (U-Th)/He eruption age. Further remobilization of this region of remnant magma (10-5 km deep) formed the eruption of the North Pardepur lava dome, forming the island Pulau Sibandang, ~60 kyrs ago (Figure 6.8F). Unlike the other lava domes, the remobilized magma erupting to form North Pardepur was heated >350°C for a time longer than 700 years, allowing the plagioclase crystals to reset, losing the YTT argon signature. As a result, both the $^{40}Ar/^{39}Ar$ ages on the plagioclase crystals and the (U-Th)/He ages on the zircon crystals reflect the same eruption age. As the

individual remobilized regions under the lava domes cooled, the remnant magma reservoir as a whole most likely continued to rise (Figure 6.8G), leading to the uplift and formation of the resurgent dome.

Activity at Sinabung

Toba-like magma has been erupted ~30 km north of Toba from Sinabung volcano where geochemical affinities with Toba are accompanied by overlapping zircon crystallization histories that continue to more recent times under Sinabung (Figure 6.6). The possibility that the Toba magma system is currently being sampled by Sinabung's active and erupting volcano suggests that Toba's magma system extends further north than previous geophysical surveys have indicated (Masturyono et al., 2001; Koulakov et al., 2009; Jaxybulatov et al., 2014), and should be considered in assessments of hazard associated with activity in this region. The new geochemical and geochronological data also suggest significant extension of the caldera-related magmatic system well beyond the Toba caldera boundary to beneath Sinabung volcano.

CONCLUSION

Magmatic Resurgence at Toba

Resurgence at Toba started just after the YTT eruption with the Samosir lava domes and progressed south with the formation of the Pardepur lava domes. The combination of (U-Th)/He and $^{40}Ar/^{39}Ar$ ages from zircon and sanidine/plagioclase crystals show that the magma erupted at these domes was remnant YTT magma, erupting as the magma reservoir was reheated and remobilized. Toba's magmatic resurgence continued, with the rising magmatic system being the driving force behind the uplifted resurgent dome (de Silva et

al., 2015). The exact mechanism causing this rising magmatic region has not yet been determined, but it has been shown that the continued rise can explain the radiocarbon ages reflected in the sedimentary layers on the resurgent dome. The resurgent footprint may have continued, as is evidenced by the geochemical link between Toba and the current activity at Sinabung. While the exact nature of the connection is unknown, a shared magmatic history and magmatic consanguinity is clear and the data are most consistent with a common magmatic reservoir with a shared thermal and chemical evolution. Magmatic complexes that extend well beyond caldera boundaries have been recognized by geophysical surveys at other large calderas (Farrell et al., 2014) and may be more common than previously thought. Like at Yellowstone, at Toba the northern extension may be facilitated by structures that in this case parallel the nearby Sumatra fault, along which the Toba depression is thought to have developed as a step-over pull-apart basin (Aldiss and Ghazali, 1984). The possibility of Toba's magmatic system extending north to Sinabung raises the need to reassess the potential hazards in this region.

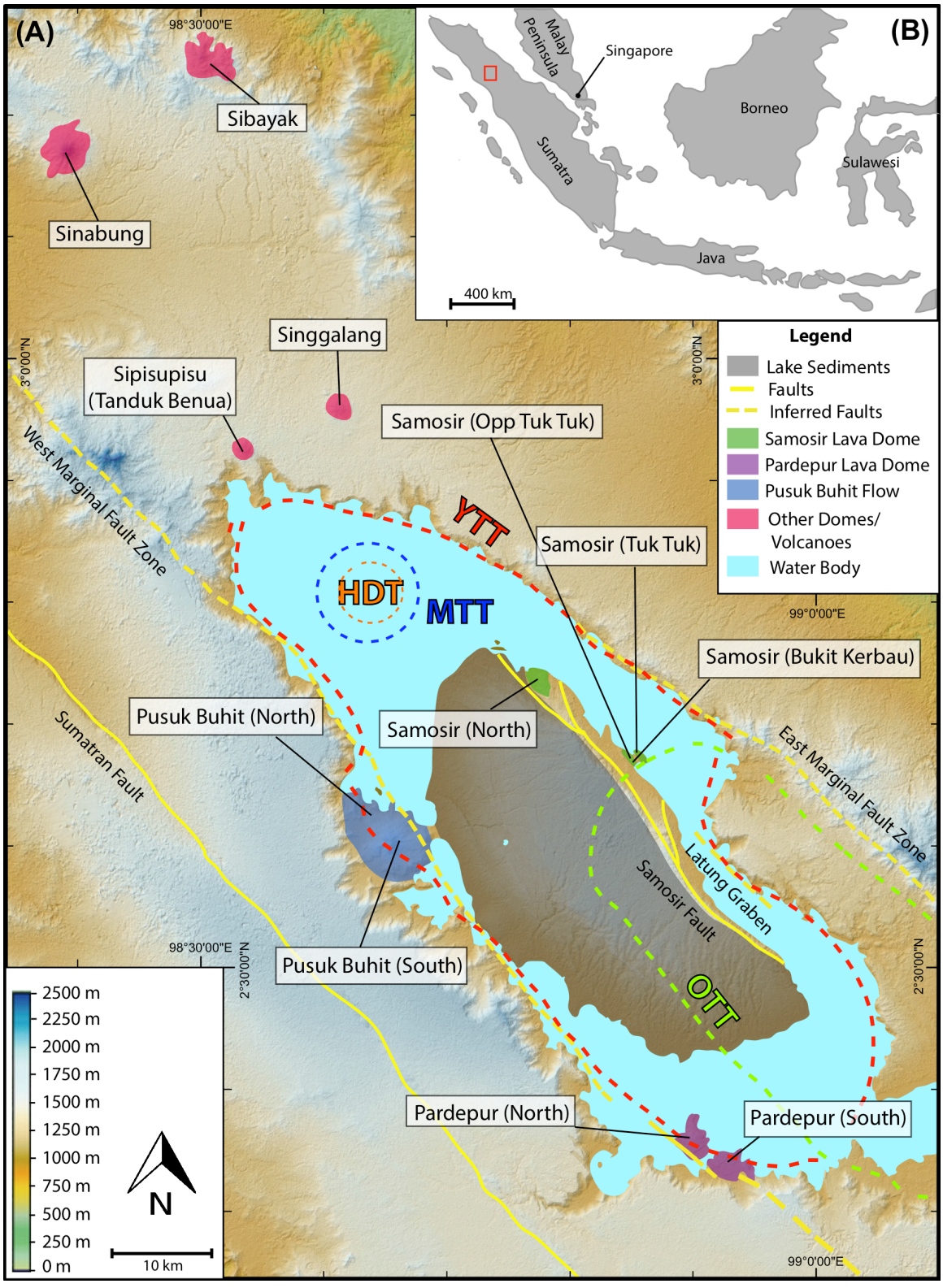
Future Work

Identifying magmatic activity related to the resurgent lava domes has been done through geochemistry and geochronology, however data from geophysical surveys would further enhance the resurgent signal found within the remnant magmatic reservoir below the caldera. Current geophysical surveys of Toba Caldera (Masturyono et al., 2001; Koulakov et al., 2009; Jaxybulatov et al., 2014) focus on looking at the velocity waves across a west-east transect. Future geophysical surveys could focus on signals along a north-south transect to better understand the activity below Pardepur and how it relates to Samosir.

Furthermore, if north-south transects extended to Sinabung, any link of resurgence between Toba and Sinabung is bound to show up, especially considering the large footprint of the Toba magma reservoir. The question of whether resurgence is continuing today at Toba and whether activity at Sinabung will promote or reduce future activity at Toba Caldera can also be best answered through an installation of a GPS network across the resurgent dome, Samosir Island, as well as around the flanks of the caldera, to measure any inflation/tilting/deformation of surfaces. At the moment, there is no monitoring network across the caldera to record ground movements; the GPS network would change that. If resurgence from Toba Caldera is extended to Sinabung, and Sinabung is actively erupting, there remains the possibility of continued resurgent activity at Toba Caldera, whether in the form of surface deformation and uplift or volcanic extrusions/intrusions. In terms of monitoring hazards associated with the period of resurgence, and better understanding how such hazard mitigation can be applied to other calderas, it is paramount that monitoring of Toba Caldera is extensive and detailed.

Figure 6.1: Digital elevation map of Toba Caldera and locations of sampled and analyzed lava domes

(Adapted from Mucek et al., 2017)
(A) Sample locations of analyzed lava domes are indicated (green: Samosir domes; blue: Pusuk Buhit flows; purple: Pardepur domes; red: other volcanic extrusions including Sinabung volcano). Inferred fault lines taken from Aldiss and Ghazali (1984). Base map is an Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) 30 m Digital Elevation Model (DEM). Inferred caldera outlines from Chesner (2012). Orange: Haranggaol Dacite Tuff (HDT); Bright Green: Oldest Toba Tuff (OTT); Dark Blue: Middle Toba Tuff (MTT); Red: Youngest Toba Tuff (YTT).
(B) Overview of Southeast Asia; red rectangle outlines study area of Toba Caldera on the island of Sumatra, Indonesia.


(A)
98°30'00"E
Sibayak
Sinabung
Singgalang
Sipisupisu
(Tanduk Benua)
Samosir (Opp Tuk Tuk)
Samosir (Tuk Tuk)
Samosir (Bukit Kerbau)
Samosir (North)
Pusuk Buhit (North)
Pusuk Buhit (South)
Pardepur (North)
Pardepur (South)
West Marginal Fault Zone
Sumatran Fault
East Marginal Fault Zone
Samosir Fault
Latung Graben
YTT
HDT
MTT
OTT
3°0'0"N
2°30'0"N
99°0'0"E
(B)
Malay Peninsula
Singapore
Borneo
Sumatra
Sulawesi
Java
400 km
Legend
Lake Sediments
Faults
Inferred Faults
Samosir Lava Dome
Pardepur Lava Dome
Pusuk Buhit Flow
Other Domes/ Volcanoes
Water Body
2500 m
2250 m
2000 m
1750 m
1500 m
1250 m
1000 m
750 m
500 m
250 m
0 m
N
10 km

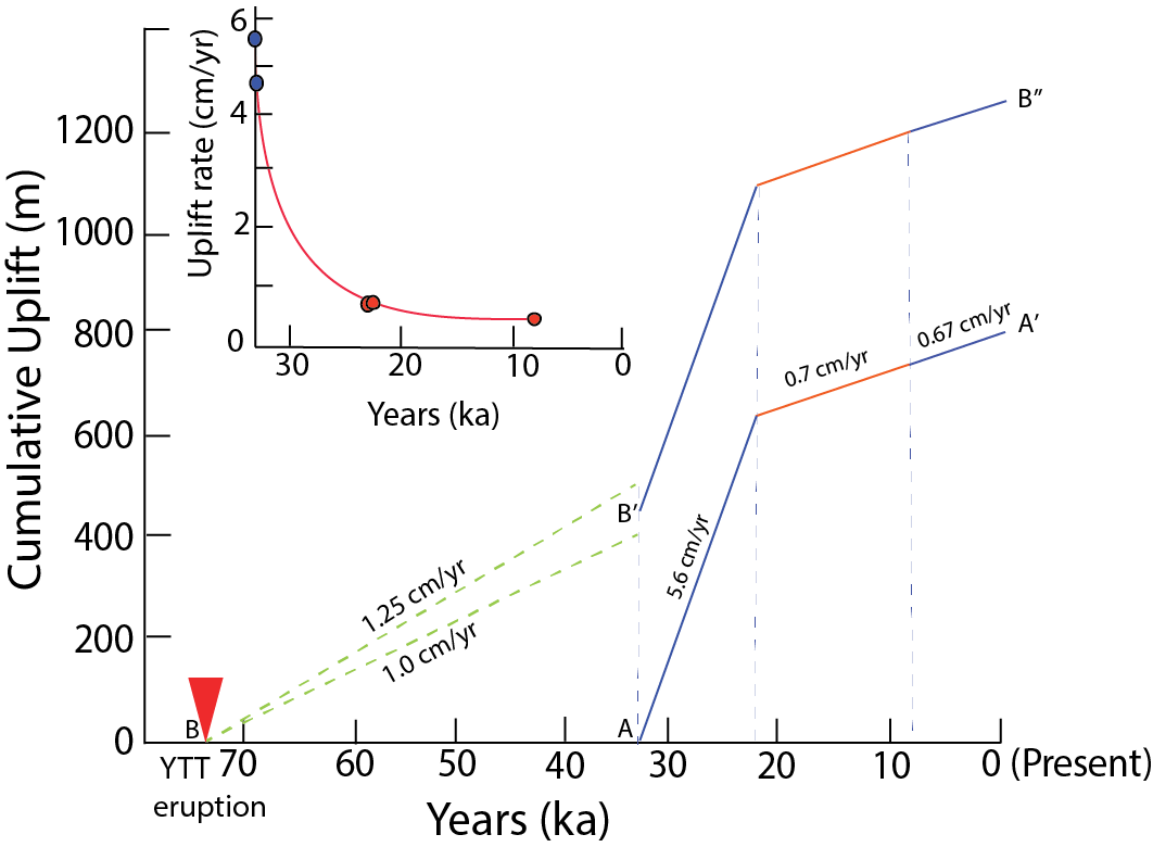


Figure 6.2: Uplift rates over time for the uplift of Samosir Island

(Adapted from de Silva et al., 2015) Main figure shows cumulative uplift over time. Slope of the lines represent uplift rate. Radiocarbon ages obtained from sediment samples (de Silva et al., 2015) calculate uplift rate A-A'. Toba eruption at 74 kyrs ago is marked by red triangle. B-B' show uplift from base of caldera to current lake level (900 m above sea level) including or excluding the 100 m of lake sediment (de Silva et al., 2015). B'-B" is the same uplift rates from the radiocarbon ages, but using maximum cumulative uplift rate from scenario 2 (de Silva et al., 2015).

Figure 6.3: Overview of temperature changes over time during eruptions of post-YTT resurgent lava domes.

Each line shows maximum temperature path of respective magmatic system in order for sanidine/plagioclase crystals to retain YTT Ar signature. If crystals remain at longer time intervals at each temperature than what is shown by the line, the crystal argon signature will reset. (a) shows maximum amount of time allowed for Samosir sanidine crystals to sit at closure temperature (T_c) before YTT Ar signature diffuses out completely. (b) shows maximum amount of allowed time for Pardepur (South) plagioclase crystal at T_c. (c) shows minimum amount of time needed at T_c for Pardepur (North) plagioclase crystals in order for YTT Ar signature to be reset, if plagioclase crystals are YTT antecrysts from a remnant YTT magma. T_c (closure temperatures) for argon and helium are shown in dashed grey lines. Maximum eruption temperatures for samples are shown in dashed grey lines. Transparent coloured boxes show 2σ error for given (U-Th)/He eruption ages as taken from Mucek et al. (2017).

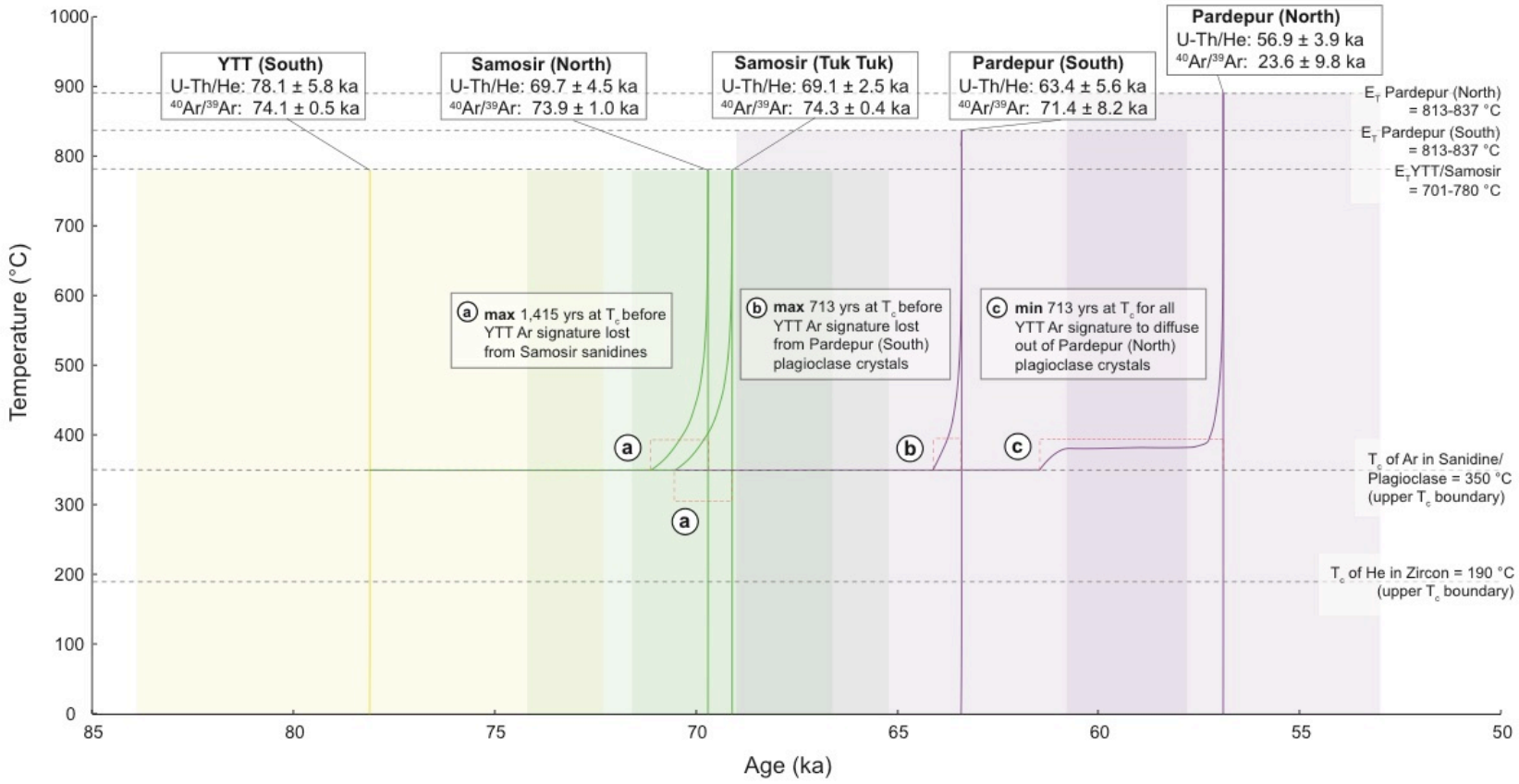
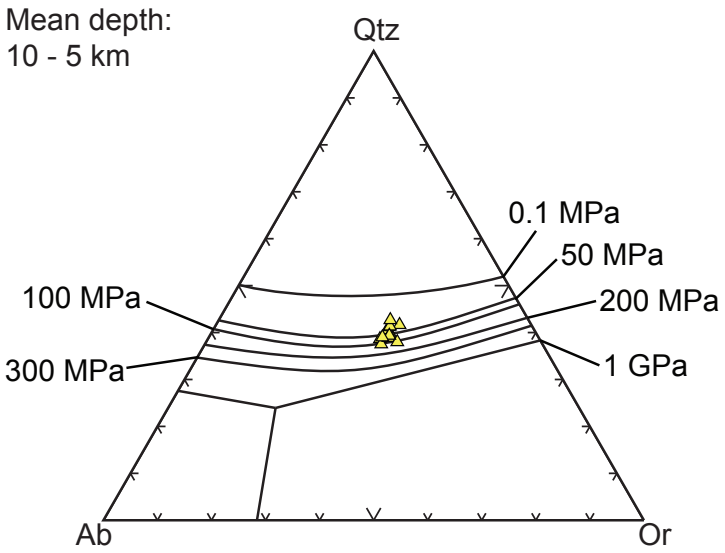

YTT (South)
U-Th/He: 78.1 ± 5.8 ka
40Ar/39Ar: 74.1 ± 0.5 ka
Samosir (North)
U-Th/He: 69.7 ± 4.5 ka
40Ar/39Ar: 73.9 ± 1.0 ka
Samosir (Tuk Tuk)
U-Th/He: 69.1 ± 2.5 ka
40Ar/39Ar: 74.3 ± 0.4 ka
Pardepur (South)
U-Th/He: 63.4 ± 5.6 ka
40Ar/39Ar: 71.4 ± 8.2 ka
Pardepur (North)
U-Th/He: 56.9 ± 3.9 ka
40Ar/39Ar: 23.6 ± 9.8 ka
ET Pardepur (North) = 813-837 °C
ET Pardepur (South) = 813-837 °C
ETYTT/Samosir = 701-780 °C
a max 1,415 yrs at Tc before YTT Ar signature lost from Samosir sanidines
b max 713 yrs at Tc before YTT Ar signature lost from Pardepur (South) plagioclase crystals
c min 713 yrs at Tc for all YTT Ar signature to diffuse out of Pardepur (North) plagioclase crystals
Tc of Ar in Sanidine/ Plagioclase = 350 °C (upper Tc boundary)
Tc of He in Zircon = 190 °C (upper Tc boundary)
Temperature (°C)
Age (ka)
1000
900
800
700
600
500
400
300
200
100
0
85
80
75
70
65
60
55
50

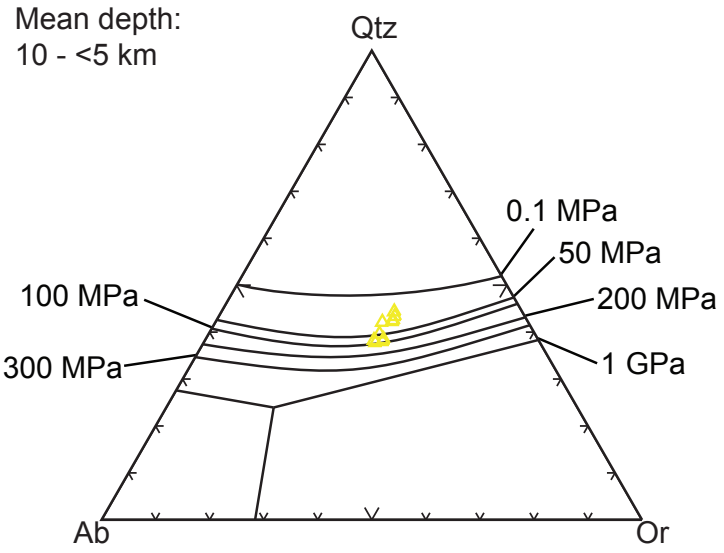
Figure 6.4: Ternary plots for Toba samples

All plots show CIPW calculations Toba Samples. Plots (A), (C), (E), and (F) are data from this study. Plots (B) and (D) are data from Chesner and Luhr (2010). All plotted data can be found in Table 6.1. (A) and (B) for Youngest Toba Tuff samples; (C) for North Samosir sample; (D) for Tuk Tuk Samosir sample; (E) for South Pardepur sample; (F) for North Pardepur sample. Qtz: Quartz; Ab: Albite; Or: Orthoclase.

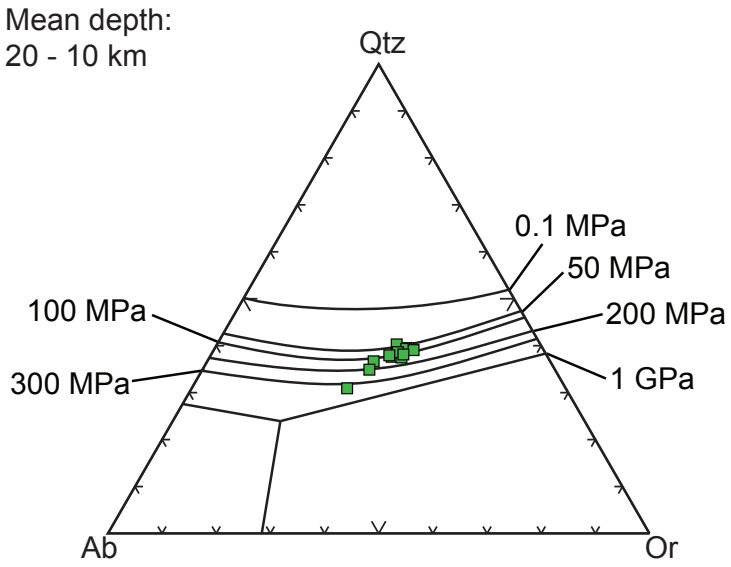
A) YTT (This Study)



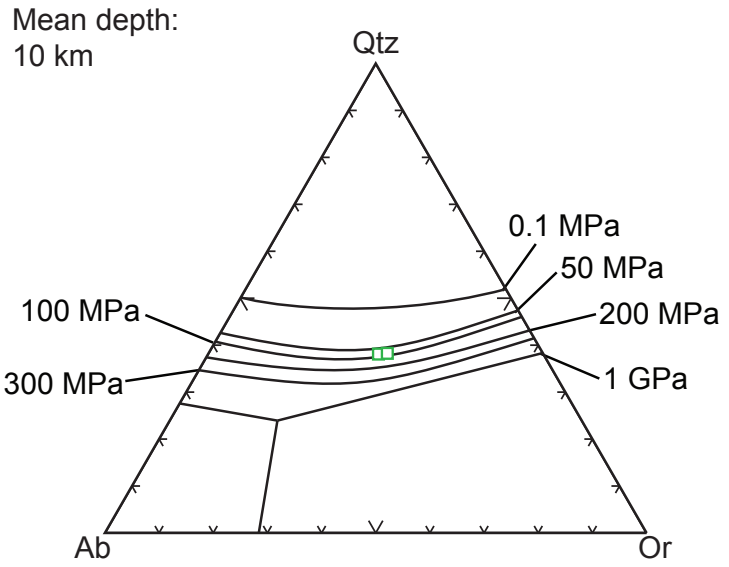
B) YTT (Chesner and Luhr, 2010)



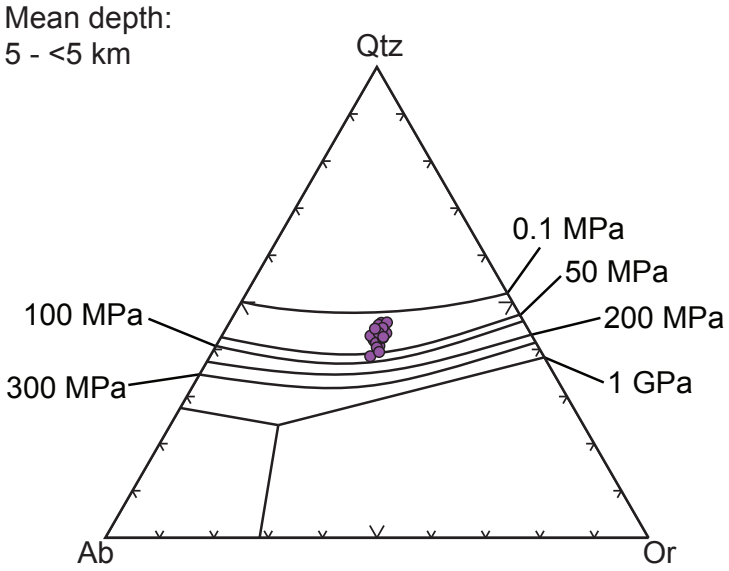
C) Samosir North (This Study)



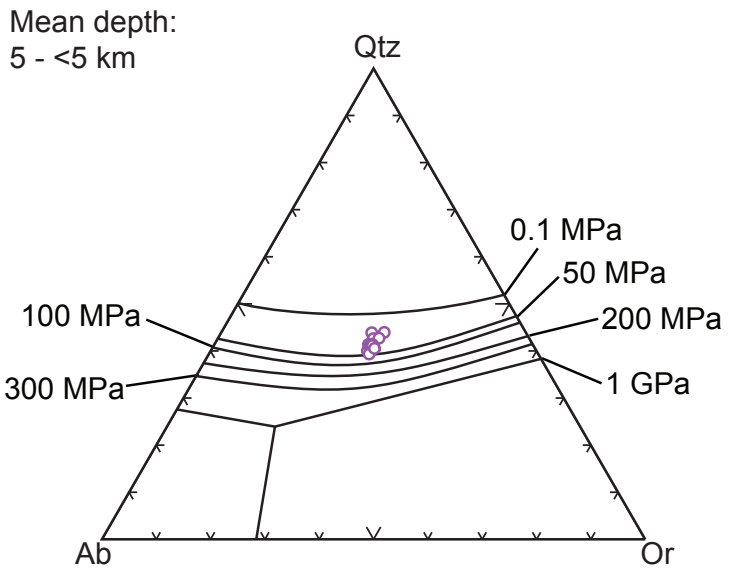
D) Samosir Tuk Tuk (Chesner and Luhr, 2010)



E) Pardepur South (This Study)



F) Pardepur North (This Study)



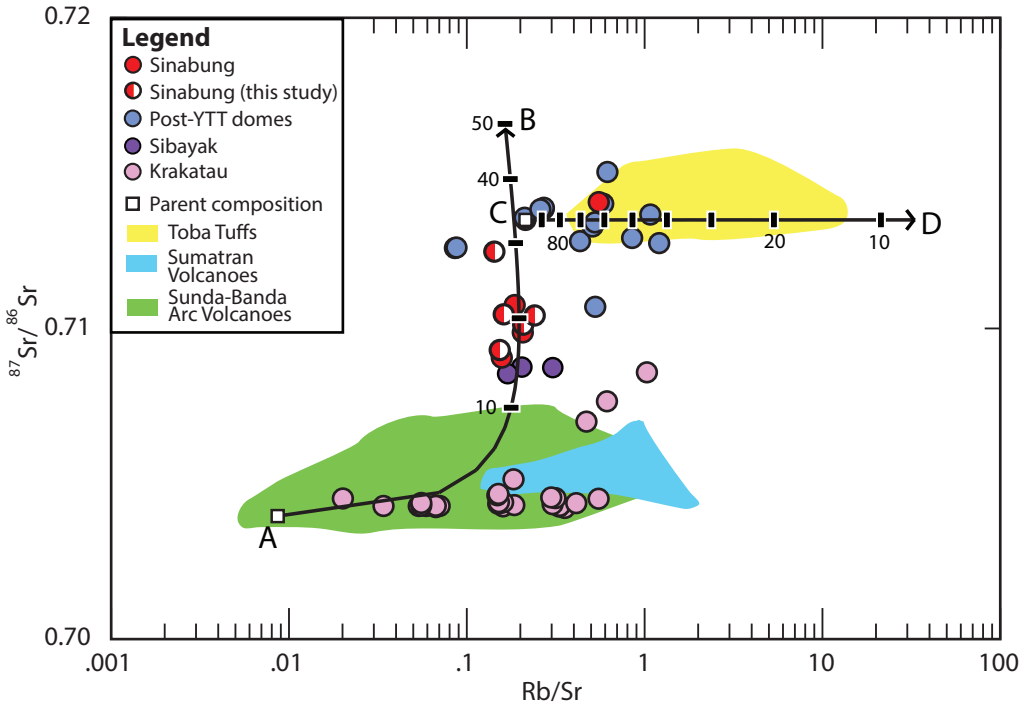
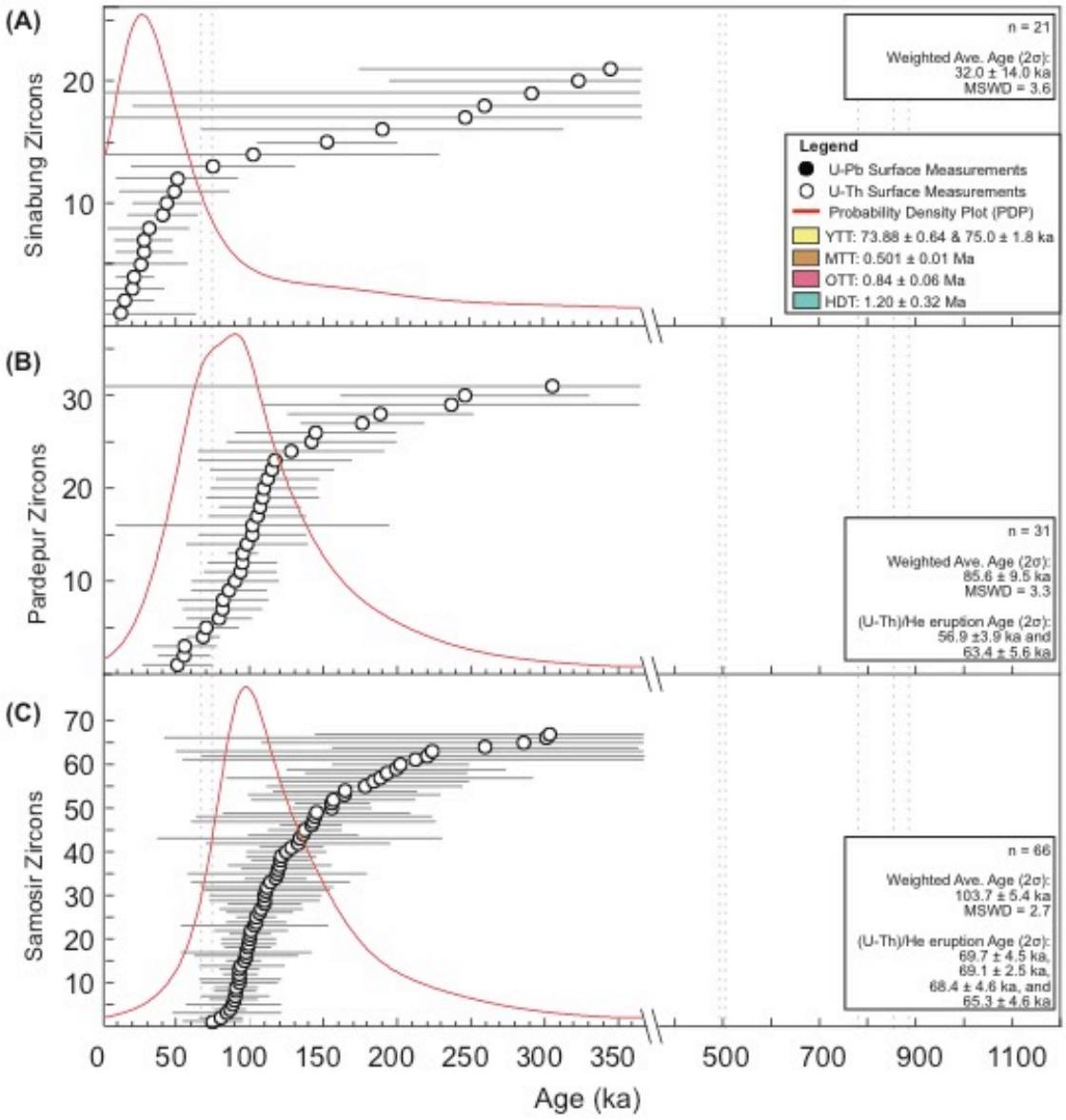


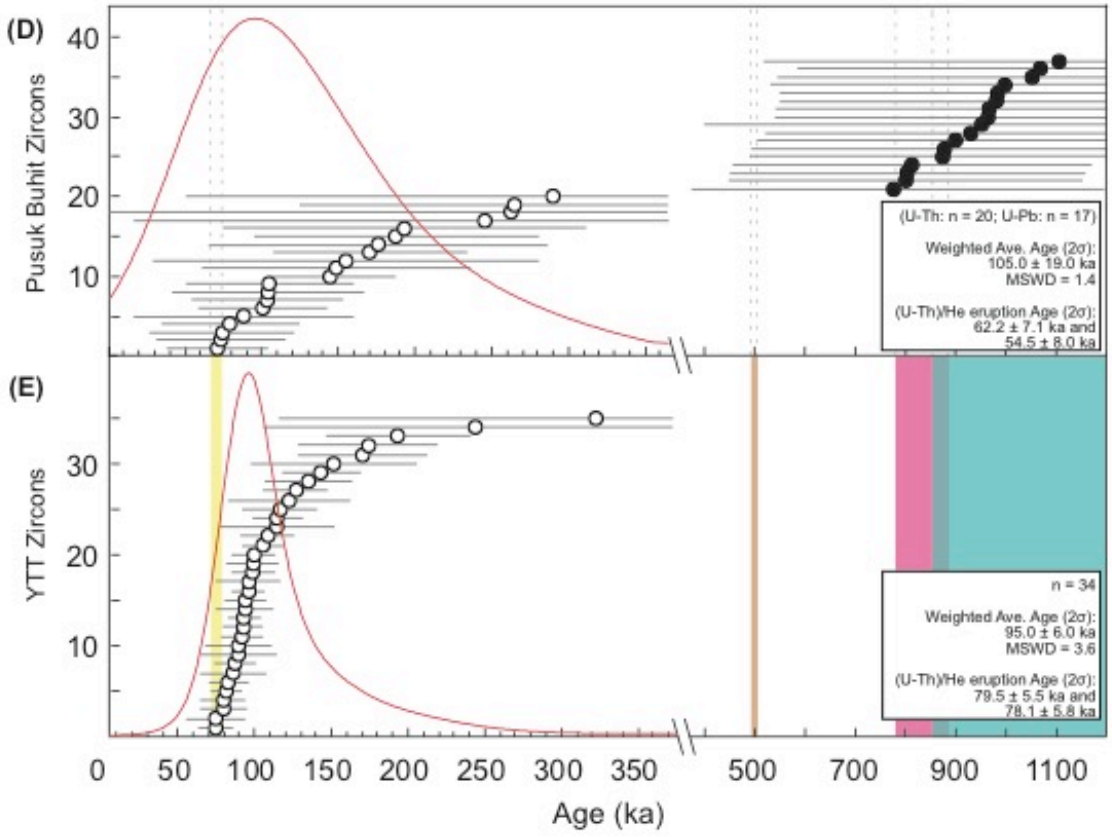
Figure 6.5: Sr-isotope data and Assimilation and Fractional Crystallization model for Sinabung and Toba samples

(From Mucek et al., 2017) Assimilation and Fractional Crystallization (AFC) model for compiled $^{87}Sr/^{86}Sr$ isotope data from Sinabung and Toba samples. Assimilation line is A-B; Parental magma: $^{87}Sr/^{86}Sr$ = 0.70396, Rb = 2.6 ppm, Sr = 301 ppm. Assimilant: $^{87}Sr/^{86}Sr$ = 0.74036, Rb = 113 ppm, Sr = 32 ppm (chosen based on most enriched $^{87}Sr/^{86}Sr$ granite rock sampled on Sumatra (Gasparon and Varne, 1995); see Appendix Table 6.3, Row 560)
Fractional Crystallization line is C-D; Parent magma: $^{87}Sr/^{86}Sr$ = 0.713494, Rb = 84.1 ppm, Sr = 393.4 ppm. Daughter magma: $^{87}Sr/^{86}Sr$ = 0.71383, Rb = 266 ppm, Sr = 24 ppm. Parent compositions for A-B and C-D lines graphed as white squares. Plotted data is found in Appendix Table 6.3 (half-red circles: Sinabung volcano data from this study; full red circles: previous Sinabung volcano data; blue circles: data for Post-YTT lava domes; purple circles: data for Sibayak volcano; pink circles: data for Krakatau volcano; green field: data for Sunda-Banda Arc volcanoes; blue field: data for Sumatra Arc volcanoes).

Figure 6.6: ^{238}U-^{230}Th and ^{238}U-^{206}Pb ages of surfaces of zircon crystals from Sinabung and Toba

(From Mucek et al., 2017) (a) – (e): ^{238}U-^{230}Th and ^{238}U-^{206}Pb ages of surfaces of zircon crystals plotted for Sinabung and Toba. Panel (a) shows Sinabung zircons, panels (b) - (d) show post-YTT lava dome zircons from Toba, and panel (e) shows YTT zircons. All zircon ages younger than 350 kyrs ago (equilibrium) are dated with ^{238}U-^{230}Th. Ages older than 350 kyrs ago are dated with ^{238}U-^{206}Pb. $^{40}Ar/^{39}Ar$ age range (Storey et al., 2012; Mark et al., 2014) for the Youngest Toba Tuff (YTT) eruption with ± 2 standard error (σ) shown by vertical yellow lines. Eruption ages (Chesner, 2012) with ± 2σ of Haranggaol Dacitic Tuff (HDT), Oldest Toba Tuff (OTT), Middle Toba Tuff (MTT) shown in aqua, pink, and brown vertical lines, respectively. All errors shown are ± 2σ; n refers to the number of grains analyzed for each sample; y-axes show numbers of zircons for ranked-order plot; MSWD refers to Mean Square of Weighted Deviates; see Appendix Table 6.4 for complete dataset.


(A)
Sinabung Zircons
n = 21
Weighted Ave. Age (2σ):
32.0 ± 14.0 ka
MSWD = 3.6
Legend
U-Pb Surface Measurements
U-Th Surface Measurements
Probability Density Plot (PDP)
YTT: 73.88 ± 0.64 & 75.0 ± 1.8 ka
MTT: 0.501 ± 0.01 Ma
OTT: 0.84 ± 0.06 Ma
HDT: 1.20 ± 0.32 Ma
(B)
Pardepur Zircons
n = 31
Weighted Ave. Age (2σ):
85.6 ± 9.5 ka
MSWD = 3.3
(U-Th)/He eruption Age (2σ):
56.9 ±3.9 ka and
63.4 ± 5.6 ka
(C)
Samosir Zircons
n = 66
Weighted Ave. Age (2σ):
103.7 ± 5.4 ka
MSWD = 2.7
(U-Th)/He eruption Age (2σ):
69.7 ± 4.5 ka,
69.1 ± 2.5 ka,
68.4 ± 4.6 ka, and
65.3 ± 4.6 ka
Age (ka)


(D)
Pusuk Buhit Zircons
40
30
20
10
(U-Th: n = 20; U-Pb: n = 17)
Weighted Ave. Age (2σ):
105.0 ± 19.0 ka
MSWD = 1.4
(U-Th)/He eruption Age (2σ):
62.2 ± 7.1 ka and
54.5 ± 8.0 ka
(E)
YTT Zircons
30
20
10
n = 34
Weighted Ave. Age (2σ):
95.0 ± 6.0 ka
MSWD = 3.6
(U-Th)/He eruption Age (2σ):
79.5 ± 5.5 ka and
78.1 ± 5.8 ka
0
50
100
150
200
250
300
350
500
700
900
1100
Age (ka)

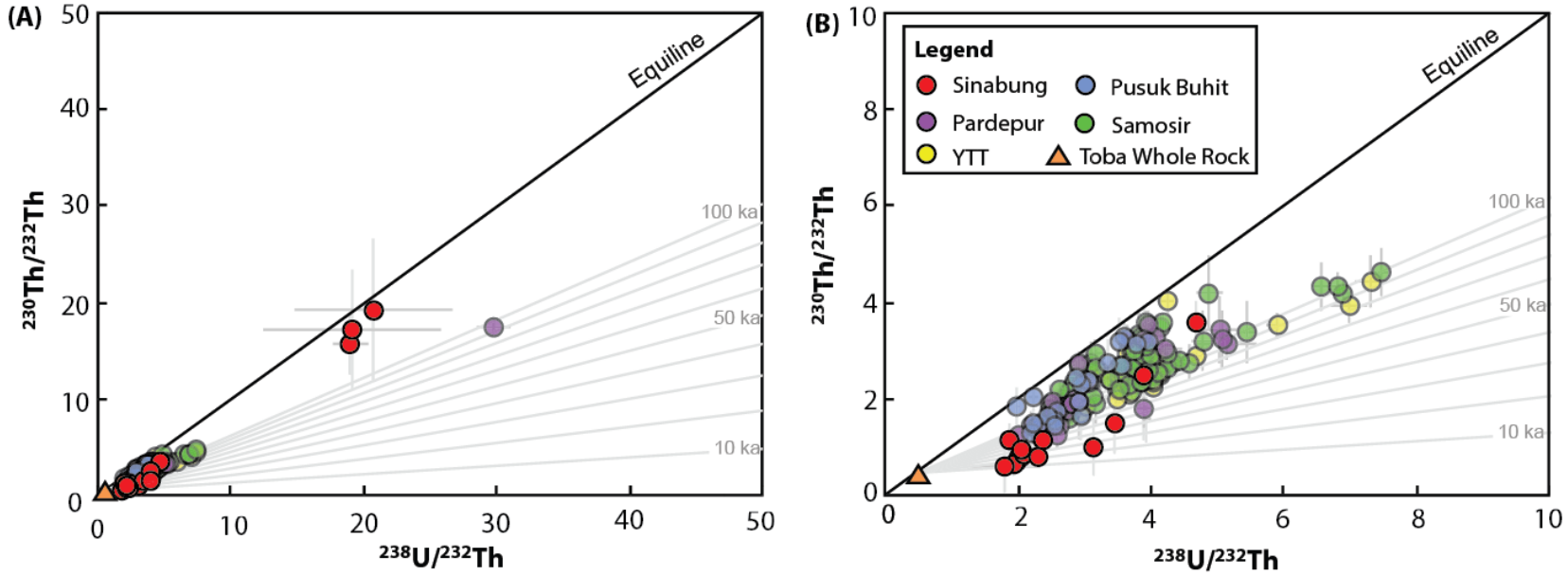


Figure 6.7: ^{238}U-^{230}Th and ^{232}Th-^{230}Th disequilibrium plot of Toba and Sinabung samples

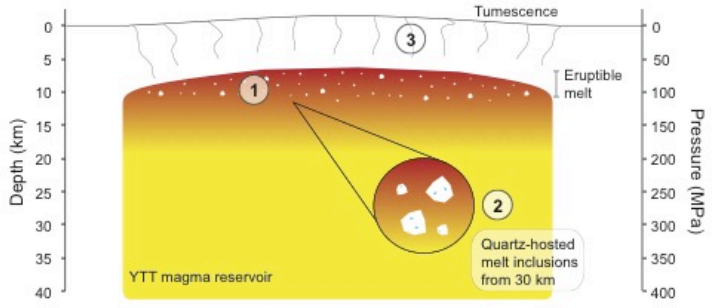
(From Mucek et al., 2017) ^{238}U-^{230}Th and ^{232}Th-^{230}Th disequilibrium plot of Youngest Toba Tuff, Samosir lava domes, Pardepur lava domes, and Pusuk Buhit lava flows, along with ^{238}U-^{230}Th and ^{232}Th-^{230}Th data from Sinabung. Toba whole rock isotopic compositions are (^{232}Th-^{230}Th) = 0.465 ± 0.004 and (^{238}U-^{230}Th) = 0.517 ± 0.002 (2 standard error (σ); Vazquez and Reid, 2004). Faint grey lines are calculated isochrons in 10 kyr increments, spanning the ages of the surface peak ages from 10 kyrs ago to 100 kyrs ago. Panel (A) shows entire data set, while panel (B) is a close up, showing the data plotted between values of 0 – 10 for both (^{238}U-^{230}Th) and (^{232}Th-^{230}Th). Error bars are ± 2σ; plotted data is found in Appendix Table 6.4.

Figure 6.8: Magmatic resurgence at Toba and the eruption of the post-caldera lava domes

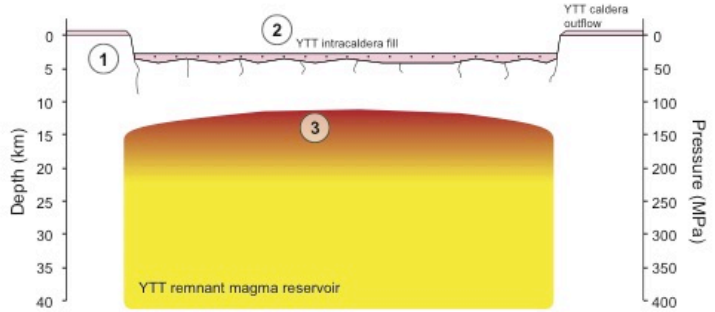
Panel A shows build up of YTT magma reservoir; Panel B shows magmatic system after the YTT eruption. Panels C-F show eruption sequence of the lava domes. Each panel shows a schematic diagram of the magmatic activity, the ternary plot of the matrix glass analyses (from Figure 6.4), and the numbered sequence of geologic processes. Panel G shows final configuration of the lava domes prior to the start of the resurgent dome uplift. Schematic diagrams do not show the filling of the lake or whether the eruption of the lava domes are subaqueaous or terrestrial for the sake of simplicity. Coloring of magma regions show temperature of magma; yellow is hotter temperatures, red is cooler temperatures. Different sample units in ternary diagrams shown by colors; Yellow: YTT matrix glass; Red: YTT melt inclusions; Green: Samosir lava domes; Purple: Pardepur lava domes. On schematic diagram: Pink with dots: YTT ignimbrite unit.

Schematic Diagram of Magmatic Activity

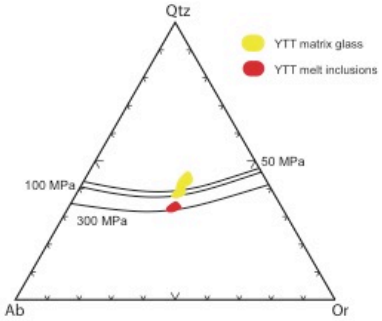
(A) Pre-YTT Eruption (before ~74 ka)



(B) Right After YTT Eruption (~74 ka)



Ternary Plot of Samples



Sequence of Processes

1. As YTT magma reservoir grows, eruptible melt builds up and equilibrates at ~10 km (from matric glass analyses).
2. Quartz-hosted melt inclusions show that parental melt originated from deeper depth (~30 km).
3. With the build up of the magma reservoir, the ground surface tumesces, with cracks/faults forming in preparation of a caldera eruption.

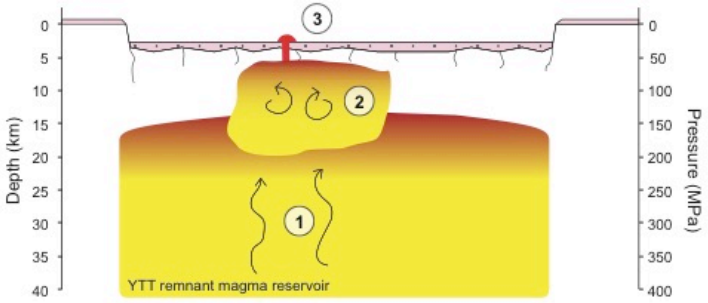
1. Following the catastrophic eruption, the caldera is formed. Estimated caldera depth formed is around 2 km. Outline of caldera on surface is thought to represent size of magma reservoir below.
2. YTT ignimbrite material was deposited both within the caldera (intracaldera fill) and as outflow. Measured thickness of intracaldera fill is ~600 m; measured thickness of outflow around caldera rim is ~400 m.
3. Erupted material evacuates upper portion of magma reservoir. Remnant magma is left at deeper depths.

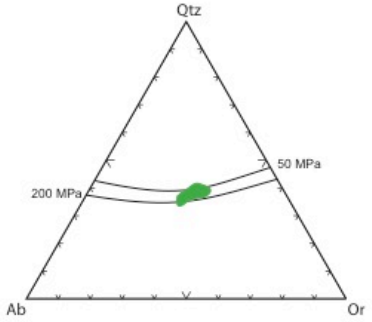
Schematic Diagram of Magmatic Activity

Ternary Plot of Samples

Sequence of Processes

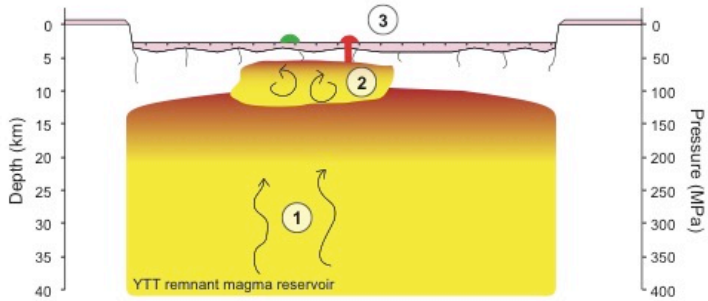
(C) North Samosir Eruption (69.7 ± 4.5 ka)

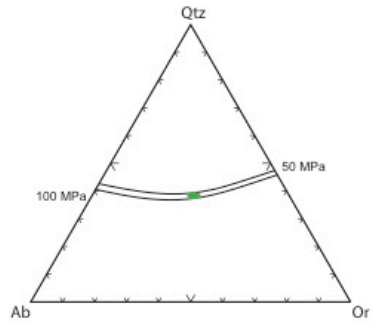




1. Rising heat (from resurgence) from deeper part of reservoir starts to reheat remnant magma.
2. Reheated remnant magma is remobilized and rises to erupt from depth of ~20 km. Temperature of reheating >350 °C for less than 700 years for sanidine crystals to retain YTT argon signature.
3. Erupted lava forms North Samosir lava dome at 69.7 ± 4.5 ka. (U-Th)/He dating on zircon crystals reflect this eruption age (as T_c of He in zircon is 190 °C) while $^{40}Ar/^{39}Ar$ dating on sanidine crystals reflect YTT eruption age.

(D) Tuk Tuk (Samosir) Eruption (69.1 ± 2.5 ka)





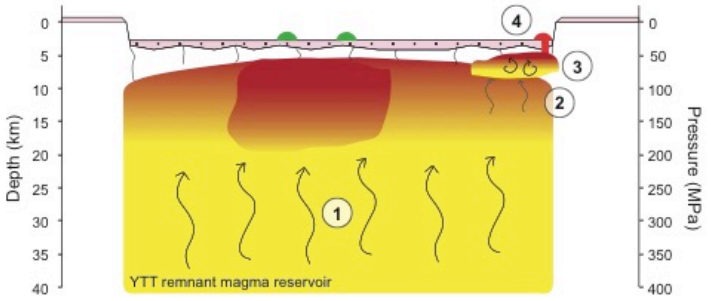
1. Rising heat (from resurgence) from deeper part of reservoir starts to reheat remnant magma and remnant magma reservoir rises.
2. Reheated remnant magma is remobilized and rises to erupt from depth of ~10 km. Temperature of reheating >350 °C for less than 700 years for sanidine crystals to retain YTT argon signature.
3. Erupted lava forms Tuk Tuk Samosir lava dome at 69.1 ± 2.5 ka. (U-Th)/He dating on zircon crystals reflect this eruption age (as T_c of He in zircon is 190 °C) while $^{40}Ar/^{39}Ar$ dating on sanidine crystals reflect YTT eruption age.

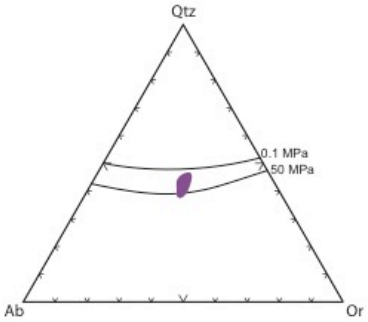
Schematic Diagram of Magmatic Activity

Ternary Plot of Samples

Sequence of Processes

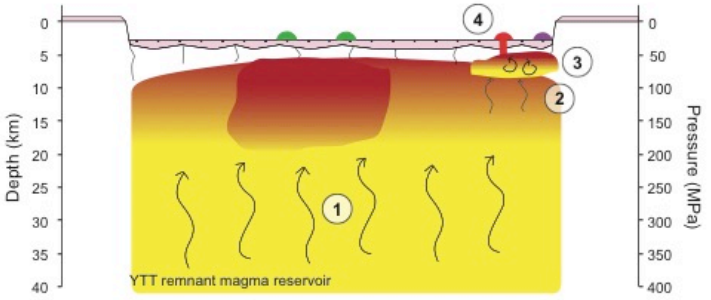
(E) South Pardepur Eruption (63.4 ± 5.6 ka)

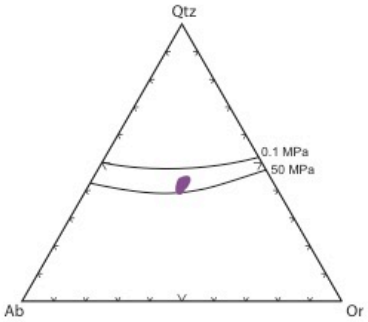




1. Remnant magma reservoir continues to rise in depth as part of ongoing resurgence.
2. Rising remnant magma is reheated from below.
3. Reheated remnant magma is remobilized and rises to erupt from depth of ~5 km. Temperature of reheating >350 °C for less than 700 years for plagioclase crystals to retain YTT argon signature.
4. Erupted lava forms South Pardepur lava dome at 63.4 ± 5.6 ka. (U-Th)/He dating on zircon crystals reflect this eruption age (as T_c of He in zircon is 190 °C) while $^{40}Ar/^{39}Ar$ dating on plagioclase crystals reflect YTT eruption age.

(F) North Pardepur Eruption (56.9 ± 3.9 ka)





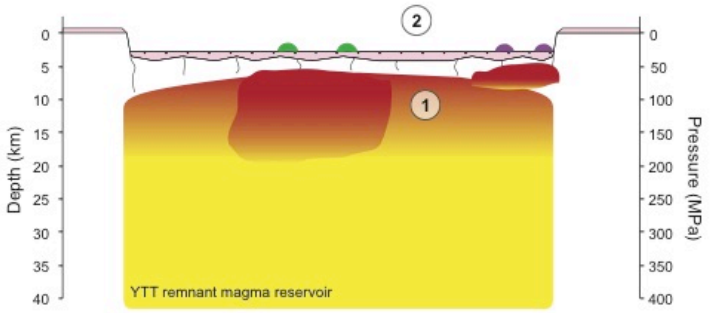
1. Remnant magma reservoir continues to rise in depth as part of ongoing resurgence.
2. Rising remnant magma is reheated from below.
3. Reheated remnant magma is remobilized and rises to erupt from depth of ~5 km. Temperature of reheating >350 °C for more than 700 years for plagioclase crystals to lose YTT argon signature.
4. Erupted lava forms North Pardepur lava dome at 56.9 ± 3.9 ka. (U-Th)/He dating on zircon crystals reflect this eruption age (as T_c of He in zircon is 190 °C) while $^{40}Ar/^{39}Ar$ dating on plagioclase crystals reflect YTT eruption age.

Schematic Diagram of Magmatic Activity

Ternary Plot of Samples

Sequence of Processes

(G) Magmatic Set Up Prior to Resurgent Dome Uplift (>33 ka)



1. Reheated and remobilized remnant magma below Samosir and Pardepur domes have cooled. Remnant magma reservoir has risen to shallower depths.Rising of the the magma below is thought to be driving mechanism behind resurgent dome uplift.
2. Samosir and Pardepur lava domes are seen on the surface, deposited on top of YTT intracaldera fill.Magmatic resurgent activity on the surface has paused within the caldera prior to resurgent dome uplift.

Table 6.1: Matrix glass analyses from electron scanning microprobe

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5
This Study										
YTT (North)										
LT_12_001	75.23	0.09	12.49	0.93	0.10	0.07	0.92	2.90	4.96	0.00
LT_12_001	75.20	0.06	12.47	0.81	0.05	0.07	0.91	2.85	4.94	0.05
LT_12_001	74.50	0.08	12.63	0.84	0.06	0.06	0.86	2.90	5.21	0.01
LT_12_001	75.48	0.08	12.10	0.75	0.06	0.07	0.90	2.62	5.22	0.01
LT_12_001	74.53	0.07	11.76	0.83	0.08	0.06	0.88	2.92	5.08	0.02
LT_12_001	73.72	0.06	12.21	0.83	0.09	0.09	0.90	3.12	4.82	0.00
LT_12_001	73.83	0.08	12.70	0.85	0.06	0.07	0.88	3.18	4.98	0.02
LT_12_001	74.28	0.05	12.67	0.84	0.08	0.06	0.91	2.78	4.89	0.03
LT_12_001	75.33	0.04	12.38	0.81	0.06	0.05	0.85	3.02	5.17	0.04
LT_12_001	74.10	0.07	11.70	0.92	0.03	0.07	0.92	2.68	4.76	0.05
LT_12_001	73.42	0.06	12.84	0.84	0.06	0.08	0.87	2.82	5.36	0.00
LT_12_001	74.68	0.07	12.29	0.84	0.09	0.07	0.96	2.93	5.08	0.02
LT_12_001	75.04	0.09	12.27	0.97	0.06	0.07	0.87	3.11	4.95	0.03
North Samosir										
LT_12_003	74.53	0.04	11.66	0.71	0.12	0.04	0.66	3.12	5.21	0.02
LT_12_003	74.71	0.02	12.05	0.55	0.05	0.02	0.76	3.55	4.79	0.00
LT_12_003	74.98	0.04	11.26	0.76	0.06	0.04	0.51	2.87	5.14	0.02
LT_12_003	74.87	0.05	12.07	0.74	0.05	0.03	0.62	2.68	5.53	0.00
LT_12_003	74.42	0.02	12.67	0.63	0.05	0.01	0.61	3.75	4.83	0.02
LT_12_003	74.33	0.06	11.78	0.76	0.05	0.04	0.56	2.72	5.46	0.04
LT_12_003	72.42	0.06	13.97	0.49	0.05	0.01	1.17	4.29	4.37	0.00
LT_12_003	61.04	0.00	25.00	0.19	0.00	0.00	6.49	7.12	0.77	0.00
LT_12_003	75.34	0.04	11.70	0.73	0.08	0.01	0.54	2.98	5.59	0.00
LT_12_003	74.79	0.06	12.06	0.79	0.11	0.02	0.40	2.96	5.34	0.03
LT_12_003	75.12	0.07	12.23	0.76	0.11	0.04	0.50	2.62	5.76	0.00
LT_12_003	75.06	0.04	11.81	0.70	0.06	0.02	0.62	3.17	5.15	0.00
LT_12_003	74.51	0.03	12.03	0.71	0.11	0.03	0.56	2.86	5.51	0.04

Sample	Total	CIPW Norm calculations				Normalized to 100%			
		ab	or	Q	Total	ab	or	Q	Total
This Study									
YTT (North)									
LT_12_001	97.70	24.54	29.31	36.51	90.36	27.16	32.44	40.41	100
LT_12_001	97.42	24.12	29.19	37.13	90.44	26.67	32.28	41.05	100
LT_12_001	97.15	24.54	30.79	35.07	90.40	27.15	34.06	38.79	100
LT_12_001	97.28	22.17	30.85	37.61	90.63	24.46	34.04	41.50	100
LT_12_001	96.24	24.71	30.02	35.53	90.26	27.38	33.26	39.36	100
LT_12_001	95.84	26.40	28.48	34.34	89.22	29.59	31.92	38.49	100
LT_12_001	96.63	26.91	29.43	33.64	89.98	29.91	32.71	37.39	100
LT_12_001	96.59	23.52	28.90	36.71	89.13	26.39	32.42	41.19	100
LT_12_001	97.75	25.55	30.55	35.50	91.60	27.89	33.35	38.76	100
LT_12_001	95.31	22.68	28.13	37.62	88.43	25.65	31.81	42.54	100
LT_12_001	96.37	23.86	31.67	33.81	89.34	26.71	35.45	37.84	100
LT_12_001	97.03	24.79	30.02	35.36	90.17	27.49	33.29	39.21	100
LT_12_001	97.45	26.32	29.25	35.33	90.90	28.95	32.18	38.87	100
North Samosir									
LT_12_003	96.11	26.40	30.79	34.52	91.71	28.79	33.57	37.64	100
LT_12_003	96.49	30.04	28.31	33.79	92.14	32.60	30.72	36.67	100
LT_12_003	95.67	24.29	30.37	36.86	91.52	26.54	33.18	40.28	100
LT_12_003	96.64	22.68	32.68	36.12	91.48	24.79	35.72	39.48	100
LT_12_003	97.00	31.73	28.54	32.30	92.57	34.28	30.83	34.89	100
LT_12_003	95.78	23.02	32.27	35.83	91.12	25.26	35.41	39.32	100
LT_12_003	96.84	36.30	25.82	27.81	89.93	40.36	28.71	30.92	100
LT_12_003	100.61	60.25	4.55	2.61	67.41	89.38	6.75	3.87	100
LT_12_003	97.00	25.22	33.03	34.93	93.18	27.07	35.45	37.49	100
LT_12_003	96.53	25.05	31.56	35.63	92.24	27.16	34.22	38.63	100
LT_12_003	97.20	22.17	34.04	36.03	92.24	24.04	36.90	39.06	100
LT_12_003	96.64	26.82	30.43	35.01	92.26	29.07	32.98	37.95	100
LT_12_003	96.39	24.20	32.56	34.99	91.75	26.38	35.49	38.14	100

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5
South Pardepur										
LT_12_015	75.77	0.14	12.18	1.11	0.01	0.11	1.15	2.75	4.19	0.02
LT_12_015	74.89	0.14	12.38	1.12	0.03	0.12	1.07	3.07	4.54	0.00
LT_12_015	74.71	0.14	12.22	1.03	0.03	0.11	1.09	3.09	4.31	0.00
LT_12_015	75.76	0.16	12.15	1.07	0.06	0.13	0.83	2.85	4.19	0.00
LT_12_015	68.75	0.14	14.28	1.53	0.05	0.13	0.94	2.39	3.93	0.08
LT_12_015	76.70	0.13	12.85	1.14	0.00	0.13	1.15	2.83	4.59	0.03
LT_12_015	75.37	0.13	11.89	1.03	0.04	0.11	1.18	3.11	4.27	0.00
LT_12_015	74.24	0.12	12.39	1.13	0.01	0.13	1.06	3.36	4.45	0.00
LT_12_015	75.32	0.14	12.38	1.08	0.00	0.11	1.17	3.11	4.11	0.00
LT_12_015	77.07	0.14	12.44	1.13	0.04	0.13	1.15	3.18	4.51	0.02
LT_12_015	76.56	0.16	13.08	1.06	0.01	0.13	1.15	2.96	4.58	0.03
LT_12_015	75.13	0.13	11.85	1.15	0.00	0.15	1.07	2.77	4.29	0.01
LT_12_015	75.39	0.18	12.05	1.11	0.05	0.11	1.15	2.92	4.28	0.00
LT_12_015	75.58	0.16	12.65	1.09	0.01	0.15	1.21	3.16	4.53	0.02
LT_12_015	74.84	0.15	12.15	1.02	0.02	0.13	1.10	2.87	4.47	0.00
LT_12_015	74.59	0.13	12.22	1.03	0.05	0.12	1.09	2.91	4.07	0.04
LT_12_015	76.77	0.16	12.70	1.12	0.04	0.13	1.19	3.23	4.76	0.01
North Pardepur										
LT_12_016	76.46	0.15	12.47	1.07	0.01	0.14	1.15	3.24	4.35	0.00
LT_12_016	74.57	0.15	12.08	1.07	0.03	0.14	1.14	3.27	4.34	0.03
LT_12_016	74.45	0.16	12.16	1.06	0.00	0.14	1.07	2.94	4.11	0.03
LT_12_016	76.46	0.17	12.77	1.09	0.02	0.13	1.17	3.07	4.45	0.05
LT_12_016	73.35	0.16	11.97	1.07	0.04	0.13	1.10	2.98	4.27	0.05
LT_12_016	73.84	0.15	12.63	1.04	0.03	0.12	1.18	2.67	4.40	0.04
LT_12_016	73.64	0.17	12.76	1.32	0.06	0.16	1.27	2.99	4.21	0.05
LT_12_016	75.24	0.15	12.72	1.15	0.01	0.16	1.11	3.19	4.36	0.00
LT_12_016	75.34	0.12	12.33	1.16	0.00	0.14	1.16	3.01	4.30	0.01
LT_12_016	73.77	0.13	12.13	0.99	0.07	0.13	1.15	2.84	4.36	0.00
LT_12_016	76.66	0.15	12.48	1.10	0.07	0.15	1.14	3.19	4.45	0.06
LT_12_016	76.89	0.14	12.57	1.28	0.03	0.15	1.21	3.27	4.56	0.03
LT_12_016	74.56	0.14	12.58	1.08	0.01	0.14	1.13	3.28	4.45	0.02
LT_12_016	74.41	0.17	12.23	1.17	0.06	0.14	1.13	3.07	4.35	0.00

Sample	Total	CIPW Norm calculations				Normalized to 100%			
		ab	or	Q	Total	ab	or	Q	Total
South Pardepur									
LT_12_015	97.44	23.27	24.76	40.34	88.37	26.33	28.02	45.65	100
LT_12_015	97.36	25.98	26.83	36.33	89.14	29.15	30.10	40.76	100
LT_12_015	96.71	26.15	25.47	36.96	88.58	29.52	28.75	41.72	100
LT_12_015	97.20	24.12	24.76	40.35	89.23	27.03	27.75	45.22	100
LT_12_015	92.21	20.22	23.22	36.61	80.05	25.26	29.01	45.73	100
LT_12_015	99.55	23.95	27.12	39.24	90.31	26.52	30.03	43.45	100
LT_12_015	97.15	26.32	25.23	37.45	89.00	29.57	28.35	42.08	100
LT_12_015	96.88	28.43	26.30	34.34	89.07	31.92	29.53	38.55	100
LT_12_015	97.42	26.32	24.29	38.03	88.64	29.69	27.40	42.90	100
LT_12_015	99.80	26.91	26.65	37.84	91.40	29.44	29.16	41.40	100
LT_12_015	99.72	25.05	27.07	38.47	90.59	27.65	29.88	42.47	100
LT_12_015	96.54	23.44	25.35	39.22	88.01	26.63	28.80	44.56	100
LT_12_015	97.23	24.71	25.29	38.56	88.56	27.90	28.56	43.54	100
LT_12_015	98.57	26.74	26.77	36.30	89.81	29.77	29.81	40.42	100
LT_12_015	96.75	24.29	26.42	37.73	88.44	27.46	29.87	42.66	100
LT_12_015	96.25	24.62	24.05	38.88	87.55	28.12	27.47	44.41	100
LT_12_015	100.12	27.33	28.13	36.17	91.63	29.83	30.70	39.47	100
North Pardepur									
LT_12_016	99.04	27.42	25.71	37.50	90.63	30.25	28.37	41.38	100
LT_12_016	96.81	27.67	25.65	35.57	88.89	31.13	28.86	40.02	100
LT_12_016	96.11	24.88	24.29	38.44	87.61	28.40	27.73	43.88	100
LT_12_016	99.37	25.98	26.30	38.21	90.49	28.71	29.06	42.23	100
LT_12_016	95.11	25.22	25.23	36.46	86.91	29.02	29.03	41.95	100
LT_12_016	96.08	22.59	26.00	38.09	86.68	26.06	30.00	43.94	100
LT_12_016	96.62	25.30	24.88	36.29	86.47	29.26	28.77	41.97	100
LT_12_016	98.08	26.99	25.77	36.52	89.28	30.23	28.86	40.91	100
LT_12_016	97.57	25.47	25.41	37.80	88.68	28.72	28.65	42.63	100
LT_12_016	95.56	24.03	25.77	37.12	86.92	27.65	29.65	42.71	100
LT_12_016	99.45	26.99	26.30	37.71	91.00	29.66	28.90	41.44	100
LT_12_016	100.12	27.67	26.95	36.70	91.32	30.30	29.51	40.19	100
LT_12_016	97.39	27.75	26.30	35.07	89.12	31.14	29.51	39.35	100
LT_12_016	96.72	25.98	25.71	36.37	88.06	29.50	29.20	41.30	100

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5
North Pardepur										
LT_12_016	74.24	0.16	12.65	1.11	0.00	0.14	1.13	3.09	4.36	0.05
LT_12_016	74.31	0.16	12.75	1.12	0.00	0.13	1.20	3.08	4.46	0.01
Chesner and Luhr (2010)										
YTT										
5B3 MG	77.31	0.07	12.37	0.92	0.13	0.05	0.71	3.41	5.01	0.02
55A1 MG	77.1	0.08	12.43	0.93	0.1	0.06	0.8	3.39	5.08	0.02
23A4 MG	77.01	0.09	12.52	0.92	0.12	0.07	0.87	3.17	5.23	0.01
12A1 MG	76.88	0.09	12.56	0.91	0.09	0.07	0.95	3.21	5.23	0.01
21A4 MG	76.76	0.13	12.69	1.06	0.09	0.1	1.08	3.14	4.94	0.02
5B3-3MI	76.35	0.07	12.77	0.97	0.1	0.07	0.78	3.65	5.21	0.02
55A1-3-MI	75.78	0.11	13.04	1.03	0.06	0.07	0.85	3.69	5.32	0.05
23A4-3-MI	76.13	0.06	12.76	1.13	0.06	0.05	0.61	3.67	5.52	0.01
12A1-3-MI	76.58	0.07	12.38	1.01	0.08	0.06	0.73	3.77	5.31	0.01
21A4-3MI	76.51	0.09	12.23	0.97	0.21	0.05	0.81	4.32	4.78	0.03
Tuk Tuk Samosir										
TT2 MG	77.4	0.08	12.26	0.89	0.16	0.05	0.71	3.4	5.03	0.01
TT7 MG	76.65	0.1	12.71	1.04	0.1	0.07	0.98	3.15	5.18	0.02

Sample	Total	CIPW Norm calculations				Normalized to 100%			
		ab	or	Q	Total	ab	or	Q	Total
North Pardepur									
LT_12_016	96.93	26.15	25.77	36.28	88.20	29.65	29.22	41.13	100
LT_12_016	97.21	26.06	26.36	35.74	88.16	29.56	29.90	40.54	100
Chesner and Luhr (2010)									
YTT									
5B3 MG	100	28.85	29.61	35.94	94.40	30.56	31.37	38.07	100
55A1 MG	99.99	28.69	30.02	35.42	94.13	30.48	31.89	37.63	100
23A4 MG	100.01	26.82	30.91	35.78	93.51	28.68	33.06	38.26	100
12A1 MG	100	27.16	30.91	35.35	93.42	29.07	33.09	37.84	100
21A4 MG	100.01	26.57	29.19	36.32	92.08	28.86	31.70	39.44	100
5B3-3MI	99.99	30.89	30.79	32.76	94.44	32.71	32.60	35	100
55A1-3-MI	100	31.22	31.44	31.47	94.13	33.17	33.40	33	100
23A4-3-MI	100	31.05	32.62	31.54	95.21	32.61	34.26	33	100
12A1-3-MI	100	31.90	31.38	32.34	95.62	33.36	32.82	34	100
21A4-3MI	100	36.29	28.25	31.42	95.96	37.82	29.44	33	100
Tuk Tuk Samosir									
TT2 MG	99.99	28.77	29.72	36.00	94.49	30.45	31.45	38.10	100
TT7 MG	100	26.65	30.61	35.48	92.74	28.74	33.01	38.26	100

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APPENDIX

Appendix Table 3.1: Complete dataset of (U-Th)/He ages and errors.

Sample Name	Sample ID	Sample Code	^{232}Th (ng)	± % *	^{238}U (ng)	± % *	^{147}Sm (ng)
Youngest Toba Tuff (North)	LT_12_001	W7-10	4.504	1.5	2.208	1.9	0.003
		W7-2	2.963	1.5	2.877	1.9	0.010
		W7-13	0.568	1.5	0.713	2.1	0.001
		W7-5	2.608	1.5	3.298	2.1	0.003
		W7-9	1.703	1.5	1.941	1.9	0.003
		W7-3	2.323	1.5	2.303	1.9	0.002
		W7-11	0.924	1.5	1.201	2.0	0.002
		W7-14	0.745	1.5	0.729	1.9	0.002
		W7-17	2.423	1.5	2.746	1.9	0.003
		W7-8	6.123	1.5	9.391	1.9	0.008
		W7-4	1.039	1.5	1.095	2.0	0.001
		W7-7	2.197	1.5	2.130	1.9	0.007
		W7-15	0.648	1.5	0.768	1.9	0.001
		W7-19	1.389	1.5	1.561	2.0	0.003
		W7-1	8.640	1.5	8.987	2.0	0.019
		W7-12	2.151	1.5	2.681	1.9	0.005
		W7-18	17.397	1.5	7.505	2.6	0.011
Youngest Toba Tuff (South)	LT_12_012	W2-12	0.273	1.5	0.292	2.0	0.001
		W2-10	3.028	1.5	3.351	2.0	0.003
		W2-8	2.254	1.5	2.724	2.2	0.004
		W2-14	5.695	1.5	5.846	2.0	0.006
		W2-3	0.809	1.5	0.875	2.0	0.001
		W2-13	1.047	1.5	1.218	2.1	0.001
		W2-20	2.199	1.5	2.728	1.9	0.005
		W2-4	0.816	1.5	0.807	1.9	0.002
		W2-17	0.400	1.5	0.489	2.0	0.001
		W2-11	0.611	1.5	0.761	1.9	0.001
		W2-15	4.932	1.5	5.686	2.3	0.005
		W2-19	0.715	1.5	0.863	1.9	0.001
		W2-16	2.476	1.5	1.470	2.1	0.001
		W2-5	2.091	1.5	2.973	1.9	0.005
		W2-18	0.733	1.5	0.842	2.0	0.001
		W2-6	3.243	1.5	4.283	1.9	0.007
		W2-9	2.682	1.5	3.593	1.9	0.003
		W2-7	2.366	1.5	6.164	1.9	0.004

Sample Name	± % *	^{4}He (ncc)	± % *	TAU[a] %	Th/U	Raw (U-Th)/He Age (ka)	± 1 s.d. (ka)	Ft[b]	± %
Youngest Toba Tuff (North)	10.9	0.014	1.3	1.9	2.0	35.9	0.7	0.8	5.0
	10.0	0.016	1.3	2.0	1.0	37.2	0.8	0.8	5.0
	21.5	0.003	1.6	2.4	0.8	33.8	0.8	0.7	5.0
	13.7	0.019	1.3	2.2	0.8	39.0	0.9	0.8	5.0
	12.5	0.012	1.4	2.1	0.9	41.4	0.9	0.8	5.0
	11.5	0.015	1.3	2.1	1.0	43.3	0.9	0.8	5.0
	14.3	0.007	1.7	2.4	0.8	41.7	1.0	0.7	5.0
	12.3	0.005	1.4	2.1	1.0	44.6	0.9	0.8	5.0
	13.9	0.018	1.3	2.1	0.9	45.9	1.0	0.8	5.0
	5.7	0.068	1.3	2.1	0.6	51.5	1.1	0.8	5.0
	18.2	0.007	1.5	2.2	0.9	43.3	1.0	0.7	5.0
	6.3	0.017	1.3	2.1	1.0	52.7	1.1	0.8	5.0
	18.3	0.005	1.4	2.2	0.8	47.7	1.0	0.7	5.0
	9.2	0.012	1.3	2.1	0.9	51.0	1.1	0.8	5.0
	4.1	0.080	1.2	2.0	1.0	59.4	1.2	0.8	5.0
	8.7	0.022	1.3	2.1	0.8	56.1	1.2	0.8	5.0
	6.3	0.089	1.2	2.1	2.3	62.8	1.3	0.8	5.0
Youngest Toba Tuff (South)	22.6	0.001	3.3	3.6	0.9	29.0	1.1	0.6	5.0
	10.5	0.019	1.2	2.0	0.9	38.4	0.8	0.8	5.0
	10.1	0.016	1.2	2.2	0.8	39.4	0.9	0.8	5.0
	14.7	0.036	1.2	2.0	1.0	40.8	0.8	0.8	5.0
	19.3	0.005	1.9	2.5	0.9	38.6	1.0	0.7	5.0
	25.2	0.007	1.2	2.2	0.9	39.0	0.8	0.7	5.0
	7.7	0.017	1.4	2.2	0.8	43.5	0.9	0.8	5.0
	12.3	0.005	2.4	2.8	1.0	41.0	1.2	0.7	5.0
	15.4	0.003	3.0	3.4	0.8	39.4	1.3	0.7	5.0
	17.8	0.005	1.3	2.1	0.8	42.8	0.9	0.7	5.0
	8.1	0.041	1.4	2.3	0.9	49.8	1.2	0.8	5.0
	16.3	0.005	2.2	2.7	0.8	42.6	1.2	0.7	5.0
	19.4	0.012	1.5	2.1	1.7	46.9	1.0	0.7	5.0
	7.3	0.022	1.2	2.0	0.7	52.8	1.1	0.8	5.0
	18.8	0.006	2.2	2.8	0.9	47.2	1.3	0.7	5.0
	6.5	0.034	1.2	2.0	0.8	54.9	1.1	0.8	5.0
	10.1	0.029	1.2	2.0	0.7	56.8	1.2	0.8	5.0
	9.1	0.047	1.3	2.2	0.4	57.2	1.3	0.7	5.0

Sample Name	α-cor.(U-Th)/He Age[c] ka	± 1 s.d.[d] (ka)	U-Pb/U-Th (ka)	± 1σ (ka)	D_{230}[e]	D_{231}[f]	(^{238}U)/(^{232}Th)	±
Youngest Toba Tuff (North)	46.5	2.5	89.5	12.7	0.2	3.0	2.7	0.03
	48.4	2.6	74.8	9.9	0.2	3.0	3.0	0.03
	49.7	2.8	95.8	5.2	0.2	3.0	4.0	0.04
	50.1	2.7	74.5	5.8	0.2	3.0	4.1	0.03
	53.9	2.9	99.0	8.5	0.2	3.0	3.8	0.03
	55.9	3.0	92.4	6.6	0.2	3.0	3.9	0.03
	56.4	3.1	143.0	12.8	0.2	3.0	4.0	0.05
	59.2	3.2	135.0	14.2	0.2	3.0	3.5	0.05
	59.3	3.2	89.6	10.7	0.2	3.0	3.6	0.11
	62.9	3.4	81.5	5.4	0.2	3.0	4.0	0.03
	64.7	3.5	79.7	7.6	0.2	3.0	3.7	0.11
	65.7	3.6	115.0	18.8	0.2	3.0	2.5	0.02
	65.9	3.6	101.6	27.3	0.2	3.0	3.3	0.08
	67.9	3.7	101.6	27.3	0.2	3.0	2.5	0.03
	70.8	3.8	101.6	27.3	0.2	3.0	2.5	0.04
	73	4.0	151.0	27.3	0.2	3.0	3.3	0.05
	78.5	4.3	101.6	27.3	0.2	3.0	3.3	0.10
	Averaged Age (± max 1σ)			**101.6 (± 27.3)**				
Youngest Toba Tuff (South)	46.5	2.9	117.0	12.2	0.2	3.0	3.5	0.05
	47.5	2.6	95.8	10.6	0.2	3.0	7.3	0.12
	49.8	2.7	93.1	5.5	0.2	3.0	4.1	0.03
	50.5	2.7	91.3	6.8	0.2	3.0	5.9	0.08
	54.5	3.0	79.7	7.4	0.2	3.0	3.5	0.08
	54.9	3.0	127.0	10.5	0.2	3.0	3.9	0.05
	55.7	3.0	105.0	6.7	0.2	3.0	4.1	0.03
	57.6	3.3	87.6	6.9	0.2	3.0	4.1	0.05
	59.6	3.6	108.0	8.7	0.2	3.0	4.2	0.05
	60.8	3.3	122.0	20.0	0.2	3.0	3.4	0.06
	63.0	3.5	193.0	23.7	0.2	3.0	3.7	0.03
	64.8	3.7	98.9	7.1	0.2	3.0	4.1	0.03
	65.8	3.6	170.0	21.2	0.2	3.0	3.6	0.03
	68.0	3.7	174.0	22.8	0.2	3.0	3.1	0.03
	68.3	3.9	117.3	23.7	0.2	3.0	4.0	0.04
	68.7	3.7	100.0	7.2	0.2	3.0	4.0	0.03
	74.7	4.0	115.0	8.3	0.2	3.0	4.1	0.04
	76.5	4.2	117.3	23.7	0.2	3.0	3.9	0.33
	Averaged Age (± max 1σ)			**117.3 (± 23.7)**				

Sample Name	(^{230}Th)/(^{232}Th)	±	Isochron slope	±	U (ppm)	Eruption Age (ka)	+ 1σ ^ (ka)
Youngest Toba Tuff (North)	1.7	0.11	0.55947	0.05	206.8	65.1	5.5
	1.7	0.11	0.49577	0.05	240.3	71.9	4.0
	2.5	0.07	0.58412	0.02	1095.8	69.2	4.8
	2.2	0.09	0.49442	0.03	986.7	75.1	4.2
	2.4	0.10	0.59629	0.03	616.8	75.1	5.4
	2.4	0.09	0.57099	0.03	630.2	80.1	5.9
	3.0	0.10	0.73118	0.03	660.4	69.2	4.8
	2.6	0.11	0.70914	0.04	377.5	74.3	5.4
	2.2	0.12	0.55969	0.04	270.4	85.5	5.0
	2.3	0.08	0.52604	0.02	886.3	91.2	7.3
	2.1	0.09	0.51809	0.03	738.6	94.6	5.7
	1.8	0.12	0.64972	0.06	218.4	86.8	8.7
	3.3	0.18	1.00437	0.07	217.7	89.9	6.4
	2.4	0.13	0.97661	0.07	253.7	91.0	7.9
	2.5	0.12	1.01533	0.06	268.2	95.6	7.3
	2.5	0.16	0.75020	0.06	271.1	88.2	9.5
	3.2	0.17	0.95702	0.07	255.7	106.2	6.9
	Error Weighted Average Eruption Age (± 2σ)					**79.5 (± 5.5)**	
Youngest Toba Tuff (South)	2.4	0.11	0.65616	0.04	323.6	59.9	4.7
	4.4	0.26	0.58428	0.04	340.3	65.9	4.7
	2.5	0.07	0.57369	0.02	957.7	70.4	4.6
	3.5	0.14	0.56648	0.03	666.9	71.7	5.2
	2.0	0.09	0.51818	0.03	453.9	80.1	4.8
	2.8	0.09	0.68714	0.03	533.7	69.7	5.0
	2.7	0.08	0.61923	0.02	754.4	75.9	5.6
	2.5	0.10	0.55157	0.03	476.2	84.4	5.0
	2.8	0.10	0.62960	0.03	674.3	81.3	6.6
	2.4	0.16	0.67314	0.06	322.5	78.4	7.5
	3.1	0.11	0.82965	0.04	406.9	71.6	4.9
	2.6	0.09	0.59574	0.03	728.3	93.5	5.2
	2.9	0.12	0.79000	0.04	505.1	77.0	6.0
	2.5	0.11	0.79711	0.04	329.5	79.5	5.9
	4.0	0.25	1.00955	0.07	267.1	90.2	8.3
	2.6	0.09	0.59851	0.03	673.6	98.6	5.1
	2.8	0.09	0.65090	0.03	651.8	104.1	6.3
	4.2	0.57	1.10542	0.20	382.7	101.9	7.9
	Error Weighted Average Eruption Age (± 2σ)					**78.1 (± 5.8)**	

Sample Name	- 1σ ^ (ka)	Average ± 1σ[g] (ka)
Youngest Toba Tuff (North)	4.5	5.0
	4.4	4.2
	4.5	4.7
	3.9	4.1
	5.2	5.3
	4.7	5.3
	4.3	4.6
	4.9	5.2
	5.3	5.1
	3.9	5.6
	5.5	5.6
	5.8	7.2
	8.4	7.4
	6.7	7.3
	7.4	7.3
	5.7	7.6
	8.0	7.4
MSWD = 3.9		
Youngest Toba Tuff (South)	4.4	4.6
	5.0	4.8
	4.8	4.7
	4.7	4.9
	4.1	4.5
	4.3	4.6
	4.7	5.1
	5.3	5.1
	6.0	6.3
	5.7	6.6
	4.6	4.7
	6.5	5.9
	4.7	5.3
	5.1	5.5
	7.4	7.9
	5.7	5.4
	7.0	6.6
	7.9	7.9
MSWD = 4.8		

Sample Name	Sample ID	Sample Code	^{232}Th (ng)	± % *	^{238}U (ng)	± % *	^{147}Sm (ng)
Samosir (North)	LT_12_003	W3-2*	7.490	1.6	8.735	2.1	0.001
		W3-10*	1.312	1.6	2.854	2.0	0.007
		W3-9*	1.711	1.6	3.139	2.0	0.007
		W3-4*	0.636	1.6	1.404	2.0	0.005
		W3-18	0.986	1.5	1.264	2.3	0.002
		W3-8*	6.721	1.6	12.644	2.1	0.005
		W3-6*	3.412	1.6	9.906	2.1	0.003
		W3-1*	5.865	1.6	8.598	2.2	0.000
		W3-17	0.533	1.5	0.545	2.2	0.001
		W3-13*	1.562	1.6	1.739	2.2	0.001
		W3-5*	2.048	1.6	2.551	2.0	0.007
		W3-7*	1.035	1.6	2.206	2.1	0.012
		W3-12*	0.633	1.6	0.769	2.2	0.001
		W3-15*	0.120	1.7	0.550	2.0	0.004
		W3-19	4.210	1.5	4.597	2.1	0.003
		W3-20	1.764	1.5	2.891	2.0	0.003
		W3-16	0.555	1.5	0.452	2.0	0.002
		W3-11*	1.504	1.6	2.066	2.1	0.008
		W3-3*	0.822	1.6	1.535	2.1	0.004
Samosir (Tuk Tuk)	LT_12_008	W1-4	2.377	1.5	2.344	1.9	0.003
		W1-7	3.097	1.5	3.140	2.3	0.002
		W1-16	2.841	1.5	4.282	2.2	0.004
		W1-17	2.286	1.5	3.403	1.9	0.006
		W1-10	1.627	1.5	1.499	1.9	0.002
		W1-11	3.192	1.5	3.605	1.9	0.006
		W1-5	8.044	1.5	4.714	1.9	0.004
		W1-9	3.289	1.5	3.942	1.9	0.010
		W1-6	1.082	1.5	0.860	1.9	0.001
		W1-12	1.697	1.5	1.667	1.9	0.001
		W1-13	1.370	1.5	1.387	1.9	0.002
		W1-14	3.926	1.5	4.489	2.3	0.004
		W1-15	4.314	1.5	3.449	1.9	0.012
		W1-1	2.576	1.5	3.357	1.9	0.007
		W1-8	4.197	1.5	5.784	2.0	0.004
		W1-3	1.585	1.5	1.808	2.1	0.001
		W1-20	2.398	1.5	3.252	1.9	0.002
		W1-18	2.476	1.5	2.348	2.3	0.004
		W1-2	2.814	1.5	2.570	1.9	0.004

Sample Name	± % *	^{4}He (ncc)	± % *	TAU[a] %	Th/U	Raw (U-Th)/He Age (ka)	± 1 s.d. (ka)	Ft[b]	± %
Samosir (North)	18.3	0.049	1.4	2.2	0.9	38.6	0.9	0.9	5.0
	4.9	0.013	1.4	2.3	0.5	33.8	0.8	0.7	5.0
	5.3	0.015	1.4	2.3	0.5	35.0	0.8	0.7	5.0
	7.0	0.006	1.7	2.5	0.4	33.5	0.8	0.7	5.0
	15.3	0.007	1.6	2.5	0.8	38.1	1.0	0.7	5.0
	7.9	0.077	1.4	2.3	0.5	44.4	1.0	0.8	5.0
	11.8	0.056	1.4	2.4	0.3	42.9	1.0	0.8	5.0
	26.9	0.054	1.4	2.3	0.7	44.3	1.0	0.8	5.0
	19.4	0.003	3.0	3.5	1.0	34.5	1.2	0.6	5.0
	17.4	0.012	1.3	2.2	0.9	45.6	1.0	0.8	5.0
	6.2	0.016	1.5	2.3	0.8	44.7	1.0	0.8	5.0
	4.4	0.013	1.4	2.3	0.5	44.2	1.0	0.8	5.0
	17.7	0.004	1.5	2.4	0.8	37.9	0.9	0.6	5.0
	7.7	0.003	2.9	3.5	0.2	37.9	1.3	0.6	5.0
	11.6	0.033	1.2	2.1	0.9	48.2	1.0	0.8	5.0
	11.1	0.020	1.4	2.2	0.6	49.7	1.1	0.8	5.0
	14.5	0.003	2.5	3.0	1.2	46.5	1.4	0.7	5.0
	6.4	0.015	1.4	2.3	0.7	52.3	1.2	0.7	5.0
	10.1	0.011	1.6	2.5	0.5	53.5	1.3	0.7	5.0
Samosir (Tuk Tuk)	12.7	0.012	1.5	2.1	1.0	33.5	0.7	0.8	5.0
	12.1	0.017	1.4	2.3	1.0	36.4	0.8	0.8	5.0
	10.9	0.022	1.2	2.2	0.7	36.0	0.8	0.8	5.0
	9.0	0.018	1.2	2.0	0.7	38.6	0.8	0.8	5.0
	15.1	0.009	1.4	2.1	1.1	39.7	0.8	0.8	5.0
	7.7	0.024	1.4	2.1	0.9	44.7	1.0	0.9	5.0
	9.4	0.036	1.4	2.0	1.7	45.0	0.9	0.8	5.0
	6.4	0.025	1.4	2.1	0.8	44.1	0.9	0.8	5.0
	16.3	0.005	1.6	2.2	1.2	39.4	0.9	0.7	5.0
	15.7	0.010	1.6	2.3	1.0	41.6	0.9	0.8	5.0
	17.0	0.009	1.5	2.2	1.0	41.3	0.9	0.7	5.0
	8.8	0.030	1.4	2.3	0.9	46.2	1.1	0.8	5.0
	4.4	0.026	1.4	2.0	1.2	47.2	1.0	0.8	5.0
	5.2	0.022	1.4	2.2	0.8	46.3	1.0	0.8	5.0
	8.2	0.039	1.4	2.2	0.7	47.3	1.0	0.8	5.0
	18.1	0.013	1.5	2.3	0.9	50.2	1.2	0.8	5.0
	13.3	0.023	1.2	2.0	0.7	49.9	1.0	0.8	5.0
	14.5	0.019	1.3	2.3	1.0	51.9	1.2	0.8	5.0
	9.1	0.023	1.3	2.0	1.1	57.6	1.2	0.8	5.0

Sample Name	α-cor.(U-Th)/He Age[c] ka	± 1 s.d.[d] (ka)	U-Pb/U-Th (ka)	± 1σ (ka)	D_{230}[e]	D_{231}[f]	(^{238}U)/(^{232}Th)	±
Samosir (North)	45.2	2.5	91.0	7.4	0.2	3.0	3.9	0.03
	45.9	2.5	100.0	7.3	0.2	3.0	4.3	0.04
	46.9	2.6	99.3	9.6	0.2	3.0	7.5	0.06
	48	2.7	93.3	6.8	0.2	3.0	4.1	0.04
	51.8	2.9	301.0	130.0	0.2	3.0	2.9	0.04
	52.6	2.9	117.0	10.5	0.2	3.0	4.3	0.05
	53	2.9	98.5	8.1	0.2	3.0	4.5	0.04
	53.3	2.9	86.7	5.5	0.2	3.0	4.0	0.03
	54.4	3.3	93.2	6.1	0.2	3.0	4.3	0.05
	57.4	3.1	141.0	10.7	0.2	3.0	3.7	0.03
	58.2	3.2	155.0	13.8	0.2	3.0	3.9	0.04
	58.3	3.2	121.0	10.0	0.2	3.0	3.7	0.04
	59.2	3.3	134.0	48.2	0.2	3.0	3.7	0.05
	62.9	3.8	95.8	5.9	0.2	3.0	6.9	0.06
	63	3.4	105.0	6.8	0.2	3.0	6.8	0.08
	63.1	3.5	122.1	130.0	0.2	3.0	4.3	0.05
	66.7	3.9	122.1	130.0	0.2	3.0	3.5	0.12
	71.2	3.9	122.1	130.0	0.2	3.0	2.5	0.02
	72.7	4.1	122.1	130.0	0.2	3.0	2.7	0.04
	Averaged Age (± max 1σ)			**122.1 (± 130)**				
Samosir (Tuk Tuk)	43.5[h]	2.4	120.0	17.7	0.2	3.0	2.5	0.02
	46.1	2.5	74.7	10.4	0.2	3.0	2.8	0.03
	47.4[h]	2.6	129.0	10.8	0.2	3.0	4.0	0.04
	48.9	2.6	92.9	13.2	0.2	3.0	3.5	0.04
	51.1	2.8	110.0	18.9	0.2	3.0	2.9	0.03
	52.3	2.8	104.0	10.2	0.2	3.0	4.0	0.07
	53.9	2.9	101.0	12.6	0.2	3.0	3.1	0.05
	53.9	2.9	94.3	14.6	0.2	3.0	2.7	0.02
	54.5	3.0	111.0	21.4	0.2	3.0	2.7	0.05
	54.6	3.0	136.0	18.9	0.2	3.0	3.1	0.05
	55.5	3.0	193.0	27.7	0.2	3.0	4.2	0.06
	57.1	3.2	260.0	52.3	0.2	3.0	3.9	0.04
	57.2	3.1	144.0	40.2	0.2	3.0	3.5	0.03
	57.5	3.1	137.0	12.6	0.2	3.0	3.9	0.03
	59.5	3.2	164.0	24.5	0.2	3.0	3.7	0.11
	63.9	3.5	184.0	32.1	0.2	3.0	2.6	0.03
	65.1	3.5	202.0	23.6	0.2	3.0	4.2	0.04
	65.7	3.6	138.6	52.3	0.2	3.0	4.2	0.14
	71.5[h]	3.9	138.6	52.3	0.2	3.0	3.2	0.05
	Averaged Age (± max 1σ)			**138.6 (± 52.3)**				

Sample Name	(^{230}Th)/(^{232}Th)	±	Isochron slope	±	U (ppm)	Eruption Age (ka)	+ 1σ ^ (ka)
Samosir (North)	2.4	0.10	0.56554	0.03	689.2	63.1	4.7
	2.8	0.10	0.60099	0.03	590.2	62.4	4.1
	4.6	0.24	0.59730	0.04	497.1	63.9	4.8
	2.5	0.09	0.57430	0.03	775.9	67.1	4.9
	2.7	0.12	0.93646	0.05	296.8	53.5	4.0
	2.9	0.12	0.65825	0.03	671.3	68.6	4.9
	2.8	0.12	0.59418	0.03	528.7	73.8	5.4
	2.4	0.08	0.54808	0.02	905.2	78.2	4.9
	2.6	0.08	0.57407	0.02	1144.4	78.3	5.5
	2.8	0.08	0.72596	0.03	685.9	70.8	4.8
	3.1	0.10	0.75879	0.03	602.0	69.9	4.6
	2.6	0.09	0.66931	0.03	580.0	76.0	5.5
	2.7	0.38	0.70629	0.12	679.7	71.8	8.3
	4.2	0.14	0.58405	0.02	742.2	90.8	6.1
	4.3	0.14	0.61599	0.02	760.2	87.4	7.1
	4.1	0.16	0.96739	0.04	425.2	68.5	8.8
	3.3	0.21	0.95099	0.08	263.6	72.8	9.2
	2.3	0.12	0.96114	0.06	291.0	78.0	9.1
	2.6	0.14	1.00101	0.07	235.3	79.6	9.5
	Error Weighted Average Eruption Age (± 2σ)					**69.7 (± 4.5)**	
Samosir (Tuk Tuk)	1.8	0.11	0.66697	0.05	215.2	55.0[h]	4.4
	1.6	0.11	0.49537	0.05	262.7	67.9	4.5
	2.9	0.10	0.69214	0.03	474.1	59.1[h]	4.1
	2.2	0.15	0.57311	0.05	339.9	68.6	5.2
	2.0	0.15	0.63440	0.06	248.3	67.1	6.4
	2.6	0.12	0.61374	0.04	265.5	71.2	5.0
	2.1	0.12	0.60306	0.05	371.6	73.9	6.1
	1.7	0.12	0.57828	0.06	217.9	75.5	5.8
	1.9	0.15	0.63946	0.07	215.5	72.9	5.8
	2.3	0.12	0.71262	0.05	265.5	67.5	5.4
	3.5	0.15	0.82916	0.04	494.1	62.7	4.1
	3.6	0.14	0.90742	0.04	441.1	60.7	4.2
	2.7	0.28	0.73223	0.09	285.7	68.4	7.4
	2.9	0.11	0.71507	0.03	602.4	71.8	4.8
	3.0	0.13	0.77806	0.05	442.0	70.1	5.3
	2.2	0.11	0.81485	0.05	272.8	73.3	5.4
	3.6	0.12	0.84327	0.03	481.4	73.1	5.0
	4.4	0.29	1.05254	0.09	126.4	78.3	9.7
	3.0	0.13	0.94846	0.05	273.6	85.1[h]	11.5
	Error Weighted Average Eruption Age (± 2σ)					**69.1 (± 2.5)**	

Sample Name	- 1σ ^ (ka)	Average ± 1σ[g] (ka)
Samosir (North)	4.1	4.4
	4.1	4.1
	4.4	4.6
	4.5	4.7
	3.2	3.6
	4.6	4.7
	5.1	5.2
	5.1	5.0
	6.3	5.9
	4.2	4.5
	4.4	4.5
	5.1	5.3
	6.7	7.5
	5.9	6.0
	5.1	6.1
	4.9	6.8
	5.7	7.5
	6.1	7.6
	6.2	7.8
MSWD = 3.3		
Samosir (Tuk Tuk)	3.8	4.1
	4.1	4.3
	3.6	3.8
	5.3	5.2
	4.9	5.7
	5.0	5.0
	5.1	5.6
	5.5	5.6
	6.8	6.3
	4.5	4.9
	4.0	4.1
	3.7	4.0
	5.4	6.4
	4.7	4.7
	4.6	4.9
	5.0	5.2
	4.3	4.6
	6.7	8.2
	6.8	9.1
MSWD = 0.86		

Sample Name	Sample ID	Sample Code	^{232}Th (ng)	± % *	^{238}U (ng)	± % *	^{147}Sm (ng)
Samosir (West Tuk Tuk)	LT_13_014	014-1	0.579	1.4	0.435	1.8	0.002
		014-10	1.776	1.4	1.337	1.8	0.002
		014-11	3.067	1.4	3.111	1.8	0.000
		014-12	1.206	1.4	1.202	1.8	0.002
		014-13	1.692	1.4	2.260	1.8	0.000
		014-14	1.220	1.4	1.483	1.8	0.002
		014-15	0.632	1.4	0.619	1.8	0.003
		014-16	1.375	1.4	0.748	1.8	0.000
		014-17	0.683	1.4	0.636	1.8	0.000
		014-18	2.842	1.4	2.998	1.8	0.004
		014-19	1.223	1.4	1.265	1.8	0.000
		014-20	0.923	1.4	1.014	1.8	0.001
		014-21	0.199	1.5	0.293	1.9	0.000
		014-3	0.971	1.4	1.062	1.8	0.002
		014-4	1.760	1.4	1.871	1.8	0.002
		014-5	1.366	1.4	1.908	1.8	0.002
		014-6	0.410	1.5	0.293	1.8	0.002
		014-7	0.644	1.4	0.749	1.8	0.002
		014-8	0.972	1.4	0.974	1.8	0.003
		014-9	2.631	1.4	3.394	1.8	0.001
Samosir (Bukit Kerbau)	LT_13_008	008-1	2.709	1.4	3.870	1.9	0.001
		008-10	2.030	2.0	2.552	2.4	0.001
		008-12	2.035	1.9	2.355	2.3	0.003
		008-14	0.950	1.4	0.798	1.8	0.002
		008-15	2.790	1.4	3.624	1.8	0.003
		008-16	0.912	1.4	1.254	1.8	0.003
		008-17	1.566	1.4	1.946	1.9	0.001
		008-2	1.301	1.4	1.347	1.8	0.003
		008-3	2.597	1.4	3.900	2.0	0.002
		008-5	0.689	1.4	0.728	1.9	0.001
		008-6	1.709	1.4	1.373	1.8	0.004
		008-7	5.797	1.4	3.420	1.9	0.002
		008-9	2.585	1.4	3.460	1.9	0.001
Pusuk Buhit (North)	LT_14_007	007-1	0.142	1.5	0.198	1.8	0.001
		007-10	0.180	1.5	0.179	1.8	0.000
		007-11	0.168	1.4	0.147	1.8	0.002
		007-2	0.504	1.4	0.632	1.8	0.002
		007-3	0.087	1.5	0.081	1.8	0.001
		007-4	0.477	1.4	0.396	1.8	0.000
		007-5	0.342	1.4	0.387	1.8	0.002
		007-6	0.188	2.0	0.141	2.3	0.002
		007-7	0.212	1.4	0.213	1.8	0.002
		007-8	0.547	1.4	0.342	1.9	0.000
		007-9	1.993	1.4	3.048	1.8	0.001

Sample Name	± % *	^{4}He (ncc)	± % *	TAU[a] %	Th/U	Raw (U-Th)/He Age (ka)	± 1 s.d. (ka)	Ft[b]	± %
Samosir (West Tuk Tuk)	18.4	0.0025	1.6	2.1	1.32	36.4	0.8	0.5	10
	6.5	0.0064	1.8	2.3	1.32	29.9	0.7	0.7	5
	1.7	0.0205	3.2	3.6	0.98	43.9	1.6	0.8	5
	11.5	0.0086	1.6	2.2	1.00	47.7	1.0	0.8	5
	1.7	0.0147	1.3	2.0	0.74	45.6	0.9	0.8	5
	16.1	0.0097	1.2	1.9	0.82	45.1	0.9	0.8	5
	13.4	0.0046	1.8	2.3	1.01	49.2	1.1	0.8	5
	2.0	0.0059	1.7	2.2	1.83	45.5	1.0	0.8	5
	4.0	0.0038	1.8	2.3	1.07	38.7	0.9	0.6	5
	8.8	0.0173	1.1	1.8	0.94	38.7	0.7	0.8	5
	2.4	0.0077	1.9	2.4	0.96	41.0	1.0	0.8	5
	7.5	0.0062	1.8	2.4	0.90	41.7	1.0	0.8	5
	5.8	0.0017	1.9	2.5	0.67	40.4	1.0	0.7	5
	13.1	0.0062	2.0	2.5	0.91	39.6	1.0	0.7	5
	12.4	0.0124	1.4	2.1	0.93	44.6	0.9	0.8	5
	11.6	0.0105	1.2	2.0	0.71	38.9	0.8	0.8	5
	11.4	0.0015	7.8	7.9	1.39	31.1	2.5	0.6	5
	13.9	0.0040	1.5	2.1	0.85	36.5	0.8	0.7	5
	14.3	0.0066	1.5	2.1	0.99	45.1	1.0	0.8	5
	12.5	0.0230	3.3	3.7	0.77	47.0	1.7	0.8	5
Samosir (Bukit Kerbau)	5.6	0.0213	1.0	1.9	0.69	38.8	0.7	0.7	5
	3.5	0.0110	0.8	2.2	0.79	29.8	0.6	0.7	5
	10.4	0.0155	0.8	2.1	0.86	45.1	0.9	0.8	5
	12.3	0.0042	1.4	2.0	1.18	33.9	0.7	0.7	5
	8.5	0.0180	0.9	1.8	0.76	34.6	0.6	0.8	5
	11.3	0.0079	1.4	2.1	0.72	44.5	0.9	0.7	5
	2.2	0.0144	1.1	1.9	0.80	51.0	1.0	0.8	5
	6.3	0.0080	1.0	1.8	0.96	39.8	0.7	0.8	5
	2.8	0.0226	0.9	2.0	0.66	41.1	0.8	0.8	5
	4.6	0.0034	1.5	2.2	0.94	31.2	0.7	0.7	5
	7.6	0.0092	1.6	2.1	1.24	42.4	0.9	0.8	5
	1.8	0.0198	1.2	1.9	1.68	34.0	0.6	0.7	5
	6.1	0.0228	1.3	2.1	0.74	46.2	1.0	0.8	5
Pusuk Buhit (North)	12.1	0.0010	2.0	2.5	0.71	37.1	0.9	0.7	5
	11.7	0.0006	2.1	2.6	1.00	22.0	0.6	0.5	10
	13.3	0.0007	2.0	2.4	1.13	29.4	0.7	0.6	10
	12.8	0.0033	1.4	2.1	0.79	35.7	0.7	0.7	5
	17.7	0.0004	5.1	5.3	1.06	28.6	1.5	0.6	10
	2.0	0.0026	1.5	2.1	1.19	41.4	0.9	0.7	5
	14.5	0.0017	1.5	2.2	0.88	29.0	0.6	0.7	5
	14.6	0.0008	1.6	2.4	1.33	35.8	0.9	0.7	5
	17.7	0.0008	2.3	2.7	0.99	26.5	0.7	0.6	10
	15.4	0.0014	1.9	2.4	1.59	23.9	0.6	0.5	10
	11.4	0.0191	1.4	2.1	0.65	44.7	1.0	0.7	5

Sample Name	α-cor.(U-Th)/He Age[c] ka	± 1 s.d.[d] (ka)	U-Pb/U-Th (ka)	± 1σ (ka)	D_{230}[e]	D_{231}[f]	(^{238}U)/(^{232}Th)	±
Samosir (West Tuk Tuk)	41.7	2.3	304.0	80.1	0.2	3	3.16	0.10
	48.1	2.6	110.4	19.2	0.2	3	2.58	0.04
	48.7	2.6	97.3	17.8	0.2	3	5.45	0.06
	49.8	4.7	106.6	11.5	0.2	3	3.91	0.05
	49.9	2.8	220.0	76.3	0.2	3	3.82	0.15
	49.9	2.8	212.6	78.9	0.2	3	4.88	0.10
	50.3	2.7	132.3	31.2	0.2	3	2.71	0.05
	55.6	3.0	103.0	24.9	0.2	3	2.53	0.04
	55.6	3.4	119.0	12.7	0.2	3	3.81	0.04
	56.1	3.1	118.5	30.8	0.2	3	3.40	0.04
	58.6	3.2	114.0	26.9	0.2	3	2.73	0.04
	58.8	3.3	188.0	52.2	0.2	3	3.18	0.07
	58.8	3.7	199.0	37.0	0.2	3	3.85	0.04
	59.1	3.2	89.9	11.9	0.2	3	4.58	0.07
	59.5	3.2	142.6	41.5	0.2	3	2.50	0.02
	59.7	3.2	93.1	14.2	0.2	3	3.68	0.05
	61.5	3.4	146.0	32.0	0.2	3	2.78	0.06
	61.8	3.4	84.2	18.4	0.2	3	3.18	0.03
	64.3	3.5	88.5	16.3	0.2	3	2.81	0.04
	66.7	6.8	164.0	32.6	0.2	3	3.71	0.06
Samosir (Bukit Kerbau)	42.2	2.3	125.0	13.4	0.2	3	3.55	0.04
	43.5	2.3	97.6	22.2	0.2	3	2.58	0.03
	44.3	2.4	224.1	87.0	0.2	3	3.11	0.04
	46.1	2.5	156.4	28.0	0.2	3	2.83	0.05
	49.4	2.7	80.0	7.4	0.2	3	3.72	0.04
	50.3	2.7	121.3	12.1	0.2	3	3.99	0.04
	51.8	2.8	108.0	14.3	0.2	3	3.82	0.04
	52	2.8	99.2	9.4	0.2	3	3.89	0.04
	53.9	2.9	178.0	33.4	0.2	3	2.85	0.04
	55.8	3.0	89.4	8.2	0.2	3	3.86	0.04
	59.4	3.2	109.9	12.6	0.2	3	6.57	0.08
	60.1	3.3	90.4	6.8	0.2	3	3.96	0.05
	60.5	3.2	112.0	22.8	0.2	3	4.78	0.08
Pusuk Buhit (North)	40.2	2.2	104.0	25.1	0.2	3	2.44	0.03
	43.3	4.5	263.0	169.6	0.2	3	3.52	0.06
	43.6	4.5	154.9	62.6	0.2	3	3.05	0.06
	47	4.9	148.3	44.0	0.2	3	2.96	0.03
	49.2	2.7	73.3	21.2	0.2	3	2.55	0.05
	51.3	5.8	176.0	55.3	0.2	3	3.35	0.06
	52.7	5.4	104.8	27.4	0.2	3	2.92	0.06
	53.3	2.9	70.8	16.7	0.2	3	2.21	0.03
	56.8	3.2	187.5	46.3	0.2	3	3.79	0.06
	61.4	3.3	101.0	21.1	0.2	3	2.22	0.07
	62.9	3.4	193.0	59.0	0.2	3	2.88	0.08

Sample Name	(^{230}Th)/(^{232}Th)	±	Isochron slope	±	U (ppm)	Eruption Age (ka)	+ 1σ ^ (ka)
Samosir (West Tuk Tuk)	2.95	0.15	0.938	0.07	1223	53.6	4.9
	1.78	0.13	0.636	0.06	928	61.1	6.0
	3.37	0.32	0.590	0.07	949	68.9	5.5
	2.58	0.13	0.623	0.04	3726	60.1	7.0
	3.33	0.23	0.867	0.08	1970	55.7	5.0
	4.20	0.37	0.857	0.09	1099	63.8	7.0
	2.01	0.18	0.702	0.08	887	71.3	4.8
	1.69	0.17	0.611	0.09	1163	66.7	6.9
	2.65	0.13	0.665	0.04	2131	76.3	7.3
	2.37	0.27	0.662	0.09	472	80.0	5.7
	1.90	0.19	0.648	0.09	825	78.2	8.0
	2.65	0.20	0.821	0.08	1140	65.8	5.0
	3.26	0.17	0.839	0.05	2154	68.7	6.6
	2.75	0.19	0.561	0.05	1254	64.0	5.4
	1.91	0.19	0.729	0.10	1249	84.4	5.5
	2.28	0.17	0.574	0.06	1529	64.7	5.6
	2.13	0.16	0.736	0.08	486	85.0	6.4
	1.90	0.21	0.538	0.08	830	82.6	5.3
	1.74	0.15	0.555	0.07	1143	80.7	8.2
	2.95	0.20	0.778	0.06	1551	70.2	7.6
	Error Weighted Average Eruption Age (± 2σ)					**68.4 (± 4.6)**	
Samosir (Bukit Kerbau)	2.53	0.11	0.680	0.04	2902	57.0	4.9
	1.68	0.17	0.591	0.08	758	63.4	4.4
	2.73	0.22	0.872	0.09	845	62.3	4.4
	2.22	0.13	0.761	0.06	956	64.8	4.6
	2.13	0.10	0.519	0.03	3438	56.4	4.2
	2.80	0.12	0.671	0.04	2037	66.7	4.9
	2.53	0.16	0.627	0.05	2744	61.0	5.1
	2.48	0.12	0.597	0.03	2391	72.0	5.1
	2.34	0.13	0.804	0.06	1112	68.4	5.4
	2.33	0.11	0.559	0.03	3169	59.9	5.0
	4.31	0.25	0.634	0.04	2895	77.4	5.8
	2.40	0.09	0.563	0.03	4104	80.6	6.5
	3.19	0.31	0.640	0.07	1128	83.1	5.9
	Error Weighted Average Eruption Age (± 2σ)					**65.3 (± 4.6)**	
Pusuk Buhit (North)	1.65	0.17	0.613	0.09	1376	52.0	5.5
	3.20	0.24	0.910	0.08	666	45.2	6.0
	2.38	0.31	0.758	0.13	307	58.2	7.8
	2.28	0.24	0.743	0.10	460	52.6	6.8
	1.46	0.20	0.489	0.10	892	72.3	4.1
	2.74	0.26	0.801	0.09	831	72.4	9.4
	1.95	0.22	0.617	0.09	507	60.2	10.1
	1.27	0.13	0.477	0.08	910	63.0	6.5
	3.15	0.23	0.820	0.07	2070	76.4	7.0
	1.49	0.12	0.603	0.08	1779	69.9	6.6
	2.43	0.19	0.829	0.08	380	70.0	6.3
	Error Weighted Average Eruption Age (± 2σ)					**62.2 (± 7.1)**	

Sample Name	- 1σ ^ (ka)	Average ± 1σ[g] (ka)
Samosir (West Tuk Tuk)	3.7	4.3
	5.5	5.7
	5.2	5.4
	6.9	7.0
	3.9	4.4
	5.0	6.0
	6.2	5.5
	5.6	6.3
	5.7	6.5
	5.1	5.4
	6.0	7.0
	4.3	4.7
	5.1	5.9
	4.4	4.9
	5.7	5.6
	4.3	5.0
	6.3	6.4
	6.9	6.1
	6.9	7.6
	7.7	7.6
MSWD = 3.0		
Samosir (Bukit Kerbau)	5.3	5.1
	4.1	4.2
	4.3	4.3
	4.2	4.4
	3.8	4.0
	4.6	4.7
	4.0	4.5
	5.1	5.1
	4.1	4.8
	3.9	4.5
	5.1	5.5
	7.5	7.0
	6.7	6.3
MSWD = 2.5		
Pusuk Buhit (North)	4.2	4.9
	4.8	5.4
	7.2	7.5
	5.8	6.3
	5.4	4.7
	7.7	8.5
	6.7	8.4
	5.2	5.8
	6.9	7.0
	5.5	6.0
	4.9	5.6
MSWD = 3.1		

Sample Name	Sample ID	Sample Code	^{232}Th (ng)	± % *	^{238}U (ng)	± % *	^{147}Sm (ng)
Pusuk Buhit (South)	LT_14_002	002-1	3.297	1.4	2.840	1.8	0.004
		002-10	1.758	1.4	1.331	1.9	0.001
		002-14	3.099	1.4	2.233	1.9	0.001
		002-15	1.033	1.4	1.157	1.8	0.003
		002-16	1.787	1.4	1.910	1.8	0.003
		002-4	8.444	1.4	4.727	1.9	0.001
		002-5	3.826	1.4	4.103	1.9	0.002
		002-6	7.364	1.4	3.609	1.8	0.005
		002-8	1.787	1.4	2.009	1.8	0.003
Pardepur (North)	LT_12_016	W6-4	5.450	1.6	14.168	2.0	0.007
		W6-18	5.265	1.6	6.176	2.0	0.001
		W6-10	1.144	1.6	1.156	2.3	0.001
		W6-1	0.456	2.3	0.538	2.6	0.012
		W6-16	0.771	1.6	1.660	2.1	0.002
		W6-13	0.786	1.6	1.071	2.3	0.000
		W6-5	0.610	1.6	0.644	2.0	0.007
		W6-17	2.286	1.6	3.788	2.0	0.025
		W6-11	1.111	1.6	1.567	2.0	0.004
		W6-6	0.162	1.7	0.228	2.1	0.008
		W6-12	0.645	1.6	0.721	2.1	0.001
		W6-15	0.375	1.6	0.420	2.2	0.002
		W6-19	0.753	1.6	0.995	2.0	0.001
		W6-9	0.977	1.6	1.081	2.2	0.001
		W6-20	1.907	1.6	2.639	2.1	0.001
		W6-14	0.983	1.6	1.252	2.3	0.001
		W6-3	0.465	1.6	0.762	2.0	0.005
		W6-8	0.579	1.6	0.463	2.2	0.001
Pardepur (South)	LT_12_015	W4-3	0.764	1.5	0.608	1.9	0.001
		W4-2	1.961	1.5	2.460	1.9	0.002
		W4-5	2.097	1.5	2.905	1.9	0.001
		W4-18	0.375	1.5	0.514	2.1	0.002
		W4-16*	0.400	1.6	0.713	2.0	0.024
		W4-7	0.788	1.5	0.821	1.9	0.001
		W4-11	4.695	1.5	5.998	1.9	0.010
		W4-6	0.416	1.5	0.447	1.9	0.001
		W4-14	1.541	1.5	1.730	1.9	0.005
		W4-19	1.146	1.5	1.168	2.2	0.002
		W4-10	1.018	1.5	0.963	1.9	0.001
		W4-15*	1.813	1.6	3.333	2.2	0.003
		W4-1	1.350	1.5	1.375	1.9	0.004
		W4-12	0.820	1.5	0.649	1.9	0.001
		W4-13	0.720	1.5	0.809	2.0	0.001
		W4-17	0.587	1.5	0.469	2.1	0.002
		W4-9	2.922	1.5	3.407	1.9	0.004
		W4-8	1.792	1.5	1.740	1.9	0.005

Sample Name	± % *	^{4}He (ncc)	± % *	TAU[a] %	Th/U	Raw (U-Th)/He Age (ka)	± 1 s.d. (ka)	Ft[b]	± %
Pusuk Buhit (South)	9.3	0.0180	0.8	1.6	1.15	40.8	0.7	0.9	5
	4.7	0.0070	1.5	2.1	1.31	33.1	0.7	0.8	5
	4.6	0.0153	1.0	1.8	1.38	42.4	0.8	0.8	5
	11.9	0.0051	1.8	2.3	0.89	29.7	0.7	0.7	5
	9.6	0.0134	0.8	1.7	0.93	47.4	0.8	0.8	5
	2.3	0.0311	1.4	2.0	1.77	38.0	0.7	0.9	5
	3.5	0.0241	0.8	1.8	0.93	39.6	0.7	0.8	5
	7.6	0.0243	2.4	2.8	2.03	37.4	1.0	0.8	5
	11.9	0.0112	0.8	1.7	0.88	37.9	0.6	0.7	5
Pardepur (North)	5.3	0.040	1.3	2.3	0.4	21.5	0.5	0.8	5.0
	15.9	0.023	1.2	2.1	0.8	25.2	0.5	0.8	5.0
	16.1	0.005	2.6	3.2	1.0	26.3	0.8	0.7	5.0
	4.4	0.002	2.3	3.2	0.8	24.7	0.8	0.7	5.0
	11.1	0.005	2.9	3.4	0.5	21.5	0.7	0.6	5.0
	19.4	0.004	2.8	3.4	0.7	28.2	1.0	0.7	5.0
	4.9	0.003	2.7	3.2	0.9	30.2	1.0	0.7	5.0
	3.6	0.018	1.3	2.2	0.6	34.1	0.7	0.8	5.0
	7.7	0.007	2.2	2.8	0.7	30.3	0.9	0.7	5.0
	6.4	0.001	2.4	3.0	0.7	28.9	0.9	0.6	5.0
	14.5	0.004	2.3	2.9	0.9	34.5	1.0	0.7	5.0
	11.6	0.002	3.1	3.6	0.9	35.4	1.3	0.7	5.0
	12.9	0.005	2.2	2.8	0.8	32.5	0.9	0.6	5.0
	17.4	0.006	2.3	2.9	0.9	37.7	1.1	0.7	5.0
	12.8	0.018	1.2	2.1	0.7	47.5	1.0	0.8	5.0
	15.3	0.007	2.3	3.0	0.8	39.0	1.2	0.7	5.0
	7.9	0.005	2.4	3.0	0.6	49.4	1.5	0.8	5.0
	17.7	0.003	2.4	3.0	1.2	42.5	1.3	0.7	5.0
Pardepur (South)	17.4	0.003	1.3	2.0	1.2	28.8	0.6	0.8	5.0
	15.1	0.011	1.2	2.0	0.8	30.6	0.6	0.8	5.0
	19.7	0.013	1.3	2.1	0.7	32.1	0.7	0.8	5.0
	17.4	0.002	2.4	3.0	0.7	30.8	0.9	0.7	5.0
	3.8	0.003	2.5	3.1	0.6	34.6	1.1	0.7	5.0
	20.2	0.004	1.7	2.3	1.0	32.6	0.8	0.7	5.0
	6.2	0.035	1.4	2.2	0.8	40.2	0.9	0.8	5.0
	23.6	0.002	2.6	3.0	0.9	33.3	1.0	0.7	5.0
	9.2	0.010	1.6	2.3	0.9	41.2	0.9	0.8	5.0
	16.1	0.007	1.4	2.3	1.0	38.8	0.9	0.7	5.0
	21.4	0.005	1.6	2.2	1.0	36.8	0.8	0.7	5.0
	12.9	0.019	1.4	2.5	0.5	41.3	1.0	0.8	5.0
	10.0	0.008	1.3	2.0	1.0	38.4	0.8	0.7	5.0
	22.0	0.004	1.7	2.3	1.3	35.5	0.8	0.7	5.0
	27.5	0.005	2.1	2.6	0.9	40.2	1.1	0.7	5.0
	17.7	0.003	1.4	2.2	1.2	39.6	0.9	0.7	5.0
	9.7	0.024	1.4	2.2	0.9	48.8	1.1	0.8	5.0
	8.5	0.013	1.5	2.2	1.0	49.3	1.1	0.8	5.0

Sample Name	α-cor.(U-Th)/He Age[c] ka	± 1 s.d.[d] (ka)	U-Pb/U-Th (ka)	± 1σ (ka)	D_{230}[e]	D_{231}[f]	(^{238}U)/(^{232}Th)	±
Pusuk Buhit (South)	40	2.2	104.0	31.0	0.2	3	2.58	0.06
	40.3	2.2	74.1	23.8	0.2	3	2.94	0.07
	44.7	2.4	265.0	70.3	0.2	3	3.60	0.04
	46.8	2.5	290.2	119.5	0.2	3	1.99	0.03
	46.9	2.5	144.7	21.1	0.2	3	3.56	0.04
	47.2	2.7	79.3	22.7	0.2	3	2.57	0.04
	52.5	2.8	246.0	114.9	0.2	3	2.25	0.04
	56	3.0	88.2	35.7	0.2	3	2.35	0.03
	61	3.2	170.6	31.9	0.2	3	3.98	0.11
Pardepur (North)	28.6	1.6	50.3	12.1	0.2	3.0	2.6	0.03
	33.1	1.8	54.7	9.0	0.2	3.0	2.4	0.03
	35.4	2.1	89.4	14.9	0.2	3.0	2.5	0.03
	35.6	2.1	55.2	10.9	0.2	3.0	3.9	0.05
	36.2	2.2	101.0	46.5	0.2	3.0	2.9	0.04
	41.4	2.5	67.7	5.8	0.2	3.0	2.6	0.05
	42.5	2.5	94.8	5.1	0.2	3.0	29.8	0.64
	43.7	2.4	111.0	17.5	0.2	3.0	2.5	0.02
	44.1	2.5	78.6	11.2	0.2	3.0	2.3	0.02
	45.2	2.6	85.3	12.9	0.2	3.0	2.3	0.03
	52.6	3.0	112.8	161.5	0.2	3.0	3.1	0.07
	52.8	3.3	106.0	14.0	0.2	3.0	2.8	0.03
	53.7	3.1	144.0	27.5	0.2	3.0	3.1	0.06
	56.9	3.3	112.8	161.5	0.2	3.0	4.7	0.04
	59.3	3.2	236.0	64.0	0.2	3.0	3.6	0.14
	59.7	3.5	112.8	161.5	0.2	3.0	2.4	0.04
	61.4	3.6	112.8	161.5	0.2	3.0	3.9	0.07
	62.4	3.6	305.0	161.5	0.2	3.0	2.9	0.04
	Averaged Age (± max 1σ)			**112.8 (± 161.5)**				
Pardepur (South)	36	1.9	128.0	31.7	0.2	3.0	4.2	0.13
	37.9	2.0	94.4	11.9	0.2	3.0	5.1	0.23
	41	2.2	69.7	11.2	0.2	3.0	2.5	0.02
	45.9	2.7	108.0	19.2	0.2	3.0	2.8	0.07
	46.2	2.7	109.0	18.1	0.2	3.0	2.6	0.03
	47.1	2.6	80.9	13.6	0.2	3.0	2.0	0.02
	47.9	2.6	93.1	12.4	0.2	3.0	2.7	0.03
	50.1	2.9	105.0	16.7	0.2	3.0	2.5	0.02
	52.3	2.9	97.5	20.7	0.2	3.0	2.2	0.02
	52.4	2.9	105.4	31.7	0.2	3.0	6.3	0.10
	52.9	2.9	81.3	15.5	0.2	3.0	2.5	0.02
	52.9	2.9	176.0	21.1	0.2	3.0	4.1	0.03
	53.7	2.9	117.0	26.2	0.2	3.0	5.0	0.14
	54.6	3.0	105.4	31.7	0.2	3.0	3.0	0.06
	58.6	3.3	114.0	21.1	0.2	3.0	2.9	0.02
	60.7	3.3	105.4	31.7	0.2	3.0	2.6	0.06
	61	3.3	101.0	18.4	0.2	3.0	5.1	0.06
	62.7	3.4	105.4	31.7	0.2	3.0	2.9	0.06
	Averaged Age (± max 1σ)			**105.4 (± 31.7)**				

Sample Name	(^{230}Th)/(^{232}Th)	±	Isochron slope	±	U (ppm)	Eruption Age (ka)	+ 1σ ^ (ka)
Pusuk Buhit (South)	1.73	0.22	0.614	0.11	1192	41.7	2.9
	1.66	0.26	0.493	0.11	552	57.1	5.4
	3.28	0.15	0.912	0.05	4576	62.9	5.6
	1.83	0.20	0.930	0.14	982	60.9	7.0
	2.70	0.15	0.734	0.05	5879	49.2	4.0
	1.52	0.20	0.516	0.10	951	63.2	7.1
	2.01	0.14	0.895	0.08	1714	61.2	4.1
	1.48	0.26	0.554	0.14	720	59.5	3.9
	3.20	0.19	0.790	0.06	2618	74.4	6.2
	Error Weighted Average Eruption Age (± 2σ)					**54.5 (± 8.0)**	
Pardepur (North)	1.2	0.14	0.36910	0.07	115.1	44.2	3.0
	1.2	0.09	0.39389	0.05	243.4	51.4	3.0
	1.6	0.12	0.55889	0.06	180.2	48.3	4.2
	1.8	0.20	0.39680	0.06	150.2	55.0	3.2
	1.9	0.38	0.60427	0.16	269.0	45.8	5.9
	1.4	0.05	0.46196	0.03	475.9	63.6	3.6
	17.4	0.44	0.58023	0.02	3093.5	58.4	4.0
	1.7	0.11	0.63932	0.06	158.8	56.4	4.8
	1.4	0.09	0.51304	0.05	266.2	64.6	4.5
	1.4	0.09	0.54210	0.05	245.0	64.6	5.0
	2.8	0.16	0.93424	0.07	223.6	56.2	6.0
	1.9	0.11	0.62256	0.05	177.1	70.5	7.0
	2.3	0.16	0.73308	0.07	215.9	64.9	5.9
	4.4	0.27	0.93754	0.07	156.9	60.8	6.6
	3.2	0.14	0.88526	0.06	403.8	63.6	5.0
	2.5	0.17	1.11366	0.10	160.6	64.0	6.9
	5.0	0.35	1.33159	0.11	127.1	65.9	7.0
	2.7	0.13	0.93891	0.06	278.9	64.0	5.2
	Error Weighted Average Eruption Age (± 2σ)					**56.9 (± 3.9)**	
Pardepur (South)	3.0	0.31	0.68896	0.09	114.7	43.6	4.1
	3.1	0.17	0.57861	0.05	1347.5	51.3	3.7
	1.4	0.11	0.47182	0.05	193.0	60.9	4.2
	1.9	0.14	0.62866	0.06	152.2	60.8	5.0
	1.8	0.13	0.63096	0.06	169.7	60.4	5.5
	1.3	0.09	0.52316	0.06	220.6	67.5	5.5
	1.7	0.11	0.57384	0.05	193.7	67.6	4.6
	1.7	0.12	0.61600	0.06	194.2	67.8	5.4
	1.5	0.13	0.59049	0.08	172.8	72.5	5.5
	6.3	0.30	1.00542	0.05	265.3	68.5	7.6
	1.5	0.13	0.52500	0.07	171.2	60.9	4.2
	3.3	0.13	0.80029	0.04	411.7	76.2	5.0
	3.4	0.35	0.65614	0.08	129.3	69.0	6.9
	4.2	0.29	1.49935	0.12	111.9	71.7	7.5
	2.0	0.16	0.64942	0.07	141.4	76.8	7.8
	3.1	0.21	1.24678	0.11	142.8	80.0	8.2
	3.2	0.30	0.60389	0.07	117.7	83.9	6.7
	3.0	0.15	1.07047	0.07	219.9	83.0	8.0
	Error Weighted Average Eruption Age (± 2σ)					**63.4 (± 5.6)**	

Sample Name	- 1σ ^ (ka)	Average ± 1σ[g] (ka)
Pusuk Buhit (South)	2.7	2.8
	5.0	5.2
	5.0	5.3
	5.3	6.1
	2.9	3.5
	6.3	6.7
	4.7	4.4
	3.8	3.9
	4.7	5.5
MSWD = 5.8		
Pardepur (North)	3.0	3.0
	3.2	3.1
	3.7	4.0
	4.0	3.6
	4.9	5.4
	4.7	4.1
	3.9	3.9
	3.9	4.4
	5.0	4.7
	5.3	5.1
	4.0	5.0
	5.1	6.0
	4.8	5.4
	4.4	5.5
	3.8	4.4
	4.7	5.8
	4.9	5.9
	3.6	4.4
MSWD = 3.2		
Pardepur (South)	3.1	3.6
	3.4	3.6
	3.9	4.0
	5.4	5.2
	4.7	5.1
	4.4	4.9
	5.8	5.2
	6.0	5.7
	7.0	6.3
	6.2	6.9
	3.7	4.0
	5.2	5.1
	5.6	6.3
	6.7	7.1
	5.9	6.8
	7.1	7.6
	6.2	6.4
	7.5	7.8
MSWD = 4.8		

* : Analytical uncertainties associated with the measurement of each isotope
a : TAU is Total Analytical Uncertainty
b : Ft is alpha ejection correction factor calculated after Farley et al., (1996)
c : α-cor. (Ft) (U-Th)/He Age
d : Error includes propagated analytical uncertainties, Ft correction uncertainties, and alpha ejection correction uncertainties

e : D_{230} is initial [$^{230}Th/^{238}U$] activity ratio when the crystal grows
f : D_{231} is initial [$^{231}Pa/^{238}U$] activity ratio when the crystal grows
^ : Error includes previous propagated errors and disequilibrium correction as calculated by MCHeCalc program

g : Average standard error calculated by {[(+1 σ) + |(-1 σ)|]/2}
h: Outliers that are not included in the final age calculation or presented in figures
Note: All σ in data represents standard error, all s.d. in data represents standard deviation
Note: MSWD refers to Mean Square of Weighted Deviates

Appendix Table 3.2: U-Th crystallization analyses and ages on zircon surfaces

Sample Name	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Youngest Toba Tuff	*Weighted Average Peak Age = 95.0 ± 6.0 ka (2σ) MSWD = 3.6*										
North											
12_001-5.1	4.05	0.06	2.21	0.19	74.5	11.82	11.21	*	*	*	987
12_001-2.1	2.96	0.06	1.68	0.22	74.8	20.64	18.86	*	*	*	240
12_001-4.1	3.69	0.23	2.11	0.18	79.7	15.69	14.63	*	*	*	739
12_001-8.1	4.05	0.07	2.32	0.16	81.5	11.02	10.49	*	*	*	886
12_001-20.1	6.98	0.28	3.91	0.34	83.1	13.91	13.07	*	*	*	908
12_001-10.1	2.74	0.06	1.71	0.23	89.5	26.96	24.00	*	*	*	207
12_001-171	3.58	0.21	2.18	0.24	89.6	22.53	20.42	*	*	*	270
12_001-3.1	3.94	0.06	2.42	0.17	92.4	13.66	12.85	*	*	*	630
12_001-16.1	4.69	0.10	2.87	0.21	94.0	14.00	13.15	*	*	*	523
12_001-13.1	4.03	0.08	2.52	0.13	95.8	10.74	10.24	*	*	*	1096
12_001-9.1	3.83	0.07	2.44	0.20	99.0	17.60	16.29	*	*	*	617
12_001-7.1	2.52	0.04	1.77	0.24	114.5	40.72	34.31	*	*	*	218
12_001-14.1	3.46	0.10	2.55	0.21	134.8	30.27	26.58	*	*	*	378
12_001-11.1	3.97	0.09	2.99	0.21	143.4	27.06	24.08	*	*	*	660
12_001-12.1	3.26	0.09	2.52	0.33	151.5	61.40	47.87	*	*	*	271
12_001-6.1	4.26	0.10	4.01	0.27	322.5	293.07	120.79	*	*	*	385
South											
12_012-3.1	3.48	0.17	2.00	0.17	79.7	15.34	14.34	*	*	*	454
12_012-1.1	3.04	0.07	1.84	0.22	85.8	22.73	20.58	*	*	*	252
12_012-4.1	4.14	0.10	2.46	0.20	87.6	14.26	13.38	*	*	*	476
12_012-14.1	5.90	0.16	3.51	0.28	91.3	14.04	13.19	*	*	*	667
12_012-8.1	4.15	0.07	2.55	0.15	93.1	11.18	10.64	*	*	*	958
12_012-2.1	3.48	0.09	2.17	0.21	93.6	19.85	18.20	*	*	*	316
12_012-10.1	7.30	0.24	4.43	0.53	95.8	22.27	20.21	*	*	*	340
12_012-19.1	4.11	0.06	2.61	0.19	98.9	14.71	13.78	*	*	*	728
12_012-6.1	4.03	0.07	2.57	0.18	99.6	14.80	13.86	*	*	*	674
12_012-20.1	4.10	0.07	2.68	0.16	105.4	13.81	12.99	*	*	*	754
12_012-17.1	4.15	0.09	2.75	0.20	108.4	17.99	16.62	*	*	*	674
12_012-9.1	4.12	0.08	2.81	0.18	114.9	17.20	15.95	*	*	*	652
12_012-12.1	3.52	0.10	2.44	0.22	116.6	25.80	23.07	*	*	*	324
12_012-11.1	3.37	0.11	2.39	0.33	122.1	43.62	36.34	*	*	*	322
12_012-13.1	3.86	0.10	2.76	0.19	126.9	22.05	20.03	*	*	*	534
12_012-16.1	3.64	0.06	2.93	0.25	170.4	46.50	38.32	*	*	*	505
12_012-5.1	3.10	0.05	2.52	0.21	174.2	50.41	40.93	*	*	*	330
12_012-15.1	3.69	0.07	3.09	0.22	193.3	52.42	42.24	*	*	*	407

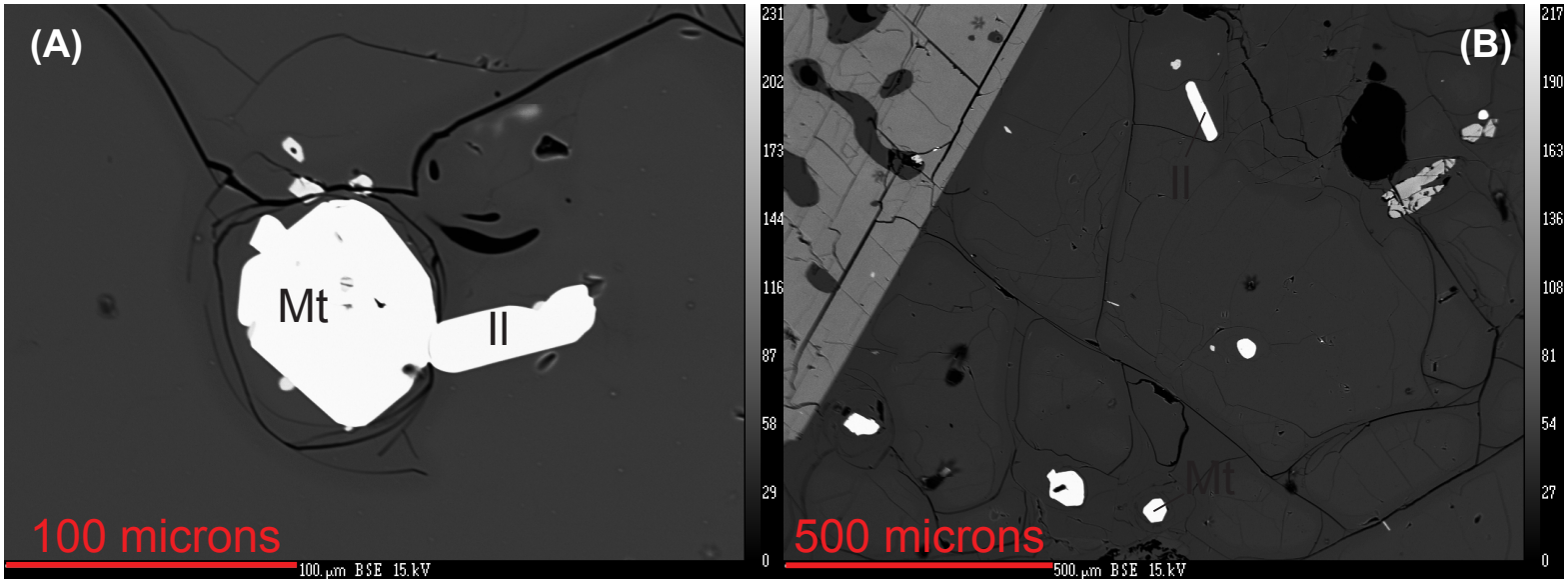
Sample Name	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Samosir Lava Domes *Weighted Average Peak Age = 103.7 ± 5.4 ka (2σ)* *MSWD = 2.7*											
Bukit Kerbau											
13_008-15.1	3.719	0.081	2.127	0.204	80.0	15.310	14.000	*	*	*	3438
13_008-5.1	3.860	0.074	2.334	0.218	89.4	17.085	16.000	*	*	*	3169
13_008-7.1	3.957	0.107	2.402	0.178	90.4	14.119	14.000	*	*	*	4104
13_008-10.1	2.576	0.052	1.682	0.336	97.6	48.818	40.000	*	*	*	758
13_008-2.1	3.891	0.074	2.478	0.231	99.2	19.716	18.000	*	*	*	2391
13_008-17.1	3.816	0.076	2.533	0.317	107.7	30.500	26.000	*	*	*	2744
13_008-6.1	6.572	0.155	4.306	0.501	109.9	26.746	24.000	*	*	*	2895
13_008-9.1	4.778	0.164	3.194	0.622	111.7	50.360	40.000	*	*	*	1128
13_008-16.1	3.991	0.083	2.795	0.247	121.3	25.602	22.000	*	*	*	2037
13_008-1.1	3.552	0.090	2.530	0.228	124.6	28.383	26.000	*	*	*	2902
13_008-14.1	2.828	0.093	2.225	0.268	156.4	63.110	48.000	*	*	*	956
13_008-3.1	2.852	0.080	2.342	0.264	177.9	76.877	56.000	*	*	*	1112
13_008-12.1	3.114	0.078	2.729	0.437	224.1	237.175	112.000	*	*	*	845
West Tuk Tuk											
13_014-7.1	3.179	0.062	1.896	0.410	84.2	39.955	34.000	*	*	*	830
13_014-8.1	2.811	0.090	1.738	0.298	88.5	34.975	30.000	*	*	*	1143
13_014-3.1	4.581	0.149	2.746	0.379	89.9	25.137	22.000	*	*	*	1254
13_014-5.1	3.681	0.092	2.280	0.346	93.1	30.313	26.000	*	*	*	1529
13_014-11.1	5.449	0.124	3.375	0.649	97.3	38.467	32.000	*	*	*	949
13_014-16.1	2.527	0.083	1.694	0.347	103.1	55.406	44.000	*	*	*	1163
13_014-12.1	3.910	0.091	2.579	0.262	106.6	24.216	22.000	*	*	*	3726
13_014-10.1	2.579	0.090	1.777	0.254	110.4	41.695	34.000	*	*	*	928
13_014-19.1	2.726	0.086	1.895	0.372	113.9	60.368	48.000	*	*	*	825
13_014-18.1	3.396	0.082	2.372	0.531	118.5	70.117	52.000	*	*	*	472
13_014-17.1	3.806	0.075	2.652	0.250	119.3	26.871	24.000	*	*	*	2131
13_014-15.1	2.711	0.097	2.006	0.356	132.3	71.070	54.000	*	*	*	887
13_014-4.1	2.501	0.050	1.911	0.389	142.6	98.490	68.000	*	*	*	1249
13_014-6.1	2.779	0.120	2.131	0.329	145.6	73.370	54.000	*	*	*	486
13_014-9.1	3.709	0.111	2.947	0.403	164.2	74.865	56.000	*	*	*	1551
13_014-20.1	3.176	0.132	2.649	0.409	188.1	128.475	80.000	*	*	*	1140
13_014-21.1	3.847	0.082	3.259	0.343	199.4	86.359	62.000	*	*	*	2154
13_014-14.1	4.876	0.204	4.201	0.750	212.6	210.506	106.000	*	*	*	1099
13_014-13.1	3.819	0.309	3.328	0.458	220.3	202.183	104.000	*	*	*	1970
13_014-1.1	3.161	0.191	2.945	0.305	304.0	160.000	160.000	*	*	*	1223

Sample Name	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Samosir Lava Domes *Weighted Average Peak Age = 103.7 ± 5.4 ka (2σ)* *MSWD = 2.7*											
North											
12_003-1.1	4.02	0.07	2.39	0.16	86.7	11.29	10.74	*	*	*	905
12_003-2.1	3.87	0.06	2.36	0.20	91.0	15.40	14.39	*	*	*	689
12_003-17.1	4.26	0.09	2.61	0.17	93.2	12.46	11.79	*	*	*	1144
12_003-4.1	4.10	0.09	2.52	0.18	93.3	13.98	13.14	*	*	*	776
12_003-15.1	6.90	0.12	4.19	0.28	95.8	12.19	11.55	*	*	*	742
12_003-6.1	4.45	0.08	2.80	0.23	98.5	16.71	15.52	*	*	*	529
12_003-9.1	7.47	0.12	4.62	0.48	99.3	19.95	18.28	*	*	*	497
12_003-10.1	4.32	0.07	2.75	0.20	100.3	15.03	14.06	*	*	*	590
12_003-19.1	6.81	0.16	4.34	0.28	104.5	14.03	13.18	*	*	*	760
12_003-8.1	4.26	0.11	2.93	0.23	117.2	21.98	19.97	*	*	*	671
12_003-7.1	3.74	0.08	2.62	0.19	120.8	20.88	19.06	*	*	*	580
12_003-12.1	3.66	0.10	2.69	0.76	133.8	117.14	75.83	*	*	*	680
12_003-13.1	3.71	0.06	2.78	0.17	141.4	22.45	20.35	*	*	*	686
12_003-5.1	3.94	0.07	3.06	0.20	155.3	29.34	25.86	*	*	*	602
12_003-18.1	2.91	0.09	2.70	0.24	301.0	387.81	132.05	*	*	*	297
Tuk Tuk											
12_008-7.1	2.78	0.06	1.58	0.21	74.7	21.71	19.74	*	*	*	263
12_008-17.1	3.55	0.08	2.20	0.31	92.9	27.91	24.74	*	*	*	340
12_008-9.1	2.68	0.04	1.72	0.24	94.3	31.05	27.18	*	*	*	218
12_008-5.1	3.15	0.10	2.05	0.23	100.9	26.69	23.78	*	*	*	372
12_008-11.1	3.97	0.14	2.59	0.23	103.9	21.33	19.43	*	*	*	266
12_008-10.1	2.89	0.05	1.97	0.30	109.9	41.15	34.61	*	*	*	248
12_008-6.1	2.69	0.10	1.85	0.30	111.4	47.00	38.66	*	*	*	215
12_008-4.1	2.50	0.04	1.79	0.21	120.1	38.34	32.60	*	*	*	215
12_008-16.1	3.99	0.08	2.87	0.20	128.6	22.66	20.53	*	*	*	474
12_008-12.1	3.11	0.10	2.31	0.24	136.2	40.94	34.46	*	*	*	266
12_008-1.1	3.88	0.07	2.87	0.21	137.1	26.62	23.73	*	*	*	602
12_008-15.1	3.54	0.06	2.68	0.57	143.9	94.85	65.91	*	*	*	286
12_008-19.1	3.93	0.08	3.06	0.18	155.7	26.97	24.00	*	*	*	616
12_008-8.1	3.73	0.21	2.97	0.27	164.4	54.54	43.61	*	*	*	442
12_008-3.1	2.63	0.05	2.19	0.22	184.2	73.57	54.93	*	*	*	273
12_008-13.1	4.16	0.12	3.49	0.29	192.9	62.27	48.40	*	*	*	494
12_008-20.1	4.19	0.07	3.57	0.24	202.4	52.23	42.12	*	*	*	481
12_008-14.1	3.95	0.07	3.58	0.28	259.8	128.81	80.48	*	*	*	441

Sample Name	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Pardepur Lava Domes Weighted Average Peak Age = 85.6 ± 9.5 ka (2σ) MSWD = 3.3											
South											
12_015-5.1	2.54	0.04	1.42	0.22	69.7	23.50	21.22	*	*	*	193
12_015-7.1	2.02	0.05	1.25	0.18	80.9	28.80	25.44	*	*	*	221
12_015-10.1	2.47	0.04	1.49	0.26	81.3	33.08	28.72	*	*	*	171
12_015-11.1	2.72	0.05	1.73	0.21	93.1	26.29	23.47	*	*	*	194
12_015-2.1	5.14	0.45	3.14	0.33	94.4	25.07	22.49	*	*	*	1348
12_015-14.1	2.21	0.04	1.46	0.26	97.5	45.37	37.55	*	*	*	173
12_015-9.1	5.07	0.12	3.21	0.60	101.1	39.79	33.65	*	*	*	118
12_015-6.1	2.51	0.05	1.69	0.23	104.5	35.91	30.83	*	*	*	194
12_015-18.1	2.82	0.15	1.91	0.28	108.2	41.87	35.12	*	*	*	152
12_015-16.1	2.64	0.06	1.81	0.25	108.9	39.13	33.17	*	*	*	170
12_015-13.1	2.86	0.05	1.99	0.31	114.5	46.25	38.15	*	*	*	141
12_015-1.1	5.03	0.27	3.43	0.71	116.6	58.57	46.14	*	*	*	129
12_015-3.1	4.23	0.26	3.03	0.63	127.5	72.51	54.34	*	*	*	115
12_015-15.1	4.06	0.07	3.30	0.26	175.9	46.21	38.12	*	*	*	412
12_015-20.1	3.96	0.06	3.55	0.26	245.7	100.73	68.67	*	*	*	388
North											
12_016-4.1	2.59	0.07	1.23	0.29	50.3	25.36	22.72	*	*	*	115
12_016-18.1	2.35	0.06	1.19	0.18	54.7	18.63	17.16	*	*	*	243
12_016-1.1	3.90	0.11	1.81	0.40	55.2	22.84	20.67	*	*	*	150
12_016-13.1	2.64	0.10	1.45	0.11	67.7	11.73	11.13	*	*	*	476
12_016-11.1	2.28	0.05	1.37	0.17	78.6	23.40	21.14	*	*	*	266
12_016-6.1	2.29	0.05	1.43	0.19	85.3	27.33	24.29	*	*	*	245
12_016-10.1	2.50	0.06	1.57	0.23	89.4	31.78	27.74	*	*	*	180
12_016-5.1	29.8	1.29	17.4	0.87	94.8	10.48	10.00	*	*	*	3094
12_016-16.1	2.93	0.08	1.93	0.77	101.2	112.21	73.76	*	*	*	269
12_016-15.1	2.82	0.05	1.90	0.22	106.4	29.76	26.19	*	*	*	177
12_016-17.1	2.51	0.05	1.74	0.23	111.4	38.06	32.40	*	*	*	159
12_016-7.1	2.52	0.07	1.92	0.28	141.4	65.42	50.27	*	*	*	247
12_016-19.1	3.05	0.13	2.32	0.32	144.2	61.67	48.03	*	*	*	216
12_016-2.1	3.88	0.06	3.23	0.34	188.2	72.43	54.30	*	*	*	335
12_016-20.1	3.65	0.28	3.24	0.29	236.4	163.63	92.49	*	*	*	404
12_016-8.1	2.92	0.08	2.72	0.25	305.2	505.42	140.31	*	*	*	279

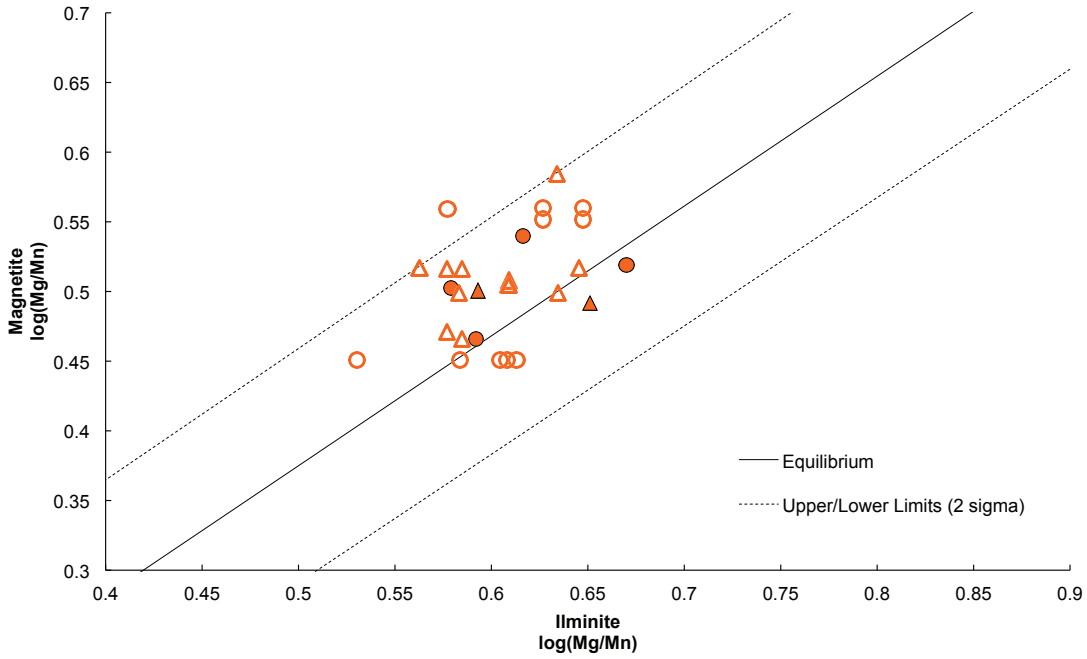
Sample Name	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Pusuk Buhit Lava Flow Weighted Average Peak Age (Young Flow) = 105.0 ± 19.0 ka (2σ) MSWD = 1.4											
South											
14_002-10.1	2.94	0.13	1.66	0.52	74.1	52.69	42.00	*	*	*	552
14_002-4.1	2.57	0.08	1.52	0.40	79.3	50.08	40.00	*	*	*	951
14_002-6.1	2.35	0.06	1.48	0.51	88.2	82.93	60.00	*	*	*	720
14_002-1.1	2.58	0.11	1.73	0.44	104.0	70.76	54.00	*	*	*	1192
14_002-16.1	3.56	0.07	2.70	0.30	144.7	46.25	38.00	*	*	*	5879
14_002-8.1	3.98	0.23	3.20	0.37	170.6	72.96	54.00	*	*	*	2618
14_002-5.1	2.25	0.07	2.01	0.28	245.8	333.33	126.00	*	*	*	1714
14_002-14.1	3.60	0.07	3.28	0.30	265.2	183.02	98.00	*	*	*	4576
14_002-15.1	1.99	0.05	1.83	0.41	290.2	239.00	240.00	*	*	*	982
North											
14_007-6.1	2.21	0.06	1.27	0.27	70.8	35.88	30.00	*	*	*	910
14_007-3.1	2.55	0.11	1.46	0.39	73.3	46.51	38.00	*	*	*	892
14_007-8.1	2.22	0.15	1.49	0.24	100.8	46.33	38.00	*	*	*	1779
14_007-1.1	2.44	0.06	1.65	0.33	103.7	55.86	44.00	*	*	*	1376
14_007-5.1	2.92	0.12	1.95	0.45	104.8	61.50	48.00	*	*	*	507
14_007-2.1	2.96	0.07	2.28	0.48	148.3	105.29	70.00	*	*	*	460
14_007-11.1	3.05	0.13	2.38	0.63	154.9	159.24	92.00	*	*	*	307
14_007-4.1	3.35	0.12	2.74	0.52	176.2	137.40	84.00	*	*	*	831
14_007-7.1	3.79	0.12	3.15	0.46	187.5	111.71	74.00	*	*	*	2070
14_007-9.1	2.88	0.16	2.43	0.37	193.1	148.40	88.00	*	*	*	380
14_007-10.1	3.52	0.11	3.20	0.49	262.5	536.72	142.00	*	*	*	666
Old Lava Flow	*Weighted Average Peak Age = 0.91 ± 0.10 Ma (2σ) MSWD = 0.2*										
12_006-6.1	*	*	*	*	*	*	*	0.777	0.419	0.343	679
12_006-4.1	*	*	*	*	*	*	*	0.801	0.352	0.530	252
12_006-8.1	*	*	*	*	*	*	*	0.804	0.354	0.409	153
12_006-3.1	*	*	*	*	*	*	*	0.813	0.358	0.330	318
12_006-19.1	*	*	*	*	*	*	*	0.875	0.384	0.360	228
12_006-10.1	*	*	*	*	*	*	*	0.878	0.386	0.224	952
12_006-7.1	*	*	*	*	*	*	*	0.900	0.396	0.481	125
12_006-20.1	*	*	*	*	*	*	*	0.931	0.409	0.361	484
12_006-5.1	*	*	*	*	*	*	*	0.952	0.553	0.345	314
12_006-18.1	*	*	*	*	*	*	*	0.964	0.424	0.336	309
12_006-17.1	*	*	*	*	*	*	*	0.967	0.425	0.354	411
12_006-11.1	*	*	*	*	*	*	*	0.981	0.431	0.505	211
12_006-12.1	*	*	*	*	*	*	*	0.984	0.434	0.176	262
12_006-1.1	*	*	*	*	*	*	*	0.998	0.466	0.451	159
12_006-16.1	*	*	*	*	*	*	*	1.052	0.507	0.448	147
12_006-14.1	*	*	*	*	*	*	*	1.068	0.484	0.443	167
12_006-15.1	*	*	*	*	*	*	*	1.106	0.588	0.479	118

* = not analyzed
Note: All σ in data represents standard error.
MSWD: Mean Square of Weighted Deviates



Appendix Figure 4.1: Ilmenite-Magnetite pairs for microprobe analysis

(A) Example of touching magnetite-ilmenite pairs analyzed from North Pardepur thin section.
(B) Example of non-touching magnetite-ilmenite pairs analyzed from North Pardepur thin section.

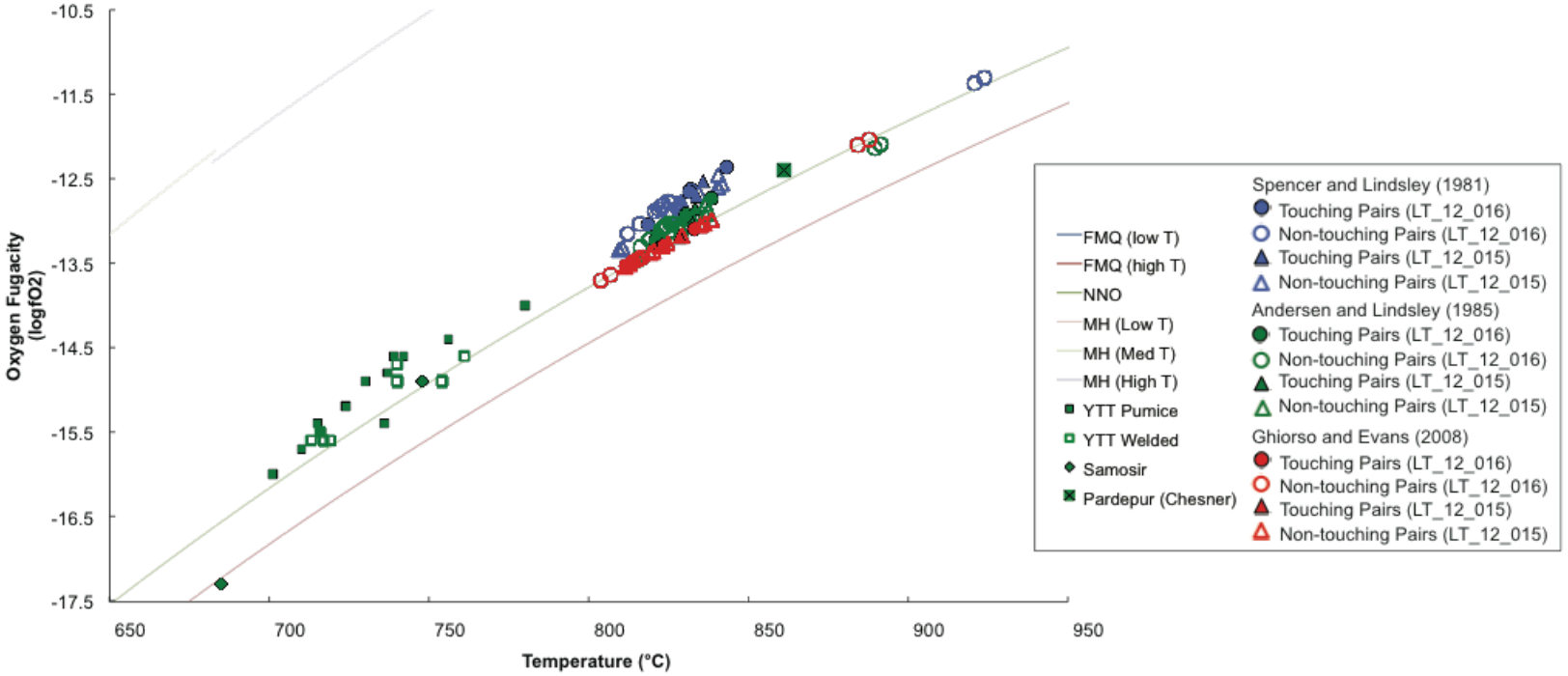


Appendix Figure 4.2: Ilmenite-magnetite equilibrium test

Ilmenite-magnetite pair analyses were put through the Bacon and Hirschmann equilibrium Samples that fell outside the 2 sigma limits were discounted from further calculations.

Appendix Figure 4.3: Oxygen fugacity – Temperature plot of Samosir Fe Ti Oxides

Calculations of geothermometry from the three different methods (Appendix Table 4.5) plotted on oxygen fugacity vs temperature plot. Legend within graph shows symbols. Curves are oxygen fugacity curves for calculated FMQ, NNO and MH curves.


-10.5
-11.5
-12.5
-13.5
-14.5
-15.5
-16.5
-17.5
Oxygen Fugacity (logfO2)
650
700
750
800
850
900
950
Temperature (°C)
FMQ (low T)
FMQ (high T)
NNO
MH (Low T)
MH (Med T)
MH (High T)
YTT Pumice
YTT Welded
Samosir
Pardepur (Chesner)
Spencer and Lindsley (1981)
Touching Pairs (LT_12_016)
Non-touching Pairs (LT_12_016)
Touching Pairs (LT_12_015)
Non-touching Pairs (LT_12_015)
Andersen and Lindsley (1985)
Touching Pairs (LT_12_016)
Non-touching Pairs (LT_12_016)
Touching Pairs (LT_12_015)
Non-touching Pairs (LT_12_015)
Ghiorso and Evans (2008)
Touching Pairs (LT_12_016)
Non-touching Pairs (LT_12_016)
Touching Pairs (LT_12_015)
Non-touching Pairs (LT_12_015)

Appendix Table 4.1: Parameters for electron microprobe analyses

Column Conditions

HV (kV)	15
I (nA)	30
Beam Size	1

Acquisition Information

Element	Line	Spectrometer	Xstal	Peak	Peak Time (s)	Bg Off1	Bg Off2	Calibration
Si	Ka	1	TAP	27744	30	-600	600	KANO
Al	Ka	2	LTAP	32488	30	-500	500	GAHN
Fe	Ka	4	LIF	48086	20	-500	500	ILMN
Mn	Ka	4	LIF	52206	20	-500	500	PYMN
Mg	Ka	2	LTAP	38542	30	-1300	1300	CROM
Ca	Ka	5	PET	38394	30	-500	500	KAUG
Ti	Ka	3	LPET	31413	20	-500	500	ILMN
V	Ka	3	LPET	28609	20	-500	500	VANA
Cr	Ka	3	LPET	26155	20	-500	500	CROM
Ni	Ka	4	LIF	41172	20	-500	500	NiSi
Cr	Ka	5	PET	26188	20	-500	500	CROM

Appendix Table 4.2: Standards run for electron microprobe analyses

ILMN Standard										
Run 1	**SiO2**	**Al2O3**	**FeO**	**MnO**	**MgO**	**CaO**	**TiO2**	**Cr2O3**	**NiO**	**Total**
	0.00	0.00	46.20	4.34	0.32	0.00	45.61	0.02	0.05	96.55
	0.00	0.00	46.08	4.63	0.33	0.00	46.30	0.02	0.00	97.37
	0.00	0.00	47.06	4.13	0.33	0.01	45.72	0.02	0.00	97.27
	0.02	0.00	46.51	4.41	0.33	0.00	46.02	0.01	0.00	97.30
	0.00	0.00	46.25	4.62	0.31	0.00	46.22	0.01	0.00	97.41
	0.00	0.00	47.11	4.48	0.32	0.00	45.77	0.03	0.00	97.71
	0.00	0.00	46.29	4.37	0.33	0.00	46.05	0.02	0.01	97.07
	36.17	6.44	0.05	4.02	0.30	0.00	0.79	2.74	0.02	0.08
Average	0.00	0.00	46.50	4.43	0.32	0.00	45.96	0.02	0.01	97.24
1 SD	0.01	0.00	0.42	0.17	0.01	0.00	0.26	0.01	0.02	0.36

Run 2	**Si**	**Al**	**Fe**	**Mn**	**Mg**	**Ca**	**Ti**	**Cr**	**Ni**	**O**	**Total**
	0.01	0.00	36.50	3.59	0.19	0.00	27.28	0.02	0.03	29.88	97.50
	0.00	0.00	36.41	3.59	0.19	0.01	27.41	0.01	0.00	29.92	97.54
	0.01	0.00	36.66	3.47	0.19	0.00	27.39	0.02	0.00	29.96	97.71
	0.00	0.00	36.22	3.58	0.19	0.00	27.78	0.01	0.02	30.11	97.92
	0.01	0.00	36.63	3.42	0.20	0.00	27.56	0.01	0.00	30.05	97.87
Average	0.01	0.00	36.48	3.53	0.19	0.00	27.49	0.01	0.01	29.98	
1 SD	0.01	0.00	0.18	0.08	0.00	0.00	0.19	0.01	0.01	0.10	

MAGT Standard										
Run 1	**SiO2**	**Al2O3**	**FeO**	**MnO**	**MgO**	**CaO**	**TiO2**	**Cr2O3**	**NiO**	**Total**
	0.04	0.04	91.79	0.05	0.08	0.00	0.11	0.14	0.02	92.27
	0.04	0.05	91.91	0.07	0.08	0.01	0.19	0.14	0.07	92.56
	0.03	0.04	91.25	0.05	0.08	0.00	0.16	0.21	0.06	91.91
	0.07	0.03	90.99	0.08	0.08	0.01	0.20	0.22	0.07	91.77
	0.04	0.04	91.45	0.06	0.08	0.01	0.18	0.22	0.12	92.19
	0.03	0.04	91.09	0.08	0.09	0.01	0.17	0.20	0.08	91.78
	0.04	0.04	91.46	0.08	0.08	0.01	0.16	0.21	0.03	92.09
Average	0.04	0.04	91.42	0.07	0.08	0.01	0.17	0.19	0.06	92.08
1 SD	0.01	0.01	0.34	0.01	0.00	0.00	0.03	0.03	0.03	0.29

Run 2	**Si**	**Al**	**Fe**	**Mn**	**Mg**	**Ca**	**Ti**	**Cr**	**Ni**	**O**	**Total**
	0.02	0.02	70.35	0.05	0.06	0.00	0.07	0.10	0.04	20.35	91.05
	0.02	0.02	70.71	0.08	0.05	0.00	0.06	0.09	0.02	20.44	91.49
	0.02	0.02	70.18	0.05	0.05	0.01	0.12	0.08	0.09	20.34	90.96
	0.01	0.02	70.20	0.06	0.04	0.00	0.11	0.13	0.01	20.33	90.92
	0.02	0.02	70.33	0.05	0.04	0.00	0.10	0.14	0.05	20.38	91.14
Average	0.02	0.02	70.35	0.06	0.05	0.00	0.09	0.11	0.04	20.37	
1 SD	0.00	0.00	0.21	0.01	0.00	0.00	0.02	0.03	0.03	0.05	

Appendix Table 4.3: Microprobe analyses for Fe-Ti oxide pairs

Sample #	LT_12_015 xstal 3		LT_12_015 xstal 7		LT_12_015 ilm 11 + mag 2p	
Wt% Oxides	Magnetite	Ilmenite	Magnetite	Ilmenite	Magnetite	Ilmenite
SiO2	0.09	0.06	0.07	0.05	0.07	0.11
TiO2	10.63	46.11	10.12	46.13	10.45	45.56
Al2O3	1.84	0.05	1.81	0.04	1.78	0.04
Fe2O3(T)						
V2O3						
Cr2O3	0.08	0.03	0.09	0.02	0.07	0.01
FeO(T)	79.90	48.66	79.95	49.41	80.86	48.13
MnO	0.48	0.68	0.44	0.77	0.41	0.73
MgO	0.85	1.74	0.78	1.71	0.74	1.59
CaO	0.01	0.05	0.03	0.03	0.01	0.03
ZnO						
NiO	0.00	0.00	0.00	0.00	0.02	0.00
Total:	93.88	97.39	93.29	98.14	94.41	96.21
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		828.50		828.40		820.30
$log_{10}fO_2$ (relative to NNO)		0.13		0.23		0.12
T °C (Fe-Mg exchange)		-917.10		-834.40		-818.90
a TiO2 (liquid, relative to rutile saturation)		0.61		0.62		0.60

Sample #	LT_12_015 ilm 13 + mag 14		LT_12_015 ilm 3 + mag 4		LT_12_015 ilm 3a + mag 4	
Wt% Oxides	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**
SiO2	0.08	0.30	0.10	0.05	0.10	0.07
TiO2	10.32	45.06	10.40	46.27	10.40	46.27
Al2O3	1.78	0.25	1.82	0.01	1.82	0.04
Fe2O3(T)						
V2O3						
Cr2O3	0.09	0.01	0.08	0.02	0.08	0.02
FeO(T)	79.97	47.07	80.43	48.90	80.43	49.01
MnO	0.46	0.67	0.44	0.76	0.44	0.67
MgO	0.84	1.54	0.82	1.58	0.82	1.69
CaO	0.01	0.04	0.02	0.02	0.02	0.02
ZnO						
NiO	0.00	0.09	0.02	0.05	0.02	0.03
Total:	93.54	95.03	94.13	97.66	94.13	97.84
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		811.40		820.20		823.10
$\log_{10}fO_2$ (relative to NNO)		0.06		0.14		0.15
T °C (Fe-Mg exchange)		-1105.50		-1057.40		-923.00
a TiO2 (liquid, relative to rutile saturation)		0.59		0.61		0.61

Sample #	LT_12_015 il 6 + mt 7p		LT_12_015 il 5 + mt 1		LT_12_015 il 5a + mt 1	
Wt% Oxides	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**
SiO2	0.07	0.21	0.06	0.01	0.06	0.05
TiO2	10.39	45.51	10.91	46.19	10.91	45.94
Al2O3	1.74	0.07	1.88	0.02	1.88	0.04
Fe2O3(T)						
V2O3						
Cr2O3	0.09	0.00	0.11	0.00	0.11	0.02
FeO(T)	80.49	49.16	79.76	48.98	79.76	48.89
MnO	0.40	0.68	0.45	0.74	0.45	0.72
MgO	0.73	1.57	0.84	1.59	0.84	1.58
CaO	0.00	0.13	0.00	0.03	0.00	0.02
ZnO						
NiO	0.00	0.05	0.02	0.04	0.02	0.02
Total:	93.92	97.39	93.92	97.59	93.92	97.28
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		834.90		836.30		838.40
$\log_{10}fO_2$ (relative to NNO)		0.24		0.13		0.14
T °C (Fe-Mg exchange)		-835.10		-1062.50		1062.9
a TiO2 (liquid, relative to rutile saturation)		0.62		0.61		0.61

Sample #	LT_12_015 il 5a + mt 11p		LT_12_015 il 5 + mt 1p		LT_12_015 il 12 + mt 10p	
Wt% Oxides	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**
SiO2	0.06	0.05	0.07	0.01	0.07	0.05
TiO2	10.67	45.94	10.35	46.19	10.68	46.11
Al2O3	1.76	0.04	1.69	0.02	1.87	0.03
Fe2O3(T)						
V2O3						
Cr2O3	0.08	0.02	0.09	0.00	0.10	0.01
FeO(T)	80.72	48.89	80.42	48.98	79.91	48.48
MnO	0.46	0.72	0.51	0.74	0.39	0.67
MgO	0.77	1.58	0.72	1.59	0.85	1.64
CaO	0.00	0.02	0.00	0.03	0.02	0.06
ZnO						
NiO	0.05	0.02	0.08	0.04	0.00	0.01
Total:	93.92	97.28	93.92	97.59	93.92	97.06
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		829.10		820.30		824.70
$\log_{10}fO_2$ (relative to NNO)		0.15		0.14		0.09
T °C (Fe-Mg exchange)		-914.70		-825.40		-1028.80
a TiO2 (liquid, relative to rutile saturation)		0.61		0.61		0.60

Sample #	LT_12_015 il 9p + mt 2p		LT_12_015 il 13 + mt 7p		LT_12_016 xstal 5	
Wt% Oxides	Magnetite	Ilmenite	Magnetite	Ilmenite	Magnetite	Ilmenite
SiO2	0.07	0.02	0.07	0.30	0.27	0.02
TiO2	10.45	45.54	10.39	45.06	9.84	46.33
Al2O3	1.78	0.03	1.74	0.25	1.79	0.04
Fe2O3(T)						
V2O3						
Cr2O3	0.07	0.02	0.09	0.01	0.08	0.02
FeO(T)	80.86	47.91	80.49	47.07	78.44	49.67
MnO	0.41	0.67	0.40	0.67	0.49	0.72
MgO	0.74	1.65	0.73	1.54	0.82	1.61
CaO	0.01	0.02	0.00	0.04	0.01	0.03
ZnO						
NiO	0.02	0.07	0.00	0.09	0.00	0.00
Total:	93.92	95.91	93.92	95.03	91.73	98.44
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		819.20		812.80		822.40
$\log_{10}fO_2$ (relative to NNO)		0.11		0.04		0.24
T °C (Fe-Mg exchange)		-760.30		-832.30		-1077.30
a TiO2 (liquid, relative to rutile saturation)		0.60		0.59		0.63

Sample #	LT_12_016 xstal 8		LT_12_016 xstal 3		LT_12_016 xstal 6	
Wt% Oxides	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**
SiO2	0.09	0.03	0.35	0.04	0.10	0.06
TiO2	10.28	46.02	10.12	45.30	10.18	45.72
Al2O3	1.75	0.02	1.78	0.05	1.73	0.03
Fe2O3(T)						
V2O3						
Cr2O3	0.08	0.01	0.08	0.02	0.08	0.02
FeO(T)	81.28	49.09	79.25	48.88	79.69	47.87
MnO	0.43	0.77	0.41	0.71	0.44	0.65
MgO	0.78	1.65	0.82	1.67	0.83	1.72
CaO	0.00	0.02	0.03	0.04	0.02	0.01
ZnO						
NiO	0.00	0.02	0.03	0.00	0.00	0.01
Total:	94.70	97.63	92.87	96.72	93.08	96.08
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		823.40		833.00		812.30
$log_{10}fO_2$ (relative to NNO)		0.20		0.27		0.10
T °C (Fe-Mg exchange)		-871.30		-950.70		-909.30
a TiO2 (liquid, relative to rutile saturation)		0.62		0.63		0.60

Sample #	LT_12_016 ilm 1 + mag 2		LT_12_016 il 1a + mt 2		LT_12_016 il 1a + mt 7	
Wt% Oxides	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**
SiO2	0.10	0.05	0.10	0.18	2.96	0.18
TiO2	9.89	46.01	9.89	45.31	11.67	45.31
Al2O3	1.78	0.02	1.78	0.06	1.87	0.06
Fe2O3(T)						
V2O3						
Cr2O3	0.10	0.01	0.10	0.01	0.10	0.01
FeO(T)	80.52	48.93	80.52	48.27	71.72	48.27
MnO	0.42	0.67	0.42	0.67	0.36	0.67
MgO	0.85	1.62	0.85	1.68	0.73	1.68
CaO	0.01	0.01	0.01	0.05	0.09	0.05
ZnO						
NiO	0.04	0.04	0.04	0.00	0.00	0.00
Total:	93.71	97.37	93.92	96.23	93.92	96.23
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		811.70		814.90		887.70
$log_{10}fO_2$ (relative to NNO)		0.21		0.22		0.07
T °C (Fe-Mg exchange)		-1091.80		-996.80		-732.20
a TiO2 (liquid, relative to rutile saturation)		0.62		0.62		0.61

Sample #	LT_12_016 il 1 + mt 7		LT_12_016 il 5 + mt 6		LT_12_016 il 4p + mt 6	
Wt% Oxides	Magnetite	Ilmenite	Magnetite	Ilmenite	Magnetite	Ilmenite
SiO2	2.96	0.05	0.10	0.05	0.10	0.02
TiO2	11.67	46.01	10.02	46.16	10.02	46.30
Al2O3	1.87	0.02	1.78	0.03	1.78	0.03
Fe2O3(T)						
V2O3						
Cr2O3	0.10	0.01	0.08	0.01	0.08	0.01
FeO(T)	71.72	48.93	81.20	48.95	81.20	49.35
MnO	0.36	0.67	0.50	0.71	0.50	0.73
MgO	0.73	1.62	0.81	1.66	0.81	1.60
CaO	0.09	0.01	0.00	0.05	0.00	0.01
ZnO						
NiO	0.00	0.04	0.05	0.00	0.05	0.00
Total:	93.92	97.37	93.92	97.63	93.92	98.05
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		884.10		811.70		813.70
$log_{10}fO_2$ (relative to NNO)		0.05		0.18		0.21
T °C (Fe-Mg exchange)		-811.90		-948.60		-1027.40
a TiO2 (liquid, relative to rutile saturation)		0.61		0.61		0.62

Sample #	LT_12_016 il 2p + mt 6		LT_12_016 il 3 + mt 6		LT_12_016 il 4 + mt 6	
Wt% Oxides	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**	**Magnetite**	**Ilmenite**
SiO2	0.10	0.02	0.10	0.07	0.10	0.03
TiO2	10.02	46.48	10.02	45.88	10.02	46.20
Al2O3	1.78	0.02	1.78	0.02	1.78	0.03
Fe2O3(T)						
V2O3						
Cr2O3	0.08	0.01	0.08	0.02	0.08	0.00
FeO(T)	81.20	49.18	81.20	48.96	81.20	48.35
MnO	0.50	0.67	0.50	0.72	0.50	0.83
MgO	0.81	1.56	0.81	1.64	0.81	1.61
CaO	0.00	0.02	0.00	0.01	0.00	0.01
ZnO						
NiO	0.05	0.03	0.05	0.00	0.05	0.04
Total:	93.92	97.99	93.92	97.31	93.92	97.10
Ghiorso and Evans (2008)						
T °C (Fe-Ti exchange)		806.80		815.80		803.70
$\log_{10}fO_2$ (relative to NNO)		0.16		0.22		0.11
T °C (Fe-Mg exchange)		-1079.70		-963.10		-1012
a TiO2 (liquid, relative to rutile saturation)		0.61		0.62		0.601

Sample #	LT_12_016 il 7p + mt 8	
Wt% Oxides	**Magnetite**	**Ilmenite**
SiO2	0.07	0.01
TiO2	10.10	46.39
Al2O3	1.79	0.03
Fe2O3(T)		
V2O3		
Cr2O3	0.08	0.01
FeO(T)	81.01	49.22
MnO	0.38	0.78
MgO	0.78	1.66
CaO	0.00	0.00
ZnO		
NiO	0.00	0.00
Total:	93.92	98.10
Ghiorso and Evans (2008)		
T °C (Fe-Ti exchange)		816.80
$\log_{10}fO_2$ (relative to NNO)		0.18
T °C (Fe-Mg exchange)		-881.70
a TiO2 (liquid, relative to rutile saturation)		0.61

Appendix Table 4.4: Data for equilibrium test for Fe-Ti oxide pairs

	Ilmenite				Magnetite			
Sample #	Mn	Mg	Mg/Mn	Log(Mg/Mn)	Mn	Mg	Mg/Mn	Log(Mg/Mn)
Touching Pairs								
LT_12_015 xstal 3	0.301	1.348	4.477	0.651	0.245	0.760	3.104	0.492
LT_12_015 xstal 7	0.336	1.315	3.917	0.593	0.217	0.686	3.168	0.501
LT_12_016 xstal 5	0.316	1.235	3.909	0.592	0.257	0.750	2.923	0.466
LT_12_016 xstal 8	0.337	1.278	3.792	0.579	0.218	0.693	3.181	0.503
LT_12_016 xstal 3	0.317	1.309	4.135	0.616	0.213	0.737	3.466	0.540
LT_12_016 xstal 6	0.289	1.351	4.677	0.670	0.228	0.751	3.302	0.519
Non-Touching Near Pairs								
LT_12_015 ilm 3a + mag 4	0.295	1.305	4.422	0.646	0.222	0.729	3.286	0.517
LT_12_015 ilm 3 + mag 4	0.334	1.221	3.654	0.563	0.222	0.729	3.286	0.517
LT_12_015 ilm 11 + mag 2p	0.327	1.252	3.830	0.583	0.208	0.656	3.156	0.499
LT_12_015 ilm 13 + mag 14	0.300	1.220	4.064	0.609	0.235	0.756	3.221	0.508
LT_12_015 il 6 + mt 7p	0.301	1.223	4.063	0.609	0.204	0.651	3.198	0.505
LT_12_016 ilm 1 + mag 2	0.298	1.261	4.233	0.627	0.215	0.764	3.562	0.552
LT_12_016 il 1a + mt 2	0.297	1.320	4.439	0.647	0.215	0.764	3.562	0.552
LT_12_016 il 5 + mt 6	0.314	1.288	4.102	0.613	0.255	0.720	2.823	0.451
Non-Touching Far Pairs								
LT_12_015 il 5 + mt 1	0.326	1.229	3.776	0.577	0.228	0.747	3.283	0.516
LT_12_015 il 5a + mt 1	0.319	1.226	3.843	0.585	0.228	0.747	3.283	0.516
LT_12_015 il 5a + mt 11p	0.319	1.226	3.843	0.585	0.233	0.681	2.925	0.466
LT_12_015 il 5 + mt 1p	0.326	1.229	3.776	0.577	0.225	0.665	2.959	0.471
LT_12_015 il 12 + mt 10p	0.297	1.277	4.305	0.634	0.198	0.760	3.840	0.584
LT_12_015 il 9p + mt 2p	0.301	1.296	4.311	0.635	0.208	0.656	3.156	0.499
LT_12_015 il 13 + mt 7p	0.300	1.220	4.064	0.609	0.204	0.651	3.198	0.505
LT_12_016 il 1a + mt 7	0.297	1.320	4.439	0.647	0.184	0.668	3.632	0.560
LT_12_016 il 1 + mt 7	0.298	1.261	4.233	0.627	0.184	0.668	3.632	0.560
LT_12_016 il 4p + mt 6	0.321	1.232	3.833	0.584	0.255	0.720	2.823	0.451
LT_12_016 il 2p + mt 6	0.296	1.201	4.058	0.608	0.255	0.720	2.823	0.451
LT_12_016 il 3 + mt 6	0.317	1.276	4.024	0.605	0.255	0.720	2.823	0.451
LT_12_016 il 4 + mt 6	0.369	1.251	3.391	0.530	0.255	0.720	2.823	0.451
LT_12_016 il 7p + mt 8	0.340	1.283	3.778	0.577	0.193	0.700	3.622	0.559

Appendix Table 4.5: Temperature calculations for oxygen fugacity-temperature plot

Assuming Geothermometer Calculation by Stormer (1983)							
	Sample #	Spencer and Lindsley (1981)		Andersen and Lindsley (1985		Ghiorso and Evans (2008)	
		T	logfO2	T	logfO2	T	del NNO
This Study							
Touching Pairs	LT_12_015 xstal 3	833.8	-12.706	831.8	-12.989	828.5	0.13
	LT_12_015 xstal 7	835.7	-12.533	833.2	-12.853	828.4	0.23
	LT_12_016 xstal 5	831.9	-12.625	830.5	-12.919	822.4	0.24
	LT_12_016 xstal 8	831.4	-12.654	830.1	-12.941	823.4	0.2
	LT_12_016 xstal 3	843.0	-12.364	838.3	-12.733	833	0.27
	LT_12_016 xstal 6	818.5	-13.044	820.8	-13.233	812.3	0.1
Non-Touching Near Pairs	LT_12_015 ilm 3a + mag 4	828.9	-12.779	828.4	-13.038	823.1	0.15
	LT_12_015 ilm 3 + mag 4	825.8	-12.869	826.1	-13.105	820.2	0.14
	LT_12_015 ilm 11 + mag 2p	825.7	-12.879	826.0	-13.113	820.3	0.12
	LT_12_015 ilm 13 + mag 14	809.4	-13.343	814.0	-13.462	811.4	0.06
	LT_12_015 il 6 + mt 7p	840.5	-12.454	836.5	-12.800	834.9	0.24
	LT_12_016 ilm 1 + mag 2	820.6	-12.887	822.4	-13.109	811.7	0.21
	LT_12_016 il 1a + mt 2	822.7	-12.826	823.9	-13.063	814.9	0.22
	LT_12_016 il 5 + mt 6	821.8	-12.861	823.3	-13.090	811.7	0.18
Non-Touching Far Pairs	LT_12_015 il 5 + mt 1	840.3	-12.601	836.4	-12.919	836.3	0.13
	LT_12_015 il 5a + mt 1	841.7	-12.562	837.4	-12.891	838.4	0.14
	LT_12_015 il 5a + mt 11p	834.4	-12.674	832.2	-12.964	829.1	0.15
	LT_12_015 il 5 + mt 1p	828.0	-12.790	827.7	-13.045	820.3	0.14
	LT_12_015 il 12 + mt 10p	829.7	-12.845	828.8	-13.094	824.7	0.09
	LT_12_015 il 9p + mt 2p	825.0	-12.898	825.5	-13.127	819.2	0.11
	LT_12_015 il 13 + mt 7p	810.6	-13.323	814.9	-13.448	812.8	0.04
	LT_12_016 il 1a + mt 7	923.8	-11.303	891.4	-12.092	887.7	0.07
	LT_12_016 il 1 + mt 7	920.7	-11.372	889.5	-12.139	884.1	0.05
	LT_12_016 il 4p + mt 6	823.3	-12.817	824.3	-13.057	813.7	0.21
	LT_12_016 il 2p + mt 6	815.9	-13.039	818.9	-13.223	806.8	0.16
	LT_12_016 il 3 + mt 6	824.8	-12.774	825.4	-13.026	815.8	0.22
	LT_12_016 il 4 + mt 6	812.1	-13.151	816.1	-13.308	803.7	0.11
	LT_12_016 il 7p + mt 8	825.7	-12.788	826.1	-13.039	816.8	0.18

Assuming Geothermometer Calculation by Stormer (1983)							
Sample #		Spencer and Lindsley (1981)		Andersen and Lindsley (1985		Ghiorso and Evans (2008)	
		T	logfO2	T	logfO2	T	del NNO
Chesner (2012)							
YTT Pumice	20A2			701	-16		
	94A5			710	-15.7		
	22A2			715	-15.4		
	51A5			737	-14.8		
	23A4			724	-15.2		
	97AA7			716	-15.5		
	63A1			736	-15.4		
	84A4			742	-14.6		
	90A7			730	-14.9		
	6A2			739	-14.6		
	21A5			756	-14.4		
	89A2			780	-14		
YTT Welded	18			717	-15.6		
	94B			719	-15.6		
	11			713	-15.6		
	87			716	-15.5		
	98			740	-14.9		
	32			740	-14.7		
	100			754	-14.9		
	30			761	-14.6		
Post YTT Domes	67 (Samosir 1)			685	-17.3		
	3 (Samosir 2)			748	-14.9		
	38 (Pardepur)			861	-12.4		

Appendix Table 4.6: Extended Argon Data

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (North; vapour phase)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013464 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11027	1.0 %	✓	0.9171126	0.034559	0.0000000	3.1115	0.66174	51.8 ± 156.9	0.24	0.12	39 ± 165
16D11028	2.5 %	✓	0.0277109	0.094335	0.0000000	25.0836	7.55411	73.3 ± 2.0	47.69	0.94	114 ± 180
16D11030	4.0 %	✓	0.0055319	0.236365	0.0101007	28.4485	8.81040	75.4 ± 1.3	83.48	1.06	52 ± 32
16D11031	6.5 %	✓	0.0171428	0.358063	0.0278393	58.2579	17.84974	74.6 ± 0.8	77.14	2.17	70 ± 30
16D11033	7.0 %	✓	0.0027659	0.102976	0.0335279	20.5822	6.10135	72.2 ± 1.7	87.20	0.77	86 ± 121
16D11034	7.7 %	✓	0.0017788	0.132681	0.0000000	14.0405	4.27218	74.1 ± 2.3	88.06	0.52	46 ± 52
16D11036	8.0 %	✓	0.0003923	0.001308	0.0000000	11.3422	3.44711	74.0 ± 2.9	95.58	0.42	3730 ± 420421
16D11037	8.5 %		0.0010707	0.067408	0.0297151	6.9379	1.92363	67.5 ± 4.5	84.87	0.26	44 ± 98
16D11039	9.0 %	✓	0.0003571	0.033593	0.0000000	1.1467	0.32438	68.9 ± 27.5	74.69	0.04	15 ± 65
16D11041	1.0 %	✓	0.0189358	0.070420	0.0339849	2.5183	0.74377	71.9 ± 20.1	11.71	0.09	15 ± 33
16D11042	2.5 %	✓	0.0016415	0.195456	0.0338799	13.3504	3.99373	72.8 ± 3.3	88.16	0.50	29 ± 22
16D11044	4.0 %	✓	0.0016167	0.484437	0.0165724	46.7397	14.16584	73.8 ± 0.9	95.57	1.74	41 ± 13
16D11045	6.5 %	✓	0.0021362	0.396993	0.0047150	59.4228	18.14961	74.4 ± 0.8	95.48	2.22	64 ± 25
16D11047	7.0 %	✓	0.0005086	0.254432	0.0011377	32.6176	9.89824	73.9 ± 1.3	97.30	1.22	55 ± 32
16D11048	7.7 %	✓	0.0004484	0.232221	0.0083029	38.5700	11.80258	74.5 ± 1.1	97.68	1.44	71 ± 46
16D11050	8.0 %	✓	0.0003504	0.192007	0.0000000	29.1325	8.87084	74.1 ± 1.5	97.63	1.09	65 ± 52
16D11051	8.5 %	✓	0.0003670	0.019444	0.0000000	5.6017	1.80558	78.5 ± 7.7	105.06	0.21	124 ± 910
16D11053	9.0 %	✓	0.0002882	0.039706	0.0000000	7.0021	2.22698	77.4 ± 6.1	102.69	0.26	76 ± 268
16D11055	1.0 %	✓	0.0353698	0.048930	0.0000000	2.8521	0.71989	61.5 ± 20.3	6.44	0.11	25 ± 72
16D11056	2.5 %	✓	0.0014600	0.082605	0.0000000	17.0734	5.12555	73.1 ± 2.3	91.17	0.64	89 ± 153
16D11058	4.0 %	✓	0.0015781	0.465405	0.0000000	75.2177	22.89203	74.1 ± 0.5	96.81	2.80	69 ± 21
16D11059	6.5 %	✓	0.0016428	0.596645	0.0000000	97.4100	29.79074	74.5 ± 0.4	97.20	3.63	70 ± 16
16D11061	7.0 %	✓	0.0005367	0.301093	0.0000000	51.0538	15.67437	74.7 ± 0.8	97.79	1.90	73 ± 35
16D11062	7.7 %	✓	0.0003873	0.209693	0.0000000	36.2642	11.20099	75.2 ± 1.1	97.79	1.35	74 ± 52
16D11064	8.0 %	✓	0.0003207	0.267289	0.0000000	42.7495	13.13427	74.8 ± 1.0	98.07	1.59	69 ± 37
16D11065	8.5 %	✓	0.0002999	0.144178	0.0152359	30.3070	9.31842	74.9 ± 1.3	97.85	1.13	90 ± 93
16D11067	9.0 %	✓	0.0002088	0.231926	0.0000000	23.0900	7.09648	74.8 ± 1.7	97.93	0.86	43 ± 27

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (North; vapour phase)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013464 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11074	1.0 %	✓	0.0515742	0.113366	0.0014831	2.3272	0.72297	75.6 ± 27.4	4.53	0.09	9 ± 11
16D11075	2.5 %	✓	0.0114118	0.196587	0.0000000	8.1939	2.48416	73.8 ± 4.9	42.19	0.31	18 ± 13
16D11077	4.0 %	✓	0.0173380	0.293337	0.0000000	47.6652	14.34445	73.3 ± 0.9	73.00	1.78	70 ± 34
16D11078	6.5 %	✓	0.0220441	0.771147	0.0000000	115.9403	35.24119	74.0 ± 0.4	83.51	4.32	65 ± 12
16D11080	7.0 %	✓	0.0100814	0.312188	0.0028066	32.8719	9.99576	74.0 ± 1.2	76.30	1.23	45 ± 20
16D11081	7.7 %	✓	0.0158090	0.194123	0.0000000	12.9075	3.81502	72.0 ± 3.3	44.69	0.48	29 ± 21
16D11083	8.0 %	✓	0.0006703	0.273372	0.0000000	17.5817	5.36966	74.4 ± 1.9	95.29	0.66	28 ± 14
16D11084	8.5 %	✓	0.0001614	0.128753	0.0038695	1.1648	0.42741	89.3 ± 26.7	111.25	0.04	4 ± 4
16D11086	9.0 %	✓	0.0001001	0.005194	0.0000000	1.1763	0.45201	93.6 ± 28.1	105.87	0.04	97 ± 2767
16D11088	1.0 %	✓	0.0333261	0.138060	0.0008653	2.2808	0.61024	65.1 ± 27.8	5.83	0.09	7 ± 8
16D11089	2.5 %	✓	0.0029133	0.113967	0.0000000	21.8454	6.85722	76.4 ± 2.1	87.89	0.81	82 ± 100
16D11091	4.0 %	✓	0.0018381	0.268567	0.0000000	51.7350	15.84925	74.6 ± 0.8	95.53	1.93	83 ± 43
16D11092	6.5 %	✓	0.0033507	0.395051	0.0091538	70.3555	21.49120	74.4 ± 0.6	94.47	2.62	77 ± 27
16D11094	7.0 %	✓	0.0005662	0.202804	0.0000000	15.2426	4.79200	76.5 ± 2.8	95.50	0.57	32 ± 22
16D11095	7.7 %	✓	0.0004391	0.240152	0.0000000	24.1994	7.46183	75.1 ± 1.8	97.11	0.90	43 ± 26
16D11097	8.0 %	✓	0.0006272	0.263036	0.0000000	31.2600	9.53538	74.3 ± 1.4	96.90	1.17	51 ± 28
16D11098	8.5 %	✓	0.0003667	0.057111	0.0195764	11.4778	3.50353	74.3 ± 3.7	95.84	0.43	86 ± 213
16D11100	9.0 %	✓	0.0000064	0.040650	0.0000000	6.2782	1.99874	77.5 ± 6.7	98.72	0.23	66 ± 233
16D11102	1.0 %	✓	0.0925458	0.163864	0.0280035	3.0760	0.98984	78.3 ± 29.3	3.49	0.11	8 ± 7
16D11103	2.5 %	✓	0.0033578	0.465258	0.0212079	15.7936	4.68576	72.2 ± 2.0	81.66	0.59	15 ± 4
16D11105	4.0 %	✓	0.0035985	0.777003	0.0000000	63.5092	19.21363	73.7 ± 0.5	93.63	2.37	35 ± 6
16D11106	6.5 %	✓	0.0314011	1.686321	0.0129190	247.6525	75.34682	74.1 ± 0.2	88.05	9.23	63 ± 5
16D11108	7.0 %	✓	0.0005846	0.131455	0.0061807	18.8015	5.74609	74.4 ± 1.6	95.92	0.70	62 ± 63
16D11109	7.7 %		0.0000867	0.139348	0.0000000	2.9148	1.10132	92.0 ± 10.1	101.33	0.11	9 ± 9
16D11111	8.0 %	✓	0.0001968	0.064538	0.0000000	2.3371	0.80829	84.2 ± 13.0	106.48	0.09	16 ± 35
16D11112	8.5 %	✓	0.0003086	0.093732	0.0301711	1.5708	0.54438	84.4 ± 18.7	118.55	0.06	7 ± 11
16D11114	9.0 %	✓	0.0003074	0.016227	0.0000000	1.2024	0.49769	100.8 ± 24.8	120.96	0.04	32 ± 297

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (North; vapour phase)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013464 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11121	1.0 %		0.0370649	0.080293	0.0000000	1.4696	0.78459	130.0 ± 42.8	6.68	0.05	8 ± 14
16D11122	2.5 %	✓	0.0018398	0.127429	0.0000000	9.3465	2.87831	75.0 ± 4.6	83.24	0.35	32 ± 34
16D11124	4.0 %	✓	0.0030615	0.409997	0.0053318	57.4965	17.44417	73.9 ± 0.8	93.94	2.14	60 ± 20
16D11125	6.5 %	✓	0.0059888	1.603030	0.0000000	264.3870	81.28481	74.9 ± 0.2	96.69	9.86	71 ± 7
16D11127	7.0 %	✓	0.0005861	0.211746	0.0266283	40.3458	12.39445	74.8 ± 1.1	97.43	1.50	82 ± 55
16D11128	7.7 %	✓	0.0001644	0.049269	0.0000000	9.2361	2.95610	77.9 ± 4.5	100.45	0.34	81 ± 233
16D11130	8.0 %	✓	0.0001848	0.012443	0.0312108	2.9391	0.99335	82.3 ± 14.6	104.56	0.11	102 ± 1136
16D11131	8.5 %	✓	0.0000522	0.004199	0.0347401	4.9793	1.62038	79.2 ± 8.6	99.78	0.19	510 ± 17279
16D11133	9.0 %	✓	0.0004241	0.100601	0.0000000	1.4404	0.32317	54.6 ± 29.2	71.18	0.05	6 ± 9
16D11223	1.0 %		0.5133241	0.007687	0.0000000	2.0159	1.35140	163.2 ± 149.6	0.90	0.08	113 ± 2171
16D11224	2.5 %	✓	0.0363646	0.043361	0.0000000	13.1809	4.03438	74.5 ± 4.2	27.20	0.49	131 ± 429
16D11226	4.0 %	✓	0.0187502	0.285639	0.0000000	51.0949	15.53060	74.0 ± 0.9	73.03	1.91	77 ± 39
16D11227	5.2 %	✓	0.0101755	0.235752	0.0104420	33.8985	10.39468	74.7 ± 1.2	76.82	1.26	62 ± 39
16D11229	6.5 %	✓	0.0031695	0.188246	0.0000000	31.5660	9.53152	73.5 ± 1.1	90.02	1.18	72 ± 57
16D11230	7.0 %	✓	0.0002588	0.035677	0.0078682	21.0283	6.52600	75.6 ± 1.6	97.65	0.78	253 ± 1046
16D11232	7.7 %	✓	0.0011457	0.244526	0.0125283	30.8986	9.39942	74.1 ± 1.1	95.37	1.15	54 ± 30
16D11233	8.0 %	✓	0.0008874	0.144996	0.0000000	12.9274	3.83198	72.2 ± 2.7	92.48	0.48	38 ± 40
16D11235	8.5 %	✓	0.0004616	0.011192	0.0318178	16.1390	4.88980	73.8 ± 2.0	96.11	0.60	620 ± 8144
16D11236	9.0 %	✓	0.0003420	0.135471	0.0103249	12.8012	3.93359	74.8 ± 2.6	96.33	0.48	41 ± 44
16D11238	1.0 %	✓	0.1095583	0.078538	0.0000000	3.3360	1.27750	93.2 ± 29.3	3.79	0.12	18 ± 32
16D11239	2.5 %	✓	0.0869357	0.052704	0.0193808	16.4800	5.06940	74.9 ± 5.0	16.45	0.61	134 ± 349
16D11241	4.0 %	✓	0.0008487	0.094176	0.0000000	22.2266	6.66987	73.1 ± 1.6	95.21	0.83	101 ± 155
16D11242	5.2 %	✓	0.0016300	0.192837	0.0092646	27.4011	8.33316	74.0 ± 1.4	93.43	1.02	61 ± 46
16D11244	6.5 %	✓	0.0044541	0.142983	0.0154516	25.9742	7.78875	73.0 ± 1.5	84.62	0.97	78 ± 76
16D11245	7.0 %	✓	0.0038512	0.179845	0.0093846	32.9933	10.02608	74.0 ± 1.2	88.80	1.23	79 ± 62
16D11247	7.7 %	✓	0.0091723	0.270020	0.0256157	24.9440	7.74097	75.6 ± 1.7	73.40	0.93	40 ± 21
16D11248	8.0 %	✓	0.0165799	0.176298	0.0433037	16.8768	4.97682	71.8 ± 2.8	50.07	0.63	41 ± 33

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (North; vapour phase)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013464 ± 0.00000031*		*FCT-NM = 28.01 ± 0.023 Ma*						
16D11250	8.5 %	✓	0.0010971	0.083837	0.0539962	4.1500	1.28697	75.5 ± 8.8	79.10	0.15	21 ± 37
16D11251	9.0 %	✓	0.0015724	0.119998	0.0193691	2.2862	0.69693	74.2 ± 15.7	59.55	0.09	8 ± 10
16D11253	1.0 %	✓	4.2229212	0.123833	0.0000000	2.2451	6.67122	723.6 ± 919.2	0.54	0.08	8 ± 9
16D11254	2.5 %	✓	0.1231866	0.004493	0.0000000	21.4724	6.88283	78.0 ± 4.9	15.87	0.80	2055 ± 67359
16D11256	4.0 %	✓	0.1224091	0.662818	0.0000000	106.6310	32.37880	73.9 ± 1.0	46.95	3.98	69 ± 15
16D11257	5.2 %	✓	0.0104420	0.441904	0.0000000	69.8330	21.24817	74.1 ± 0.7	86.37	2.60	68 ± 21
16D11259	6.5 %	✓	0.0072057	0.275388	0.0024786	39.9548	12.07613	73.6 ± 1.1	84.11	1.49	62 ± 35
16D11260	7.0 %	✓	0.0017565	0.097503	0.0000000	13.1074	4.02330	74.7 ± 3.1	87.61	0.49	58 ± 83
16D11262	7.7 %	✓	0.0011657	0.038230	0.0000000	14.5341	4.47472	75.0 ± 2.8	91.79	0.54	163 ± 589
16D11263	8.0 %	✓	0.0000374	0.057738	0.0127682	6.7776	2.11604	76.0 ± 6.0	98.28	0.25	50 ± 125
16D11265	8.5 %	✓	0.0004168	0.065472	0.0000000	1.8570	0.48375	63.4 ± 21.2	78.79	0.07	12 ± 26
16D11266	9.0 %	✓	0.0001372	0.052112	0.0000000	0.5000	0.13653	66.5 ± 77.8	76.28	0.02	4 ± 11
		Σ	6.7021603	18.856591	0.7331537	2682.0568	808.53231				
Plateau Age = 74.3 ± 0.4 ka		**MSWD = 1.53**	**Total Fusion Age = 73.4 ± 0.9 ka**		**Inverse Isochron Age = 74.3 ± 0.4 ka**			**$^{40}Ar/^{36}Ar$ = 294.4 ± 1.23**			
Youngest Toba Tuff (North)											
	Sanidine	*Irradiation 17-OSU-04*	*J = 0.00013921 ± 0.00000026*		*FCT-NM = 28.01 ± 0.023 Ma*						
17D16909	1.5 %	✓	0.0042756	0.0824656	0.0239219	20.48879	6.076397	74.7 ± 2.1	81.91	7.69	107 ± 154
17D16910	3.5 %	✓	0.0004968	0.0597010	0.0162310	14.35566	4.214291	73.9 ± 3.0	95.43	5.39	103 ± 208
17D16912	5.5 %	✓	0.0004506	0.0549907	0.0000000	20.78090	6.325881	76.6 ± 1.9	96.75	7.80	162 ± 345
17D16913	7.5 %	✓	0.0020208	0.0259631	0.0000000	2.96475	0.975342	82.8 ± 12.9	61.58	1.11	49 ± 224
17D16915	9.5 %	✓	0.0036456	0.1055116	0.0000000	0.77107	0.099784	32.6 ± 54.6	8.46	0.29	3 ± 3
17D16916	11.0 %		0.0048719	0.0499073	0.0607028	0.34294	0.073702	54.1 ± 120.3	5.39	0.13	3 ± 7
17D16950	0.4 %	✓	0.0017410	0.0287463	0.0002953	7.38941	2.099974	71.5 ± 5.5	79.46	2.77	111 ± 462
17D16952	0.7 %	✓	0.0005629	0.0724216	0.0000000	12.62021	3.534909	70.5 ± 3.0	94.28	4.73	75 ± 120

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (North)											
	Sanidine	*Irradiation 17-OSU-04*	*J = 0.00013921 ± 0.00000026*			*FCT-NM = 28.01 ± 0.023 Ma*					
17D16953	1.0 %	✓	0.0001636	0.0104096	0.0000000	9.92869	2.908793	73.8 ± 4.1	100.36	3.73	410 ± 4629
17D16955	2.5 %	✓	0.0000168	0.0208888	0.0155498	9.80673	2.849502	73.1 ± 4.0	98.87	3.68	202 ± 1098
17D16956	3.5 %	✓	0.0003526	0.0091855	0.0000000	12.44247	3.654809	73.9 ± 3.4	96.01	4.67	582 ± 7306
17D16958	4.5 %	✓	0.0004055	0.0617561	0.0078486	6.19001	1.713828	69.7 ± 6.3	92.27	2.32	43 ± 80
17D16959	6.0 %	✓	0.0005788	0.0020471	0.0194196	1.48710	0.318808	54.0 ± 25.5	64.34	0.56	312 ± 18304
17D16961	8.5 %	✓	0.0008292	0.0386111	0.0059274	0.76214	0.249815	82.5 ± 52.2	50.19	0.29	8 ± 24
17D16934	0.5 %		0.0975941	0.0747223	0.0000000	17.14376	3.319815	48.7 ± 7.8	10.30	6.43	99 ± 150
17D16936	1.0 %	✓	0.0100360	0.1174525	0.0000000	11.13262	3.157670	71.4 ± 9.6	51.21	4.18	41 ± 42
17D16938	2.5 %	✓	0.0003372	0.2260929	0.0000000	24.23588	7.179845	74.6 ± 4.4	97.39	9.09	46 ± 24
17D16939	3.5 %	✓	0.0072396	0.1491786	0.0055054	23.76722	7.053341	74.7 ± 4.5	75.98	8.92	69 ± 50
17D16941	4.5 %	✓	0.0082512	0.0446126	0.0000000	9.04593	2.789493	77.6 ± 11.9	53.01	3.39	87 ± 213
17D16942	6.0 %	✓	0.0006625	0.0235818	0.0000000	5.50690	1.748309	79.9 ± 19.2	88.97	2.07	100 ± 518
17D16944	8.5 %	✓	0.0037097	0.2295363	0.0000000	1.78833	0.486327	68.5 ± 59.3	30.60	0.67	3 ± 2
17D16945	10.0 %	✓	0.0014086	0.2663635	0.0000000	0.26139	0.023988	23.1 ± 403.3	6.10	0.10	0 ± 0
17D16921	1.0 %	✓	0.0069742	0.0200646	0.0000000	10.58142	3.090320	73.5 ± 4.0	59.52	3.97	227 ± 1370
17D16923	2.5 %	✓	0.0023665	0.1348994	0.0112227	18.21504	5.513627	76.2 ± 2.3	87.76	6.83	58 ± 49
17D16924	3.5 %	✓	0.0018849	0.1458074	0.0096575	9.74012	2.937040	75.9 ± 4.1	83.17	3.65	29 ± 23
17D16926	4.5 %	✓	0.0143870	0.1384122	0.0000000	11.11649	3.285204	74.4 ± 4.6	43.35	4.17	35 ± 29
17D16927	6.0 %	✓	0.0017704	0.0444150	0.0000000	3.48846	0.935026	67.5 ± 11.4	63.54	1.31	34 ± 91
17D16929	8.5 %	✓	0.0008648	0.0619360	0.0000000	0.18719	0.120160	161.6 ± 214.4	31.92	0.07	1 ± 3
		Σ	0.1775376	0.6931136	0.1762820	266.54161	76.540621				

Plateau Age = 74.5 ± 0.9 ka MSWD = 1.18 Total Fusion Age = 72.3 ± 1.4 ka Inverse Isochron Age = 74.6 ± 1.1 ka $^{40}Ar/^{36}Ar$ = 294.91 ± 12.88

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (South)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013626 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D10977	2.0 %		0.0154319	0.0131325	0.0023435	7.8209	2.63189	82.9 ± 6.8	36.44	0.58	256 ± 2870
16D10978	5.0 %	✓	0.0015180	0.0526597	0.0000000	16.5845	5.26478	78.2 ± 2.2	91.14	1.22	135 ± 333
16D10980	6.0 %	✓	0.0001281	0.1521654	0.0000000	21.0784	6.43987	75.3 ± 1.5	98.19	1.56	60 ± 50
16D10981	9.0 %	✓	0.0002166	0.1304454	0.0000000	19.8937	6.14044	76.1 ± 1.7	97.77	1.47	66 ± 70
16D10983	12.0 %	✓	0.0002308	0.0987266	0.0188235	5.8678	1.95206	82.0 ± 5.8	102.40	0.43	26 ± 35
16D10984	15.0 %	✓	0.0001476	0.0627242	0.0000000	0.9782	0.32448	81.7 ± 33.6	87.27	0.07	7 ± 14
16D10986	18.0 %	✓	0.0017494	0.0285507	0.0000000	0.0956	0.01662	42.8 ± 345.0	3.32	0.01	1 ± 7
16D10988	2.0 %	✓	0.0060462	0.0370231	0.0141411	4.3001	1.07308	61.5 ± 11.1	37.31	0.32	50 ± 184
16D10989	3.5 %	✓	0.0012469	0.1695402	0.0128955	20.6401	6.05605	72.3 ± 2.1	93.12	1.52	52 ± 43
16D10991	5.0 %	✓	0.0001190	0.0519471	0.0170783	3.3283	1.03232	76.4 ± 12.9	102.22	0.25	28 ± 71
16D10992	5.5 %	✓	0.0000740	0.0181878	0.0000000	2.3985	0.70451	72.4 ± 17.6	95.78	0.18	57 ± 406
16D10994	6.0 %	✓	0.0004155	0.0823755	0.0000000	10.9478	3.21852	72.4 ± 3.9	95.13	0.81	57 ± 100
16D10995	7.5 %	✓	0.0001257	0.0099776	0.0059805	11.4082	3.50022	75.6 ± 3.7	99.82	0.84	492 ± 6648
16D10997	9.0 %	✓	0.0000570	0.0622265	0.0178156	7.0118	2.13439	75.0 ± 6.1	98.00	0.52	48 ± 114
16D10998	10.5 %	✓	0.0000197	0.0425609	0.0000000	2.0309	0.60164	73.0 ± 21.1	97.79	0.15	21 ± 69
16D11000	14.0 %	✓	0.0003899	0.0487053	0.0000000	0.0345	0.18201	1297.9 ± 2098.2	271.90	0.00	0 ± 1
16D11002	2.0 %	✓	0.0227772	0.0456228	0.0000000	5.8680	1.71667	72.1 ± 8.6	20.27	0.43	55 ± 168
16D11003	3.5 %	✓	0.0148120	0.2178919	0.0274436	29.5740	8.76485	73.0 ± 1.4	66.13	2.18	58 ± 38
16D11005	5.0 %	✓	0.0007091	0.0711522	0.0000000	4.7654	1.44533	74.7 ± 6.4	86.39	0.35	29 ± 55
16D11006	5.5 %	✓	0.0052584	0.0971104	0.0085823	9.5353	2.73350	70.6 ± 3.7	63.22	0.70	42 ± 62
16D11008	6.0 %	✓	0.0016770	0.2029735	0.0000000	14.4298	4.21413	72.0 ± 2.3	88.44	1.07	31 ± 22
16D11009	7.5 %	✓	0.0013240	0.1776507	0.0000000	16.4687	4.90940	73.5 ± 2.0	91.53	1.22	40 ± 33
16D11011	9.0 %	✓	0.0002525	0.0481581	0.0004849	10.3821	3.21686	76.3 ± 2.9	96.57	0.77	93 ± 285
16D11012	10.5 %		0.0000066	0.0021448	0.0176363	2.8185	0.99660	87.1 ± 10.7	99.12	0.21	565 ± 38190
16D11014	2.0 %	✓	0.0239064	0.1430933	0.0000000	19.8411	6.27058	77.9 ± 3.1	46.76	1.46	60 ± 61
16D11015	3.5 %	✓	0.0012832	0.0147296	0.0000000	6.7525	1.93437	70.6 ± 6.5	82.69	0.50	197 ± 1955
16D11017	5.0 %	✓	0.0001484	0.0291165	0.0000000	3.4366	1.10629	79.3 ± 13.0	95.10	0.25	51 ± 264

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (South)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013626 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11018	5.5 %	✓	0.0002965	0.1023764	0.0000000	1.7229	0.51123	73.1 ± 25.5	84.44	0.13	7 ± 10
16D11020	6.0 %	✓	0.0001519	0.0000005	0.0032762	4.2400	1.29994	75.5 ± 10.4	95.51	0.31	3412213 ± 910480690170
16D11021	7.5 %	✓	0.0009572	0.1087656	0.0000000	10.4403	3.08631	72.8 ± 4.2	90.53	0.77	41 ± 54
16D11023	9.0 %	✓	0.0002844	0.0181254	0.0000000	1.6073	0.46041	70.6 ± 27.4	83.62	0.12	38 ± 305
16D11024	10.5 %	✓	0.0000164	0.0685305	0.0000000	0.1111	0.09027	200.3 ± 401.1	105.16	0.01	1 ± 2
16D11268	2.0 %		0.0226157	0.0749965	0.0000000	7.6952	1.93957	62.1 ± 6.5	22.42	0.57	44 ± 85
16D11269	3.5 %	✓	0.0106529	0.1661821	0.0064325	28.1549	8.11748	71.0 ± 1.5	71.37	2.08	73 ± 63
16D11271	5.0 %	✓	0.0055390	0.0693254	0.0054818	11.8320	3.62863	75.6 ± 3.4	68.33	0.87	73 ± 167
16D11272	5.5 %	✓	0.0027058	0.0424756	0.0180455	7.2297	2.11013	71.9 ± 5.2	71.84	0.53	73 ± 243
16D11274	6.0 %	✓	0.0018690	0.0479703	0.0000000	15.3369	4.54067	72.9 ± 2.5	88.14	1.13	137 ± 414
16D11275	7.5 %	✓	0.0005966	0.0201795	0.0083414	20.4296	6.06199	73.1 ± 1.8	95.97	1.51	435 ± 3056
16D11277	9.0 %		0.0001378	0.0184553	0.0097697	8.3357	2.60193	76.9 ± 4.4	100.34	0.62	194 ± 1560
16D11278	10.5 %		0.0003153	0.0399402	0.0075602	2.1265	0.79588	92.2 ± 17.1	111.97	0.16	23 ± 85
16D11285	2.0 %	✓	0.0064726	0.1173852	0.0166255	18.9730	5.59405	72.6 ± 1.8	73.81	1.40	70 ± 83
16D11286	3.5 %	✓	0.0000178	0.0306652	0.0000000	7.9624	2.48681	77.0 ± 3.6	99.00	0.59	112 ± 529
16D11288	5.0 %	✓	0.0000856	0.0157279	0.0000000	3.9254	1.26365	79.3 ± 7.2	100.82	0.29	107 ± 997
16D11289	5.5 %	✓	0.0000551	0.0001326	0.0089060	2.6426	0.79033	73.7 ± 10.6	96.77	0.20	8570 ± 9265381
16D11291	6.0 %	✓	0.0001404	0.0287649	0.0199138	4.0219	1.18032	72.3 ± 7.4	95.40	0.30	60 ± 304
16D11292	7.5 %	✓	0.0002272	0.0223494	0.0292980	13.3940	4.16631	76.6 ± 2.1	100.38	0.99	258 ± 1586
16D11294	9.0 %	✓	0.0003278	0.0472741	0.0224024	0.6371	0.26256	101.5 ± 45.7	156.17	0.05	6 ± 18
16D11295	10.5 %	✓	0.0000864	0.0948338	0.0200746	0.1368	0.05945	107.1 ± 215.6	172.64	0.01	1 ± 1
16D11297	2.0 %	✓	0.0075324	0.1005748	0.0288195	16.8742	5.12839	74.9 ± 3.6	69.13	1.25	72 ± 105
16D11298	3.5 %	✓	0.0002383	0.1078315	0.0095819	19.7696	5.82263	72.6 ± 2.8	97.55	1.46	79 ± 106
16D11300	5.0 %	✓	0.0005037	0.1861126	0.0721195	12.6233	3.65705	71.4 ± 4.4	94.89	0.93	29 ± 22
16D11301	5.5 %	✓	0.0002143	0.0159515	0.0227209	8.4654	2.51943	73.3 ± 6.5	96.34	0.62	228 ± 2115
16D11303	6.0 %	✓	0.0004071	0.0868973	0.0097119	8.2711	2.34038	69.7 ± 6.7	93.90	0.61	41 ± 69
16D11304	7.5 %	✓	0.0000228	0.1023424	0.0000000	14.3021	4.25606	73.3 ± 3.9	98.89	1.06	60 ± 88

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (South)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013626 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11306	9.0 %	✓	0.0001031	0.1046392	0.0484764	5.0120	1.53215	75.3 ± 10.9	100.74	0.37	21 ± 28
16D11307	10.5 %	✓	0.0002380	0.1071206	0.0466094	0.8366	0.18303	53.9 ± 66.6	71.34	0.06	3 ± 4
16D11309	2.0 %	✓	0.0082579	0.0448014	0.0180924	3.8725	1.28102	81.5 ± 11.5	34.29	0.29	37 ± 158
16D11310	3.5 %	✓	0.0073049	0.0843954	0.0000000	17.8638	5.26801	72.7 ± 2.2	70.29	1.32	91 ± 203
16D11312	5.0 %	✓	0.0009645	0.0240995	0.0000000	11.1252	3.32522	73.6 ± 3.2	91.03	0.82	199 ± 1542
16D11313	5.5 %	✓	0.0000630	0.0300146	0.0000000	4.0582	1.20835	73.4 ± 9.0	97.25	0.30	58 ± 364
16D11315	6.0 %	✓	0.0000493	0.0045453	0.0078590	3.0013	0.95243	78.2 ± 11.6	100.33	0.22	284 ± 11676
16D11316	7.5 %	✓	0.0001646	0.0368233	0.0000000	6.4111	1.97041	75.7 ± 5.4	96.42	0.47	75 ± 369
16D11318	9.0 %	✓	0.0002127	0.0003555	0.0000000	8.2500	2.54145	75.9 ± 4.3	96.42	0.61	9979 ± 5260402
16D11319	10.5 %	✓	0.0001615	0.0092810	0.0000000	1.9405	0.65101	82.7 ± 17.9	92.19	0.14	90 ± 1792
16D11321	2.0 %	✓	0.0154203	0.0822099	0.0000000	17.6829	5.20743	72.6 ± 2.5	52.97	1.31	92 ± 165
16D11322	3.5 %	✓	0.0020831	0.1163910	0.0042555	20.9102	6.41248	75.6 ± 1.4	90.22	1.54	77 ± 92
16D11324	5.0 %	✓	0.0000736	0.0012133	0.0000000	4.3917	1.40633	78.9 ± 6.9	100.35	0.32	1556 ± 181526
16D11325	5.5 %	✓	0.0000262	0.0518307	0.0000000	3.2551	1.00478	76.1 ± 9.1	98.03	0.24	27 ± 74
16D11327	6.0 %	✓	0.0007986	0.0279735	0.0064001	4.0773	1.12897	68.2 ± 7.3	81.78	0.30	63 ± 334
16D11328	7.5 %	✓	0.0005224	0.1302875	0.0362316	15.8819	4.82614	74.9 ± 1.9	95.73	1.17	52 ± 58
16D11330	9.0 %	✓	0.0000050	0.0749855	0.0362862	16.6247	5.09995	75.6 ± 1.8	98.80	1.23	95 ± 176
16D11331	10.5 %	✓	0.0005305	0.0331116	0.0434122	5.7435	1.86295	79.9 ± 5.1	107.80	0.42	75 ± 322
16D11611	2.0 %	✓	0.0081473	0.3634424	0.0051529	36.3064	10.89838	74.0 ± 1.2	81.06	2.68	43 ± 19
16D11612	3.5 %	✓	0.0003990	0.3403074	0.0019027	21.3365	6.44804	74.5 ± 1.7	97.00	1.57	27 ± 12
16D11614	5.0 %	✓	0.0000230	0.1448169	0.0000000	7.1999	2.18666	74.8 ± 4.9	98.46	0.53	21 ± 23
16D11615	5.5 %	✓	0.0001964	0.1375737	0.0000000	15.1418	4.56636	74.3 ± 2.3	97.52	1.12	47 ± 51
16D11617	6.0 %	✓	0.0004283	0.2510725	0.0000000	14.1714	4.35448	75.7 ± 2.6	96.01	1.05	24 ± 15
16D11618	7.5 %	✓	0.0000956	0.2191332	0.0000000	31.0646	9.56119	75.8 ± 1.2	99.06	2.29	61 ± 42
16D11620	9.0 %		0.0005931	0.1558444	0.0063130	6.1959	2.11102	83.9 ± 5.7	107.74	0.46	17 ± 17
16D11621	10.5 %	✓	0.0002554	0.1161125	0.0000000	1.0881	0.41492	94.0 ± 33.0	120.75	0.08	4 ± 5
16D11623	2.0 %		0.0061341	0.0587063	0.0222836	8.9074	3.08315	85.3 ± 4.4	62.54	0.66	65 ± 170

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (South)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013626 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11624	3.5 %	✓	0.0016050	0.2221197	0.0171603	42.7957	12.92925	74.4 ± 0.9	95.30	3.16	83 ± 58
16D11626	5.0 %	✓	0.0000197	0.1786354	0.0000000	40.3785	12.28883	75.0 ± 0.9	98.71	2.98	97 ± 83
16D11627	5.5 %	✓	0.0004128	0.1438338	0.0074456	21.7146	6.39563	72.6 ± 1.6	96.89	1.60	65 ± 69
16D11629	6.0 %	✓	0.0000123	0.2233182	0.0309186	30.6570	9.32844	75.0 ± 1.2	98.80	2.26	59 ± 40
16D11630	7.5 %	✓	0.0003181	0.1503338	0.0000000	15.2012	4.52153	73.3 ± 2.3	96.75	1.12	43 ± 47
16D11632	9.0 %	✓	0.0000029	0.1694964	0.0000000	0.8657	0.33159	94.4 ± 40.6	99.26	0.06	2 ± 2
16D11633	10.5 %	✓	0.0002512	0.2330905	0.0000000	0.9129	0.39272	106.0 ± 39.3	121.97	0.07	2 ± 1
16D11635	2.0 %	✓	0.0155047	0.0756476	0.0138005	23.8333	7.32904	75.8 ± 2.1	61.07	1.76	135 ± 275
16D11636	3.5 %	✓	0.0027429	0.0364548	0.0000000	15.1903	4.52741	73.4 ± 2.7	83.90	1.12	179 ± 756
16D11638	5.0 %	✓	0.0025861	0.0128085	0.0172794	27.7986	8.32784	73.8 ± 1.4	90.54	2.05	933 ± 10793
16D11639	5.5 %	✓	0.0002983	0.1447064	0.0069910	7.7315	2.31826	73.9 ± 5.1	95.17	0.57	23 ± 24
16D11641	6.0 %	✓	0.0002270	0.0535371	0.0000000	7.7842	2.33370	73.9 ± 4.9	96.02	0.57	63 ± 189
16D11642	7.5 %	✓	0.0005750	0.0804757	0.0000000	6.9058	1.98299	70.8 ± 5.6	90.99	0.51	37 ± 69
16D11644	8.5 %	✓	0.0000107	0.0107563	0.0077301	0.6347	0.19970	77.5 ± 61.0	100.37	0.05	25 ± 373
16D11645	9.5 %	✓	0.0002053	0.0812730	0.0290609	0.2059	0.14143	169.3 ± 192.9	173.40	0.02	1 ± 2
16D11647	10.5 %	✓	0.0002299	0.0331223	0.0000000	0.2554	0.01988	19.2 ± 149.1	22.39	0.02	3 ± 15
16D11648	11.5 %	✓	0.0000730	0.0559026	0.0000000	0.0965	0.02405	61.4 ± 399.0	847.92	0.01	1 ± 2
16D11650	12.5 %	✓	0.0002235	0.0234000	0.0000000	0.0655	0.04923	185.2 ± 594.1	288.20	0.00	1 ± 8
16D11657	2.0 %	✓	0.0064148	0.1003586	0.0000000	9.7163	2.82417	71.6 ± 4.1	59.37	0.72	42 ± 67
16D11658	3.5 %	✓	0.0006711	0.1720887	0.0000000	25.3897	7.52872	73.1 ± 1.5	96.22	1.87	63 ± 60
16D11660	5.0 %	✓	0.0001041	0.0329462	0.0000000	14.9999	4.46739	73.4 ± 2.4	98.07	1.11	196 ± 914
16D11661	5.5 %	✓	0.0001520	0.0512994	0.0022087	8.9815	2.71840	74.6 ± 4.1	97.17	0.66	75 ± 239
16D11663	6.0 %	✓	0.0001499	0.0576500	0.0286003	15.9265	4.77069	73.8 ± 2.3	97.84	1.18	119 ± 325
16D11664	7.5 %	✓	0.0001562	0.0542717	0.0001887	19.1951	5.84107	75.0 ± 1.9	99.54	1.42	152 ± 450
16D11666	8.5 %	✓	0.0001643	0.0446135	0.0284814	5.4466	1.68474	76.2 ± 6.8	101.67	0.40	52 ± 184
16D11667	9.5 %	✓	0.0001158	0.0039046	0.0000000	2.2181	0.63523	70.6 ± 16.4	93.70	0.16	244 ± 10168
16D11669	10.5 %	✓	0.0002634	0.0470126	0.0210858	0.5698	0.29127	126.0 ± 66.0	135.09	0.04	5 ± 17

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Youngest Toba Tuff (South)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013626 ± 0.00000031*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11670	11.5 %	✓	0.0003500	0.0732143	0.0171043	0.0586	0.10279	432.6 ± 689.5	12056.51	0.00	0 ± 1
16D11672	12.5 %	✓	0.0001338	0.0885210	0.0000000	0.0179	0.00440	60.6 ± 2034.6	10.01	0.00	0 ± 0
16D11674	2.0 %	✓	0.0201681	0.1133311	0.0000000	5.6840	1.60954	69.8 ± 8.5	21.20	0.42	22 ± 29
16D11675	3.5 %	✓	0.0122173	0.2148604	0.0000000	24.5312	7.23087	72.6 ± 1.9	66.13	1.81	49 ± 36
16D11677	5.0 %	✓	0.0032876	0.1280734	0.0000000	33.2604	9.80110	72.6 ± 1.2	89.92	2.46	112 ± 133
16D11678	5.5 %	✓	0.0005417	0.1004245	0.0000000	13.8304	4.15165	74.0 ± 2.7	95.12	1.02	59 ± 93
16D11680	6.0 %	✓	0.0001516	0.0818146	0.0000000	7.6763	2.32958	74.8 ± 4.8	100.67	0.57	40 ± 77
16D11681	7.5 %	✓	0.0001422	0.0386009	0.0000000	3.4621	1.06250	75.6 ± 10.3	102.79	0.26	39 ± 159
16D11683	8.5 %	✓	0.0000494	0.1536669	0.0000000	0.3679	0.08245	55.2 ± 102.9	83.73	0.03	1 ± 1
16D11684	9.5 %	✓	0.0002475	0.0083511	0.0000000	0.2727	0.03507	31.7 ± 138.5	32.10	0.02	14 ± 270
16D11686	10.5 %	✓	0.0002184	0.0281161	0.0000000	0.1906	0.11574	149.6 ± 194.4	222.90	0.01	3 ± 16
16D11688	2.0 %		0.0157050	0.1498976	0.0000000	6.9128	2.37917	84.8 ± 6.1	33.76	0.51	20 ± 21
16D11689	3.5 %	✓	0.0142118	0.2906402	0.0000000	35.9618	10.73513	73.6 ± 1.2	71.22	2.65	53 ± 29
16D11691	5.0 %	✓	0.0037023	0.0933421	0.0000000	13.6713	3.94271	71.1 ± 2.5	77.48	1.01	63 ± 101
16D11692	5.5 %	✓	0.0014758	0.2254161	0.0000000	17.2777	5.26316	75.1 ± 2.0	91.29	1.28	33 ± 22
16D11694	6.0 %	✓	0.0049178	0.0860802	0.0000000	9.1140	2.57152	69.5 ± 3.8	63.34	0.67	46 ± 83
16D11695	7.5 %	✓	0.0023377	0.1936004	0.0000000	24.1388	7.22358	73.7 ± 1.4	90.22	1.78	54 ± 45
16D11697	8.5 %	✓	0.0078083	0.1243603	0.0000000	10.0679	2.97267	72.7 ± 3.7	55.89	0.74	35 ± 45
16D11698	9.5 %	✓	0.0003505	0.0980347	0.0002987	0.6523	0.15070	56.9 ± 48.3	58.69	0.05	3 ± 5
16D11700	10.5 %	✓	0.0001564	0.0262256	0.0000000	0.2007	0.02238	27.5 ± 168.8	32.27	0.01	3 ± 20
		Σ	0.3265230	9.6914121	0.9739356	1354.7231	408.49231				

Plateau Age = 74.1 ± 0.5 ka MSWD = 1.64 Total Fusion Age = 74.3 ± 0.5 ka Inverse Isochron Age = 74.3 ± 0.5 ka $^{40}Ar/^{36}Ar$ = 289.77 ± 4.71

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (North)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013364 ± 0.00000030*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11166	0.5 %	✓	0.0024397	0.0163924	0.0000000	0.42367	0.323089	184.3 ± 92.0	30.90	0.19	11 ± 97
16D11167	1.0 %	✓	0.0002529	0.0259906	0.0022621	1.22391	0.389277	76.9 ± 31.1	83.06	0.56	20 ± 108
16D11169	2.0 %	✓	0.0008449	0.1125825	0.0000000	5.05484	1.501013	71.8 ± 7.3	84.80	2.31	19 ± 26
16D11170	2.5 %	✓	0.0002253	0.0906123	0.0104740	6.14170	1.816703	71.5 ± 6.3	95.28	2.81	29 ± 46
16D11172	3.5 %	✓	0.0000713	0.0550101	0.0340544	12.20422	3.718283	73.6 ± 3.1	98.21	5.58	95 ± 258
16D11173	4.0 %	✓	0.0001015	0.0040968	0.0179612	3.87570	1.099292	68.5 ± 9.4	96.08	1.77	407 ± 14639
16D11175	5.0 %	✓	0.0000995	0.0474758	0.0000000	3.59009	1.157056	77.9 ± 10.0	101.37	1.64	33 ± 104
16D11176	6.0 %	✓	0.0002041	0.0580388	0.0001119	2.72955	0.946504	83.8 ± 13.9	105.56	1.25	20 ± 51
16D11178	7.5 %	✓	0.0001017	0.0368835	0.0054895	4.54839	1.416599	75.3 ± 7.8	100.90	2.08	53 ± 208
16D11179	9.0 %	✓	0.0001385	0.0511865	0.0121762	0.40408	0.165719	99.1 ± 85.2	131.18	0.18	3 ± 10
16D11181	0.5 %	✓	0.0010228	0.0204546	0.0000000	0.31367	0.000543	0.4 ± 112.7	0.18	0.14	7 ± 68
16D11182	1.0 %	✓	0.0002328	0.0554015	0.0063344	0.34109	0.054882	38.9 ± 98.3	43.91	0.16	3 ± 10
16D11184	2.0 %	✓	0.0009176	0.0812822	0.0073078	7.11269	2.145706	72.9 ± 4.8	87.79	3.25	38 ± 100
16D11185	2.5 %	✓	0.0000678	0.0769252	0.0025314	5.96627	1.894117	76.7 ± 5.6	97.79	2.73	33 ± 92
16D11187	3.5 %	✓	0.0000832	0.0733677	0.0082308	3.68917	1.202851	78.8 ± 9.3	100.88	1.69	22 ± 63
16D11188	4.0 %	✓	0.0005305	0.0277817	0.0109277	1.77448	0.735801	100.2 ± 19.0	125.60	0.81	27 ± 209
16D11190	5.0 %	✓	0.0000157	0.0528336	0.0072879	0.87647	0.273345	75.4 ± 39.4	100.47	0.40	7 ± 29
16D11191	6.0 %	✓	0.0000239	0.0062265	0.0100481	0.64504	0.216543	81.1 ± 52.8	102.18	0.29	45 ± 1485
16D11194	2.0 %	✓	0.0007535	0.0769241	0.0192721	8.93149	2.827207	76.5 ± 3.4	91.67	4.08	50 ± 82
16D11195	2.5 %	✓	0.0002921	0.0477565	0.0392419	1.69789	0.597286	85.0 ± 16.9	115.43	0.78	15 ± 43
16D11197	3.5 %		0.0005634	0.0157892	0.0049113	0.77034	0.108198	33.9 ± 39.5	38.97	0.35	21 ± 187
16D11198	4.0 %	✓	0.0003899	0.1276125	0.0224787	0.34817	0.003640	2.5 ± 84.5	3.03	0.16	1 ± 1
16D11200	2.0 %	✓	0.0006467	0.0603640	0.0000000	16.31053	4.982033	73.8 ± 1.8	95.16	7.45	116 ± 271
16D11201	2.5 %	✓	0.0001857	0.0280089	0.0000000	2.07456	0.511642	59.6 ± 14.0	89.07	0.95	32 ± 165
16D11203	3.5 %		0.0003826	0.0709741	0.0000000	1.28998	0.515331	96.5 ± 23.2	126.56	0.59	8 ± 14
16D11204	4.0 %	✓	0.0001807	0.0376184	0.0044420	0.66758	0.180846	65.5 ± 43.3	139.12	0.31	8 ± 29
16D11206	2.0 %	✓	0.0004048	0.0835226	0.0394877	1.74451	0.810146	112.2 ± 29.3	86.51	0.80	9 ± 16

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (North)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013364 ± 0.00000030*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11207	2.5 %	✓	0.0001724	0.0217706	0.0000000	1.46067	0.450082	74.5 ± 35.0	88.84	0.67	29 ± 191
16D11209	3.5 %	✓	0.0001850	0.1672420	0.0451177	12.57100	3.946122	75.9 ± 4.1	97.46	5.75	32 ± 28
16D11210	4.0 %	✓	0.0000512	0.0121779	0.0113994	5.51237	1.755390	77.0 ± 9.2	97.98	2.52	195 ± 2510
16D11212	5.0 %	✓	0.0001976	0.0081459	0.0117063	5.35038	1.724456	77.9 ± 9.6	102.25	2.45	282 ± 4932
16D11213	6.0 %	✓	0.0002091	0.1025586	0.0000000	4.60192	1.470244	77.2 ± 11.3	103.10	2.10	19 ± 27
16D11215	7.5 %	✓	0.0000574	0.0040971	0.0000000	8.06057	2.375139	71.2 ± 6.3	98.03	3.68	846 ± 29434
16D11216	9.0 %	✓	0.0001592	0.0282710	0.0000000	1.50911	0.431585	69.1 ± 33.5	89.10	0.69	23 ± 117
16D11338	2.0 %	✓	0.0007233	0.0213835	0.0000000	2.17096	0.796993	88.7 ± 12.9	78.21	0.99	44 ± 298
16D11339	2.5 %	✓	0.0001424	0.0022080	0.0000000	5.66814	1.775436	75.7 ± 4.8	96.53	2.59	1104 ± 75753
16D11341	3.5 %	✓	0.0001659	0.0694150	0.0000000	9.79795	2.942630	72.6 ± 2.8	97.14	4.48	61 ± 119
16D11342	4.0 %	✓	0.0001125	0.0684778	0.0000000	3.60774	1.039106	69.6 ± 7.7	95.67	1.65	23 ± 46
16D11344	5.0 %		0.0002509	0.0778594	0.0000000	0.96895	0.190848	47.6 ± 28.4	71.03	0.44	5 ± 10
16D11345	6.0 %	✓	0.0001859	0.0978246	0.0000000	0.76147	0.182231	57.8 ± 34.7	75.91	0.35	3 ± 5
16D11347	2.0 %	✓	0.0014353	0.0946202	0.0000000	9.40069	2.845057	73.1 ± 3.6	86.08	4.30	43 ± 65
16D11348	2.5 %	✓	0.0001105	0.0161982	0.0291364	4.45729	1.350935	73.2 ± 7.6	101.17	2.04	118 ± 1028
16D11350	3.5 %	✓	0.0000042	0.0459089	0.0168639	2.35741	0.691639	70.9 ± 13.9	98.89	1.08	22 ± 65
16D11351	4.0 %	✓	0.0000190	0.0181977	0.0244231	1.12574	0.324411	69.6 ± 30.1	97.03	0.51	27 ± 217
16D11353	5.0 %	✓	0.0003337	0.0718662	0.0094166	0.78022	0.308145	95.4 ± 44.0	145.00	0.36	5 ± 9
16D11355	2.0 %	✓	0.0018990	0.0216138	0.0049909	11.32572	3.482832	74.3 ± 2.7	85.21	5.18	225 ± 1499
16D11356	2.5 %	✓	0.0001382	0.0784410	0.0084408	1.91198	0.570798	72.1 ± 14.3	92.22	0.87	10 ± 19
16D11358	3.5 %	✓	0.0002053	0.0102208	0.0003074	0.57450	0.137725	57.9 ± 51.9	68.66	0.26	24 ± 344
16D11359	4.0 %	✓	0.0002278	0.1015319	0.0462601	0.26256	0.133972	123.3 ± 109.1	197.97	0.12	1 ± 2
16D11361	2.0 %	✓	0.0042026	0.0134927	0.0000000	10.72800	3.190882	71.9 ± 3.6	71.32	4.90	342 ± 3760
16D11362	2.5 %	✓	0.0001812	0.0653883	0.0000000	1.56659	0.585541	90.3 ± 22.4	108.84	0.72	10 ± 23
16D11364	3.5 %	✓	0.0001898	0.0148503	0.0120677	0.69617	0.293762	102.0 ± 50.5	122.22	0.32	20 ± 184
16D11366	2.0 %	✓	0.0024448	0.0607814	0.0134642	12.40296	3.731043	72.7 ± 2.9	82.90	5.67	88 ± 207
16D11367	2.5 %	✓	0.0002594	0.0502953	0.0347176	2.42410	0.599461	59.8 ± 14.0	87.47	1.11	21 ± 59

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (North)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013364 ± 0.00000030*		*FCT-NM = 28.01 ± 0.023 Ma*						
16D11369	3.5 %	✓	0.0002866	0.0174925	0.0432747	1.39469	0.493210	85.5 ± 24.0	119.18	0.64	34 ± 294
16D11370	4.0 %	✓	0.0000631	0.0164963	0.0103985	0.59862	0.188637	76.1 ± 59.2	90.01	0.27	16 ± 142
		Σ	0.0182006	0.6251829	0.5870162	218.79855	67.601960				
Plateau Age = 73.9 ± 0.1 ka		MSWD = 1.28	Total Fusion Age = 74.7 ± 1.3 ka		Inverse Isochron Age = 73.4 ± 1.2 ka			$^{40}Ar/^{36}Ar$ = 321.72 ± 35.77			
Samosir (Tuk Tuk)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013654 ± 0.00000032*		*FCT-NM = 28.01 ± 0.023 Ma*						
16D11372	1.0 %	✓	0.0226521	0.019445	0.0000000	4.8073	1.5830	81.3 ± 9.7	19.08	0.12	106 ± 787
16D11373	2.5 %	✓	0.0187696	0.418839	0.0274543	71.2059	21.3395	74.0 ± 0.6	78.57	1.84	73 ± 27
16D11375	4.0 %	✓	0.0129908	0.674514	0.0000000	100.1780	30.2928	74.7 ± 0.4	87.77	2.59	64 ± 14
16D11376	5.0 %	✓	0.0020525	0.406282	0.0069366	46.9329	14.0896	74.1 ± 0.7	94.72	1.21	50 ± 18
16D11378	6.5 %	✓	0.0007564	0.250488	0.0000000	44.8537	13.6381	75.1 ± 0.7	97.19	1.16	77 ± 46
16D11379	7.5 %	✓	0.0009050	0.311071	0.0000000	58.5528	17.7426	74.8 ± 0.6	97.31	1.51	81 ± 37
16D11381	8.5 %	✓	0.0022070	0.382606	0.0072653	45.8390	13.9032	74.9 ± 0.7	94.38	1.19	52 ± 19
16D11382	9.5 %	✓	0.0008146	0.158292	0.0210190	16.5765	4.9554	73.8 ± 1.9	94.22	0.43	45 ± 41
16D11384	10.5 %	✓	0.0017075	0.071466	0.0075238	8.0299	2.4212	74.4 ± 3.9	81.89	0.21	48 ± 103
16D11385	11.5 %	✓	0.0005593	0.080663	0.0336579	2.2216	0.6056	67.3 ± 14.0	77.70	0.06	12 ± 21
16D11387	12.5 %	✓	0.0002049	0.051487	0.0000000	1.4765	0.4701	78.6 ± 21.0	87.66	0.04	12 ± 35
16D11394	1.0 %	✓	0.0181044	0.143850	0.0262167	5.0811	1.3452	65.4 ± 8.3	20.03	0.13	15 ± 15
16D11395	2.5 %	✓	0.0250533	0.645329	0.0410945	95.6007	28.0930	72.6 ± 0.5	78.34	2.47	64 ± 15
16D11397	4.0 %	✓	0.0016780	0.266864	0.0099003	44.2308	13.1704	73.5 ± 0.7	95.19	1.14	71 ± 39
16D11398	4.5 %	✓	0.0013938	0.176315	0.0007608	26.3111	7.7692	72.9 ± 1.1	93.81	0.68	64 ± 54
16D11400	5.0 %	✓	0.0002277	0.085258	0.0012948	13.8540	4.1645	74.2 ± 2.2	97.19	0.36	70 ± 118
16D11401	6.5 %		0.0014018	0.239890	0.0000000	37.5074	11.2754	74.2 ± 0.8	95.29	0.97	67 ± 41

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (Tuk Tuk)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013654 ± 0.00000032*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11403	7.5 %	✓	0.0034095	0.161972	0.0083359	28.9645	8.6007	73.3 ± 1.1	88.49	0.75	77 ± 70
16D11404	8.5 %	✓	0.0051230	0.336362	0.0098501	54.1879	15.9577	72.7 ± 0.7	90.27	1.40	69 ± 30
16D11406	9.5 %	✓	0.0025214	0.348082	0.0197187	56.8951	16.8541	73.1 ± 0.7	94.60	1.47	70 ± 29
16D11407	10.5 %	✓	0.0003988	0.038453	0.0000000	4.6096	1.2879	69.0 ± 6.6	90.48	0.12	52 ± 191
16D11409	11.5 %		0.0007083	0.024038	0.0000000	4.4206	1.1580	64.7 ± 6.6	83.66	0.11	79 ± 479
16D11410	12.5 %	✓	0.0012826	0.210711	0.0000000	0.8960	0.2053	56.6 ± 31.3	34.94	0.02	2 ± 1
16D11443	1.0 %	✓	0.0126226	0.021329	0.0097078	1.7463	0.7061	99.8 ± 29.7	15.89	0.05	35 ± 239
16D11444	2.5 %	✓	0.0067578	0.091138	0.0186781	15.6031	4.7263	74.8 ± 2.8	69.68	0.40	74 ± 118
16D11446	4.0 %	✓	0.0054592	0.524302	0.0089762	86.3067	26.1763	74.9 ± 0.5	93.09	2.23	71 ± 20
16D11447	4.5 %	✓	0.0011662	0.415220	0.0000000	57.0041	17.4236	75.5 ± 0.7	96.87	1.47	59 ± 20
16D11449	5.0 %	✓	0.0006752	0.243593	0.0000000	44.5914	13.6307	75.5 ± 0.9	97.36	1.15	79 ± 46
16D11450	6.5 %	✓	0.0005698	0.280030	0.0000000	35.1657	10.7101	75.2 ± 1.1	97.25	0.91	54 ± 28
16D11452	7.5 %	✓	0.0002477	0.229944	0.0000000	41.5637	12.7591	75.8 ± 1.0	98.21	1.08	78 ± 46
16D11453	8.5 %		0.0010918	0.265645	0.0000000	34.7280	10.2815	73.1 ± 1.1	95.76	0.90	56 ± 32
16D11455	9.5 %	✓	0.0009101	0.168278	0.0000000	30.8720	9.3965	75.1 ± 1.3	96.04	0.80	79 ± 70
16D11456	10.5 %	✓	0.0017374	0.210666	0.0557100	40.1754	12.1762	74.8 ± 1.0	94.81	1.04	82 ± 57
16D11458	11.5 %	✓	0.0005128	0.339953	0.0041182	53.8426	16.3625	75.0 ± 0.7	97.86	1.39	68 ± 32
16D11459	12.5 %	✓	0.0005967	0.175800	0.0228819	14.6055	4.2252	71.4 ± 2.7	94.79	0.38	36 ± 30
16D11461	1.0 %	✓	0.0059453	0.117329	0.0000000	1.6063	0.6005	92.3 ± 22.6	25.41	0.04	6 ± 7
16D11462	2.5 %	✓	0.0016931	0.162100	0.0000000	9.8263	2.8724	72.2 ± 3.8	84.23	0.25	26 ± 23
16D11464	4.0 %	✓	0.0037556	0.554494	0.0000000	83.8156	24.8862	73.3 ± 0.4	94.57	2.17	65 ± 17
16D11465	4.5 %	✓	0.0042051	0.278882	0.0000000	35.9051	10.8041	74.3 ± 1.0	88.67	0.93	55 ± 30
16D11467	5.0 %		0.0002649	0.187792	0.0100201	23.5091	7.1766	75.4 ± 1.4	99.84	0.61	54 ± 42
16D11468	6.5 %	✓	0.0000789	0.368935	0.0000000	48.2205	14.5072	74.3 ± 0.7	98.59	1.25	56 ± 23
16D11470	7.5 %	✓	0.0001657	0.214388	0.0000000	48.8236	14.6673	74.2 ± 0.7	98.42	1.26	98 ± 67
16D11471	8.5 %	✓	0.0002104	0.266470	0.0000000	40.5022	12.1384	74.0 ± 0.8	98.24	1.05	65 ± 36
16D11473	9.5 %	✓	0.0003054	0.225223	0.0000000	39.2639	11.7453	73.9 ± 0.8	97.99	1.02	75 ± 50

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (Tuk Tuk)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013654 ± 0.00000032*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11474	10.5 %		0.0004034	0.017202	0.0000000	8.3030	2.3508	69.9 ± 3.8	93.97	0.21	208 ± 1792
16D11476	11.5 %		0.0006058	0.098323	0.0028049	3.0310	0.7700	62.7 ± 10.3	80.16	0.08	13 ± 19
16D11477	12.5 %		0.0010324	0.004520	0.0000000	4.6016	1.1106	59.6 ± 7.1	77.49	0.12	438 ± 14340
16D11479	1.0 %	✓	0.0238737	0.054847	0.0000000	1.1854	0.4094	85.3 ± 59.6	5.48	0.03	9 ± 26
16D11480	2.5 %	✓	0.0067653	0.024606	0.0193728	10.3509	3.0384	72.5 ± 5.6	59.85	0.27	181 ± 1063
16D11482	4.0 %	✓	0.0133235	0.587505	0.0124624	78.9641	23.6496	73.9 ± 0.8	84.80	2.04	58 ± 14
16D11483	4.5 %	✓	0.0021773	0.320122	0.0297130	49.8898	15.0197	74.3 ± 1.2	94.74	1.29	67 ± 33
16D11485	5.0 %	✓	0.0007021	0.268573	0.0144734	51.7239	15.7655	75.3 ± 1.1	97.49	1.34	83 ± 46
16D11486	6.5 %	✓	0.0014484	0.482230	0.0000000	73.4062	22.3974	75.3 ± 0.8	96.93	1.90	65 ± 19
16D11488	7.5 %	✓	0.0017141	0.343474	0.0000360	59.2575	17.8697	74.5 ± 1.0	96.06	1.53	74 ± 33
16D11489	8.5 %	✓	0.0016342	0.333596	0.0433146	55.3021	16.6867	74.5 ± 1.0	96.01	1.43	71 ± 30
16D11491	9.5 %	✓	0.0011870	0.306959	0.0000000	57.0118	17.0880	74.0 ± 1.0	96.78	1.47	80 ± 38
16D11492	10.5 %	✓	0.0003161	0.030214	0.0429115	6.5954	1.8608	69.7 ± 8.3	94.01	0.17	94 ± 496
16D11494	11.5 %	✓	0.0006871	0.053942	0.0000000	16.7658	5.0456	74.3 ± 3.3	94.97	0.43	134 ± 354
16D11495	12.5 %		0.0020579	0.200542	0.0000000	1.9990	1.3527	167.1 ± 49.4	179.83	0.05	4 ± 3
16D11502	1.0 %	✓	0.0240116	0.093114	0.0060797	2.3454	0.5999	63.2 ± 23.2	7.79	0.06	11 ± 17
16D11503	2.5 %	✓	0.0234930	0.269590	0.0298306	25.6861	7.6233	73.3 ± 2.2	51.99	0.66	41 ± 22
16D11505	4.0 %	✓	0.0090711	0.282022	0.0511201	60.6996	18.4274	75.0 ± 0.8	86.35	1.57	93 ± 49
16D11506	4.5 %	✓	0.0020256	0.117758	0.0036905	18.3410	5.4682	73.6 ± 2.3	89.10	0.47	67 ± 87
16D11508	5.0 %	✓	0.0021053	0.175417	0.0059262	22.4708	6.9265	76.1 ± 1.9	90.73	0.58	55 ± 46
16D11509	6.5 %	✓	0.0010668	0.145070	0.0000000	25.3798	7.7366	75.3 ± 1.6	94.94	0.66	75 ± 73
16D11511	7.5 %	✓	0.0005187	0.117501	0.0089016	23.5708	7.2609	76.1 ± 1.8	96.76	0.61	86 ± 116
16D11512	8.5 %	✓	0.0004455	0.159727	0.0106229	34.3790	10.5551	75.8 ± 1.2	97.57	0.89	93 ± 89
16D11514	9.5 %	✓	0.0005114	0.266037	0.0024795	30.7669	9.3132	74.7 ± 1.3	97.20	0.80	50 ± 28
16D11515	10.5 %	✓	0.0005654	0.090565	0.0094428	15.0734	4.5376	74.3 ± 2.7	95.28	0.39	72 ± 120
16D11517	11.5 %	✓	0.0001971	0.162312	0.0000000	16.2749	4.8982	74.3 ± 2.5	97.60	0.42	43 ± 41
16D11518	12.5 %	✓	0.0001166	0.044071	0.0000000	7.5960	2.2407	72.8 ± 5.4	97.24	0.20	74 ± 237

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (Tuk Tuk)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013654 ± 0.00000032*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11520	14.0 %	✓	0.0000159	0.059684	0.0000000	2.5406	0.7203	70.0 ± 16.2	99.31	0.07	18 ± 50
16D11522	1.0 %		0.1157230	0.012838	0.0242346	4.8139	2.5612	131.4 ± 21.3	6.96	0.12	161 ± 1927
16D11523	2.5 %	✓	0.0122077	0.600548	0.0173605	86.3843	25.8847	74.0 ± 0.6	86.80	2.23	62 ± 16
16D11525	4.0 %	✓	0.0012210	0.271809	0.0000000	33.4679	10.0782	74.3 ± 1.4	95.37	0.87	53 ± 30
16D11526	4.5 %	✓	0.0008253	0.251544	0.0118838	39.7660	12.0195	74.6 ± 1.1	96.81	1.03	68 ± 40
16D11528	5.0 %	✓	0.0003127	0.159774	0.0142229	18.8073	5.7703	75.7 ± 2.4	97.23	0.49	51 ± 51
16D11529	6.5 %	✓	0.0005163	0.239974	0.0165143	32.3697	9.9047	75.5 ± 1.4	97.29	0.84	58 ± 35
16D11531	7.5 %	✓	0.0004973	0.266132	0.0000000	31.7079	9.6103	74.8 ± 1.5	97.29	0.82	51 ± 30
16D11532	8.5 %	✓	0.0003172	0.166901	0.0000000	37.5452	11.4306	75.2 ± 1.2	97.97	0.97	97 ± 86
16D11534	9.5 %	✓	0.0003222	0.195798	0.0014912	29.0324	8.8110	74.9 ± 1.5	97.71	0.75	64 ± 48
16D11535	10.5 %	✓	0.0001629	0.036890	0.0000000	3.5426	1.0767	75.0 ± 12.9	103.32	0.09	41 ± 181
16D11537	11.5 %	✓	0.0001345	0.065836	0.0241912	2.3664	0.5945	62.0 ± 18.7	92.42	0.06	15 ± 36
16D11538	12.5 %	✓	0.0000586	0.026091	0.0000000	0.1868	0.0594	78.5 ± 245.9	76.70	0.00	3 ± 17
16D11552	1.0 %	✓	0.0341187	0.118950	0.0080511	3.9928	0.9814	60.7 ± 14.1	8.86	0.10	14 ± 18
16D11553	2.5 %		0.0165390	0.482903	0.0037884	28.3035	8.1428	71.0 ± 1.6	61.98	0.73	25 ± 8
16D11555	4.0 %	✓	0.0205927	0.913778	0.0000000	109.2702	32.3428	73.1 ± 0.5	83.26	2.83	51 ± 8
16D11556	4.5 %	✓	0.0016313	0.324826	0.0000000	49.7658	14.8066	73.5 ± 0.7	95.66	1.29	66 ± 31
16D11558	5.0 %	✓	0.0002254	0.080640	0.0000000	23.5699	7.1262	74.6 ± 1.4	99.67	0.61	126 ± 226
16D11559	6.5 %	✓	0.0008298	0.247999	0.0000000	30.5981	9.0871	73.3 ± 1.1	96.17	0.79	53 ± 32
16D11561	7.5 %		0.0032215	0.182995	0.0144255	19.1513	5.3377	68.8 ± 1.7	83.89	0.50	45 ± 38
16D11562	8.5 %	✓	0.0017269	0.161581	0.0000000	34.8743	10.2950	72.9 ± 1.0	94.12	0.90	93 ± 86
16D11564	9.5 %	✓	0.0019280	0.153606	0.0138632	32.6573	9.7036	73.4 ± 1.1	93.32	0.84	91 ± 83
16D11565	10.5 %	✓	0.0012823	0.115717	0.0059325	19.0649	5.5702	72.1 ± 1.8	92.50	0.49	71 ± 94
16D11567	11.5 %	✓	0.0001477	0.017471	0.0000000	4.2087	1.2269	72.0 ± 7.7	95.36	0.11	104 ± 866
16D11568	12.5 %	✓	0.0010052	0.000378	0.0000000	11.6019	3.3226	70.7 ± 2.8	90.68	0.30	13214 ± 5314396
16D11570	1.0 %	✓	0.0209531	0.070809	0.0000000	4.9187	1.5755	79.1 ± 8.8	20.23	0.13	30 ± 65
16D11571	2.5 %		0.0124433	0.274350	0.0000000	38.8711	11.2861	71.7 ± 1.0	74.68	1.01	61 ± 36

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Samosir (Tuk Tuk)											
	Sanidine	*Irradiation 16-OSU-02*	*J = 0.00013654 ± 0.00000032*			*FCT-NM = 28.01 ± 0.023 Ma*					
16D11573	4.0 %		0.0056834	0.679128	0.0205161	92.8002	27.7956	74.0 ± 0.4	93.18	2.40	59 ± 14
16D11574	4.5 %	✓	0.0007160	0.340230	0.0000000	51.0004	15.4767	74.9 ± 0.7	97.44	1.32	64 ± 29
16D11576	5.0 %	✓	0.0056773	0.288428	0.0211777	45.4318	13.6253	74.0 ± 0.8	88.04	1.18	68 ± 37
16D11577	6.5 %	✓	0.0011756	0.302796	0.0246668	46.2566	14.0566	75.0 ± 0.8	96.40	1.20	66 ± 33
16D11579	7.5 %	✓	0.0013866	0.183972	0.0259767	34.6635	10.4508	74.4 ± 0.9	95.07	0.90	81 ± 70
16D11580	8.5 %	✓	0.0023352	0.504157	0.0204490	70.0173	21.0146	74.1 ± 0.5	95.64	1.81	60 ± 19
16D11582	9.5 %		0.0005649	0.113980	0.0061160	21.3655	6.2894	72.7 ± 1.4	96.20	0.55	81 ± 115
16D11583	10.5 %		0.0001804	0.106569	0.0051792	11.6938	3.4789	73.5 ± 3.1	97.26	0.30	47 ± 69
16D11585	11.5 %		0.0003032	0.097529	0.0025725	4.2409	1.1717	68.2 ± 7.2	91.72	0.11	19 ± 30
16D11586	12.5 %		0.0001271	0.019049	0.0001794	2.5301	0.7129	69.6 ± 12.4	93.78	0.07	57 ± 447
16D11588	1.0 %	✓	0.0127958	0.025089	0.0000000	1.2434	0.3983	79.1 ± 35.4	9.52	0.03	21 ± 133
16D11589	2.5 %	✓	0.0056748	0.216659	0.0000000	7.9768	2.3252	72.0 ± 4.8	57.66	0.21	16 ± 11
16D11591	4.0 %	✓	0.0056300	0.233897	0.0000000	74.7430	22.6407	74.8 ± 0.5	92.07	1.93	137 ± 90
16D11592	4.5 %	✓	0.0006245	0.175752	0.0138808	43.6526	13.2275	74.8 ± 0.8	97.41	1.13	107 ± 94
16D11594	5.0 %	✓	0.0006457	0.252103	0.0000000	61.3525	18.6691	75.1 ± 0.6	97.77	1.59	105 ± 60
16D11595	6.5 %	✓	0.0003036	0.291203	0.0269498	51.9798	15.8324	75.2 ± 0.7	98.21	1.34	77 ± 39
16D11597	7.5 %	✓	0.0007078	0.302093	0.0000000	45.8686	13.8967	74.8 ± 0.8	97.31	1.19	65 ± 32
16D11598	8.5 %	✓	0.0001514	0.424244	0.0025487	56.2280	17.2008	75.5 ± 0.7	98.51	1.45	57 ± 20
16D11600	9.5 %	✓	0.0003908	0.467295	0.0004097	46.1375	14.0812	75.4 ± 0.8	97.97	1.19	42 ± 14
16D11601	10.5 %	✓	0.0001820	0.289971	0.0458276	28.4614	8.7263	75.7 ± 1.2	98.17	0.74	42 ± 22
16D11603	11.5 %	✓	0.0000333	0.189856	0.0383727	5.4649	1.7062	77.1 ± 6.3	98.23	0.14	12 ± 10
16D11604	12.5 %	✓	0.0002409	0.651833	0.0669625	7.5829	2.2375	72.9 ± 4.4	95.72	0.20	5 ± 1
		Σ	0.5849864	24.856562	1.1220476	3865.9520	1163.2373				

Plateau Age = 74.3 ± 0.4 ka MSWD = 3.62 Total Fusion Age = 74.3 ± 0.4 ka Inverse Isochron Age = 74.4 ± 0.4 ka $^{40}Ar/^{36}Ar$ = 289.95 ± 4.98

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Pardepur (North)											
	Plagioclase	*Irradiation 16-OSU-02/17-OSU-04*		*J = 0.00013981 ± 0.00000025*			*FCT-NM = 28.01 ± 0.023 Ma*				
17D18321	0.4 %		0.0067480	0.048732	0.0000000	0.13673	0.5017006	927.4 ± 993.1	33.63	0.09	1.21 ± 3.66
17D18323	0.7 %		0.0091616	0.025723	0.0000000	0.08768	0.3505014	1010.3 ± 1576.5	14.87	0.06	1.47 ± 7.87
17D18324	1.7 %		0.0994108	0.061681	0.0000000	0.20147	2.3935141	3006.0 ± 1194.8	8.87	0.13	1.40 ± 3.36
17D18326	3.0 %		0.1923659	0.155149	0.0000000	1.29456	1.8493261	361.2 ± 196.9	3.36	0.82	3.59 ± 3.45
17D18327	4.0 %		0.1048195	0.127425	0.0000000	1.02969	2.2145517	543.8 ± 207.1	7.70	0.65	3.47 ± 3.97
17D18329	5.0 %	✓	0.1218061	0.380450	0.0000000	2.13926	0.5457654	64.5 ± 74.7	1.54	1.36	2.42 ± 0.92
17D18330	6.0 %	✓	0.1101621	0.471183	0.0000000	3.08007	0.5961388	48.9 ± 49.7	1.86	1.95	2.81 ± 0.90
17D18332	7.0 %	✓	0.1163213	0.811896	0.0000000	3.21294	0.0456993	3.6 ± 49.0	0.13	2.04	1.70 ± 0.31
17D18333	8.0 %	✓	0.1053537	0.661978	0.0197252	2.79416	0.5597573	50.6 ± 54.3	1.83	1.77	1.81 ± 0.39
17D18335	9.0 %	✓	0.0737137	0.499864	0.0000000	1.84248	0.8174594	112.2 ± 77.2	3.90	1.17	1.58 ± 0.43
17D18336	10.0 %	✓	0.3182662	1.020305	0.0117324	4.22534	0.4670543	27.9 ± 52.0	0.49	2.68	1.78 ± 0.25
17D18338	11.0 %	✓	0.1883693	1.317870	0.0032370	6.51404	0.1881987	7.3 ± 27.0	0.34	4.13	2.13 ± 0.24
17D18339	12.0 %	✓	0.0391282	0.448933	0.0168725	1.56690	0.1257868	20.3 ± 87.7	1.10	0.99	1.50 ± 0.49
17D18341	13.0 %	✓	0.0333693	0.546115	0.0000000	2.01062	0.1706738	21.5 ± 67.0	1.70	1.28	1.58 ± 0.44
17D18342	14.0 %	✓	0.0435211	0.769949	0.0165255	2.88240	0.2184364	19.2 ± 47.9	1.73	1.83	1.61 ± 0.31
17D18344	15.0 %	✓	0.0791748	0.699488	0.0073134	2.71158	0.7529810	70.2 ± 54.8	3.32	1.72	1.67 ± 0.36
17D18345	16.0 %	✓	0.0264980	0.275534	0.0009689	1.22496	0.2975752	61.4 ± 111.3	3.95	0.78	1.91 ± 1.04
17D18347	17.0 %	✓	0.0361081	0.473349	0.0000000	1.40087	0.0749125	13.5 ± 96.8	0.71	0.89	1.27 ± 0.39
17D18348	18.0 %	✓	0.0192774	0.273798	0.0029961	0.56462	0.2379692	106.6 ± 233.0	4.36	0.36	0.89 ± 0.49
17D18391	21.0 %		0.1712140	10.233272	2.3482774	0.22078	3.5001060	4003.6 ± 1155.7	7.43	0.14	0.01 ± 0.00
17D18423	0.5 %		0.0017223	0.030537	0.0240742	0.03189	0.1678454	1331.2 ± 2568.8	49.19	0.02	0.45 ± 2.27
17D18425	0.7 %		0.0031548	0.019889	0.0000000	0.05557	0.1296579	590.0 ± 1195.8	16.15	0.04	1.20 ± 9.01
17D18426	1.7 %		0.1409471	0.119274	0.0191103	0.62914	1.0457007	420.3 ± 261.3	2.58	0.40	2.27 ± 3.01
17D18429	3.0 %		0.0335690	0.436440	0.0307276	1.47550	0.1155100	19.8 ± 53.1	1.18	0.94	1.45 ± 0.51
17D18430	4.0 %		0.0238785	0.403305	0.0088588	1.87421	0.4080914	55.0 ± 36.2	5.46	1.19	2.00 ± 0.77
17D18432	5.0 %		0.0790602	1.084945	0.0188507	4.73621	1.1470987	61.2 ± 20.0	4.68	3.01	1.88 ± 0.27
17D18433	6.0 %	✓	0.0575415	1.082176	0.0000000	4.73444	0.6580105	35.1 ± 17.7	3.72	3.00	1.88 ± 0.26

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Pardepur (North)											
	Plagioclase	*Irradiation 16-OSU-02/17-OSU-04*	*J = 0.00013981 ± 0.00000025*		*FCT-NM = 28.01 ± 0.023 Ma*						
17D18435	7.0 %	✓	0.1304322	2.067666	0.0193615	8.07354	0.7351460	23.0 ± 13.2	1.87	5.12	1.68 ± 0.12
17D18436	8.0 %	✓	0.1339989	2.196220	0.0278469	8.75387	0.5663832	16.4 ± 12.6	1.41	5.55	1.71 ± 0.12
17D18438	9.0 %	✓	0.1335758	2.187981	0.0163414	7.60084	0.9145749	30.4 ± 15.7	2.26	4.82	1.49 ± 0.10
17D18439	10.0 %	✓	0.0910462	2.165411	0.0126517	6.86801	0.4007202	14.8 ± 14.8	1.47	4.36	1.36 ± 0.09
17D18441	11.0 %	✓	0.1208089	2.465685	0.0305852	7.82319	0.5154180	16.7 ± 14.1	1.42	4.96	1.36 ± 0.08
17D18442	12.0 %	✓	0.1107989	2.453534	0.0165143	7.09038	0.3719546	13.3 ± 15.5	1.12	4.50	1.24 ± 0.08
17D18444	13.0 %		0.1592957	3.089414	0.0197821	9.33117	0.0158342	0.4 ± 12.9	0.03	5.92	1.30 ± 0.07
17D18445	14.0 %		0.0814711	2.378648	0.0136216	4.96413	0.2920242	14.9 ± 21.6	1.20	3.15	0.90 ± 0.06
17D18447	15.0 %		0.1057066	2.479339	0.0164392	6.13521	0.0789573	3.3 ± 18.8	0.25	3.89	1.06 ± 0.06
17D18448	16.0 %		0.1593178	2.515857	0.0368161	7.04728	0.8686220	31.2 ± 17.8	1.88	4.47	1.20 ± 0.07
17D18450	17.0 %		0.1222349	1.980921	0.0262992	5.09692	0.4627712	23.0 ± 22.6	1.30	3.23	1.11 ± 0.09
17D18451	18.0 %		0.1510917	2.647456	0.0092443	8.39976	0.2812374	8.5 ± 14.2	0.63	5.33	1.36 ± 0.08
17D18453	19.0 %		0.1204005	2.345661	0.0000000	6.30424	0.0703229	2.8 ± 18.6	0.20	4.00	1.16 ± 0.08
17D18454	20.0 %		0.0667621	1.713435	0.0000000	3.36787	0.2437706	18.3 ± 24.7	1.25	2.14	0.85 ± 0.07
17D18456	21.0 %		0.0223460	1.020573	0.0000000	1.18801	0.4202945	89.4 ± 57.5	5.98	0.75	0.50 ± 0.08
17D18457	22.0 %		0.0119129	0.693685	0.0000000	0.52882	0.5325465	254.6 ± 117.0	13.13	0.34	0.33 ± 0.07
16D11540	0.5 %	✓	0.0012098	0.037294	0.0014840	0.40080	0.1492322	94.1 ± 98.7	29.36	0.25	4.62 ± 18.62
16D11541	1.0 %	✓	0.0004172	0.116344	0.0000000	0.02800	0.0679262	613.4 ± 1816.1	122.46	0.02	0.10 ± 0.23
16D11543	5.0 %		0.0006751	0.157023	0.0000000	0.27201	0.0883957	82.2 ± 110.1	78.84	0.17	0.74 ± 0.76
16D11544	10.0 %	✓	0.0007468	0.102621	0.0023607	0.12967	0.0878134	171.2 ± 248.5	65.86	0.08	0.54 ± 0.84
16D11546	16.0 %	✓	0.0300507	0.276399	0.0000000	2.22073	0.6117834	69.6 ± 23.4	6.44	1.41	3.45 ± 1.79
16D11548	16.0 %	✓	0.0037752	0.320547	0.0186296	2.43963	0.4921205	51.0 ± 14.3	30.44	1.55	3.27 ± 1.51
16D11550	16.0 %	✓	0.0005947	0.277614	0.0000000	1.74678	0.4009852	58.0 ± 19.2	68.76	1.11	2.71 ± 1.61
		Σ	3.9933325	57.700018	2.7972479	157.59857	8.9885746				

Plateau Age = 23.6 ± 9.8 ka MSWD = 4.48 Total Fusion Age = -14.4 ± 5.7 ka Inverse Isochron Age = 47.9 ± 11.1 ka $^{40}Ar/^{36}Ar$ = 289.00 ± 3.14

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Pardepur (South)											
	Plagioclase	*Irradiation 16-OSU-02/17-OSU-04*	*J = 0.00013964 ± 0.00000026*		*FCT-NM = 28.01 ± 0.023 Ma*						
17D18353	0.4 %		0.561005	0.01128	0.0000000	0.10575	1.986416	4749.7 ± 4213.0	1.21	0.02	4.03 ± 50.05
17D18355	1.0 %		1.638316	0.04645	0.0000000	0.30183	6.294863	5274.1 ± 2700.4	1.32	0.07	2.79 ± 9.55
17D18356	2.0 %		4.105769	0.36250	0.0000054	1.45075	15.331733	2670.6 ± 1166.1	1.28	0.31	1.72 ± 0.72
17D18358	3.0 %		5.679624	1.30459	0.0144646	3.69774	15.516795	1060.0 ± 618.4	0.93	0.80	1.22 ± 0.13
17D18359	4.0 %		6.339380	2.58042	0.0335181	6.64388	17.483954	664.6 ± 380.2	0.94	1.44	1.11 ± 0.06
17D18361	5.0 %		6.663391	4.80334	0.0517639	11.09059	15.641023	356.2 ± 240.2	0.80	2.40	0.99 ± 0.03
17D18362	6.0 %		5.013379	7.05524	0.0488487	15.26557	7.991804	132.2 ± 132.6	0.54	3.31	0.93 ± 0.02
17D18364	7.0 %		5.616381	9.18760	0.0330407	17.80288	12.316585	174.7 ± 126.3	0.75	3.86	0.83 ± 0.01
17D18365	8.0 %	✓	5.188119	11.99744	0.0387021	23.61073	2.839084	30.4 ± 88.6	0.19	5.11	0.85 ± 0.01
17D18367	9.0 %	✓	4.905681	12.19887	0.0832267	25.00681	3.404525	34.4 ± 79.0	0.24	5.42	0.88 ± 0.01
17D18368	10.0 %	✓	6.592085	13.68965	0.0891054	30.55836	0.189558	1.6 ± 86.6	0.01	6.62	0.96 ± 0.01
17D18370	11.0 %	✓	4.176882	13.40330	0.0568529	30.59491	3.815994	31.5 ± 55.1	0.31	6.63	0.98 ± 0.01
17D18371	12.0 %	✓	3.903303	12.85023	0.0587106	28.01488	0.621745	5.6 ± 57.3	0.05	6.07	0.94 ± 0.01
17D18373	13.0 %	✓	5.513009	14.20442	0.0604213	31.36706	7.237357	58.3 ± 70.6	0.44	6.79	0.95 ± 0.01
17D18374	14.0 %	✓	5.755102	14.15083	0.0576725	28.24674	13.335019	119.2 ± 81.9	0.78	6.12	0.86 ± 0.01
17D18376	15.0 %		4.936409	15.04961	0.0398626	29.54810	22.615569	193.3 ± 67.3	1.53	6.40	0.84 ± 0.01
17D18377	16.0 %		2.883639	13.48881	0.0613820	24.29631	19.176926	199.3 ± 49.6	2.20	5.26	0.77 ± 0.01
17D18379	17.0 %		1.980848	15.14231	0.0492342	26.55234	14.631825	139.1 ± 32.0	2.44	5.75	0.75 ± 0.01
17D18380	18.0 %		1.564265	13.52201	0.0186698	22.64527	8.567315	95.5 ± 29.8	1.82	4.90	0.72 ± 0.01
17D18382	19.0 %		0.781517	13.06575	0.0373105	20.30073	7.377272	91.8 ± 19.0	3.09	4.40	0.67 ± 0.01
17D18383	20.0 %		0.706794	11.89149	0.0241862	17.91168	4.545248	64.1 ± 19.5	2.13	3.88	0.65 ± 0.01
17D18385	21.0 %		0.512428	10.37146	0.0265564	16.87463	3.561608	53.3 ± 16.7	2.30	3.65	0.70 ± 0.01
17D18386	21.0 %		0.457280	6.90644	0.0000000	9.95424	3.789032	96.1 ± 24.9	2.73	2.16	0.62 ± 0.01
17D18388	21.0 %	✓	0.309856	4.71457	0.0000000	4.30131	0.698449	41.0 ± 47.0	0.76	0.93	0.39 ± 0.01
17D18389	21.0 %	✓	0.248419	3.67580	0.0000000	3.20348	0.537739	42.4 ± 57.7	0.73	0.69	0.37 ± 0.02
17D18391	21.0 %	✓	0.208056	2.86518	0.0046684	1.58363	0.203897	32.5 ± 104.3	0.33	0.34	0.24 ± 0.02
16D11803	0.5 %	✓	0.020492	0.09148	0.0000000	0.11165	0.004755	10.8 ± 471.7	0.08	0.02	0.52 ± 0.91

Run #	% Laser Power	Steps Used in Age	36Ar(a) [fA]	37Ar(ca) [fA]	38Ar(cl) [fA]	39Ar(k) [fA]	40Ar(r) [fA]	Age ± 2s (ka)	40Ar(r) (%)	39Ar(k) (%)	K/Ca ± 2s
Pardepur (South)											
	Plagioclase	*Irradiation 16-OSU-02/17-OSU-04*	*J = 0.00013964 ± 0.00000026*		*FCT-NM = 28.01 ± 0.023 Ma*						
16D11804	1.0 %	✓	0.000234	0.28947	0.0045672	0.20115	0.169268	212.5 ± 201.9	70.78	0.04	0.30 ± 0.18
16D11806	3.0 %	✓	0.002257	1.35942	0.0000000	1.43650	0.520067	91.4 ± 28.4	43.62	0.31	0.45 ± 0.05
16D11807	5.0 %		0.007718	1.51939	0.0000000	0.61099	3.477895	1436.8 ± 127.5	60.37	0.13	0.17 ± 0.02
16D11809	8.0 %	✓	0.000057	0.37176	0.0000000	0.10006	0.089881	226.8 ± 390.2	83.93	0.02	0.12 ± 0.07
16D11811	1.0 %	✓	0.003636	0.69149	0.0000000	1.11915	0.354196	79.9 ± 99.5	24.72	0.24	0.70 ± 0.17
16D11812	3.0 %	✓	0.000565	1.29644	0.0592476	0.77746	0.603366	196.0 ± 142.2	78.04	0.17	0.26 ± 0.04
16D11814	6.0 %	✓	0.000124	0.68465	0.0028521	0.21868	0.181602	209.7 ± 507.4	124.57	0.05	0.14 ± 0.04
16D11815	9.0 %	✓	0.000076	0.82815	0.0090015	0.18900	0.106729	142.6 ± 584.3	82.22	0.04	0.10 ± 0.03
16D11817	16.0 %	✓	0.008145	0.80176	0.0123159	5.88836	1.737526	74.5 ± 7.4	41.70	1.28	3.16 ± 0.63
16D11819	16.0 %		0.029324	4.72752	0.0186724	3.38868	1.625164	121.1 ± 16.8	15.77	0.73	0.31 ± 0.01
16D11821	16.0 %		0.766858	6.64559	0.0194473	3.49390	1.820589	131.6 ± 125.3	0.80	0.76	0.23 ± 0.01
16D11823	16.0 %		0.025828	3.65768	0.0129881	0.36442	0.686509	475.6 ± 160.1	8.25	0.08	0.04 ± 0.01
16D11825	16.0 %		0.011038	0.69904	0.0435134	4.12317	0.916209	56.1 ± 11.1	21.85	0.89	2.54 ± 0.59
16D11827	16.0 %		0.022050	6.43828	0.0000000	0.85294	1.948933	576.9 ± 73.1	23.02	0.18	0.06 ± 0.00
16D11829	16.0 %	✓	0.044349	2.75634	0.0166170	3.76296	1.343439	90.2 ± 18.0	9.29	0.81	0.59 ± 0.04
16D11831	16.0 %	✓	0.012979	1.15777	0.0000000	4.21347	1.093351	65.5 ± 10.6	22.11	0.91	1.56 ± 0.22
		Σ	87.196418	262.44036	1.0874255	461.78274	27.980829				

Plateau Age = 71.4 ± 8.2 ka MSWD = 2.26 Total Fusion Age = 15.3 ± 18.1 ka Inverse Isochron Age = 75.4 ± 7 ka $^{40}Ar/^{36}Ar$ = 294.24 ± 0.74

Notes:
Check marks - Heating steps selected for Age calculation
Red - negative numbers
Grey - unselected rows
fA- Phento Amp
MSWD- Mean Square Weighted Deviates
FCT-NM- Fish Canyon Tuff (New Mexico Geochronology Research Laboratory sanidine standard
J- J value

cl- ^{38}Ar derived from 38Cl (Chlorine)
r- Radiogenic ^{40}Ar derived from ^{40}K (potassium)
k- ^{39}Ar derived from ^{39}K (potassium)
ca- ^{38}Ar derived from ^{42}Ca (calcium)
a- Atmospheric ^{36}Ar

Age Equations = Min et al. (2000)
Negative Intensities = Allowed
Decay Constant ^{40}K = 5.530 ± 0.048 E-10 1/a
Decay Constant ^{39}Ar = 2.940 ± 0.016 E-07 1/h

Decay Constant ^{37}Ar = 8.230 ± 0.012 E-04 1/h
Decay Constant ^{36}Cl = 2.257 ± 0.015 E-06 1/a
Decay Constant ^{40}K(EC,β+) = 0.580 ± 0.009 E-10 1/a
Decay Constant ^{40}K(β−) = 4.950 ± 0.043 E-10 1/a

Atmospheric Ratio 40/36(a) = 295.50
Atmospheric Ratio 38/36(a) = 0.1869
Production Ratio 39/37(ca) = 0.000676 ± 0.000009
Production Ratio 38/37(ca) = 0.000072 ± 0.000009

Production Ratio 36/37(ca) = 0.000266 ± 0.000000
Production Ratio 40/39(k) = 0.003823 ± 0.000102
Production Ratio 38/39(k) = 0.012031 ± 0.000019
Production Ratio 36/38(cl) = 262.80 ± 1.71

Scaling Ratio K/Ca = 0.430
Abundance Ratio 40K/K = 1.1700 ± 0.0100 E-04
Atomic Weight K = 39.0983 ± 0.0001 g

Appendix Table 5.1: Generated data for stream profiles from Geomorph Tools

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	6750.2	871	9610	852	94	388	0	0	476619.1	302390	22387.21	0.20612
	6706.4	852	4938579	856.3333	93	389	43.8	0	476649.9	302421	28183.83	0.59657
	6675.4	865	4922242	866.3333	94	389	74.8	0	476649.9	302390	35481.34	0.80485
	6644.4	882	4917437	878	95	389	105.8	0	476649.9	302359	44668.36	0.40241
	6613.4	887	4915515	886	96	389	136.8	0	476649.9	302329	56234.13	0.23943
	6569.6	889	4872270	888.6667	97	388	180.6	0	476619.1	302298	141253.8	0.11348
	6538.6	894	4868426	889.6667	97	387	211.6	0	476588.3	302298	354813.4	0.06941
	6494.8	894	4867465	890	98	386	255.4	50.9453	476557.5	302267	562341.3	0.25752
	6463.8	890	4863621	892.6667	98	385	286.4	50.9453	476526.7	302267	707945.8	0.19863
	6420	898	4802117	897.6667	99	384	330.2	50.9453	476495.9	302236	891250.9	0.25521
	6389	905	4793468	903	100	384	361.2	50.9453	476495.9	302206	1122018	0.061
	6345.2	906	4783858	907	101	385	405	50.9453	476526.7	302175	2238721	0.07824
	6301.4	912	4766560	908.6667	102	386	448.8	50.9453	476557.5	302144	2818383	0.20825
	6257.6	913	4746379	910	103	387	492.6	50.9453	476588.3	302113	3548134	0.11425
	6226.6	921	4725237	910	104	387	523.6	50.9453	476588.3	302082	4466836	0.14654
	6182.8	935	4723315	910	105	386	567.4	50.9453	476557.5	302052		
	6151.8	938	4722354	910	106	386	598.4	50.9453	476557.5	302021		
	6108	945	4720432	910	107	385	642.2	50.9453	476526.7	301990		
	6077	949	4719471	910	108	385	673.2	50.9453	476526.7	301959		
	6046	949	4718510	910	109	385	704.2	50.9453	476526.7	301928		
	6002.2	944	4468650	910	110	386	748	50.9453	476557.5	301898		
	5958.4	949	4463845	910	111	385	791.8	326.074	476526.7	301867		
	5927.4	952	4449430	910	112	385	822.8	326.074	476526.7	301836		
	5883.6	954	4436937	910	113	384	866.6	326.074	476495.9	301805		
	5839.8	951	4435976	910	114	383	910.4	326.074	476465.1	301774		
	5796	953	4361018	910	115	382	954.2	326.074	476434.3	301744		
	5765	940	4244737	910	116	382	985.2	326.074	476434.3	301713		
	5734	927	4243776	910	117	382	1016.2	326.074	476434.3	301682		
	5703	926	4242815	910	118	382	1047.2	326.074	476434.3	301651		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	5672	915	4241854	910	119	382	1078.2	326.074	476434.3	301620		
	5641	910	4240893	914.6667	120	382	1109.2	326.074	476434.3	301590		
	5610	924	4239932	923	121	382	1140.2	326.074	476434.3	301559		
	5579	935	4238971	935.6667	122	382	1171.2	326.074	476434.3	301528		
	5548	948	4238010	944.6667	123	382	1202.2	326.074	476434.3	301497		
	5517	951	4237049	956	124	382	1233.2	326.074	476434.3	301466		
	5486	969	4210141	966.3333	125	382	1264.2	326.074	476434.3	301436		
	5455	979	4209180	978.3333	126	382	1295.2	241	476434.3	301405		
	5424	987	4208219	986.6667	127	382	1326.2	241	476434.3	301374		
	5380.2	994	4204375	991.6667	128	381	1370	241	476403.5	301343		
	5349.2	996	4197648	994	129	381	1401	241	476403.5	301312		
	5318.2	994	4182272	994.6667	130	381	1432	241	476403.5	301282		
	5274.4	996	4181311	995.6667	131	380	1475.8	241	476372.7	301251		
	5230.6	997	3835351	996.6667	132	381	1519.6	241	476403.5	301220		
	5186.8	1000	3686396	997	133	380	1563.4	129.505	476372.7	301189		
	5155.8	997	3685435	1000	134	380	1594.4	129.505	476372.7	301158		
	5112	1006	3683513	1007.333	135	379	1638.2	129.505	476341.9	301128		
	5081	1019	3665254	1015.667	136	379	1669.2	129.505	476341.9	301097		
	5050	1022	3658527	1022.333	137	379	1700.2	129.505	476341.9	301066		
	5019	1026	3647956	1025.333	138	379	1731.2	129.505	476341.9	301035		
	4988	1029	3645073	1027.333	139	379	1762.2	129.505	476341.9	301005		
	4944.2	1033	3633541	1028	140	380	1806	105.343	476372.7	300974		
	4900.4	1032	3632580	1028	141	381	1849.8	105.343	476403.5	300943		
	4856.6	1038	3629697	1028	142	380	1893.6	105.343	476372.7	300912		
	4825.6	1033	3628736	1028	143	380	1924.6	105.343	476372.7	300881		
	4794.6	1028	3503806	1030	144	380	1955.6	105.343	476372.7	300851		
	4750.8	1034	3491313	1032.333	145	381	1999.4	105.343	476403.5	300820		
	4719.8	1035	3489391	1034.667	146	381	2030.4	109.517	476403.5	300789		
	4676	1035	3487469	1035.333	147	382	2074.2	109.517	476434.3	300758		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	4645	1036	3009852	1042	148	382	2105.2	109.517	476434.3	300727		
	4601.2	1055	3003125	1050.333	149	381	2149	109.517	476403.5	300697		
	4557.4	1060	3002164	1058.333	150	380	2192.8	109.517	476372.7	300666		
	4513.6	1060	2996398	1062	151	379	2236.6	109.517	476341.9	300635		
	4482.6	1066	2972373	1067	152	379	2267.6	162.345	476341.9	300604		
	4451.6	1075	2970451	1075.667	153	379	2298.6	162.345	476341.9	300573		
	4420.6	1086	2968529	1087	154	379	2329.6	162.345	476341.9	300543		
	4376.8	1100	2942582	1100	155	378	2373.4	162.345	476311.1	300512		
	4333	1114	2941621	1111.667	156	377	2417.2	162.345	476280.3	300481		
	4302	1121	2932972	1121.333	157	377	2448.2	162.345	476280.3	300450		
	4258.2	1129	2932011	1126.333	158	376	2492	162.345	476249.5	300419		
	4227.2	1138	2931050	1129	158	375	2523	181.987	476218.7	300419		
	4183.4	1147	2930089	1129	159	374	2566.8	181.987	476187.9	300389		
	4139.6	1143	2929128	1129	160	373	2610.6	181.987	476157.1	300358		
	4095.8	1141	2784978	1129	161	372	2654.4	181.987	476126.3	300327		
	4052	1141	2776329	1129	162	371	2698.2	181.987	476095.6	300296		
	4021	1136	2694644	1129	163	371	2729.2	181.987	476095.6	300265		
	3990	1132	2693683	1129	164	371	2760.2	181.987	476095.6	300235		
	3959	1129	2692722	1131.667	165	371	2791.2	41.0276	476095.6	300204		
	3928	1137	2691761	1135	166	371	2822.2	41.0276	476095.6	300173		
	3897	1145	2690800	1138.333	167	371	2853.2	41.0276	476095.6	300142		
	3853.2	1144	2659087	1139	168	372	2897	41.0276	476126.3	300111		
	3822.2	1139	2657165	1139.333	169	372	2928	41.0276	476126.3	300081		
	3778.4	1141	2594700	1139.667	170	373	2971.8	41.0276	476157.1	300050		
	3747.4	1140	2588934	1140	171	373	3002.8	41.0276	476157.1	300019		
	3716.4	1142	2587973	1140	172	373	3033.8	32.9476	476157.1	299988		
	3685.4	1140	2587012	1143	173	373	3064.8	32.9476	476157.1	299957		
	3641.6	1149	2584129	1146.333	174	374	3108.6	32.9476	476187.9	299927		
	3597.8	1154	2582207	1149.667	175	375	3152.4	32.9476	476218.7	299896		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	3554	1154	2504366	1150	176	376	3196.2	32.9476	476249.5	299865		
	3510.2	1155	2501483	1150	177	377	3240	32.9476	476280.3	299834		
	3479.2	1156	2498600	1150	177	378	3271	71.3961	476311.1	299834		
	3435.4	1157	2493795	1150	178	379	3314.8	71.3961	476341.9	299804		
	3391.6	1151	2488029	1150	179	380	3358.6	71.3961	476372.7	299773		
	3347.8	1154	2477458	1150	180	381	3402.4	71.3961	476403.5	299742		
	3304	1150	2458238	1152.667	181	382	3446.2	71.3961	476434.3	299711		
	3273	1158	2367904	1159	182	382	3477.2	71.3961	476434.3	299680		
	3229.2	1169	2363099	1167.667	183	383	3521	71.3961	476465.1	299650		
	3198.2	1176	2362138	1175	184	383	3552	95.4955	476465.1	299619		
	3154.4	1180	2357333	1180.667	185	384	3595.8	95.4955	476495.9	299588		
	3123.4	1189	2354450	1184	186	384	3626.8	95.4955	476495.9	299557		
	3079.6	1193	2341957	1186	187	383	3670.6	95.4955	476465.1	299526		
	3035.8	1193	2340996	1186	188	382	3714.4	95.4955	476434.3	299496		
	2992	1186	2332347	1187.333	189	381	3758.2	95.4955	476403.5	299465		
	2948.2	1194	2316971	1188.667	190	380	3802	42.1124	476372.7	299434		
	2904.4	1190	2281414	1190.333	191	381	3845.8	42.1124	476403.5	299403		
	2873.4	1192	2268921	1190.667	191	382	3876.8	42.1124	476434.3	299403		
	2842.4	1194	2267960	1191	191	383	3907.8	42.1124	476465.1	299403		
	2798.6	1195	2264116	1191	192	384	3951.6	42.1124	476495.9	299372		
	2767.6	1198	2252584	1191	192	385	3982.6	42.1124	476526.7	299372		
	2736.6	1200	2250662	1191	192	386	4013.6	42.1124	476557.5	299372		
	2692.8	1197	2249701	1191	193	387	4057.4	6.40602	476588.3	299342		
	2661.8	1198	2128615	1191	194	387	4088.4	6.40602	476588.3	299311		
	2618	1201	2122849	1191	195	386	4132.2	6.40602	476557.5	299280		
	2574.2	1208	2119005	1191	196	385	4176	6.40602	476526.7	299249		
	2530.4	1207	2090175	1191	197	384	4219.8	6.40602	476495.9	299218		
	2486.6	1194	1739410	1191	198	383	4263.6	6.40602	476465.1	299188		
	2455.6	1197	1355010	1191	199	383	4294.6	22.421	476465.1	299157		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	2424.6	1200	1354049	1191	200	383	4325.6	22.421	476465.1	299126		
	2393.6	1193	1353088	1191	201	383	4356.6	22.421	476465.1	299095		
	2362.6	1191	1352127	1193.333	202	383	4387.6	22.421	476465.1	299064		
	2331.6	1198	1351166	1196.333	203	383	4418.6	22.421	476465.1	299034		
	2300.6	1200	1350205	1199.333	204	383	4449.6	22.421	476465.1	299003		
	2269.6	1207	1349244	1200	205	383	4480.6	22.421	476465.1	298972		
	2238.6	1208	1348283	1200	206	383	4511.6	22.421	476465.1	298941		
	2207.6	1203	1341556	1200	207	383	4542.6	35.7097	476465.1	298910		
	2176.6	1208	1339634	1200	208	383	4573.6	35.7097	476465.1	298880		
	2145.6	1207	1333868	1200	209	383	4604.6	35.7097	476465.1	298849		
	2101.8	1200	1024426	1201.333	210	384	4648.4	35.7097	476495.9	298818		
	2058	1204	1012894	1204.333	211	385	4692.2	35.7097	476526.7	298787		
	2027	1209	1009050	1209	211	386	4723.2	35.7097	476557.5	298787		
	1983.2	1214	970610	1212.333	212	387	4767	35.7097	476588.3	298756		
	1939.4	1214	967727	1218.667	213	388	4810.8	92.9658	476619.1	298726		
	1895.6	1228	838953	1227	214	389	4854.6	92.9658	476649.9	298695		
	1851.8	1239	833187	1237.667	215	390	4898.4	92.9658	476680.7	298664		
	1808	1246	832226	1245.667	216	391	4942.2	92.9658	476711.5	298633		
	1777	1252	808201	1255	217	391	4973.2	92.9658	476711.5	298603		
	1733.2	1267	794747	1265	218	392	5017	92.9658	476742.2	298572		
	1689.4	1276	793786	1275.333	219	393	5060.8	91.9208	476773	298541		
	1645.6	1283	792825	1284	220	394	5104.6	91.9208	476803.8	298510		
	1614.6	1293	791864	1292.667	221	394	5135.6	91.9208	476803.8	298479		
	1570.8	1307	686154	1299	222	395	5179.4	91.9208	476834.6	298449		
	1527	1302	685193	1303	223	396	5223.2	91.9208	476865.4	298418		
	1483.2	1305	638104	1305	224	397	5267	91.9208	476896.2	298387		
	1439.4	1308	631377	1309.667	225	398	5310.8	76.7994	476927	298356		
	1408.4	1316	593898	1316.333	226	398	5341.8	76.7994	476927	298325		
	1364.6	1325	589093	1328.667	227	399	5385.6	76.7994	476957.8	298295		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	1320.8	1345	586210	1342	228	400	5429.4	76.7994	476988.6	298264		
	1277	1357	521823	1352.333	229	401	5473.2	76.7994	477019.4	298233		
	1233.2	1356	519901	1356	230	402	5517	76.7994	477050.2	298202		
	1189.4	1357	393049	1356	231	403	5560.8	56.1904	477081	298171		
	1158.4	1356	382478	1358	231	404	5591.8	56.1904	477111.8	298171		
	1127.4	1362	376712	1360.667	231	405	5622.8	56.1904	477142.6	298171		
	1083.6	1364	374790	1364	232	406	5666.6	56.1904	477173.4	298141		
	1039.8	1368	363258	1365.333	231	407	5710.4	56.1904	477204.2	298171		
	1008.8	1375	359414	1366	231	408	5741.4	56.1904	477235	298171		
	965	1372	356531	1366	232	409	5785.2	9.0953	477265.8	298141		
	921.2	1375	341155	1366	233	410	5829	9.0953	477296.6	298110		
	877.4	1374	274846	1366	234	411	5872.8	9.0953	477327.3	298079		
	833.6	1367	188356	1366	233	412	5916.6	9.0953	477358.1	298110		
	789.8	1374	176824	1366	232	413	5960.4	9.0953	477388.9	298141		
	758.8	1368	172980	1366	232	414	5991.4	9.0953	477419.7	298141		
	727.8	1366	171058	1367	232	415	6022.4	21.7875	477450.5	298141		
	696.8	1369	166253	1368.333	232	416	6053.4	21.7875	477481.3	298141		
	665.8	1370	163370	1371.667	232	417	6084.4	21.7875	477512.1	298141		
	634.8	1376	147033	1374	232	418	6115.4	21.7875	477542.9	298141		
	603.8	1376	145111	1378	232	419	6146.4	21.7875	477573.7	298141		
	560	1382	132618	1382	233	420	6190.2	21.7875	477604.5	298110		
	529	1388	129735	1387	233	421	6221.2	21.7875	477635.3	298110		
	485.2	1391	126852	1391	234	422	6265	21.7875	477666.1	298079		
	441.4	1394	60543	1395	235	423	6308.8	43.8439	477696.9	298048		
	410.4	1400	59582	1401	236	423	6339.8	43.8439	477696.9	298017		
	379.4	1409	58621	1408.333	237	423	6370.8	43.8439	477696.9	297987		
	348.4	1416	54777	1416	238	423	6401.8	43.8439	477696.9	297956		
	317.4	1423	41323	1426.333	239	423	6432.8	43.8439	477696.9	297925		
	286.4	1440	36518	1443	240	423	6463.8	43.8439	477696.9	297894		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 1												
	255.4	1466	35557	1466.667	241	423	6494.8	43.8439	477696.9	297863		
	224.4	1494	29791	1492	242	423	6525.8	51.5771	477696.9	297833		
	193.4	1516	28830	1516	243	423	6556.8	51.5771	477696.9	297802		
	149.6	1538	25947	1533.667	244	424	6600.6	51.5771	477727.7	297771		
	118.6	1547	22103	1545.333	245	424	6631.6	51.5771	477727.7	297740		
	74.8	1553	21142	1549.667	246	423	6675.4	51.5771	477696.9	297709		
	31	1552	15376	1551	247	422	6719.2	51.5771	477666.1	297679		
	0	1551	9610	1551	248	422	6750.2	51.5771	477666.1	297648		
North 2												
	8240.8	894	2883	872	59	264	0	0	472800.5	303468	14125.38	0.08961
	8209.8	894	1.1E+07	872	59	265	31	0	472831.3	303468	22387.21	0.08961
	8178.8	894	1.1E+07	872	60	265	62	0	472831.3	303437	89125.09	0.0601
	8147.8	894	1.1E+07	872	61	265	93	0	472831.3	303406	112201.8	0.21763
	8116.8	894	1.1E+07	872	62	265	124	0	472831.3	303376	141253.8	0.27862
	8073	895	1E+07	872	63	266	167.8	0	472862.1	303345	223872.1	0.20548
	8029.2	880	1E+07	872	64	267	211.6	0	472892.9	303314	281838.3	0.12554
	7985.4	881	1E+07	872	65	268	255.4	177.433	472923.7	303283	446683.6	0.1562
	7954.4	872	1E+07	872	66	268	286.4	177.433	472923.7	303253	562341.3	0.08603
	7923.4	872	1E+07	873	67	268	317.4	177.433	472923.7	303222	891250.9	0.26118
	7892.4	875	1E+07	875	68	268	348.4	177.433	472923.7	303191	1122018	0.2696
	7861.4	886	1E+07	877	69	268	379.4	177.433	472923.7	303160	1778279	0.05862
	7830.4	878	1E+07	880.3333	70	268	410.4	177.433	472923.7	303129	2238721	0.11451
	7799.4	885	1E+07	885.6667	71	268	441.4	177.433	472923.7	303099	2818383	0.16833
	7768.4	894	1E+07	893.6667	72	268	472.4	177.433	472923.7	303068	3548134	0.12153
	7724.6	902	1E+07	900.6667	73	269	516.2	177.433	472954.5	303037	4466836	0.11988
	7693.6	906	1E+07	905.3333	74	269	547.2	177.433	472954.5	303006	7079458	0.04806
	7662.6	910	1E+07	907.3333	75	269	578.2	177.433	472954.5	302975	8912509	0.03849
	7618.8	918	1E+07	908	76	270	622	177.433	472985.3	302945	11220185	0.06645

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	7575	917	1E+07	908	77	271	665.8	177.433	473016.1	302914		
	7531.2	916	1E+07	908	78	272	709.6	177.433	473046.9	302883		
	7487.4	909	1E+07	908	79	273	753.4	177.433	473077.7	302852		
	7456.4	908	8561549	908.6667	79	274	784.4	56.9448	473108.5	302852		
	7425.4	912	8560588	909.3333	79	275	815.4	56.9448	473139.3	302852		
	7394.4	916	8559627	910	79	276	846.4	56.9448	473170	302852		
	7363.4	916	8558666	910	79	277	877.4	56.9448	473200.8	302852		
	7319.6	914	8557705	910	80	278	921.2	56.9448	473231.6	302821		
	7288.6	914	8537524	910	80	279	952.2	56.9448	473262.4	302821		
	7244.8	917	8531758	910	81	280	996	56.9448	473293.2	302791		
	7201	917	8469293	910	82	281	1039.8	8.85629	473324	302760		
	7170	910	8461605	910	82	282	1070.8	8.85629	473354.8	302760		
	7126.2	918	8456800	910	83	283	1114.6	8.85629	473385.6	302729		
	7082.4	915	8448151	910	84	284	1158.4	8.85629	473416.4	302698		
	7051.4	916	8446229	910	84	285	1189.4	8.85629	473447.2	302698		
	7020.4	917	8444307	910	84	286	1220.4	8.85629	473478	302698		
	6976.6	918	8441424	910	85	287	1264.2	93.9083	473508.8	302667		
	6932.8	919	8422204	910	86	286	1308	93.9083	473478	302637		
	6889	914	8415477	910	87	285	1351.8	93.9083	473447.2	302606		
	6858	911	8397218	910	88	285	1382.8	93.9083	473447.2	302575		
	6827	916	8396257	910	89	285	1413.8	93.9083	473447.2	302544		
	6796	917	8395296	910	90	285	1444.8	93.9083	473447.2	302513		
	6752.2	927	8365505	910	91	286	1488.6	93.9083	473478	302483		
	6708.4	915	8364544	910	92	287	1532.4	93.9083	473508.8	302452		
	6677.4	910	8350129	911	92	288	1563.4	93.9083	473539.6	302452		
	6646.4	913	8349168	915.6667	92	289	1594.4	93.9083	473570.4	302452		
	6615.4	924	8348207	922	92	290	1625.4	93.9083	473601.2	302452		
	6571.6	929	8342441	927.3333	93	291	1669.2	93.9083	473632	302421		
	6540.6	933	8326104	929	93	292	1700.2	93.9083	473662.8	302421		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	6496.8	935	8325143	929	92	293	1744	93.9083	473693.6	302452		
	6453	934	8318416	929	93	294	1787.8	93.9083	473724.4	302421		
	6422	932	8316494	929	94	294	1818.8	93.9083	473724.4	302390		
	6391	933	8315533	929	95	294	1849.8	93.9083	473724.4	302359		
	6360	935	8314572	929	96	294	1880.8	93.9083	473724.4	302329		
	6316.2	931	8308806	929	97	293	1924.6	93.9083	473693.6	302298		
	6272.4	934	8304962	929	98	292	1968.4	93.9083	473662.8	302267		
	6228.6	929	8296313	929.6667	99	291	2012.2	93.9083	473632	302236		
	6197.6	932	8292469	930.3333	100	291	2043.2	14.429	473632	302206		
	6166.6	932	7752387	931	101	291	2074.2	14.429	473632	302175		
	6135.6	931	7751426	931.3333	102	291	2105.2	14.429	473632	302144		
	6104.6	934	7750465	931.6667	103	291	2136.2	14.429	473632	302113		
	6060.8	933	7742777	932	104	292	2180	14.429	473662.8	302082		
	6017	934	7730284	932	105	293	2223.8	14.429	473693.6	302052		
	5973.2	934	7718752	932	106	294	2267.6	40.6785	473724.4	302021		
	5929.4	933	6764479	932	107	295	2311.4	40.6785	473755.1	301990		
	5898.4	935	6760635	932	108	295	2342.4	40.6785	473755.1	301959		
	5867.4	935	6758713	932	109	295	2373.4	40.6785	473755.1	301928		
	5836.4	933	6756791	932	110	295	2404.4	40.6785	473755.1	301898		
	5805.4	932	6748142	932.3333	111	295	2435.4	40.6785	473755.1	301867		
	5774.4	933	6745259	933.6667	112	295	2466.4	40.6785	473755.1	301836		
	5743.4	936	6742376	937.3333	113	295	2497.4	40.6785	473755.1	301805		
	5699.6	943	6709702	941	114	294	2541.2	29.7799	473724.4	301774		
	5668.6	947	6707780	943.6667	115	294	2572.2	29.7799	473724.4	301744		
	5624.8	945	6657808	944	116	295	2616	29.7799	473755.1	301713		
	5593.8	945	6655886	944	117	295	2647	29.7799	473755.1	301682		
	5562.8	947	6653964	944	118	295	2678	29.7799	473755.1	301651		
	5519	945	6637627	944	119	296	2721.8	29.7799	473785.9	301620		
	5488	950	6625134	944	120	296	2752.8	29.7799	473785.9	301590		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	5457	954	6622251	944	121	296	2783.8	7.73311	473785.9	301559		
	5413.2	957	6617446	944	122	297	2827.6	7.73311	473816.7	301528		
	5382.2	960	6613602	944	123	297	2858.6	7.73311	473816.7	301497		
	5338.4	962	6607836	944	124	298	2902.4	7.73311	473847.5	301466		
	5307.4	956	4610878	944	124	299	2933.4	7.73311	473878.3	301466		
	5263.6	963	4607995	944	123	300	2977.2	7.73311	473909.1	301497		
	5232.6	964	4604151	944	122	300	3008.2	86.755	473909.1	301528		
	5188.8	961	4602229	944	121	301	3052	86.755	473939.9	301559		
	5145	957	4581087	944	122	302	3095.8	86.755	473970.7	301528		
	5101.2	964	4571477	944	123	303	3139.6	86.755	474001.5	301497		
	5057.4	962	4559945	944	124	304	3183.4	86.755	474032.3	301466		
	5013.6	958	4544569	944	125	305	3227.2	86.755	474063.1	301436		
	4969.8	944	4530154	944.6667	126	306	3271	86.755	474093.9	301405		
	4926	951	4522466	945.3333	127	307	3314.8	86.755	474124.7	301374		
	4882.2	952	4501324	946	128	308	3358.6	86.755	474155.5	301343		
	4838.4	946	4486909	949.6667	129	309	3402.4	86.755	474186.3	301312		
	4794.6	962	4460962	953.3333	130	310	3446.2	86.755	474217.1	301282		
	4763.6	957	4459040	958.6667	130	311	3477.2	86.755	474247.9	301282		
	4732.6	962	4455196	962.3333	130	312	3508.2	82.5646	474278.7	301282		
	4688.8	968	3501884	968.3333	131	313	3552	82.5646	474309.5	301251		
	4657.8	975	3492274	973	132	313	3583	82.5646	474309.5	301220		
	4626.8	976	3488430	975.6667	133	313	3614	82.5646	474309.5	301189		
	4595.8	980	3485547	976	134	313	3645	82.5646	474309.5	301158		
	4564.8	976	3484586	978	135	313	3676	82.5646	474309.5	301128		
	4533.8	986	3458639	980	136	313	3707	82.5646	474309.5	301097		
	4502.8	986	3457678	982	137	313	3738	82.5646	474309.5	301066		
	4471.8	985	3442302	982	138	313	3769	99.2383	474309.5	301035		
	4440.8	982	3439419	984.3333	139	313	3800	99.2383	474309.5	301005		
	4397	989	3405784	990.3333	140	314	3843.8	99.2383	474340.3	300974		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	4366	1000	3369266	998.6667	140	315	3874.8	99.2383	474371	300974		
	4322.2	1007	3368305	1007	141	316	3918.6	99.2383	474401.8	300943		
	4291.2	1014	3363500	1012.667	142	316	3949.6	99.2383	474401.8	300912		
	4247.4	1019	3362539	1016	143	317	3993.4	99.2383	474432.6	300881		
	4203.6	1024	3357734	1017	144	318	4037.2	95.2488	474463.4	300851		
	4159.8	1021	3198208	1017	145	319	4081	95.2488	474494.2	300820		
	4128.8	1017	3194364	1018	146	319	4112	95.2488	474494.2	300789		
	4085	1021	3190520	1019	147	320	4155.8	95.2488	474525	300758		
	4041.2	1023	3181871	1020	148	321	4199.6	95.2488	474555.8	300727		
	4010.2	1022	3178988	1020	148	322	4230.6	95.2488	474586.6	300727		
	3966.4	1025	3160729	1020	149	323	4274.4	75.774	474617.4	300697		
	3922.6	1020	3128055	1021.667	150	324	4318.2	75.774	474648.2	300666		
	3878.8	1025	2817652	1024	151	325	4362	75.774	474679	300635		
	3835	1027	2779212	1028.667	152	326	4405.8	75.774	474709.8	300604		
	3791.2	1034	2776329	1033.333	153	327	4449.6	75.774	474740.6	300573		
	3760.2	1039	2773446	1039.667	153	328	4480.6	75.774	474771.4	300573		
	3716.4	1046	2770563	1045.667	154	329	4524.4	105.328	474802.2	300543		
	3685.4	1052	2766719	1050	154	330	4555.4	105.328	474833	300543		
	3641.6	1054	2754226	1052	155	331	4599.2	105.328	474863.8	300512		
	3610.6	1052	2752304	1052.667	156	331	4630.2	105.328	474863.8	300481		
	3566.8	1054	2733084	1053.333	157	332	4674	105.328	474894.6	300450		
	3535.8	1054	2729240	1056.333	158	332	4705	105.328	474894.6	300419		
	3504.8	1061	2719630	1065	159	332	4736	105.328	474894.6	300389		
	3473.8	1080	2717708	1075.667	160	332	4767	132.21	474894.6	300358		
	3430	1086	2712903	1084.333	161	333	4810.8	132.21	474925.4	300327		
	3386.2	1087	2704254	1089.667	162	334	4854.6	132.21	474956.1	300296		
	3342.4	1096	2667736	1095	163	335	4898.4	132.21	474986.9	300265		
	3298.6	1102	2660048	1103.667	164	336	4942.2	132.21	475017.7	300235		
	3267.6	1113	2658126	1111	165	336	4973.2	132.21	475017.7	300204		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	3236.6	1119	2656204	1116.333	166	336	5004.2	132.21	475017.7	300173		
	3192.8	1118	2654282	1120	167	337	5048	111.653	475048.5	300142		
	3149	1129	2639867	1122	168	336	5091.8	111.653	475017.7	300111		
	3105.2	1129	2638906	1124	169	335	5135.6	111.653	474986.9	300081		
	3074.2	1128	2434213	1124	170	335	5166.6	111.653	474986.9	300050		
	3030.4	1124	2427486	1125.333	171	334	5210.4	111.653	474956.1	300019		
	2999.4	1128	2420759	1127.667	172	334	5241.4	111.653	474956.1	299988		
	2968.4	1133	2417876	1130	173	334	5272.4	56.8219	474956.1	299957		
	2924.6	1131	2405383	1133	174	335	5316.2	56.8219	474986.9	299927		
	2880.8	1137	2284297	1139	175	336	5360	56.8219	475017.7	299896		
	2837	1149	2273726	1145	176	337	5403.8	56.8219	475048.5	299865		
	2793.2	1149	2266999	1149	177	338	5447.6	56.8219	475079.3	299834		
	2749.4	1149	2258350	1149.667	178	339	5491.4	56.8219	475110.1	299804		
	2718.4	1151	2195885	1152.667	179	339	5522.4	60.6321	475110.1	299773		
	2687.4	1158	2193963	1155.667	180	339	5553.4	60.6321	475110.1	299742		
	2656.4	1161	2166094	1158	181	339	5584.4	60.6321	475110.1	299711		
	2625.4	1158	2165133	1159.667	182	339	5615.4	60.6321	475110.1	299680		
	2594.4	1163	2147835	1164.333	183	339	5646.4	60.6321	475110.1	299650		
	2563.4	1172	2143991	1169.667	184	339	5677.4	60.6321	475110.1	299619		
	2532.4	1176	2142069	1173.333	185	339	5708.4	60.6321	475110.1	299588		
	2488.6	1174	1908546	1175.333	186	340	5752.2	60.6321	475140.9	299557		
	2444.8	1181	1899897	1176.667	187	341	5796	54.509	475171.7	299526		
	2401	1178	1849925	1178.333	188	342	5839.8	54.509	475202.5	299496		
	2357.2	1186	1842237	1178.667	189	343	5883.6	54.509	475233.3	299465		
	2313.4	1193	1841276	1179	190	344	5927.4	54.509	475264.1	299434		
	2269.6	1191	1838393	1179	191	345	5971.2	54.509	475294.9	299403		
	2225.8	1181	1723073	1179	192	346	6015	176.364	475325.7	299372		
	2194.8	1183	1070554	1179	193	346	6046	176.364	475325.7	299342		
	2163.8	1179	1069593	1181	194	346	6077	176.364	475325.7	299311		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	2132.8	1185	1068632	1187.667	195	346	6108	176.364	475325.7	299280		
	2101.8	1199	1067671	1201.667	196	346	6139	176.364	475325.7	299249		
	2058	1221	1046529	1218	197	345	6182.8	176.364	475294.9	299218		
	2014.2	1234	1043646	1233.667	198	344	6226.6	176.364	475264.1	299188		
	1983.2	1246	1037880	1244	198	343	6257.6	132.241	475233.3	299188		
	1939.4	1252	1021543	1253.667	199	342	6301.4	132.241	475202.5	299157		
	1895.6	1263	1019621	1259.333	200	341	6345.2	132.241	475171.7	299126		
	1864.6	1265	1018660	1263	200	340	6376.2	132.241	475140.9	299126		
	1833.6	1263	1016738	1264	200	339	6407.2	132.241	475110.1	299126		
	1789.8	1266	943702	1268	201	338	6451	132.241	475079.3	299095		
	1746	1275	888925	1277	202	339	6494.8	132.241	475110.1	299064		
	1715	1290	887003	1288	203	339	6525.8	100.061	475110.1	299034		
	1684	1299	881237	1297.333	204	339	6556.8	100.061	475110.1	299003		
	1653	1303	880276	1303.667	205	339	6587.8	100.061	475110.1	298972		
	1622	1309	878354	1309.333	206	339	6618.8	100.061	475110.1	298941		
	1578.2	1316	860095	1317.667	207	340	6662.6	100.061	475140.9	298910		
	1547.2	1328	857212	1329	208	340	6693.6	100.061	475140.9	298880		
	1516.2	1343	856251	1339.333	209	340	6724.6	100.061	475140.9	298849		
	1485.2	1351	853368	1345.667	210	340	6755.6	100.061	475140.9	298818		
	1441.4	1354	845680	1347	211	341	6799.4	104.874	475171.7	298787		
	1397.6	1347	834148	1347.333	212	342	6843.2	104.874	475202.5	298756		
	1353.8	1351	808201	1347.667	213	343	6887	104.874	475233.3	298726		
	1310	1350	798591	1348	214	344	6930.8	104.874	475264.1	298695		
	1266.2	1348	792825	1348	215	345	6974.6	104.874	475294.9	298664		
	1222.4	1348	632338	1349.667	216	346	7018.4	37.4451	475325.7	298633		
	1191.4	1353	623689	1354.667	217	346	7049.4	37.4451	475325.7	298603		
	1160.4	1363	619845	1360	218	346	7080.4	37.4451	475325.7	298572		
	1116.6	1369	598703	1363.667	219	347	7124.2	37.4451	475356.5	298541		
	1072.8	1370	596781	1364	220	348	7168	37.4451	475387.3	298510		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 2												
	1041.8	1364	565068	1365.667	221	348	7199	37.4451	475387.3	298479		
	998	1369	547770	1367.667	222	349	7242.8	37.4451	475418.1	298449		
	967	1370	545848	1370	223	349	7273.8	34.4802	475418.1	298418		
	936	1371	541043	1371.667	224	349	7304.8	34.4802	475418.1	298387		
	892.2	1374	525667	1373	225	350	7348.6	34.4802	475448.9	298356		
	848.4	1376	516057	1374	226	351	7392.4	34.4802	475479.7	298325		
	817.4	1374	507408	1375.667	226	352	7423.4	34.4802	475510.5	298325		
	773.6	1379	492032	1378.667	227	353	7467.2	34.4802	475541.2	298295		
	742.6	1383	310403	1385	227	354	7498.2	34.4802	475572	298295		
	698.8	1393	258509	1390.667	228	355	7542	38.5337	475602.8	298264		
	655	1396	257548	1395.667	229	356	7585.8	38.5337	475633.6	298233		
	611.2	1398	246016	1400.333	230	357	7629.6	38.5337	475664.4	298202		
	567.4	1407	125891	1409.333	231	356	7673.4	38.5337	475633.6	298171		
	523.6	1423	121086	1419.667	232	357	7717.2	38.5337	475664.4	298141		
	479.8	1429	116281	1431	233	356	7761	38.5337	475633.6	298110		
	436	1441	99944	1437	234	357	7804.8	30.5325	475664.4	298079		
	392.2	1441	98983	1442.667	235	358	7848.6	30.5325	475695.2	298048		
	361.2	1446	93217	1444.667	236	358	7879.6	30.5325	475695.2	298017		
	317.4	1454	85529	1446.667	237	359	7923.4	30.5325	475726	297987		
	273.6	1451	83607	1447	238	360	7967.2	30.5325	475756.8	297956		
	229.8	1447	50933	1447.667	239	361	8011	30.5325	475787.6	297925		
	186	1449	46128	1449.667	240	362	8054.8	9.27199	475818.4	297894		
	155	1453	29791	1451.667	240	363	8085.8	9.27199	475849.2	297894		
	124	1453	24025	1453.667	240	364	8116.8	9.27199	475880	297894		
	93	1455	23064	1454.667	240	365	8147.8	9.27199	475910.8	297894		
	62	1456	15376	1457.333	240	366	8178.8	9.27199	475941.6	297894		
	31	1461	12493	1460.333	240	367	8209.8	9.27199	475972.4	297894		
	0	1464	5766	1464	240	368	8240.8	9.27199	476003.2	297894		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	15625.2	894	24025	894	231	25	0	0	465440.6	298171	44668.36	0.18265
	15594.2	894	2.4E+07	894.3333	232	25	31	0	465440.6	298141	141253.8	0.12685
	15563.2	895	2.4E+07	895.6667	232	26	62	0	465471.3	298141	223872.1	0.13825
	15519.4	898	2.4E+07	898.3333	233	27	105.8	0	465502.1	298110	354813.4	0.06302
	15488.4	904	2.4E+07	900.6667	234	27	136.8	131.128	465502.1	298079	446683.6	0.02063
	15444.6	902	2.4E+07	902	235	28	180.6	131.128	465532.9	298048	562341.3	0.06738
	15413.6	903	2.4E+07	902	235	29	211.6	131.128	465563.7	298048	891250.9	0.0875
	15382.6	902	2.4E+07	902	235	30	242.6	131.128	465594.5	298048	1122018	0.05076
	15351.6	902	2.4E+07	902	235	31	273.6	131.128	465625.3	298048	1412538	0.02534
	15320.6	903	2.4E+07	902	235	32	304.6	131.128	465656.1	298048	1778279	0.04699
	15276.8	903	2.4E+07	902	236	33	348.4	131.128	465686.9	298017	2238721	0.04711
	15245.8	902	2.4E+07	903.3333	236	34	379.4	131.128	465717.7	298017	2818383	0.12591
	15214.8	906	2.4E+07	906	236	35	410.4	131.128	465748.5	298017	3548134	0.04478
	15183.8	910	2.4E+07	909.3333	236	36	441.4	131.128	465779.3	298017	4466836	0.04254
	15152.8	912	2.4E+07	912	236	37	472.4	131.128	465810.1	298017	5623413	0.01074
	15121.8	914	2.4E+07	913.3333	236	38	503.4	131.128	465840.9	298017	7079458	0.05109
	15078	914	2.4E+07	914.3333	237	39	547.2	131.128	465871.7	297987	8912509	0.07761
	15034.2	915	2.3E+07	916	238	40	591	131.128	465902.5	297956	14125375	0.31175
	15003.2	921	2.3E+07	917.6667	238	41	622	131.128	465933.3	297956	17782794	0.32258
	14959.4	919	2.3E+07	921.3333	237	42	665.8	139.044	465964.1	297987	22387211	0.07721
	14928.4	926	2.3E+07	925	237	43	696.8	139.044	465994.9	297987		
	14897.4	930	2.3E+07	929	237	44	727.8	139.044	466025.7	297987		
	14853.6	932	2.3E+07	930.6667	238	45	771.6	139.044	466056.4	297956		
	14809.8	931	2.3E+07	932	239	46	815.4	139.044	466087.2	297925		
	14778.8	934	2.3E+07	933.6667	239	47	846.4	139.044	466118	297925		
	14735	937	2.3E+07	935.3333	240	48	890.2	139.044	466148.8	297894		
	14704	936	2.3E+07	937	241	48	921.2	146.465	466148.8	297863		
	14660.2	939	2.3E+07	940.6667	242	49	965	146.465	466179.6	297833		
	14629.2	947	2.3E+07	945.3333	242	50	996	146.465	466210.4	297833		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	14585.4	950	2.3E+07	949	243	51	1039.8	146.465	466241.2	297802		
	14541.6	950	2.3E+07	951.3333	244	52	1083.6	146.465	466272	297771		
	14497.8	954	2.3E+07	953	243	53	1127.4	146.465	466302.8	297802		
	14466.8	956	2.3E+07	954.6667	243	54	1158.4	98.2514	466333.6	297802		
	14423	956	2.3E+07	955	244	55	1202.2	98.2514	466364.4	297771		
	14379.2	956	2.3E+07	955	243	56	1246	98.2514	466395.2	297802		
	14335.4	955	2.3E+07	955	242	57	1289.8	98.2514	466426	297833		
	14304.4	957	2.3E+07	955	242	58	1320.8	98.2514	466456.8	297833		
	14260.6	958	2.3E+07	955	243	59	1364.6	98.2514	466487.6	297802		
	14216.8	955	2.3E+07	955.6667	242	60	1408.4	115.738	466518.4	297833		
	14173	959	2.3E+07	956.3333	241	61	1452.2	115.738	466549.2	297863		
	14129.2	958	2.3E+07	957	240	62	1496	115.738	466580	297894		
	14098.2	957	2.3E+07	957.6667	240	63	1527	115.738	466610.8	297894		
	14067.2	959	2.3E+07	959.3333	240	64	1558	115.738	466641.6	297894		
	14036.2	962	2.3E+07	964	240	65	1589	115.738	466672.3	297894		
	13992.4	971	2.3E+07	968.3333	241	66	1632.8	115.738	466703.1	297863		
	13948.6	972	2.3E+07	972	242	67	1676.6	139.25	466733.9	297833		
	13917.6	973	2.3E+07	972.6667	242	68	1707.6	139.25	466764.7	297833		
	13886.6	973	2.3E+07	973	242	69	1738.6	139.25	466795.5	297833		
	13855.6	973	2.3E+07	973.3333	242	70	1769.6	139.25	466826.3	297833		
	13824.6	974	2.3E+07	974.3333	242	71	1800.6	139.25	466857.1	297833		
	13780.8	976	2.3E+07	976	243	72	1844.4	139.25	466887.9	297802		
	13737	978	2.3E+07	978.3333	242	73	1888.2	139.25	466918.7	297833		
	13693.2	981	2.3E+07	981.6667	241	74	1932	83.0288	466949.5	297863		
	13662.2	987	2.3E+07	984.3333	241	75	1963	83.0288	466980.3	297863		
	13618.4	990	2.3E+07	986	240	76	2006.8	83.0288	467011.1	297894		
	13574.6	990	2.3E+07	986	239	77	2050.6	83.0288	467041.9	297925		
	13543.6	986	2.3E+07	986.3333	238	77	2081.6	83.0288	467041.9	297956		
	13512.6	987	2.3E+07	987	237	77	2112.6	83.0288	467041.9	297987		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	13481.6	988	2.3E+07	988.3333	236	77	2143.6	169.009	467041.9	298017		
	13437.8	990	2.3E+07	989.3333	235	78	2187.4	169.009	467072.7	298048		
	13394	990	2.3E+07	991.6667	236	79	2231.2	169.009	467103.5	298017		
	13363	995	2.3E+07	994	236	80	2262.2	169.009	467134.3	298017		
	13332	997	2.3E+07	996.6667	236	81	2293.2	169.009	467165.1	298017		
	13301	998	2.3E+07	1002.667	236	82	2324.2	169.009	467195.9	298017		
	13257.2	1013	2.3E+07	1008	235	83	2368	169.009	467226.7	298048		
	13226.2	1013	2.3E+07	1013.333	235	84	2399	185.769	467257.4	298048		
	13182.4	1014	2.3E+07	1014.333	236	85	2442.8	185.769	467288.2	298017		
	13138.6	1016	2.3E+07	1017.333	237	86	2486.6	185.769	467319	297987		
	13094.8	1022	2.3E+07	1021.667	236	87	2530.4	185.769	467349.8	298017		
	13051	1028	2.3E+07	1025.333	235	88	2574.2	185.769	467380.6	298048		
	13007.2	1027	2.3E+07	1027.667	234	89	2618	185.769	467411.4	298079		
	12976.2	1031	2.3E+07	1028.333	234	90	2649	157.676	467442.2	298079		
	12945.2	1029	2.3E+07	1030.333	234	91	2680	157.676	467473	298079		
	12914.2	1033	2.3E+07	1032	234	92	2711	157.676	467503.8	298079		
	12870.4	1034	2.3E+07	1034.333	233	93	2754.8	157.676	467534.6	298110		
	12839.4	1036	2.3E+07	1038	233	94	2785.8	157.676	467565.4	298110		
	12795.6	1044	2.3E+07	1041.667	234	95	2829.6	157.676	467596.2	298079		
	12764.6	1045	2.3E+07	1045.333	234	96	2860.6	157.676	467627	298079		
	12733.6	1047	2.3E+07	1047.667	234	97	2891.6	145.28	467657.8	298079		
	12702.6	1051	2.3E+07	1050.667	234	98	2922.6	145.28	467688.6	298079		
	12671.6	1054	2.3E+07	1054	234	99	2953.6	145.28	467719.4	298079		
	12627.8	1057	2.3E+07	1056.333	235	100	2997.4	145.28	467750.2	298048		
	12596.8	1058	2.3E+07	1057.667	236	100	3028.4	145.28	467750.2	298017		
	12553	1058	2.3E+07	1058.333	237	101	3072.2	145.28	467781	297987		
	12522	1059	2.3E+07	1059.667	237	102	3103.2	145.28	467811.8	297987		
	12478.2	1062	2.3E+07	1062	238	103	3147	145.28	467842.5	297956		
	12447.2	1066	2.3E+07	1064	238	104	3178	131.022	467873.3	297956		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	12416.2	1065	2.3E+07	1065.333	238	105	3209	131.022	467904.1	297956		
	12372.4	1066	2.3E+07	1068	239	106	3252.8	131.022	467934.9	297925		
	12328.6	1073	2.2E+07	1071	238	107	3296.6	131.022	467965.7	297956		
	12284.8	1074	2.2E+07	1075.333	237	108	3340.4	131.022	467996.5	297987		
	12241	1079	2.2E+07	1077.667	236	109	3384.2	131.022	468027.3	298017		
	12197.2	1080	2.2E+07	1082.333	235	110	3428	152.658	468058.1	298048		
	12166.2	1089	2.2E+07	1085.333	234	110	3459	152.658	468058.1	298079		
	12122.4	1088	2.2E+07	1088.333	233	111	3502.8	152.658	468088.9	298110		
	12091.4	1089	2.2E+07	1088.667	233	112	3533.8	152.658	468119.7	298110		
	12060.4	1089	2.2E+07	1092.333	233	113	3564.8	152.658	468150.5	298110		
	12029.4	1099	2.2E+07	1095.667	233	114	3595.8	152.658	468181.3	298110		
	11985.6	1101	2.2E+07	1099	234	115	3639.6	152.658	468212.1	298079		
	11941.8	1099	2.2E+07	1100	235	116	3683.4	163.444	468242.9	298048		
	11910.8	1102	2.2E+07	1102.667	235	117	3714.4	163.444	468273.7	298048		
	11879.8	1107	2.2E+07	1105.333	235	118	3745.4	163.444	468304.5	298048		
	11836	1107	2.2E+07	1107	236	119	3789.2	163.444	468335.3	298017		
	11805	1107	2.2E+07	1109	236	120	3820.2	163.444	468366.1	298017		
	11761.2	1113	2.2E+07	1114.667	235	121	3864	163.444	468396.9	298048		
	11730.2	1124	2.2E+07	1122.333	235	122	3895	175.382	468427.6	298048		
	11699.2	1133	2.2E+07	1128	235	123	3926	175.382	468458.4	298048		
	11655.4	1134	2.2E+07	1130	236	124	3969.8	175.382	468489.2	298017		
	11624.4	1134	2.2E+07	1130	236	125	4000.8	175.382	468520	298017		
	11580.6	1130	2.2E+07	1130.333	235	126	4044.6	175.382	468550.8	298048		
	11536.8	1136	2.2E+07	1130.667	236	127	4088.4	175.382	468581.6	298017		
	11505.8	1136	2.2E+07	1131	236	128	4119.4	175.382	468612.4	298017		
	11462	1136	2.2E+07	1131	237	129	4163.2	143.606	468643.2	297987		
	11418.2	1136	2.2E+07	1131	236	130	4207	143.606	468674	298017		
	11374.4	1131	2.2E+07	1131	237	131	4250.8	143.606	468704.8	297987		
	11330.6	1131	2.2E+07	1132	238	132	4294.6	143.606	468735.6	297956		
	11299.6	1134	2.2E+07	1133.333	239	132	4325.6	143.606	468735.6	297925		
	11255.8	1135	2.2E+07	1136	240	133	4369.4	143.606	468766.4	297894		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	11224.8	1140	2.2E+07	1137.667	241	133	4400.4	119.401	468766.4	297863		
	11181	1140	2.2E+07	1139	242	134	4444.2	119.401	468797.2	297833		
	11150	1140	2.2E+07	1139	242	135	4475.2	119.401	468828	297833		
	11119	1139	2.2E+07	1140	242	136	4506.2	119.401	468858.8	297833		
	11075.2	1146	2.2E+07	1141	241	137	4550	119.401	468889.6	297863		
	11044.2	1142	2.2E+07	1144.333	241	138	4581	119.401	468920.4	297863		
	11000.4	1149	2.2E+07	1148.667	242	139	4624.8	119.401	468951.2	297833		
	10956.6	1155	2.2E+07	1154	243	140	4668.6	114.673	468982	297802		
	10912.8	1161	2.2E+07	1157	244	141	4712.4	114.673	469012.7	297771		
	10881.8	1164	2.2E+07	1158	245	141	4743.4	114.673	469012.7	297740		
	10850.8	1168	2.2E+07	1158	246	141	4774.4	114.673	469012.7	297709		
	10819.8	1162	2.2E+07	1158	247	141	4805.4	114.673	469012.7	297679		
	10788.8	1163	2.2E+07	1158	248	141	4836.4	114.673	469012.7	297648		
	10745	1165	2.2E+07	1158	249	142	4880.2	114.673	469043.5	297617		
	10714	1164	2.2E+07	1158	250	142	4911.2	88.7658	469043.5	297586		
	10683	1163	2.2E+07	1158	251	142	4942.2	88.7658	469043.5	297555		
	10639.2	1158	2.2E+07	1159	252	143	4986	88.7658	469074.3	297525		
	10595.4	1161	2.2E+07	1161.667	253	144	5029.8	88.7658	469105.1	297494		
	10564.4	1166	2.2E+07	1165.333	253	145	5060.8	88.7658	469135.9	297494		
	10533.4	1169	2.2E+07	1169	253	146	5091.8	88.7658	469166.7	297494		
	10489.6	1173	2.2E+07	1171	252	147	5135.6	88.7658	469197.5	297525		
	10445.8	1179	2.2E+07	1172	253	148	5179.4	93.7851	469228.3	297494		
	10402	1179	2.2E+07	1172	254	149	5223.2	93.7851	469259.1	297463		
	10358.2	1178	2.2E+07	1172	255	150	5267	93.7851	469289.9	297432		
	10314.4	1176	2.2E+07	1172	256	151	5310.8	93.7851	469320.7	297402		
	10283.4	1178	2.2E+07	1172	256	152	5341.8	93.7851	469351.5	297402		
	10252.4	1175	2.2E+07	1172	256	153	5372.8	93.7851	469382.3	297402		
	10221.4	1177	2.2E+07	1172	256	154	5403.8	128.515	469413.1	297402		
	10190.4	1178	2.2E+07	1172	256	155	5434.8	128.515	469443.9	297402		
	10159.4	1172	2.2E+07	1172.667	256	156	5465.8	128.515	469474.7	297402		
	10128.4	1174	2.2E+07	1174.333	256	157	5496.8	128.515	469505.5	297402		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	10097.4	1177	2.2E+07	1176.333	256	158	5527.8	128.515	469536.3	297402		
	10053.6	1178	2.2E+07	1178	257	159	5571.6	128.515	469567.1	297371		
	10022.6	1179	2.2E+07	1179.667	257	160	5602.6	128.515	469597.9	297371		
	9991.6	1182	2.1E+07	1181.333	257	161	5633.6	128.515	469628.6	297371		
	9947.8	1183	2.1E+07	1186	256	162	5677.4	131.937	469659.4	297402		
	9916.8	1193	9092021	1191.667	255	162	5708.4	131.937	469659.4	297432		
	9873	1206	9091060	1197	254	163	5752.2	131.937	469690.2	297463		
	9829.2	1209	9090099	1199	253	164	5796	131.937	469721	297494		
	9785.4	1206	9056464	1199	252	165	5839.8	131.937	469751.8	297525		
	9754.4	1202	9046854	1199	252	166	5870.8	131.937	469782.6	297525		
	9723.4	1203	9045893	1199	252	167	5901.8	137.225	469813.4	297525		
	9679.6	1199	9031478	1200.667	251	168	5945.6	137.225	469844.2	297555		
	9648.6	1204	8800838	1202.667	251	169	5976.6	137.225	469875	297555		
	9617.6	1205	8796994	1207.333	251	170	6007.6	137.225	469905.8	297555		
	9586.6	1213	8793150	1213.333	251	171	6038.6	137.225	469936.6	297555		
	9555.6	1222	8791228	1219.667	251	172	6069.6	137.225	469967.4	297555		
	9511.8	1224	8789306	1223.333	250	173	6113.4	137.225	469998.2	297586		
	9480.8	1224	8785462	1224	250	174	6144.4	112.057	470029	297586		
	9449.8	1229	8747983	1224	250	175	6175.4	112.057	470059.8	297586		
	9418.8	1227	8747022	1224	250	176	6206.4	112.057	470090.6	297586		
	9387.8	1224	8745100	1224	250	177	6237.4	112.057	470121.4	297586		
	9356.8	1224	8741256	1224.667	250	178	6268.4	112.057	470152.2	297586		
	9325.8	1226	8733568	1226.333	250	179	6299.4	112.057	470183	297586		
	9282	1234	8727802	1228	251	180	6343.2	112.057	470213.7	297555		
	9238.2	1234	8723958	1229	250	181	6387	112.057	470244.5	297586		
	9207.2	1229	8717231	1229	250	182	6418	56.4693	470275.3	297586		
	9176.2	1229	8714348	1230	250	183	6449	56.4693	470306.1	297586		
	9145.2	1237	8701855	1231	250	184	6480	56.4693	470336.9	297586		
	9101.4	1232	8624014	1234.333	249	185	6523.8	56.4693	470367.7	297617		
	9070.4	1239	8578847	1237	249	186	6554.8	56.4693	470398.5	297617		
	9039.4	1242	8576925	1239.667	249	187	6585.8	56.4693	470429.3	297617		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	8995.6	1240	8570198	1241	248	188	6629.6	56.4693	470460.1	297648		
	8964.6	1243	8569237	1242.333	248	189	6660.6	65.7204	470490.9	297648		
	8933.6	1245	8563471	1243.667	248	190	6691.6	65.7204	470521.7	297648		
	8889.8	1246	8558666	1244	247	191	6735.4	65.7204	470552.5	297679		
	8846	1246	8547134	1244	246	192	6779.2	65.7204	470583.3	297709		
	8802.2	1244	8427970	1246.333	247	193	6823	65.7204	470614.1	297679		
	8758.4	1251	8418360	1248.667	248	194	6866.8	65.7204	470644.9	297648		
	8714.6	1252	8416438	1251	249	195	6910.6	95.0934	470675.7	297617		
	8670.8	1253	8197330	1251	248	196	6954.4	95.0934	470706.5	297648		
	8639.8	1251	8195408	1253	248	197	6985.4	95.0934	470737.3	297648		
	8596	1257	8183876	1257.667	249	198	7029.2	95.0934	470768.1	297617		
	8565	1265	8177149	1262.667	249	199	7060.2	95.0934	470798.8	297617		
	8521.2	1266	8175227	1266	248	200	7104	95.0934	470829.6	297648		
	8490.2	1267	8169461	1268.333	247	200	7135	95.0934	470829.6	297679		
	8446.4	1272	8164656	1270.667	246	201	7178.8	90.5669	470860.4	297709		
	8402.6	1273	8161773	1272.667	245	202	7222.6	90.5669	470891.2	297740		
	8358.8	1273	8143514	1275.333	246	203	7266.4	90.5669	470922	297709		
	8327.8	1280	8138709	1277.667	246	204	7297.4	90.5669	470952.8	297709		
	8296.8	1281	8113723	1280	246	205	7328.4	90.5669	470983.6	297709		
	8265.8	1280	8112762	1281.667	246	206	7359.4	90.5669	471014.4	297709		
	8234.8	1292	8087776	1283.333	246	207	7390.4	90.5669	471045.2	297709		
	8203.8	1290	8061829	1285	246	208	7421.4	58.9506	471076	297709		
	8172.8	1291	8059907	1285	246	209	7452.4	58.9506	471106.8	297709		
	8141.8	1291	7974378	1285	246	210	7483.4	58.9506	471137.6	297709		
	8110.8	1289	7973417	1285	246	211	7514.4	58.9506	471168.4	297709		
	8079.8	1285	7972456	1286.333	246	212	7545.4	58.9506	471199.2	297709		
	8048.8	1289	7971495	1287.667	246	213	7576.4	58.9506	471230	297709		
	8017.8	1289	7970534	1289.333	246	214	7607.4	58.9506	471260.8	297709		
	7974	1291	7959963	1289.667	245	215	7651.2	27.3795	471291.6	297740		
	7930.2	1290	7955158	1291.333	244	216	7695	27.3795	471322.4	297771		
	7886.4	1301	7843682	1292.667	245	217	7738.8	27.3795	471353.2	297740		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	7842.6	1300	7842721	1294	246	218	7782.6	27.3795	471383.9	297709		
	7798.8	1295	7827345	1294	247	219	7826.4	27.3795	471414.7	297679		
	7767.8	1297	7816774	1294	247	220	7857.4	27.3795	471445.5	297679		
	7736.8	1294	7815813	1295	247	221	7888.4	27.3795	471476.3	297679		
	7693	1299	7790827	1296	248	222	7932.2	22.6591	471507.1	297648		
	7662	1298	7788905	1297	249	222	7963.2	22.6591	471507.1	297617		
	7618.2	1301	7785061	1297	250	223	8007	22.6591	471537.9	297586		
	7574.4	1297	7337235	1297.667	249	224	8050.8	22.6591	471568.7	297617		
	7530.6	1302	7327625	1298.333	248	225	8094.6	22.6591	471599.5	297648		
	7499.6	1300	7326664	1299	248	226	8125.6	22.6591	471630.3	297648		
	7468.6	1300	7325703	1299	248	227	8156.6	33.8917	471661.1	297648		
	7437.6	1303	7324742	1299	248	228	8187.6	33.8917	471691.9	297648		
	7406.6	1304	7321859	1299	248	229	8218.6	33.8917	471722.7	297648		
	7375.6	1299	7273809	1301.333	248	230	8249.6	33.8917	471753.5	297648		
	7331.8	1306	7270926	1304	247	231	8293.4	33.8917	471784.3	297679		
	7300.8	1307	5044289	1306.667	246	231	8324.4	33.8917	471784.3	297709		
	7257	1314	5037562	1307	245	232	8368.2	33.8917	471815.1	297740		
	7226	1314	5036601	1307	244	232	8399.2	33.8917	471815.1	297771		
	7182.2	1310	5012576	1307	243	233	8443	33.8917	471845.9	297802		
	7138.4	1309	5008732	1307	242	234	8486.8	33.8917	471876.7	297833		
	7094.6	1312	4998161	1307	241	235	8530.6	33.8917	471907.5	297863		
	7050.8	1307	4977019	1307.333	240	236	8574.4	33.8917	471938.3	297894		
	7007	1308	4950111	1308	239	237	8618.2	33.8917	471969.1	297925		
	6963.2	1311	4929930	1308.667	238	238	8662	13.3688	471999.8	297956		
	6919.4	1309	4921281	1309.667	237	239	8705.8	13.3688	472030.6	297987		
	6875.6	1312	4916476	1310.333	236	240	8749.6	13.3688	472061.4	298017		
	6831.8	1313	4912632	1311	237	241	8793.4	13.3688	472092.2	297987		
	6800.8	1316	4909749	1311	237	242	8824.4	13.3688	472123	297987		
	6757	1313	4900139	1311	238	243	8868.2	13.3688	472153.8	297956		
	6713.2	1313	4888607	1311	239	244	8912	31.4707	472184.6	297925		
	6669.4	1314	4883802	1311	240	245	8955.8	31.4707	472215.4	297894		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	6638.4	1315	4880919	1311	240	246	8986.8	31.4707	472246.2	297894		
	6594.6	1314	4860738	1311	239	247	9030.6	31.4707	472277	297925		
	6550.8	1311	4818454	1312	238	248	9074.4	31.4707	472307.8	297956		
	6519.8	1314	4813649	1314.333	238	249	9105.4	31.4707	472338.6	297956		
	6488.8	1318	4808844	1317.667	238	250	9136.4	31.4707	472369.4	297956		
	6445	1326	4770404	1320	237	251	9180.2	57.8028	472400.2	297987		
	6401.2	1321	4769443	1323.333	236	252	9224	57.8028	472431	298017		
	6370.2	1328	4482104	1327.667	236	253	9255	57.8028	472461.8	298017		
	6339.2	1334	4481143	1332.667	236	254	9286	57.8028	472492.6	298017		
	6308.2	1336	4472494	1335.333	236	255	9317	57.8028	472523.4	298017		
	6264.4	1341	4470572	1336	237	256	9360.8	57.8028	472554.2	297987		
	6220.6	1339	4469611	1336	236	257	9404.6	54.3257	472584.9	298017		
	6176.8	1341	4434054	1336	237	258	9448.4	54.3257	472615.7	297987		
	6145.8	1339	4430210	1336	237	259	9479.4	54.3257	472646.5	297987		
	6114.8	1339	4426366	1336	237	260	9510.4	54.3257	472677.3	297987		
	6083.8	1341	4422522	1336	237	261	9541.4	54.3257	472708.1	297987		
	6040	1344	4410029	1336	236	262	9585.2	54.3257	472738.9	298017		
	6009	1340	4378316	1336	236	263	9616.2	54.3257	472769.7	298017		
	5978	1340	4365823	1336	236	264	9647.2	0	472800.5	298017		
	5947	1336	4364862	1336.667	236	265	9678.2	0	472831.3	298017		
	5916	1340	4363901	1337.333	236	266	9709.2	0	472862.1	298017		
	5885	1342	4362940	1338	236	267	9740.2	0	472892.9	298017		
	5854	1344	4359096	1338	236	268	9771.2	0	472923.7	298017		
	5810.2	1346	4350447	1338	237	269	9815	0	472954.5	297987		
	5779.2	1349	4344681	1338	237	270	9846	0	472985.3	297987		
	5735.4	1349	4016019	1338	236	271	9889.8	38.9353	473016.1	298017		
	5691.6	1340	4013136	1338	235	272	9933.6	38.9353	473046.9	298048		
	5660.6	1343	3747900	1338	235	273	9964.6	38.9353	473077.7	298048		
	5629.6	1346	3746939	1338	235	274	9995.6	38.9353	473108.5	298048		
	5598.6	1346	3745978	1338	235	275	10026.6	38.9353	473139.3	298048		
	5567.6	1348	3710421	1338	235	276	10057.6	38.9353	473170	298048		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	5536.6	1345	3709460	1338	235	277	10088.6	38.9353	473200.8	298048		
	5505.6	1342	3708499	1338	235	278	10119.6	38.9353	473231.6	298048		
	5474.6	1338	3707538	1338.333	235	279	10150.6	38.9353	473262.4	298048		
	5443.6	1339	3706577	1340.333	235	280	10181.6	38.9353	473293.2	298048		
	5412.6	1344	3705616	1342.667	235	281	10212.6	38.9353	473324	298048		
	5381.6	1345	3704655	1345.667	235	282	10243.6	38.9353	473354.8	298048		
	5350.6	1353	3703694	1347	235	283	10274.6	38.9353	473385.6	298048		
	5306.8	1355	3702733	1348	234	284	10318.4	38.9353	473416.4	298079		
	5275.8	1349	3667176	1348	234	285	10349.4	38.9353	473447.2	298079		
	5244.8	1349	3665254	1348	234	286	10380.4	38.9353	473478	298079		
	5213.8	1348	3663332	1348	234	287	10411.4	32.2536	473508.8	298079		
	5182.8	1348	3661410	1348.667	234	288	10442.4	32.2536	473539.6	298079		
	5151.8	1350	3645073	1351	234	289	10473.4	32.2536	473570.4	298079		
	5120.8	1368	3641229	1353.333	234	290	10504.4	32.2536	473601.2	298079		
	5077	1369	3640268	1355	233	291	10548.2	32.2536	473632	298110		
	5046	1368	3619126	1355	233	292	10579.2	32.2536	473662.8	298110		
	5015	1373	3617204	1355	233	293	10610.2	32.2536	473693.6	298110		
	4971.2	1372	3614321	1355	234	294	10654	40.188	473724.4	298079		
	4927.4	1365	3604711	1355	235	295	10697.8	40.188	473755.1	298048		
	4883.6	1371	3387525	1355	236	296	10741.6	40.188	473785.9	298017		
	4839.8	1364	3373110	1355	237	297	10785.4	40.188	473816.7	297987		
	4796	1355	3363500	1357.333	238	298	10829.2	40.188	473847.5	297956		
	4752.2	1362	3349085	1360.333	239	299	10873	40.188	473878.3	297925		
	4721.2	1364	3340436	1364	239	300	10904	37.4089	473909.1	297925		
	4690.2	1366	3339475	1366.667	239	301	10935	37.4089	473939.9	297925		
	4659.2	1372	3338514	1368.667	239	302	10966	37.4089	473970.7	297925		
	4615.4	1374	3335631	1370	240	303	11009.8	37.4089	474001.5	297894		
	4571.6	1371	3326021	1370	241	304	11053.6	37.4089	474032.3	297863		
	4527.8	1372	3275088	1370	242	305	11097.4	37.4089	474063.1	297833		
	4496.8	1371	3272205	1370	242	306	11128.4	37.4089	474093.9	297833		
	4453	1373	3260673	1370	243	307	11172.2	30.1944	474124.7	297802		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	4409.2	1377	3255868	1370	244	308	11216	30.1944	474155.5	297771		
	4365.4	1374	3247219	1370	245	309	11259.8	30.1944	474186.3	297740		
	4334.4	1370	3183793	1371	245	310	11290.8	30.1944	474217.1	297740		
	4303.4	1373	3182832	1372.667	245	311	11321.8	30.1944	474247.9	297740		
	4259.6	1375	3179949	1376	244	312	11365.6	30.1944	474278.7	297771		
	4215.8	1381	3171300	1378.333	243	313	11409.4	49.3231	474309.5	297802		
	4172	1380	3165534	1380.667	242	314	11453.2	49.3231	474340.3	297833		
	4128.2	1382	3156885	1382.333	241	315	11497	49.3231	474371	297863		
	4084.4	1385	3057902	1386.333	242	316	11540.8	49.3231	474401.8	297833		
	4053.4	1392	3050214	1392	242	317	11571.8	49.3231	474432.6	297833		
	4022.4	1402	3040604	1396.667	242	318	11602.8	49.3231	474463.4	297833		
	3991.4	1410	3037721	1399	242	319	11633.8	49.3231	474494.2	297833		
	3947.6	1409	3026189	1399	243	320	11677.6	49.7089	474525	297802		
	3903.8	1415	3017540	1399	244	321	11721.4	49.7089	474555.8	297771		
	3860	1409	3011774	1399	245	322	11765.2	49.7089	474586.6	297740		
	3829	1410	2996398	1399	246	322	11796.2	49.7089	474586.6	297709		
	3798	1415	2995437	1399	247	322	11827.2	49.7089	474586.6	297679		
	3767	1413	2994476	1399	248	322	11858.2	49.7089	474586.6	297648		
	3736	1414	2981983	1399	249	322	11889.2	49.7089	474586.6	297617		
	3692.2	1411	2965646	1399	250	323	11933	23.0518	474617.4	297586		
	3648.4	1405	2956997	1399	251	324	11976.8	23.0518	474648.2	297555		
	3604.6	1410	2585090	1399	252	325	12020.6	23.0518	474679	297525		
	3573.6	1409	2581246	1399	252	326	12051.6	23.0518	474709.8	297525		
	3542.6	1405	2105551	1399	252	327	12082.6	23.0518	474740.6	297525		
	3511.6	1399	2104590	1399.667	252	328	12113.6	23.0518	474771.4	297525		
	3480.6	1401	2103629	1400.333	252	329	12144.6	23.0518	474802.2	297525		
	3449.6	1401	2102668	1402	252	330	12175.6	23.0518	474833	297525		
	3418.6	1405	2101707	1403	252	331	12206.6	23.0518	474863.8	297525		
	3387.6	1404	2100746	1404.667	252	332	12237.6	23.0518	474894.6	297525		
	3356.6	1409	2099785	1405.333	252	333	12268.6	23.0518	474925.4	297525		
	3325.6	1407	2098824	1406	252	334	12299.6	23.0518	474956.1	297525		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	3294.6	1410	2097863	1406	252	335	12330.6	23.0518	474986.9	297525		
	3263.6	1406	2096902	1406	252	336	12361.6	23.0518	475017.7	297525		
	3232.6	1406	2095941	1407	252	337	12392.6	29.3505	475048.5	297525		
	3201.6	1409	2094980	1409	252	338	12423.6	29.3505	475079.3	297525		
	3170.6	1412	2094019	1411	252	339	12454.6	29.3505	475110.1	297525		
	3139.6	1412	2092097	1412.667	252	340	12485.6	29.3505	475140.9	297525		
	3108.6	1414	2088253	1415.333	252	341	12516.6	29.3505	475171.7	297525		
	3077.6	1420	2080565	1418.333	252	342	12547.6	29.3505	475202.5	297525		
	3046.6	1423	2079604	1420.667	252	343	12578.6	29.3505	475233.3	297525		
	3002.8	1429	2076721	1421	251	344	12622.4	29.3505	475264.1	297555		
	2959	1422	2002724	1421	252	345	12666.2	39.7954	475294.9	297525		
	2915.2	1424	1922000	1421	253	346	12710	39.7954	475325.7	297494		
	2884.2	1421	1909507	1421.667	253	347	12741	39.7954	475356.5	297494		
	2853.2	1424	1908546	1422.333	253	348	12772	39.7954	475387.3	297494		
	2822.2	1423	1907585	1423.667	253	349	12803	39.7954	475418.1	297494		
	2791.2	1425	1857613	1426.667	253	350	12834	39.7954	475448.9	297494		
	2760.2	1434	1855691	1429.667	253	351	12865	39.7954	475479.7	297494		
	2716.4	1433	1851847	1432	254	352	12908.8	14.3069	475510.5	297463		
	2685.4	1435	1802836	1432	254	353	12939.8	14.3069	475541.2	297463		
	2641.6	1438	1795148	1432	253	354	12983.6	14.3069	475572	297494		
	2610.6	1442	1787460	1432	253	355	13014.6	14.3069	475602.8	297494		
	2579.6	1443	1782655	1432	253	356	13045.6	14.3069	475633.6	297494		
	2535.8	1442	1362698	1432	252	357	13089.4	14.3069	475664.4	297525		
	2504.8	1438	1342517	1432	252	358	13120.4	14.3069	475695.2	297525		
	2473.8	1434	1341556	1432	252	359	13151.4	3.3452	475726	297525		
	2442.8	1441	1340595	1432	252	360	13182.4	3.3452	475756.8	297525		
	2411.8	1446	1337712	1432	252	361	13213.4	3.3452	475787.6	297525		
	2368	1448	1330985	1432	251	362	13257.2	3.3452	475818.4	297555		
	2324.2	1445	1328102	1432	250	363	13301	3.3452	475849.2	297586		
	2280.4	1445	1320414	1432	249	364	13344.8	3.3452	475880	297617		
	2236.6	1447	1302155	1432	248	365	13388.6	3.3452	475910.8	297648		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	2192.8	1448	1298311	1432	247	366	13432.4	89.4527	475941.6	297679		
	2161.8	1447	1286779	1432	246	366	13463.4	89.4527	475941.6	297709		
	2118	1451	1272364	1432	245	367	13507.2	89.4527	475972.4	297740		
	2074.2	1455	1268520	1432	246	368	13551	89.4527	476003.2	297709		
	2030.4	1459	1246417	1432	247	369	13594.8	89.4527	476034	297679		
	1986.6	1452	1206055	1432	248	370	13638.6	89.4527	476064.8	297648		
	1942.8	1456	1160888	1432	249	371	13682.4	89.4527	476095.6	297617		
	1911.8	1455	1159927	1432	249	372	13713.4	89.4527	476126.3	297617		
	1880.8	1447	1158005	1432	249	373	13744.4	89.4527	476157.1	297617		
	1837	1453	1145512	1432	250	374	13788.2	89.4527	476187.9	297586		
	1806	1441	1066710	1432	250	375	13819.2	89.4527	476218.7	297586		
	1775	1432	1065749	1433.333	250	376	13850.2	89.4527	476249.5	297586		
	1744	1436	1064788	1438.333	250	377	13881.2	89.4527	476280.3	297586		
	1713	1447	1063827	1444.667	250	378	13912.2	64.8054	476311.1	297586		
	1682	1451	1062866	1450.333	250	379	13943.2	64.8054	476341.9	297586		
	1651	1457	1061905	1452.333	250	380	13974.2	64.8054	476372.7	297586		
	1620	1460	1060944	1453	250	381	14005.2	64.8054	476403.5	297586		
	1589	1453	938897	1454.333	250	382	14036.2	64.8054	476434.3	297586		
	1558	1457	937936	1458.667	250	383	14067.2	64.8054	476465.1	297586		
	1514.2	1466	931209	1463.667	251	384	14111	64.8054	476495.9	297555		
	1470.4	1475	930248	1467.333	252	385	14154.8	42.6461	476526.7	297525		
	1426.6	1474	929287	1468	253	386	14198.6	42.6461	476557.5	297494		
	1382.8	1468	919677	1469.333	254	387	14242.4	42.6461	476588.3	297463		
	1339	1474	862017	1470.667	255	388	14286.2	42.6461	476619.1	297432		
	1308	1474	768800	1472	255	389	14317.2	42.6461	476649.9	297432		
	1264.2	1472	766878	1472.333	256	390	14361	42.6461	476680.7	297402		
	1220.4	1473	555458	1475.333	257	391	14404.8	16.2689	476711.5	297371		
	1176.6	1481	550653	1479	258	392	14448.6	16.2689	476742.2	297340		
	1132.8	1486	547770	1482.333	259	393	14492.4	16.2689	476773	297309		
	1089	1486	539121	1483	260	394	14536.2	16.2689	476803.8	297278		
	1058	1483	429567	1484.333	260	395	14567.2	16.2689	476834.6	297278		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8a												
	1027	1487	425723	1485.667	260	396	14598.2	16.2689	476865.4	297278		
	996	1493	423801	1487	260	397	14629.2	16.2689	476896.2	297278		
	952.2	1490	340194	1487	259	398	14673	20.2116	476927	297309		
	908.4	1490	336350	1487	258	399	14716.8	20.2116	476957.8	297340		
	864.6	1489	331545	1487	257	400	14760.6	20.2116	476988.6	297371		
	833.6	1487	326740	1488.333	256	400	14791.6	20.2116	476988.6	297402		
	789.8	1491	323857	1491.333	255	401	14835.4	20.2116	477019.4	297432		
	758.8	1496	322896	1495.667	255	402	14866.4	20.2116	477050.2	297432		
	727.8	1500	319052	1499	255	403	14897.4	29.9964	477081	297432		
	696.8	1502	314247	1500.667	255	404	14928.4	29.9964	477111.8	297432		
	665.8	1504	311364	1501	255	405	14959.4	29.9964	477142.6	297432		
	634.8	1504	310403	1501	255	406	14990.4	29.9964	477173.4	297432		
	591	1501	304637	1502.667	256	407	15034.2	29.9964	477204.2	297402		
	560	1506	151838	1506.333	256	408	15065.2	29.9964	477235	297402		
	529	1512	150877	1512.667	256	409	15096.2	29.9964	477265.8	297402		
	498	1520	149916	1518.667	256	410	15127.2	29.9964	477296.6	297402		
	467	1524	142228	1524.333	256	411	15158.2	22.2682	477327.3	297402		
	436	1529	139345	1528.333	256	412	15189.2	22.2682	477358.1	297402		
	405	1532	138384	1532	256	413	15220.2	22.2682	477388.9	297402		
	374	1535	133579	1535.667	256	414	15251.2	22.2682	477419.7	297402		
	343	1540	130696	1538.333	256	415	15282.2	22.2682	477450.5	297402		
	312	1541	128774	1540	256	416	15313.2	22.2682	477481.3	297402		
	268.2	1542	109554	1540	257	417	15357	22.2682	477512.1	297371		
	224.4	1540	78802	1540	258	418	15400.8	11.8769	477542.9	297340		
	193.4	1540	52855	1541.667	259	418	15431.8	11.8769	477542.9	297309		
	149.6	1550	43245	1543.333	260	419	15475.6	11.8769	477573.7	297278		
	105.8	1551	42284	1545	261	420	15519.4	11.8769	477604.5	297248		
	62	1545	22103	1545	262	421	15563.2	11.8769	477635.3	297217		
	31	1545	10571	1547	263	421	15594.2	11.8769	477635.3	297186		
	0	1551	9610	1551	264	421	15625.2	11.8769	477635.3	297155		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	17628.6	894	24025	894	231	25	0	0	465440.6	298171	70794.58	0.03957
	17597.6	894	2.4E+07	894.3333	232	25	31	0	465440.6	298141	89125.09	0.10426
	17566.6	895	2.4E+07	895.6667	232	26	62	0	465471.3	298141	141253.8	0.09833
	17522.8	898	2.4E+07	898.3333	233	27	105.8	0	465502.1	298110	223872.1	0.02416
	17491.8	904	2.4E+07	900.6667	234	27	136.8	131.128	465502.1	298079	446683.6	0.04505
	17448	902	2.4E+07	902	235	28	180.6	131.128	465532.9	298048	562341.3	0.02519
	17417	903	2.4E+07	902	235	29	211.6	131.128	465563.7	298048	891250.9	0.03642
	17386	902	2.4E+07	902	235	30	242.6	131.128	465594.5	298048	1412538	0.03425
	17355	902	2.4E+07	902	235	31	273.6	131.128	465625.3	298048	1778279	0.04588
	17324	903	2.4E+07	902	235	32	304.6	131.128	465656.1	298048	2238721	0.12965
	17280.2	903	2.4E+07	902	236	33	348.4	131.128	465686.9	298017	2818383	0.03295
	17249.2	902	2.4E+07	903.3333	236	34	379.4	131.128	465717.7	298017	5623413	0.0276
	17218.2	906	2.4E+07	906	236	35	410.4	131.128	465748.5	298017	7079458	0.05611
	17187.2	910	2.4E+07	909.3333	236	36	441.4	131.128	465779.3	298017	8912509	0.06019
	17156.2	912	2.4E+07	912	236	37	472.4	131.128	465810.1	298017	11220185	0.08585
	17125.2	914	2.4E+07	913.3333	236	38	503.4	131.128	465840.9	298017	22387211	0.07649
	17081.4	914	2.4E+07	914.3333	237	39	547.2	131.128	465871.7	297987		
	17037.6	915	2.3E+07	916	238	40	591	131.128	465902.5	297956		
	17006.6	921	2.3E+07	917.6667	238	41	622	131.128	465933.3	297956		
	16962.8	919	2.3E+07	921.3333	237	42	665.8	139.044	465964.1	297987		
	16931.8	926	2.3E+07	925	237	43	696.8	139.044	465994.9	297987		
	16900.8	930	2.3E+07	929	237	44	727.8	139.044	466025.7	297987		
	16857	932	2.3E+07	930.6667	238	45	771.6	139.044	466056.4	297956		
	16813.2	931	2.3E+07	932	239	46	815.4	139.044	466087.2	297925		
	16782.2	934	2.3E+07	933.6667	239	47	846.4	139.044	466118	297925		
	16738.4	937	2.3E+07	935.3333	240	48	890.2	139.044	466148.8	297894		
	16707.4	936	2.3E+07	937	241	48	921.2	146.465	466148.8	297863		
	16663.6	939	2.3E+07	940.6667	242	49	965	146.465	466179.6	297833		
	16632.6	947	2.3E+07	945.3333	242	50	996	146.465	466210.4	297833		
	16588.8	950	2.3E+07	949	243	51	1039.8	146.465	466241.2	297802		
	16545	950	2.3E+07	951.3333	244	52	1083.6	146.465	466272	297771		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	16501.2	954	2.3E+07	953	243	53	1127.4	146.465	466302.8	297802		
	16470.2	956	2.3E+07	954.6667	243	54	1158.4	98.2514	466333.6	297802		
	16426.4	956	2.3E+07	955	244	55	1202.2	98.2514	466364.4	297771		
	16382.6	956	2.3E+07	955	243	56	1246	98.2514	466395.2	297802		
	16338.8	955	2.3E+07	955	242	57	1289.8	98.2514	466426	297833		
	16307.8	957	2.3E+07	955	242	58	1320.8	98.2514	466456.8	297833		
	16264	958	2.3E+07	955	243	59	1364.6	98.2514	466487.6	297802		
	16220.2	955	2.3E+07	955.6667	242	60	1408.4	115.738	466518.4	297833		
	16176.4	959	2.3E+07	956.3333	241	61	1452.2	115.738	466549.2	297863		
	16132.6	958	2.3E+07	957	240	62	1496	115.738	466580	297894		
	16101.6	957	2.3E+07	957.6667	240	63	1527	115.738	466610.8	297894		
	16070.6	959	2.3E+07	959.3333	240	64	1558	115.738	466641.6	297894		
	16039.6	962	2.3E+07	964	240	65	1589	115.738	466672.3	297894		
	15995.8	971	2.3E+07	968.3333	241	66	1632.8	115.738	466703.1	297863		
	15952	972	2.3E+07	972	242	67	1676.6	139.25	466733.9	297833		
	15921	973	2.3E+07	972.6667	242	68	1707.6	139.25	466764.7	297833		
	15890	973	2.3E+07	973	242	69	1738.6	139.25	466795.5	297833		
	15859	973	2.3E+07	973.3333	242	70	1769.6	139.25	466826.3	297833		
	15828	974	2.3E+07	974.3333	242	71	1800.6	139.25	466857.1	297833		
	15784.2	976	2.3E+07	976	243	72	1844.4	139.25	466887.9	297802		
	15740.4	978	2.3E+07	978.3333	242	73	1888.2	139.25	466918.7	297833		
	15696.6	981	2.3E+07	981.6667	241	74	1932	83.0288	466949.5	297863		
	15665.6	987	2.3E+07	984.3333	241	75	1963	83.0288	466980.3	297863		
	15621.8	990	2.3E+07	986	240	76	2006.8	83.0288	467011.1	297894		
	15578	990	2.3E+07	986	239	77	2050.6	83.0288	467041.9	297925		
	15547	986	2.3E+07	986.3333	238	77	2081.6	83.0288	467041.9	297956		
	15516	987	2.3E+07	987	237	77	2112.6	83.0288	467041.9	297987		
	15485	988	2.3E+07	988.3333	236	77	2143.6	83.0288	467041.9	298017		
	15441.2	990	2.3E+07	989.3333	235	78	2187.4	169.009	467072.7	298048		
	15397.4	990	2.3E+07	991.6667	236	79	2231.2	169.009	467103.5	298017		
	15366.4	995	2.3E+07	994	236	80	2262.2	169.009	467134.3	298017		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	15335.4	997	2.3E+07	996.6667	236	81	2293.2	169.009	467165.1	298017		
	15304.4	998	2.3E+07	1002.667	236	82	2324.2	169.009	467195.9	298017		
	15260.6	1013	2.3E+07	1008	235	83	2368	169.009	467226.7	298048		
	15229.6	1013	2.3E+07	1013.333	235	84	2399	185.769	467257.4	298048		
	15185.8	1014	2.3E+07	1014.333	236	85	2442.8	185.769	467288.2	298017		
	15142	1016	2.3E+07	1017.333	237	86	2486.6	185.769	467319	297987		
	15098.2	1022	2.3E+07	1021.667	236	87	2530.4	185.769	467349.8	298017		
	15054.4	1028	2.3E+07	1025.333	235	88	2574.2	185.769	467380.6	298048		
	15010.6	1027	2.3E+07	1027.667	234	89	2618	185.769	467411.4	298079		
	14979.6	1031	2.3E+07	1028.333	234	90	2649	157.676	467442.2	298079		
	14948.6	1029	2.3E+07	1030.333	234	91	2680	157.676	467473	298079		
	14917.6	1033	2.3E+07	1032	234	92	2711	157.676	467503.8	298079		
	14873.8	1034	2.3E+07	1034.333	233	93	2754.8	157.676	467534.6	298110		
	14842.8	1036	2.3E+07	1038	233	94	2785.8	157.676	467565.4	298110		
	14799	1044	2.3E+07	1041.667	234	95	2829.6	157.676	467596.2	298079		
	14768	1045	2.3E+07	1045.333	234	96	2860.6	157.676	467627	298079		
	14737	1047	2.3E+07	1047.667	234	97	2891.6	157.676	467657.8	298079		
	14706	1051	2.3E+07	1050.667	234	98	2922.6	145.28	467688.6	298079		
	14675	1054	2.3E+07	1054	234	99	2953.6	145.28	467719.4	298079		
	14631.2	1057	2.3E+07	1056.333	235	100	2997.4	145.28	467750.2	298048		
	14600.2	1058	2.3E+07	1057.667	236	100	3028.4	145.28	467750.2	298017		
	14556.4	1058	2.3E+07	1058.333	237	101	3072.2	145.28	467781	297987		
	14525.4	1059	2.3E+07	1059.667	237	102	3103.2	145.28	467811.8	297987		
	14481.6	1062	2.3E+07	1062	238	103	3147	145.28	467842.5	297956		
	14450.6	1066	2.3E+07	1064	238	104	3178	131.022	467873.3	297956		
	14419.6	1065	2.3E+07	1065.333	238	105	3209	131.022	467904.1	297956		
	14375.8	1066	2.3E+07	1068	239	106	3252.8	131.022	467934.9	297925		
	14332	1073	2.2E+07	1071	238	107	3296.6	131.022	467965.7	297956		
	14288.2	1074	2.2E+07	1075.333	237	108	3340.4	131.022	467996.5	297987		
	14244.4	1079	2.2E+07	1077.667	236	109	3384.2	131.022	468027.3	298017		
	14200.6	1080	2.2E+07	1082.333	235	110	3428	152.658	468058.1	298048		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	14169.6	1089	2.2E+07	1085.333	234	110	3459	152.658	468058.1	298079		
	14125.8	1088	2.2E+07	1088.333	233	111	3502.8	152.658	468088.9	298110		
	14094.8	1089	2.2E+07	1088.667	233	112	3533.8	152.658	468119.7	298110		
	14063.8	1089	2.2E+07	1092.333	233	113	3564.8	152.658	468150.5	298110		
	14032.8	1099	2.2E+07	1095.667	233	114	3595.8	152.658	468181.3	298110		
	13989	1101	2.2E+07	1099	234	115	3639.6	152.658	468212.1	298079		
	13945.2	1099	2.2E+07	1100	235	116	3683.4	163.444	468242.9	298048		
	13914.2	1102	2.2E+07	1102.667	235	117	3714.4	163.444	468273.7	298048		
	13883.2	1107	2.2E+07	1105.333	235	118	3745.4	163.444	468304.5	298048		
	13839.4	1107	2.2E+07	1107	236	119	3789.2	163.444	468335.3	298017		
	13808.4	1107	2.2E+07	1109	236	120	3820.2	163.444	468366.1	298017		
	13764.6	1113	2.2E+07	1114.667	235	121	3864	163.444	468396.9	298048		
	13733.6	1124	2.2E+07	1122.333	235	122	3895	175.382	468427.6	298048		
	13702.6	1133	2.2E+07	1128	235	123	3926	175.382	468458.4	298048		
	13658.8	1134	2.2E+07	1130	236	124	3969.8	175.382	468489.2	298017		
	13627.8	1134	2.2E+07	1130	236	125	4000.8	175.382	468520	298017		
	13584	1130	2.2E+07	1130.333	235	126	4044.6	175.382	468550.8	298048		
	13540.2	1136	2.2E+07	1130.667	236	127	4088.4	175.382	468581.6	298017		
	13509.2	1136	2.2E+07	1131	236	128	4119.4	175.382	468612.4	298017		
	13465.4	1136	2.2E+07	1131	237	129	4163.2	143.606	468643.2	297987		
	13421.6	1136	2.2E+07	1131	236	130	4207	143.606	468674	298017		
	13377.8	1131	2.2E+07	1131	237	131	4250.8	143.606	468704.8	297987		
	13334	1131	2.2E+07	1132	238	132	4294.6	143.606	468735.6	297956		
	13303	1134	2.2E+07	1133.333	239	132	4325.6	143.606	468735.6	297925		
	13259.2	1135	2.2E+07	1136	240	133	4369.4	143.606	468766.4	297894		
	13228.2	1140	2.2E+07	1137.667	241	133	4400.4	119.401	468766.4	297863		
	13184.4	1140	2.2E+07	1139	242	134	4444.2	119.401	468797.2	297833		
	13153.4	1140	2.2E+07	1139	242	135	4475.2	119.401	468828	297833		
	13122.4	1139	2.2E+07	1140	242	136	4506.2	119.401	468858.8	297833		
	13078.6	1146	2.2E+07	1141	241	137	4550	119.401	468889.6	297863		
	13047.6	1142	2.2E+07	1144.333	241	138	4581	119.401	468920.4	297863		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	13003.8	1149	2.2E+07	1148.667	242	139	4624.8	119.401	468951.2	297833		
	12960	1155	2.2E+07	1154	243	140	4668.6	114.673	468982	297802		
	12916.2	1161	2.2E+07	1157	244	141	4712.4	114.673	469012.7	297771		
	12885.2	1164	2.2E+07	1158	245	141	4743.4	114.673	469012.7	297740		
	12854.2	1168	2.2E+07	1158	246	141	4774.4	114.673	469012.7	297709		
	12823.2	1162	2.2E+07	1158	247	141	4805.4	114.673	469012.7	297679		
	12792.2	1163	2.2E+07	1158	248	141	4836.4	114.673	469012.7	297648		
	12748.4	1165	2.2E+07	1158	249	142	4880.2	114.673	469043.5	297617		
	12717.4	1164	2.2E+07	1158	250	142	4911.2	88.7658	469043.5	297586		
	12686.4	1163	2.2E+07	1158	251	142	4942.2	88.7658	469043.5	297555		
	12642.6	1158	2.2E+07	1159	252	143	4986	88.7658	469074.3	297525		
	12598.8	1161	2.2E+07	1161.667	253	144	5029.8	88.7658	469105.1	297494		
	12567.8	1166	2.2E+07	1165.333	253	145	5060.8	88.7658	469135.9	297494		
	12536.8	1169	2.2E+07	1169	253	146	5091.8	88.7658	469166.7	297494		
	12493	1173	2.2E+07	1171	252	147	5135.6	88.7658	469197.5	297525		
	12449.2	1179	2.2E+07	1172	253	148	5179.4	93.7851	469228.3	297494		
	12405.4	1179	2.2E+07	1172	254	149	5223.2	93.7851	469259.1	297463		
	12361.6	1178	2.2E+07	1172	255	150	5267	93.7851	469289.9	297432		
	12317.8	1176	2.2E+07	1172	256	151	5310.8	93.7851	469320.7	297402		
	12286.8	1178	2.2E+07	1172	256	152	5341.8	93.7851	469351.5	297402		
	12255.8	1175	2.2E+07	1172	256	153	5372.8	93.7851	469382.3	297402		
	12224.8	1177	2.2E+07	1172	256	154	5403.8	92.6422	469413.1	297402		
	12193.8	1178	2.2E+07	1172	256	155	5434.8	92.6422	469443.9	297402		
	12162.8	1172	2.2E+07	1172.667	256	156	5465.8	92.6422	469474.7	297402		
	12131.8	1174	2.2E+07	1174.333	256	157	5496.8	92.6422	469505.5	297402		
	12100.8	1177	2.2E+07	1176.333	256	158	5527.8	92.6422	469536.3	297402		
	12057	1178	2.2E+07	1178	257	159	5571.6	92.6422	469567.1	297371		
	12026	1179	2.2E+07	1179.667	257	160	5602.6	92.6422	469597.9	297371		
	11995	1182	2.1E+07	1181.333	257	161	5633.6	92.6422	469628.6	297371		
	11951.2	1183	2.1E+07	1182.667	256	162	5677.4	231.039	469659.4	297402		
	11907.4	1183	1.2E+07	1184.667	257	163	5721.2	231.039	469690.2	297371		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	11876.4	1188	1.2E+07	1191.333	257	164	5752.2	231.039	469721	297371		
	11845.4	1203	1.2E+07	1200.667	257	165	5783.2	231.039	469751.8	297371		
	11801.6	1211	1.2E+07	1209.333	258	166	5827	231.039	469782.6	297340		
	11770.6	1214	1.2E+07	1213.667	258	167	5858	231.039	469813.4	297340		
	11726.8	1216	1.2E+07	1216	259	168	5901.8	189.662	469844.2	297309		
	11695.8	1218	1.2E+07	1217.667	259	169	5932.8	189.662	469875	297309		
	11664.8	1219	1.2E+07	1220	259	170	5963.8	189.662	469905.8	297309		
	11633.8	1223	1.2E+07	1222.667	259	171	5994.8	189.662	469936.6	297309		
	11590	1226	1.2E+07	1226	258	172	6038.6	189.662	469967.4	297340		
	11546.2	1229	1.2E+07	1228.667	257	173	6082.4	189.662	469998.2	297371		
	11515.2	1234	1.2E+07	1230.333	257	174	6113.4	189.662	470029	297371		
	11471.4	1236	1.2E+07	1231	258	175	6157.2	69.9789	470059.8	297340		
	11427.6	1231	1.2E+07	1232	259	176	6201	69.9789	470090.6	297309		
	11396.6	1234	1.2E+07	1234	259	177	6232	69.9789	470121.4	297309		
	11365.6	1240	1.2E+07	1236	259	178	6263	69.9789	470152.2	297309		
	11321.8	1237	1.2E+07	1237.667	260	179	6306.8	69.9789	470183	297278		
	11290.8	1243	1.2E+07	1238.333	261	179	6337.8	69.9789	470183	297248		
	11259.8	1247	1.2E+07	1239	262	179	6368.8	69.9789	470183	297217		
	11216	1247	1.2E+07	1239	263	180	6412.6	37.1935	470213.7	297186		
	11185	1245	1.2E+07	1239	264	180	6443.6	37.1935	470213.7	297155		
	11141.2	1243	1.2E+07	1239	265	181	6487.4	37.1935	470244.5	297124		
	11110.2	1241	1.2E+07	1239	266	181	6518.4	37.1935	470244.5	297094		
	11079.2	1239	1.2E+07	1240.333	267	181	6549.4	37.1935	470244.5	297063		
	11048.2	1243	1.2E+07	1241.667	268	181	6580.4	37.1935	470244.5	297032		
	11004.4	1246	1.2E+07	1243	269	182	6624.2	37.1935	470275.3	297001		
	10960.6	1243	1.2E+07	1244	270	183	6668	39.3608	470306.1	296970		
	10929.6	1246	1.2E+07	1245.667	271	183	6699	39.3608	470306.1	296940		
	10898.6	1251	1.2E+07	1247.333	272	183	6730	39.3608	470306.1	296909		
	10854.8	1252	1.2E+07	1248	273	184	6773.8	39.3608	470336.9	296878		
	10811	1248	1.2E+07	1249.667	274	185	6817.6	39.3608	470367.7	296847		
	10780	1253	1.2E+07	1251.667	274	186	6848.6	39.3608	470398.5	296847		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	10749	1256	1.2E+07	1253.667	274	187	6879.6	39.3608	470429.3	296847		
	10705.2	1257	1.2E+07	1254	273	188	6923.4	34.086	470460.1	296878		
	10661.4	1255	1.2E+07	1254	272	189	6967.2	34.086	470490.9	296909		
	10630.4	1256	1.2E+07	1254	272	190	6998.2	34.086	470521.7	296909		
	10599.4	1257	1.2E+07	1254	272	191	7029.2	34.086	470552.5	296909		
	10568.4	1258	1.2E+07	1254	272	192	7060.2	34.086	470583.3	296909		
	10524.6	1257	1.2E+07	1254	273	193	7104	34.086	470614.1	296878		
	10493.6	1254	1.1E+07	1254.333	274	193	7135	34.086	470614.1	296847		
	10462.6	1258	1.1E+07	1254.667	275	193	7166	40.9347	470614.1	296816		
	10418.8	1255	1.1E+07	1255.333	276	194	7209.8	40.9347	470644.9	296786		
	10387.8	1256	1.1E+07	1257.667	276	195	7240.8	40.9347	470675.7	296786		
	10344	1262	1.1E+07	1260.333	277	196	7284.6	40.9347	470706.5	296755		
	10313	1264	1.1E+07	1262.667	277	197	7315.6	40.9347	470737.3	296755		
	10269.2	1265	1.1E+07	1263	278	198	7359.4	40.9347	470768.1	296724		
	10225.4	1263	1.1E+07	1263.333	279	199	7403.2	40.9347	470798.8	296693		
	10194.4	1267	1.1E+07	1263.667	280	199	7434.2	40.9347	470798.8	296662		
	10163.4	1266	1.1E+07	1264	281	199	7465.2	40.9347	470798.8	296632		
	10119.6	1268	1.1E+07	1264	282	200	7509	40.9347	470829.6	296601		
	10088.6	1273	1.1E+07	1264	283	200	7540	40.9347	470829.6	296570		
	10044.8	1272	1.1E+07	1264	284	201	7583.8	40.9347	470860.4	296539		
	10001	1271	1.1E+07	1264	285	202	7627.6	40.9347	470891.2	296508		
	9970	1264	1.1E+07	1266.333	286	202	7658.6	176.926	470891.2	296478		
	9939	1271	1.1E+07	1270.667	287	202	7689.6	176.926	470891.2	296447		
	9895.2	1277	1.1E+07	1275	288	203	7733.4	176.926	470922	296416		
	9864.2	1277	1.1E+07	1278.333	289	203	7764.4	176.926	470922	296385		
	9820.4	1281	1.1E+07	1283.667	290	202	7808.2	176.926	470891.2	296354		
	9776.6	1293	1.1E+07	1290.333	291	203	7852	176.926	470922	296324		
	9732.8	1297	1.1E+07	1295.667	292	204	7895.8	176.926	470952.8	296293		
	9701.8	1297	1.1E+07	1299.667	292	205	7926.8	134.989	470983.6	296293		
	9658	1306	1.1E+07	1302.333	293	206	7970.6	134.989	471014.4	296262		
	9614.2	1305	1.1E+07	1305.333	292	207	8014.4	134.989	471045.2	296293		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	9583.2	1315	1.1E+07	1305.667	292	208	8045.4	134.989	471076	296293		
	9539.4	1311	1.1E+07	1306	293	209	8089.2	134.989	471106.8	296262		
	9495.6	1307	1.1E+07	1306	294	210	8133	134.989	471137.6	296231		
	9451.8	1306	1.1E+07	1307	295	211	8176.8	75.2021	471168.4	296201		
	9408	1315	9945389	1308	296	212	8220.6	75.2021	471199.2	296170		
	9377	1313	9941545	1309	296	213	8251.6	75.2021	471230	296170		
	9346	1309	9923286	1312.333	296	214	8282.6	75.2021	471260.8	296170		
	9315	1319	9922325	1316	296	215	8313.6	75.2021	471291.6	296170		
	9271.2	1323	9921364	1319.667	297	216	8357.4	75.2021	471322.4	296139		
	9227.4	1324	9909832	1320	298	217	8401.2	76.4425	471353.2	296108		
	9196.4	1331	9905027	1320	298	218	8432.2	76.4425	471383.9	296108		
	9152.6	1334	9902144	1320	299	219	8476	76.4425	471414.7	296077		
	9121.6	1322	9834874	1320	299	220	8507	76.4425	471445.5	296077		
	9077.8	1320	9815654	1323	300	221	8550.8	76.4425	471476.3	296047		
	9046.8	1329	9803161	1326.333	301	221	8581.8	76.4425	471476.3	296016		
	9003	1342	9800278	1329.667	302	220	8625.6	76.4425	471445.5	295985		
	8959.2	1341	9788746	1330	303	221	8669.4	34.124	471476.3	295954		
	8928.2	1342	9781058	1330	303	222	8700.4	34.124	471507.1	295954		
	8897.2	1342	9742618	1330	303	223	8731.4	34.124	471537.9	295954		
	8866.2	1342	9741657	1330	303	224	8762.4	34.124	471568.7	295954		
	8835.2	1340	9740696	1330	303	225	8793.4	34.124	471599.5	295954		
	8804.2	1339	9738774	1330	303	226	8824.4	34.124	471630.3	295954		
	8773.2	1341	9736852	1330	303	227	8855.4	34.124	471661.1	295954		
	8742.2	1335	9141032	1330	303	228	8886.4	34.124	471691.9	295954		
	8711.2	1341	9138149	1330	303	229	8917.4	13.5713	471722.7	295954		
	8667.4	1339	9131422	1330	302	230	8961.2	13.5713	471753.5	295985		
	8623.6	1336	9098748	1330	301	231	9005	13.5713	471784.3	296016		
	8579.8	1335	9083372	1330	300	232	9048.8	13.5713	471815.1	296047		
	8536	1333	9069918	1330	299	233	9092.6	13.5713	471845.9	296077		
	8492.2	1330	9045893	1330	298	234	9136.4	13.5713	471876.7	296108		
	8461.2	1330	8766242	1332	298	235	9167.4	123.843	471907.5	296108		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	8430.2	1336	8765281	1337.333	298	236	9198.4	123.843	471938.3	296108		
	8399.2	1346	8761437	1343.333	298	237	9229.4	123.843	471969.1	296108		
	8368.2	1352	8759515	1347.333	298	238	9260.4	123.843	471999.8	296108		
	8324.4	1351	8753749	1348	297	239	9304.2	123.843	472030.6	296139		
	8293.4	1352	8750866	1348	297	240	9335.2	123.843	472061.4	296139		
	8249.6	1348	8701855	1348.333	298	241	9379	123.843	472092.2	296108		
	8218.6	1349	8698011	1349.333	298	242	9410	79.5955	472123	296108		
	8187.6	1352	8567315	1350.333	298	243	9441	79.5955	472153.8	296108		
	8156.6	1351	8563471	1351.667	298	244	9472	79.5955	472184.6	296108		
	8125.6	1357	8555783	1352.333	298	245	9503	79.5955	472215.4	296108		
	8094.6	1361	8552900	1353	298	246	9534	79.5955	472246.2	296108		
	8063.6	1357	8551939	1353	298	247	9565	79.5955	472277	296108		
	8032.6	1356	8549056	1353	298	248	9596	79.5955	472307.8	296108		
	8001.6	1358	8542329	1353	298	249	9627	79.5955	472338.6	296108		
	7970.6	1359	8540407	1353	298	250	9658	92.3497	472369.4	296108		
	7926.8	1357	8512538	1353	299	251	9701.8	92.3497	472400.2	296077		
	7895.8	1353	8490435	1353.667	299	252	9732.8	92.3497	472431	296077		
	7864.8	1355	8489474	1357.667	299	253	9763.8	92.3497	472461.8	296077		
	7833.8	1365	8487552	1362.333	299	254	9794.8	92.3497	472492.6	296077		
	7790	1367	8484669	1367.667	300	255	9838.6	92.3497	472523.4	296047		
	7759	1371	8454878	1369.667	300	256	9869.6	92.3497	472554.2	296047		
	7728	1374	8451995	1371	300	257	9900.6	111.349	472584.9	296047		
	7697	1372	8451034	1371	300	258	9931.6	111.349	472615.7	296047		
	7666	1371	8439502	1371	300	259	9962.6	111.349	472646.5	296047		
	7622.2	1374	8408750	1371	299	260	10006.4	111.349	472677.3	296077		
	7578.4	1371	8140631	1373.333	298	261	10050.2	111.349	472708.1	296108		
	7547.4	1378	8127177	1376.667	298	262	10081.2	111.349	472738.9	296108		
	7516.4	1381	8126216	1381.333	298	263	10112.2	111.349	472769.7	296108		
	7485.4	1385	8123333	1383.667	298	264	10143.2	111.349	472800.5	296108		
	7441.6	1385	8119489	1385.667	297	265	10187	61.7339	472831.3	296139		
	7397.8	1387	8107957	1387	296	266	10230.8	61.7339	472862.1	296170		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	7354	1396	8103152	1388.333	295	267	10274.6	61.7339	472892.9	296201		
	7310.2	1395	8099308	1389	294	268	10318.4	61.7339	472923.7	296231		
	7279.2	1392	7282458	1389	294	269	10349.4	61.7339	472954.5	296231		
	7248.2	1389	7279575	1389.333	294	270	10380.4	61.7339	472985.3	296231		
	7217.2	1391	7276692	1389.667	294	271	10411.4	35.1739	473016.1	296231		
	7186.2	1390	7271887	1391.333	294	272	10442.4	35.1739	473046.9	296231		
	7142.4	1394	7266121	1393.667	295	273	10486.2	35.1739	473077.7	296201		
	7111.4	1397	7264199	1396	295	274	10517.2	35.1739	473108.5	296201		
	7080.4	1400	7259394	1397	295	275	10548.2	35.1739	473139.3	296201		
	7036.6	1402	7258433	1397	296	276	10592	35.1739	473170	296170		
	7005.6	1405	7244018	1397	296	277	10623	35.1739	473200.8	296170		
	6961.8	1400	7229603	1397	297	278	10666.8	34.3428	473231.6	296139		
	6918	1397	7216149	1398.333	298	279	10710.6	34.3428	473262.4	296108		
	6874.2	1402	7205578	1399.667	299	280	10754.4	34.3428	473293.2	296077		
	6830.4	1406	7200773	1401	300	281	10798.2	34.3428	473324	296047		
	6786.6	1401	7174826	1401.333	301	282	10842	34.3428	473354.8	296016		
	6742.8	1402	6397377	1402	302	283	10885.8	34.3428	473385.6	295985		
	6711.8	1403	6383923	1402.667	302	284	10916.8	32.9191	473416.4	295985		
	6680.8	1403	6382962	1403.333	302	285	10947.8	32.9191	473447.2	295985		
	6649.8	1404	6371430	1404	302	286	10978.8	32.9191	473478	295985		
	6618.8	1405	6363742	1404.667	302	287	11009.8	32.9191	473508.8	295985		
	6587.8	1405	6359898	1406.667	302	288	11040.8	32.9191	473539.6	295985		
	6556.8	1410	6338756	1409.667	302	289	11071.8	32.9191	473570.4	295985		
	6525.8	1417	6336834	1412.667	302	290	11102.8	32.9191	473601.2	295985		
	6482	1421	6333951	1414	303	291	11146.6	32.9191	473632	295954		
	6438.2	1419	6321458	1414	304	292	11190.4	38.2266	473662.8	295923		
	6407.2	1419	6290706	1414	304	293	11221.4	38.2266	473693.6	295923		
	6376.2	1419	6288784	1414	304	294	11252.4	38.2266	473724.4	295923		
	6332.4	1423	6284940	1414	305	295	11296.2	38.2266	473755.1	295893		
	6301.4	1426	6281096	1414	306	295	11327.2	38.2266	473755.1	295862		
	6257.6	1430	6278213	1414	307	296	11371	38.2266	473785.9	295831		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	6226.6	1427	6206138	1414	307	297	11402	35.4174	473816.7	295831		
	6195.6	1422	6204216	1414	307	298	11433	35.4174	473847.5	295831		
	6164.6	1414	6202294	1415.667	307	299	11464	35.4174	473878.3	295831		
	6133.6	1419	6198450	1417.667	307	300	11495	35.4174	473909.1	295831		
	6089.8	1426	6192684	1419.667	308	301	11538.8	35.4174	473939.9	295800		
	6046	1426	6186918	1420	309	302	11582.6	35.4174	473970.7	295769		
	6002.2	1420	6177308	1420	310	303	11626.4	35.4174	474001.5	295739		
	5971.2	1425	6167698	1420	311	303	11657.4	29.0881	474001.5	295708		
	5927.4	1420	6165776	1420.333	312	304	11701.2	29.0881	474032.3	295677		
	5896.4	1421	2648516	1421.667	312	305	11732.2	29.0881	474063.1	295677		
	5852.6	1424	2647555	1424.667	313	306	11776	29.0881	474093.9	295646		
	5821.6	1434	2646594	1427.333	313	307	11807	29.0881	474124.7	295646		
	5777.8	1433	2636984	1429	312	308	11850.8	29.0881	474155.5	295677		
	5734	1429	2616803	1430.333	311	309	11894.6	29.0881	474186.3	295708		
	5703	1433	2603349	1431.667	310	309	11925.6	23.8899	474186.3	295739		
	5659.2	1433	2597583	1433	309	310	11969.4	23.8899	474217.1	295769		
	5628.2	1438	2592778	1433	309	311	12000.4	23.8899	474247.9	295769		
	5584.4	1440	2589895	1433	310	312	12044.2	23.8899	474278.7	295739		
	5553.4	1433	2452472	1433.667	310	313	12075.2	23.8899	474309.5	295739		
	5522.4	1437	2451511	1434.333	310	314	12106.2	23.8899	474340.3	295739		
	5491.4	1439	2450550	1435	310	315	12137.2	23.8899	474371	295739		
	5460.4	1438	2443823	1435	310	316	12168.2	10.0615	474401.8	295739		
	5416.6	1440	2432291	1435	311	317	12212	10.0615	474432.6	295708		
	5385.6	1438	2429408	1435	311	318	12243	10.0615	474463.4	295708		
	5354.6	1436	2426525	1435	311	319	12274	10.0615	474494.2	295708		
	5323.6	1435	2418837	1435.667	311	320	12305	10.0615	474525	295708		
	5292.6	1438	2414993	1436.333	311	321	12336	10.0615	474555.8	295708		
	5261.6	1443	2393851	1437	311	322	12367	10.0615	474586.6	295708		
	5230.6	1446	2390968	1437	311	323	12398	11.01	474617.4	295708		
	5186.8	1440	2367904	1437	310	324	12441.8	11.01	474648.2	295739		
	5155.8	1437	2333308	1438	310	325	12472.8	11.01	474679	295739		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	5124.8	1440	2332347	1439.667	310	326	12503.8	11.01	474709.8	295739		
	5093.8	1445	2331386	1441.333	310	327	12534.8	11.01	474740.6	295739		
	5050	1448	2329464	1442	311	328	12578.6	11.01	474771.4	295708		
	5006.2	1448	2322737	1442	310	329	12622.4	11.01	474802.2	295739		
	4962.4	1447	2272765	1442	309	330	12666.2	26.8865	474833	295769		
	4931.4	1445	2268921	1442	309	331	12697.2	26.8865	474863.8	295769		
	4900.4	1447	2205495	1442	309	332	12728.2	26.8865	474894.6	295769		
	4856.6	1445	2190119	1442	308	333	12772	26.8865	474925.4	295800		
	4812.8	1442	2164172	1443.333	307	334	12815.8	26.8865	474956.1	295831		
	4769	1446	2156484	1446	306	335	12859.6	26.8865	474986.9	295862		
	4725.2	1450	2138225	1450.667	305	336	12903.4	103.971	475017.7	295893		
	4694.2	1457	2132459	1454	305	337	12934.4	103.971	475048.5	295893		
	4650.4	1456	2131498	1458.333	304	338	12978.2	103.971	475079.3	295923		
	4619.4	1463	2119966	1466	303	338	13009.2	103.971	475079.3	295954		
	4575.6	1479	2111317	1473.667	302	337	13053	103.971	475048.5	295985		
	4544.6	1479	2110356	1479.667	301	337	13084	103.971	475048.5	296016		
	4500.8	1481	2102668	1485	300	338	13127.8	103.971	475079.3	296047		
	4457	1498	2092097	1490.333	299	339	13171.6	80.399	475110.1	296077		
	4413.2	1506	2091136	1495	298	340	13215.4	80.399	475140.9	296108		
	4369.4	1504	2087292	1495	297	341	13259.2	80.399	475171.7	296139		
	4325.6	1503	2073838	1495	296	342	13303	80.399	475202.5	296170		
	4281.8	1496	2047891	1495	295	343	13346.8	80.399	475233.3	296201		
	4238	1503	2033476	1495	294	344	13390.6	80.399	475264.1	296231		
	4207	1495	2000802	1495	294	345	13421.6	25.2271	475294.9	296231		
	4176	1495	1999841	1496	294	346	13452.6	25.2271	475325.7	296231		
	4145	1499	1998880	1497	294	347	13483.6	25.2271	475356.5	296231		
	4101.2	1504	1984465	1498	293	348	13527.4	25.2271	475387.3	296262		
	4057.4	1499	1976777	1498	292	349	13571.2	25.2271	475418.1	296293		
	4013.6	1498	1963323	1499.333	291	350	13615	25.2271	475448.9	296324		
	3982.6	1502	1937376	1501	291	351	13646	9.77582	475479.7	296324		
	3951.6	1503	1936415	1503.333	291	352	13677	9.77582	475510.5	296324		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	3907.8	1509	1934493	1504.333	292	353	13720.8	9.77582	475541.2	296293		
	3864	1507	1925844	1505	293	354	13764.6	9.77582	475572	296262		
	3833	1505	1902780	1505	293	355	13795.6	9.77582	475602.8	296262		
	3789.2	1508	1895092	1505	292	356	13839.4	9.77582	475633.6	296293		
	3745.4	1507	1871067	1505	291	357	13883.2	9.77582	475664.4	296324		
	3714.4	1505	1794187	1505.333	291	358	13914.2	9.77582	475695.2	296324		
	3683.4	1507	1792265	1505.667	291	359	13945.2	9.77582	475726	296324		
	3652.4	1509	1789382	1506	291	360	13976.2	9.77582	475756.8	296324		
	3621.4	1511	1760552	1506	291	361	14007.2	9.77582	475787.6	296324		
	3590.4	1516	1756708	1506	291	362	14038.2	9.77582	475818.4	296324		
	3546.6	1520	1752864	1506	290	363	14082	9.77582	475849.2	296354		
	3502.8	1515	1696165	1506	289	364	14125.8	9.77582	475880	296385		
	3459	1508	1683672	1506	288	365	14169.6	0	475910.8	296416		
	3415.2	1513	1668296	1506	287	366	14213.4	0	475941.6	296447		
	3371.4	1511	1536639	1506	286	367	14257.2	0	475972.4	296478		
	3327.6	1514	1527990	1506	285	368	14301	0	476003.2	296508		
	3283.8	1516	1519341	1506	284	369	14344.8	0	476034	296539		
	3240	1511	1462642	1506	283	370	14388.6	33.1868	476064.8	296570		
	3196.2	1506	1409787	1507	282	371	14432.4	33.1868	476095.6	296601		
	3165.2	1509	1369425	1508	282	372	14463.4	33.1868	476126.3	296601		
	3134.2	1510	1368464	1509	282	373	14494.4	33.1868	476157.1	296601		
	3103.2	1510	1367503	1509	282	374	14525.4	33.1868	476187.9	296601		
	3072.2	1515	1366542	1509	282	375	14556.4	33.1868	476218.7	296601		
	3041.2	1519	1365581	1509	282	376	14587.4	33.1868	476249.5	296601		
	3010.2	1509	1359815	1509	282	377	14618.4	33.1868	476280.3	296601		
	2979.2	1509	1358854	1511	282	378	14649.4	33.1868	476311.1	296601		
	2948.2	1515	1357893	1514	282	379	14680.4	33.1868	476341.9	296601		
	2904.4	1525	1354049	1517	281	380	14724.2	33.1868	476372.7	296632		
	2860.6	1523	1353088	1518	280	381	14768	33.1868	476403.5	296662		
	2816.8	1518	1344439	1518	279	382	14811.8	33.1868	476434.3	296693		
	2773	1518	1330024	1520	278	383	14855.6	33.1868	476465.1	296724		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	2729.2	1524	1297350	1522.667	277	384	14899.4	33.1868	476495.9	296755		
	2685.4	1526	1281974	1527.333	276	385	14943.2	21.0476	476526.7	296786		
	2641.6	1532	1275247	1530	277	386	14987	21.0476	476557.5	296755		
	2610.6	1536	1260832	1532	277	387	15018	21.0476	476588.3	296755		
	2579.6	1533	1259871	1532	277	388	15049	21.0476	476619.1	296755		
	2548.6	1533	1256988	1532	277	389	15080	21.0476	476649.9	296755		
	2504.8	1533	1232002	1532	278	390	15123.8	21.0476	476680.7	296724		
	2473.8	1536	955234	1532	279	390	15154.8	10.6307	476680.7	296693		
	2442.8	1536	945624	1532	280	390	15185.8	10.6307	476680.7	296662		
	2399	1536	938897	1532	281	391	15229.6	10.6307	476711.5	296632		
	2368	1532	920638	1532	282	391	15260.6	10.6307	476711.5	296601		
	2337	1536	919677	1532	283	391	15291.6	10.6307	476711.5	296570		
	2306	1537	918716	1532	284	391	15322.6	10.6307	476711.5	296539		
	2262.2	1544	911028	1532	285	390	15366.4	10.6307	476680.7	296508		
	2218.4	1539	910067	1532	286	389	15410.2	0	476649.9	296478		
	2174.6	1538	884120	1532	287	390	15454	0	476680.7	296447		
	2130.8	1538	873549	1532	288	391	15497.8	0	476711.5	296416		
	2087	1542	868744	1532	289	392	15541.6	0	476742.2	296385		
	2056	1548	863939	1532	289	393	15572.6	0	476773	296385		
	2025	1547	852407	1532	289	394	15603.6	0	476803.8	296385		
	1981.2	1552	837992	1532	290	395	15647.4	61.5953	476834.6	296354		
	1950.2	1556	837031	1532	291	395	15678.4	61.5953	476834.6	296324		
	1906.4	1555	810123	1532	292	396	15722.2	61.5953	476865.4	296293		
	1875.4	1554	615040	1532	292	397	15753.2	61.5953	476896.2	296293		
	1844.4	1554	614079	1532	292	398	15784.2	61.5953	476927	296293		
	1800.6	1554	554497	1532	291	399	15828	61.5953	476957.8	296324		
	1769.6	1548	552575	1532	291	400	15859	61.5953	476988.6	296324		
	1738.6	1545	549692	1532	291	401	15890	61.5953	477019.4	296324		
	1707.6	1549	545848	1532	291	402	15921	61.5953	477050.2	296324		
	1676.6	1551	543926	1532	291	403	15952	61.5953	477081	296324		
	1645.6	1539	542004	1532	291	404	15983	61.5953	477111.8	296324		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	1614.6	1538	534316	1532	291	405	16014	61.5953	477142.6	296324		
	1583.6	1532	532394	1535	291	406	16045	61.5953	477173.4	296324		
	1539.8	1541	524706	1542.333	290	407	16088.8	61.5953	477204.2	296354		
	1496	1554	516057	1550.667	289	408	16132.6	61.5953	477235	296385		
	1452.2	1561	509330	1556	288	409	16176.4	31.2008	477265.8	296416		
	1421.2	1559	507408	1557	288	410	16207.4	31.2008	477296.6	296416		
	1390.2	1561	487227	1557	288	411	16238.4	31.2008	477327.3	296416		
	1359.2	1561	483383	1557	288	412	16269.4	31.2008	477358.1	296416		
	1315.4	1557	479539	1558.333	287	413	16313.2	31.2008	477388.9	296447		
	1284.4	1561	472812	1562	287	414	16344.2	31.2008	477419.7	296447		
	1240.6	1569	467046	1565.667	288	415	16388	31.2008	477450.5	296416		
	1196.8	1572	465124	1568	287	416	16431.8	12.5986	477481.3	296447		
	1165.8	1572	463202	1568	287	417	16462.8	12.5986	477512.1	296447		
	1122	1572	458397	1568	288	418	16506.6	12.5986	477542.9	296416		
	1091	1572	415152	1568	288	419	16537.6	12.5986	477573.7	296416		
	1047.2	1568	411308	1568	287	420	16581.4	12.5986	477604.5	296447		
	1003.4	1568	229679	1568	286	421	16625.2	12.5986	477635.3	296478		
	972.4	1570	227757	1568	286	422	16656.2	7.1703	477666.1	296478		
	941.4	1568	222952	1568.667	286	423	16687.2	7.1703	477696.9	296478		
	910.4	1570	213342	1569.667	286	424	16718.2	7.1703	477727.7	296478		
	866.6	1578	186434	1570.667	285	425	16762	7.1703	477758.5	296508		
	822.8	1577	185473	1571	284	426	16805.8	7.1703	477789.3	296539		
	779	1571	163370	1571.667	285	427	16849.6	7.1703	477820.1	296508		
	748	1573	162409	1573	285	428	16880.6	7.1703	477850.9	296508		
	717	1575	160487	1575.667	285	429	16911.6	17.9829	477881.7	296508		
	686	1579	158565	1580	285	430	16942.6	17.9829	477912.4	296508		
	655	1586	150877	1584.333	285	431	16973.6	17.9829	477943.2	296508		
	624	1588	149916	1588.667	285	432	17004.6	17.9829	477974	296508		
	580.2	1592	143189	1590.667	286	433	17048.4	17.9829	478004.8	296478		
	536.4	1592	141267	1592.333	287	434	17092.2	17.9829	478035.6	296447		
	505.4	1593	98022	1595.667	288	434	17123.2	17.9829	478035.6	296416		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 8b												
	474.4	1602	95139	1599.667	289	434	17154.2	15.3834	478035.6	296385		
	430.6	1605	84568	1603.333	290	435	17198	15.3834	478066.4	296354		
	386.8	1604	82646	1605	291	436	17241.8	15.3834	478097.2	296324		
	343	1607	73036	1606.667	290	437	17285.6	15.3834	478128	296354		
	312	1609	72075	1609	290	438	17316.6	15.3834	478158.8	296354		
	281	1613	69192	1610.333	290	439	17347.6	15.3834	478189.6	296354		
	250	1620	66309	1611	290	440	17378.6	15.3834	478220.4	296354		
	206.2	1619	65348	1611	291	441	17422.4	8.72832	478251.2	296324		
	162.4	1611	36518	1611.333	292	442	17466.2	8.72832	478282	296293		
	118.6	1612	29791	1613	293	443	17510	8.72832	478312.8	296262		
	74.8	1616	23064	1615	294	444	17553.8	8.72832	478343.6	296231		
	31	1617	18259	1617.333	295	445	17597.6	8.72832	478374.4	296201		
	0	1619	4805	1619	295	446	17628.6	8.72832	478405.2	296201		
North 12a												
	18214.2	904	3844	897	419	5	0	0	464824.7	292382	28183.83	0.06523
	18183.2	900	9.1E+07	897	418	5	31	0	464824.7	292413	35481.34	0.06523
	18139.4	902	9.1E+07	897	419	6	74.8	0	464855.5	292382	44668.36	0.15982
	18108.4	903	9.1E+07	897	419	7	105.8	0	464886.2	292382	56234.13	0.21881
	18064.6	901	9.1E+07	897	418	8	149.6	0	464917	292413	70794.58	0.3653
	18033.6	901	9.1E+07	897	418	9	180.6	0	464947.8	292413	141253.8	0.07595
	18002.6	901	9.1E+07	897	418	10	211.6	0	464978.6	292413	223872.1	0.11484
	17971.6	901	9.1E+07	897	418	11	242.6	0	465009.4	292413	281838.3	0.32258
	17940.6	902	9.1E+07	897	418	12	273.6	0	465040.2	292413	354813.4	0.06827
	17909.6	902	9.1E+07	897	418	13	304.6	0	465071	292413	1412538	0.00651
	17865.8	905	9.1E+07	897	419	14	348.4	0	465101.8	292382	1778279	0.03527
	17834.8	909	9.1E+07	897	419	15	379.4	0	465132.6	292382	2238721	0.05159
	17803.8	907	9.1E+07	897	419	16	410.4	0	465163.4	292382	5623413	0.00457
	17772.8	906	9.1E+07	897	419	17	441.4	0	465194.2	292382	7079458	0.094
	17729	907	9.1E+07	897	420	18	485.2	64.4758	465225	292351	8912509	0.08517
	17685.2	907	9.1E+07	897	421	19	529	64.4758	465255.8	292320	17782794	0.09465

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	17641.4	906	9.1E+07	897	422	20	572.8	64.4758	465286.6	292290	28183829	0.12017
	17597.6	906	9.1E+07	897	423	21	616.6	64.4758	465317.4	292259	35481339	0.15099
	17553.8	903	9E+07	897	424	22	660.4	64.4758	465348.2	292228	89125094	0.0266
	17522.8	902	9E+07	897	424	23	691.4	64.4758	465379	292228		
	17491.8	897	9E+07	897.3333	424	24	722.4	64.4758	465409.8	292228		
	17460.8	898	9E+07	898.6667	424	25	753.4	64.4758	465440.6	292228		
	17429.8	901	9E+07	901	424	26	784.4	64.4758	465471.3	292228		
	17398.8	904	9E+07	903.6667	424	27	815.4	64.4758	465502.1	292228		
	17367.8	906	9E+07	905.3333	424	28	846.4	64.4758	465532.9	292228		
	17336.8	909	9E+07	906	424	29	877.4	64.4758	465563.7	292228		
	17293	911	9E+07	906	425	30	921.2	64.4758	465594.5	292197		
	17249.2	907	9E+07	906	426	31	965	64.4758	465625.3	292166		
	17205.4	910	9E+07	906	427	32	1008.8	64.4758	465656.1	292136		
	17161.6	910	9E+07	906	428	33	1052.6	64.4758	465686.9	292105		
	17117.8	908	9E+07	906	429	34	1096.4	64.4758	465717.7	292074		
	17074	909	9E+07	906	430	35	1140.2	64.4758	465748.5	292043		
	17030.2	908	9E+07	906	431	36	1184	64.4758	465779.3	292012		
	16986.4	909	9E+07	906	432	37	1227.8	64.4758	465810.1	291982		
	16942.6	911	9E+07	906	433	38	1271.6	0	465840.9	291951		
	16911.6	911	9E+07	906	433	39	1302.6	0	465871.7	291951		
	16880.6	912	9E+07	906	433	40	1333.6	0	465902.5	291951		
	16836.8	912	9E+07	906	432	41	1377.4	0	465933.3	291982		
	16805.8	911	9E+07	906	432	42	1408.4	0	465964.1	291982		
	16762	909	9E+07	906	433	43	1452.2	0	465994.9	291951		
	16731	907	9E+07	906	433	44	1483.2	0	466025.7	291951		
	16700	906	9E+07	907	433	45	1514.2	0	466056.4	291951		
	16669	909	9E+07	908	433	46	1545.2	0	466087.2	291951		
	16638	909	9E+07	909	433	47	1576.2	0	466118	291951		
	16607	910	9E+07	909	433	48	1607.2	0	466148.8	291951		
	16563.2	914	9E+07	909	434	49	1651	0	466179.6	291920		
	16532.2	917	9E+07	909	434	50	1682	0	466210.4	291920		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	16488.4	917	9E+07	909	435	51	1725.8	197.49	466241.2	291889		
	16457.4	913	9E+07	909	435	52	1756.8	197.49	466272	291889		
	16426.4	915	9E+07	909	435	53	1787.8	197.49	466302.8	291889		
	16395.4	917	9E+07	909	435	54	1818.8	197.49	466333.6	291889		
	16351.6	917	9E+07	909	436	55	1862.6	197.49	466364.4	291858		
	16307.8	918	9E+07	909	437	54	1906.4	197.49	466333.6	291828		
	16264	914	9E+07	909	438	55	1950.2	197.49	466364.4	291797		
	16233	915	9E+07	909	438	56	1981.2	197.49	466395.2	291797		
	16189.2	918	9E+07	909	439	57	2025	197.49	466426	291766		
	16158.2	915	9E+07	909	439	58	2056	197.49	466456.8	291766		
	16127.2	910	9E+07	909	439	59	2087	197.49	466487.6	291766		
	16096.2	909	9E+07	911.3333	439	60	2118	197.49	466518.4	291766		
	16065.2	916	9E+07	915.6667	439	61	2149	197.49	466549.2	291766		
	16034.2	925	9E+07	920	439	62	2180	197.49	466580	291766		
	15990.4	923	9E+07	922	440	63	2223.8	197.49	466610.8	291735		
	15946.6	922	9E+07	922	441	64	2267.6	197.49	466641.6	291704		
	15902.8	923	9E+07	922	442	65	2311.4	197.49	466672.3	291674		
	15871.8	922	9E+07	922.3333	442	66	2342.4	197.49	466703.1	291674		
	15840.8	923	9E+07	922.6667	442	67	2373.4	197.49	466733.9	291674		
	15809.8	924	9E+07	923	442	68	2404.4	197.49	466764.7	291674		
	15778.8	924	9E+07	923	442	69	2435.4	197.49	466795.5	291674		
	15735	927	9E+07	923	443	70	2479.2	197.49	466826.3	291643		
	15691.2	927	9E+07	923	444	71	2523	81.5103	466857.1	291612		
	15660.2	925	9E+07	923	444	72	2554	81.5103	466887.9	291612		
	15629.2	926	9E+07	923	444	73	2585	81.5103	466918.7	291612		
	15585.4	928	8.9E+07	923	445	74	2628.8	81.5103	466949.5	291581		
	15554.4	925	8.9E+07	923	445	75	2659.8	81.5103	466980.3	291581		
	15523.4	923	8.7E+07	923.3333	445	76	2690.8	81.5103	467011.1	291581		
	15492.4	924	8.7E+07	924.3333	445	77	2721.8	81.5103	467041.9	291581		
	15461.4	935	8.7E+07	925.3333	445	78	2752.8	81.5103	467072.7	291581		
	15417.6	929	8.7E+07	926	446	79	2796.6	81.5103	467103.5	291550		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	15373.8	926	8.7E+07	926.6667	447	80	2840.4	81.5103	467134.3	291520		
	15330	928	8.7E+07	928	448	81	2884.2	81.5103	467165.1	291489		
	15286.2	930	8.7E+07	929.3333	449	82	2928	81.5103	467195.9	291458		
	15242.4	930	8.7E+07	930	450	83	2971.8	81.5103	467226.7	291427		
	15198.6	930	8.7E+07	931	451	84	3015.6	133.045	467257.4	291397		
	15154.8	933	8.7E+07	934	452	85	3059.4	133.045	467288.2	291366		
	15123.8	939	8.7E+07	937	452	86	3090.4	133.045	467319	291366		
	15080	942	8.7E+07	939	453	87	3134.2	133.045	467349.8	291335		
	15049	939	8.7E+07	939.6667	453	88	3165.2	133.045	467380.6	291335		
	15005.2	943	8.7E+07	940.3333	454	89	3209	133.045	467411.4	291304		
	14961.4	944	8.7E+07	941	455	90	3252.8	234.182	467442.2	291273		
	14917.6	942	3.3E+07	941	454	91	3296.6	234.182	467473	291304		
	14886.6	941	3.3E+07	943.3333	454	92	3327.6	234.182	467503.8	291304		
	14855.6	948	3.3E+07	950.6667	454	93	3358.6	234.182	467534.6	291304		
	14811.8	965	3.3E+07	958	453	94	3402.4	234.182	467565.4	291335		
	14768	963	3.3E+07	963.3333	452	95	3446.2	234.182	467596.2	291366		
	14737	967	3.3E+07	963.6667	451	95	3477.2	234.182	467596.2	291397		
	14693.2	966	3.3E+07	964	450	94	3521	281.676	467565.4	291427		
	14649.4	964	3.3E+07	966	449	93	3564.8	281.676	467534.6	291458		
	14605.6	970	3.3E+07	968.6667	448	94	3608.6	281.676	467565.4	291489		
	14574.6	974	3.3E+07	971.3333	447	94	3639.6	281.676	467565.4	291520		
	14530.8	972	3.3E+07	975.3333	446	95	3683.4	281.676	467596.2	291550		
	14487	982	3.3E+07	980.6667	445	96	3727.2	281.676	467627	291581		
	14456	988	3.3E+07	988.3333	445	97	3758.2	315.044	467657.8	291581		
	14425	995	3.3E+07	995.3333	445	98	3789.2	315.044	467688.6	291581		
	14394	1003	3.3E+07	1002.333	445	99	3820.2	315.044	467719.4	291581		
	14363	1009	3.2E+07	1009.667	445	100	3851.2	315.044	467750.2	291581		
	14332	1018	3.2E+07	1014.333	445	101	3882.2	315.044	467781	291581		
	14301	1021	3.2E+07	1017	445	102	3913.2	315.044	467811.8	291581		
	14257.2	1023	3.2E+07	1017	446	103	3957	315.044	467842.5	291550		
	14226.2	1025	3.2E+07	1017	446	104	3988	348.702	467873.3	291550		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	14195.2	1023	3.2E+07	1017	446	105	4019	348.702	467904.1	291550		
	14151.4	1025	3.2E+07	1017	447	106	4062.8	348.702	467934.9	291520		
	14107.6	1024	3.2E+07	1017	448	107	4106.6	348.702	467965.7	291489		
	14063.8	1022	3.2E+07	1017	449	108	4150.4	348.702	467996.5	291458		
	14032.8	1017	3.2E+07	1018	449	109	4181.4	348.702	468027.3	291458		
	14001.8	1020	3.2E+07	1020	449	110	4212.4	348.702	468058.1	291458		
	13958	1026	3.2E+07	1022	450	111	4256.2	82.6112	468088.9	291427		
	13927	1030	3.2E+07	1023	450	112	4287.2	82.6112	468119.7	291427		
	13883.2	1028	3.2E+07	1023	451	113	4331	82.6112	468150.5	291397		
	13852.2	1023	3.2E+07	1024	451	114	4362	82.6112	468181.3	291397		
	13821.2	1027	3.2E+07	1025	451	115	4393	82.6112	468212.1	291397		
	13790.2	1026	3.2E+07	1027	451	116	4424	82.6112	468242.9	291397		
	13759.2	1029	3.2E+07	1028.333	451	117	4455	82.6112	468273.7	291397		
	13715.4	1034	3.2E+07	1029.667	450	118	4498.8	355.008	468304.5	291427		
	13671.6	1030	3.2E+07	1031.333	449	119	4542.6	355.008	468335.3	291458		
	13640.6	1034	3.2E+07	1036.667	449	120	4573.6	355.008	468366.1	291458		
	13609.6	1046	3.2E+07	1046	449	121	4604.6	355.008	468396.9	291458		
	13578.6	1058	3.2E+07	1055	449	122	4635.6	355.008	468427.6	291458		
	13534.8	1063	3.2E+07	1060	448	123	4679.4	355.008	468458.4	291489		
	13503.8	1061	3.2E+07	1063	448	124	4710.4	355.008	468489.2	291489		
	13472.8	1067	3.2E+07	1065.667	448	125	4741.4	314.12	468520	291489		
	13441.8	1071	3.2E+07	1068.333	448	126	4772.4	314.12	468550.8	291489		
	13398	1069	3.2E+07	1070.667	447	127	4816.2	314.12	468581.6	291520		
	13354.2	1074	3.2E+07	1073.333	448	128	4860	314.12	468612.4	291489		
	13323.2	1077	3.2E+07	1077	448	129	4891	314.12	468643.2	291489		
	13292.2	1081	3.2E+07	1079	448	130	4922	314.12	468674	291489		
	13261.2	1080	3.2E+07	1081	448	131	4953	314.12	468704.8	291489		
	13230.2	1083	3.2E+07	1084	448	132	4984	226.467	468735.6	291489		
	13199.2	1089	3.1E+07	1089.333	448	133	5015	226.467	468766.4	291489		
	13168.2	1096	3.1E+07	1094.667	448	134	5046	226.467	468797.2	291489		
	13137.2	1099	3.1E+07	1100.333	448	135	5077	226.467	468828	291489		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	13093.4	1106	3.1E+07	1105.333	449	136	5120.8	226.467	468858.8	291458		
	13062.4	1111	3.1E+07	1109.667	449	137	5151.8	226.467	468889.6	291458		
	13018.6	1115	3.1E+07	1111.667	448	138	5195.6	226.467	468920.4	291489		
	12974.8	1118	3.1E+07	1112	447	139	5239.4	236.809	468951.2	291520		
	12943.8	1118	3.1E+07	1112	447	140	5270.4	236.809	468982	291520		
	12900	1117	3.1E+07	1112	448	141	5314.2	236.809	469012.7	291489		
	12856.2	1112	3.1E+07	1112.333	449	142	5358	236.809	469043.5	291458		
	12825.2	1113	3.1E+07	1115.333	449	143	5389	236.809	469074.3	291458		
	12781.4	1121	3.1E+07	1118.667	450	144	5432.8	236.809	469105.1	291427		
	12737.6	1122	3.1E+07	1122.667	451	145	5476.6	236.809	469135.9	291397		
	12706.6	1125	3.1E+07	1124.333	451	146	5507.6	153.039	469166.7	291397		
	12675.6	1126	3.1E+07	1127.667	451	147	5538.6	153.039	469197.5	291397		
	12631.8	1132	3.1E+07	1130.667	452	148	5582.4	153.039	469228.3	291366		
	12588	1136	3.1E+07	1133.333	451	149	5626.2	153.039	469259.1	291397		
	12557	1136	3.1E+07	1134	450	149	5657.2	153.039	469259.1	291427		
	12513.2	1134	3.1E+07	1134.667	449	150	5701	153.039	469289.9	291458		
	12482.2	1136	3.1E+07	1135.333	449	151	5732	119.386	469320.7	291458		
	12451.2	1136	3.1E+07	1138	449	152	5763	119.386	469351.5	291458		
	12420.2	1142	3.1E+07	1140.333	449	153	5794	119.386	469382.3	291458		
	12376.4	1143	3.1E+07	1143.333	450	154	5837.8	119.386	469413.1	291427		
	12345.4	1145	3.1E+07	1145.333	450	155	5868.8	119.386	469443.9	291427		
	12314.4	1148	3.1E+07	1148.333	450	156	5899.8	119.386	469474.7	291427		
	12283.4	1160	3.1E+07	1150.667	450	157	5930.8	119.386	469505.5	291427		
	12239.6	1167	3.1E+07	1152	449	158	5974.6	119.386	469536.3	291458		
	12208.6	1166	3.1E+07	1152	449	159	6005.6	115.436	469567.1	291458		
	12177.6	1170	3.1E+07	1152	449	160	6036.6	115.436	469597.9	291458		
	12133.8	1162	3.1E+07	1152	448	161	6080.4	115.436	469628.6	291489		
	12090	1162	3.1E+07	1152	447	162	6124.2	115.436	469659.4	291520		
	12059	1161	3.1E+07	1152	447	163	6155.2	115.436	469690.2	291520		
	12028	1163	3.1E+07	1152	447	164	6186.2	115.436	469721	291520		
	11997	1159	3.1E+07	1152	447	165	6217.2	115.436	469751.8	291520		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	11966	1152	3.1E+07	1154	447	166	6248.2	94.013	469782.6	291520		
	11935	1158	3.1E+07	1157	447	167	6279.2	94.013	469813.4	291520		
	11904	1165	3.1E+07	1160	447	168	6310.2	94.013	469844.2	291520		
	11873	1166	3.1E+07	1161	447	169	6341.2	94.013	469875	291520		
	11842	1170	3.1E+07	1161	447	170	6372.2	94.013	469905.8	291520		
	11798.2	1169	3.1E+07	1161	446	171	6416	94.013	469936.6	291550		
	11767.2	1163	3.1E+07	1161	446	172	6447	94.013	469967.4	291550		
	11723.4	1166	3.1E+07	1161	445	173	6490.8	89.0324	469998.2	291581		
	11679.6	1161	3E+07	1161	444	174	6534.6	89.0324	470029	291612		
	11648.6	1161	3E+07	1162.667	444	175	6565.6	89.0324	470059.8	291612		
	11617.6	1166	3E+07	1164.333	444	176	6596.6	89.0324	470090.6	291612		
	11586.6	1168	3E+07	1166	444	177	6627.6	89.0324	470121.4	291612		
	11542.8	1168	2.9E+07	1166	443	178	6671.4	89.0324	470152.2	291643		
	11499	1167	2.9E+07	1166	442	179	6715.2	89.0324	470183	291674		
	11468	1166	2.9E+07	1169.333	442	180	6746.2	145.415	470213.7	291674		
	11424.2	1177	2.8E+07	1172.667	441	181	6790	145.415	470244.5	291704		
	11380.4	1179	2.8E+07	1176	440	182	6833.8	145.415	470275.3	291735		
	11336.6	1181	2.8E+07	1176	439	183	6877.6	145.415	470306.1	291766		
	11292.8	1176	2.8E+07	1178.667	438	184	6921.4	145.415	470336.9	291797		
	11249	1184	2.8E+07	1184.667	437	185	6965.2	145.415	470367.7	291828		
	11218	1194	2.8E+07	1192	437	186	6996.2	351.589	470398.5	291828		
	11174.2	1198	2.8E+07	1198.333	436	187	7040	351.589	470429.3	291858		
	11130.4	1203	2.8E+07	1205.333	435	188	7083.8	351.589	470460.1	291889		
	11099.4	1215	2.8E+07	1212.333	435	189	7114.8	351.589	470490.9	291889		
	11068.4	1219	2.8E+07	1219.667	435	190	7145.8	351.589	470521.7	291889		
	11037.4	1225	2.8E+07	1225.667	435	191	7176.8	351.589	470552.5	291889		
	11006.4	1233	2.8E+07	1231.667	435	192	7207.8	351.589	470583.3	291889		
	10975.4	1237	2.8E+07	1236	435	193	7238.8	325.134	470614.1	291889		
	10944.4	1238	2.8E+07	1242.333	435	194	7269.8	325.134	470644.9	291889		
	10900.6	1252	2.8E+07	1247.667	434	195	7313.6	325.134	470675.7	291920		
	10856.8	1262	2.8E+07	1252.667	433	196	7357.4	325.134	470706.5	291951		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	10813	1260	2.8E+07	1253	432	197	7401.2	325.134	470737.3	291982		
	10782	1263	2.8E+07	1253	432	198	7432.2	325.134	470768.1	291982		
	10738.2	1263	2.8E+07	1253	431	199	7476	325.134	470798.8	292012		
	10694.4	1260	2.8E+07	1253	430	200	7519.8	160.194	470829.6	292043		
	10650.6	1260	2.8E+07	1253	429	201	7563.6	160.194	470860.4	292074		
	10606.8	1260	2.8E+07	1253	428	202	7607.4	160.194	470891.2	292105		
	10563	1259	2.8E+07	1253	427	203	7651.2	160.194	470922	292136		
	10519.2	1264	2.8E+07	1253	426	204	7695	160.194	470952.8	292166		
	10488.2	1267	2.8E+07	1253	426	205	7726	160.194	470983.6	292166		
	10457.2	1270	1.9E+07	1253	426	206	7757	148.261	471014.4	292166		
	10413.4	1270	1.9E+07	1253	427	207	7800.8	148.261	471045.2	292136		
	10369.6	1268	1.9E+07	1253	428	208	7844.6	148.261	471076	292105		
	10325.8	1265	1.9E+07	1253	429	209	7888.4	148.261	471106.8	292074		
	10294.8	1264	1.9E+07	1253	429	210	7919.4	148.261	471137.6	292074		
	10263.8	1254	1.9E+07	1253	429	211	7950.4	148.261	471168.4	292074		
	10232.8	1253	1.9E+07	1255	429	212	7981.4	148.261	471199.2	292074		
	10201.8	1259	1.9E+07	1258	429	213	8012.4	148.261	471230	292074		
	10170.8	1262	1.9E+07	1261.667	429	214	8043.4	148.261	471260.8	292074		
	10139.8	1264	1.9E+07	1266	429	215	8074.4	148.261	471291.6	292074		
	10108.8	1272	1.9E+07	1271.667	429	216	8105.4	148.261	471322.4	292074		
	10077.8	1289	1.9E+07	1276.667	429	217	8136.4	148.261	471353.2	292074		
	10034	1296	1.9E+07	1279	430	218	8180.2	148.261	471383.9	292043		
	9990.2	1297	1.9E+07	1279	429	219	8224	148.261	471414.7	292074		
	9946.4	1299	1.9E+07	1279	428	220	8267.8	148.261	471445.5	292105		
	9902.6	1299	1.9E+07	1279	427	221	8311.6	148.261	471476.3	292136		
	9871.6	1296	1.8E+07	1279	427	222	8342.6	148.261	471507.1	292136		
	9840.6	1292	1.8E+07	1279	427	223	8373.6	148.261	471537.9	292136		
	9796.8	1297	1.8E+07	1279	428	224	8417.4	148.261	471568.7	292105		
	9753	1292	1.8E+07	1279	429	225	8461.2	148.261	471599.5	292074		
	9709.2	1303	1.8E+07	1279	430	224	8505	138.052	471568.7	292043		
	9665.4	1300	1.8E+07	1279	431	223	8548.8	138.052	471537.9	292012		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	9621.6	1293	1.8E+07	1279	432	224	8592.6	138.052	471568.7	291982		
	9577.8	1292	1.8E+07	1279	433	225	8636.4	138.052	471599.5	291951		
	9534	1298	1.8E+07	1279	434	226	8680.2	138.052	471630.3	291920		
	9490.2	1282	1.8E+07	1279	435	227	8724	138.052	471661.1	291889		
	9459.2	1284	1.7E+07	1279	435	228	8755	138.052	471691.9	291889		
	9428.2	1279	1.7E+07	1281.667	435	229	8786	138.052	471722.7	291889		
	9397.2	1287	1.7E+07	1284.667	435	230	8817	138.052	471753.5	291889		
	9366.2	1289	1.7E+07	1287.667	435	231	8848	138.052	471784.3	291889		
	9335.2	1291	1.7E+07	1288	435	232	8879	138.052	471815.1	291889		
	9304.2	1288	1.7E+07	1288.333	435	233	8910	138.052	471845.9	291889		
	9273.2	1289	1.7E+07	1291.333	435	234	8941	138.052	471876.7	291889		
	9242.2	1297	1.7E+07	1294.667	435	235	8972	138.052	471907.5	291889		
	9211.2	1303	1.7E+07	1297.667	435	236	9003	103.333	471938.3	291889		
	9180.2	1298	1.7E+07	1298.333	435	237	9034	103.333	471969.1	291889		
	9136.4	1299	1.7E+07	1301.333	434	238	9077.8	103.333	471999.8	291920		
	9092.6	1307	1.7E+07	1305	433	239	9121.6	103.333	472030.6	291951		
	9061.6	1317	1.7E+07	1308.333	432	239	9152.6	103.333	472030.6	291982		
	9017.8	1312	1.7E+07	1309	431	240	9196.4	103.333	472061.4	292012		
	8974	1309	9501407	1309	430	241	9240.2	84.3645	472092.2	292043		
	8930.2	1318	9490836	1309	429	242	9284	84.3645	472123	292074		
	8899.2	1323	9489875	1309	428	242	9315	84.3645	472123	292105		
	8855.4	1318	9488914	1309	427	241	9358.8	84.3645	472092.2	292136		
	8811.6	1313	9469694	1309	426	242	9402.6	84.3645	472123	292166		
	8767.8	1309	9444708	1311.333	425	243	9446.4	84.3645	472153.8	292197		
	8736.8	1316	9442786	1314.333	425	244	9477.4	84.3645	472184.6	292197		
	8705.8	1318	9431254	1317.333	425	245	9508.4	105.034	472215.4	292197		
	8674.8	1323	9428371	1318	425	246	9539.4	105.034	472246.2	292197		
	8643.8	1318	9424527	1319.333	425	247	9570.4	105.034	472277	292197		
	8612.8	1322	9421644	1323	425	248	9601.4	105.034	472307.8	292197		
	8569	1329	8934417	1327.667	424	249	9645.2	105.034	472338.6	292228		
	8538	1336	8932495	1331	424	250	9676.2	105.034	472369.4	292228		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	8494.2	1333	8930573	1332	423	251	9720	105.034	472400.2	292259		
	8463.2	1332	8923846	1333.667	423	252	9751	89.6169	472431	292259		
	8432.2	1337	8902704	1336.667	423	253	9782	89.6169	472461.8	292259		
	8401.2	1345	8895977	1339.667	423	254	9813	89.6169	472492.6	292259		
	8357.4	1349	8891172	1341	422	255	9856.8	89.6169	472523.4	292290		
	8313.6	1348	8873874	1341	421	256	9900.6	89.6169	472554.2	292320		
	8269.8	1344	8856576	1341	420	257	9944.4	89.6169	472584.9	292351		
	8238.8	1341	8845044	1342.667	420	258	9975.4	89.6169	472615.7	292351		
	8207.8	1346	8843122	1346.333	420	259	10006.4	86.4164	472646.5	292351		
	8164	1353	8831590	1350	419	260	10050.2	86.4164	472677.3	292382		
	8120.2	1355	8826785	1352	418	261	10094	86.4164	472708.1	292413		
	8076.4	1353	8814292	1352	417	262	10137.8	86.4164	472738.9	292444		
	8045.4	1352	8812370	1354	417	263	10168.8	86.4164	472769.7	292444		
	8001.6	1358	8774891	1359.333	416	264	10212.6	86.4164	472800.5	292474		
	7957.8	1368	8772008	1367.333	415	265	10256.4	131.642	472831.3	292505		
	7926.8	1376	8770086	1374	415	266	10287.4	131.642	472862.1	292505		
	7883	1380	8766242	1377.333	414	267	10331.2	131.642	472892.9	292536		
	7839.2	1378	8757593	1380	413	268	10375	131.642	472923.7	292567		
	7795.4	1384	8747983	1382	412	269	10418.8	131.642	472954.5	292598		
	7764.4	1384	8746061	1384.333	412	270	10449.8	131.642	472985.3	292598		
	7720.6	1385	8733568	1385.667	411	271	10493.6	106.359	473016.1	292628		
	7689.6	1391	8729724	1387	411	272	10524.6	106.359	473046.9	292628		
	7645.8	1388	8723958	1388.667	410	273	10568.4	106.359	473077.7	292659		
	7602	1391	8710504	1389.333	409	274	10612.2	106.359	473108.5	292690		
	7558.2	1390	8703777	1390	408	275	10656	106.359	473139.3	292721		
	7514.4	1390	8686479	1390	407	276	10699.8	106.359	473170	292751		
	7483.4	1390	8682635	1390.333	407	277	10730.8	25.0124	473200.8	292751		
	7452.4	1391	8674947	1393	407	278	10761.8	25.0124	473231.6	292751		
	7421.4	1406	8663415	1395.667	407	279	10792.8	25.0124	473262.4	292751		
	7390.4	1408	8661493	1398	407	280	10823.8	25.0124	473293.2	292751		
	7359.4	1410	8655727	1398	407	281	10854.8	25.0124	473324	292751		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	7315.6	1408	8634585	1398	406	282	10898.6	25.0124	473354.8	292782		
	7284.6	1407	8631702	1398	406	283	10929.6	25.0124	473385.6	292782		
	7240.8	1409	8625936	1398	405	284	10973.4	25.0124	473416.4	292813		
	7209.8	1409	8621131	1398	405	285	11004.4	8.43847	473447.2	292813		
	7166	1407	8606716	1398	404	286	11048.2	8.43847	473478	292844		
	7122.2	1403	8600950	1398	403	287	11092	8.43847	473508.8	292875		
	7078.4	1401	8340519	1398	402	288	11135.8	8.43847	473539.6	292905		
	7047.4	1400	8280937	1398	402	289	11166.8	8.43847	473570.4	292905		
	7016.4	1405	8279976	1398	402	290	11197.8	8.43847	473601.2	292905		
	6985.4	1401	8269405	1398	402	291	11228.8	8.43847	473632	292905		
	6954.4	1408	8268444	1398	402	292	11259.8	24.3305	473662.8	292905		
	6923.4	1408	8267483	1398	402	293	11290.8	24.3305	473693.6	292905		
	6892.4	1399	8222316	1398	402	294	11321.8	24.3305	473724.4	292905		
	6861.4	1399	8221355	1398	402	295	11352.8	24.3305	473755.1	292905		
	6830.4	1402	8220394	1398	402	296	11383.8	24.3305	473785.9	292905		
	6799.4	1409	8219433	1398	402	297	11414.8	24.3305	473816.7	292905		
	6768.4	1400	8218472	1398	402	298	11445.8	24.3305	473847.5	292905		
	6737.4	1399	8217511	1398	402	299	11476.8	24.3305	473878.3	292905		
	6706.4	1398	8216550	1398.667	402	300	11507.8	24.3305	473909.1	292905		
	6675.4	1404	8215589	1399.333	402	301	11538.8	24.3305	473939.9	292905		
	6644.4	1400	8212706	1400	402	302	11569.8	24.3305	473970.7	292905		
	6613.4	1402	8210784	1400	402	303	11600.8	24.3305	474001.5	292905		
	6582.4	1409	8208862	1400	402	304	11631.8	24.3305	474032.3	292905		
	6538.6	1412	8199252	1400	401	305	11675.6	24.3305	474063.1	292936		
	6507.6	1409	7998403	1400	400	305	11706.6	24.3305	474063.1	292967		
	6476.6	1400	7563070	1400.333	399	305	11737.6	46.3275	474063.1	292998		
	6445.6	1404	7562109	1400.667	398	305	11768.6	46.3275	474063.1	293029		
	6414.6	1401	7561148	1402.333	397	305	11799.6	46.3275	474063.1	293059		
	6383.6	1405	7560187	1404.667	396	305	11830.6	46.3275	474063.1	293090		
	6339.8	1408	7549616	1407.667	395	306	11874.4	46.3275	474093.9	293121		
	6308.8	1410	7546733	1409.333	394	306	11905.4	46.3275	474093.9	293152		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	6265	1410	7541928	1411	393	307	11949.2	46.3275	474124.7	293183		
	6221.2	1413	7506371	1412.667	392	308	11993	88.5738	474155.5	293213		
	6177.4	1415	7482346	1415.333	391	309	12036.8	88.5738	474186.3	293244		
	6133.6	1418	7477541	1417.333	390	310	12080.6	88.5738	474217.1	293275		
	6089.8	1419	7471775	1422.667	389	311	12124.4	88.5738	474247.9	293306		
	6046	1431	7441023	1427.667	388	312	12168.2	88.5738	474278.7	293337		
	6002.2	1434	7438140	1432.333	387	313	12212	88.5738	474309.5	293367		
	5971.2	1439	7428530	1433	387	314	12243	66.5256	474340.3	293367		
	5940.2	1433	7425647	1434.667	387	315	12274	66.5256	474371	293367		
	5896.4	1438	7417959	1436.667	386	316	12317.8	66.5256	474401.8	293398		
	5865.4	1440	7377597	1438.667	386	317	12348.8	66.5256	474432.6	293398		
	5834.4	1439	7376636	1439	386	318	12379.8	66.5256	474463.4	293398		
	5803.4	1439	7372792	1439.333	386	319	12410.8	66.5256	474494.2	293398		
	5772.4	1440	7366065	1441	386	320	12441.8	66.5256	474525	293398		
	5728.6	1445	7336274	1442.667	385	321	12485.6	66.5256	474555.8	293429		
	5697.6	1450	7334352	1444	385	322	12516.6	27.0853	474586.6	293429		
	5653.8	1452	7330508	1444	384	323	12560.4	27.0853	474617.4	293460		
	5622.8	1454	7324742	1444	384	324	12591.4	27.0853	474648.2	293460		
	5579	1454	7320898	1444	383	325	12635.2	27.0853	474679	293491		
	5535.2	1454	7033559	1444	382	326	12679	27.0853	474709.8	293521		
	5491.4	1451	7014339	1444	381	327	12722.8	27.0853	474740.6	293552		
	5447.6	1448	6971094	1444	380	328	12766.6	49.9248	474771.4	293583		
	5403.8	1444	6962445	1446	379	329	12810.4	49.9248	474802.2	293614		
	5360	1452	6933615	1448	378	330	12854.2	49.9248	474833	293645		
	5329	1450	6927849	1450.667	377	330	12885.2	49.9248	474833	293675		
	5285.2	1460	6896136	1451.333	376	331	12929	49.9248	474863.8	293706		
	5254.2	1458	6895175	1452	376	332	12960	49.9248	474894.6	293706		
	5210.4	1452	6861540	1452.333	375	333	13003.8	55.8171	474925.4	293737		
	5179.4	1453	6856735	1454.333	375	334	13034.8	55.8171	474956.1	293737		
	5148.4	1458	6852891	1458.667	375	335	13065.8	55.8171	474986.9	293737		
	5117.4	1465	6835593	1462.667	375	336	13096.8	55.8171	475017.7	293737		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	5073.6	1482	6827905	1465	374	337	13140.6	55.8171	475048.5	293768		
	5029.8	1484	6825983	1465	373	338	13184.4	55.8171	475079.3	293799		
	4986	1477	6803880	1465	372	339	13228.2	55.8171	475110.1	293829		
	4942.2	1474	6775050	1465	371	340	13272	60.1268	475140.9	293860		
	4898.4	1479	6763518	1465	370	341	13315.8	60.1268	475171.7	293891		
	4854.6	1484	6756791	1465	369	342	13359.6	60.1268	475202.5	293922		
	4810.8	1477	6750064	1465	368	343	13403.4	60.1268	475233.3	293952		
	4767	1479	6740454	1465	367	344	13447.2	60.1268	475264.1	293983		
	4736	1482	6737571	1465	367	345	13478.2	60.1268	475294.9	293983		
	4692.2	1465	6491555	1467.667	366	346	13522	17.9043	475325.7	294014		
	4648.4	1473	6349327	1471	365	347	13565.8	17.9043	475356.5	294045		
	4604.6	1475	6336834	1474.333	364	348	13609.6	17.9043	475387.3	294076		
	4573.6	1479	6323380	1475	364	349	13640.6	17.9043	475418.1	294076		
	4542.6	1481	6322419	1475	364	350	13671.6	17.9043	475448.9	294076		
	4511.6	1483	6321458	1475	364	351	13702.6	17.9043	475479.7	294076		
	4480.6	1483	6320497	1475	364	352	13733.6	17.9043	475510.5	294076		
	4449.6	1481	6316653	1475	364	353	13764.6	17.9043	475541.2	294076		
	4405.8	1492	6305121	1475	363	354	13808.4	17.9043	475572	294106		
	4362	1490	6303199	1475	362	355	13852.2	17.9043	475602.8	294137		
	4318.2	1493	6285901	1475	363	356	13896	17.9043	475633.6	294106		
	4274.4	1494	6278213	1475	364	357	13939.8	17.9043	475664.4	294076		
	4243.4	1486	6249383	1475	364	358	13970.8	17.9043	475695.2	294076		
	4199.6	1488	6231124	1475	363	359	14014.6	0	475726	294106		
	4155.8	1486	6204216	1475	362	360	14058.4	0	475756.8	294137		
	4112	1489	5829426	1475	361	361	14102.2	0	475787.6	294168		
	4081	1486	5568034	1475	361	362	14133.2	0	475818.4	294168		
	4050	1487	5567073	1475	361	363	14164.2	0	475849.2	294168		
	4019	1488	5566112	1475	361	364	14195.2	0	475880	294168		
	3975.2	1488	5486349	1475	360	365	14239	0	475910.8	294199		
	3931.4	1492	2849365	1475	359	366	14282.8	0	475941.6	294230		
	3887.6	1486	2837833	1475	358	367	14326.6	0	475972.4	294260		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	3843.8	1492	2822457	1475	357	368	14370.4	0	476003.2	294291		
	3800	1490	2819574	1475	356	369	14414.2	0	476034	294322		
	3756.2	1482	2806120	1475	355	370	14458	65.6127	476064.8	294353		
	3712.4	1477	2801315	1475	354	371	14501.8	65.6127	476095.6	294384		
	3668.6	1483	2796510	1475	353	372	14545.6	65.6127	476126.3	294414		
	3624.8	1482	2793627	1475	352	373	14589.4	65.6127	476157.1	294445		
	3581	1484	2778251	1475	351	374	14633.2	65.6127	476187.9	294476		
	3537.2	1492	2769602	1475	350	375	14677	65.6127	476218.7	294507		
	3493.4	1481	2759031	1475	349	376	14720.8	65.6127	476249.5	294538		
	3462.4	1477	2054618	1475	349	377	14751.8	65.6127	476280.3	294538		
	3431.4	1475	2053657	1476	349	378	14782.8	65.6127	476311.1	294538		
	3400.4	1478	2052696	1479.333	349	379	14813.8	65.6127	476341.9	294538		
	3369.4	1485	2051735	1484.667	349	380	14844.8	65.6127	476372.7	294538		
	3338.4	1491	2050774	1489.667	349	381	14875.8	65.6127	476403.5	294538		
	3307.4	1496	2049813	1492.333	349	382	14906.8	65.6127	476434.3	294538		
	3263.6	1493	2036359	1493	348	383	14950.6	65.6127	476465.1	294568		
	3219.8	1493	2024827	1493.333	347	384	14994.4	40.826	476495.9	294599		
	3188.8	1494	2004646	1494.667	346	384	15025.4	40.826	476495.9	294630		
	3157.8	1499	2003685	1496	345	384	15056.4	40.826	476495.9	294661		
	3126.8	1498	2002724	1497	344	384	15087.4	40.826	476495.9	294692		
	3083	1503	1995036	1497	343	385	15131.2	40.826	476526.7	294722		
	3039.2	1510	1991192	1497	342	386	15175	40.826	476557.5	294753		
	2995.4	1508	1750942	1497	341	387	15218.8	40.826	476588.3	294784		
	2964.4	1502	1742293	1497	341	388	15249.8	18.6411	476619.1	294784		
	2933.4	1499	1741332	1497	341	389	15280.8	18.6411	476649.9	294784		
	2902.4	1503	1717307	1497	341	390	15311.8	18.6411	476680.7	294784		
	2871.4	1497	1716346	1498.333	341	391	15342.8	18.6411	476711.5	294784		
	2840.4	1509	1715385	1499.667	341	392	15373.8	18.6411	476742.2	294784		
	2809.4	1508	1714424	1501	341	393	15404.8	18.6411	476773	294784		
	2778.4	1501	1713463	1502.667	341	394	15435.8	18.6411	476803.8	294784		
	2747.4	1510	1712502	1504.333	341	395	15466.8	18.6411	476834.6	294784		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	2716.4	1506	1711541	1508.333	341	396	15497.8	51.478	476865.4	294784		
	2672.6	1513	1694243	1512.333	340	397	15541.6	51.478	476896.2	294815		
	2641.6	1518	1692321	1517	339	397	15572.6	51.478	476896.2	294846		
	2610.6	1520	1690399	1520	338	397	15603.6	51.478	476896.2	294876		
	2579.6	1522	1684633	1522	337	397	15634.6	51.478	476896.2	294907		
	2535.8	1524	1674062	1523.667	336	396	15678.4	51.478	476865.4	294938		
	2492	1525	1671179	1525	335	395	15722.2	51.478	476834.6	294969		
	2448.2	1529	1666374	1525.667	334	396	15766	29.9607	476865.4	295000		
	2404.4	1529	1665413	1526	333	397	15809.8	29.9607	476896.2	295030		
	2360.6	1527	1653881	1526	332	398	15853.6	29.9607	476927	295061		
	2329.6	1526	1643310	1526	332	399	15884.6	29.9607	476957.8	295061		
	2298.6	1529	1642349	1526	332	400	15915.6	29.9607	476988.6	295061		
	2267.6	1528	1640427	1526	332	401	15946.6	29.9607	477019.4	295061		
	2223.8	1532	1622168	1526	333	402	15990.4	0	477050.2	295030		
	2192.8	1533	1620246	1526	333	403	16021.4	0	477081	295030		
	2149	1526	1618324	1526	334	404	16065.2	0	477111.8	295000		
	2105.2	1531	1602948	1526	333	405	16109	0	477142.6	295030		
	2074.2	1532	1601026	1526	333	406	16140	0	477173.4	295030		
	2030.4	1532	1559703	1526	332	407	16183.8	0	477204.2	295061		
	1986.6	1529	1527029	1526	331	408	16227.6	0	477235	295092		
	1955.6	1529	1526068	1526	331	409	16258.6	0	477265.8	295092		
	1924.6	1528	1524146	1526	331	410	16289.6	0	477296.6	295092		
	1893.6	1530	1521263	1526	331	411	16320.6	0	477327.3	295092		
	1862.6	1534	1519341	1526	331	412	16351.6	0	477358.1	295092		
	1818.8	1534	1517419	1526	330	413	16395.4	0	477388.9	295123		
	1787.8	1534	1514536	1526	330	414	16426.4	0	477419.7	295123		
	1744	1536	1501082	1526	331	415	16470.2	0	477450.5	295092		
	1700.2	1535	1427085	1526	332	416	16514	0	477481.3	295061		
	1669.2	1532	1386723	1526	332	417	16545	0	477512.1	295061		
	1638.2	1532	1385762	1526	332	418	16576	0	477542.9	295061		
	1607.2	1534	1384801	1526	332	419	16607	0	477573.7	295061		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	1576.2	1536	1383840	1526	332	420	16638	0	477604.5	295061		
	1545.2	1534	1382879	1526	332	421	16669	0	477635.3	295061		
	1514.2	1536	1380957	1526	332	422	16700	21.1882	477666.1	295061		
	1483.2	1536	1026348	1526	332	423	16731	21.1882	477696.9	295061		
	1452.2	1533	1025387	1526	332	424	16762	21.1882	477727.7	295061		
	1421.2	1535	1008089	1526	332	425	16793	21.1882	477758.5	295061		
	1390.2	1533	1006167	1526	332	426	16824	21.1882	477789.3	295061		
	1359.2	1526	1004245	1526	332	427	16855	21.1882	477820.1	295061		
	1315.4	1534	566029	1526	331	428	16898.8	21.1882	477850.9	295092		
	1271.6	1527	435333	1526	332	429	16942.6	21.1882	477881.7	295061		
	1240.6	1526	434372	1526	332	430	16973.6	21.1882	477912.4	295061		
	1209.6	1526	433411	1527	332	431	17004.6	21.1882	477943.2	295061		
	1178.6	1529	432450	1528.667	332	432	17035.6	21.1882	477974	295061		
	1147.6	1534	431489	1530.333	332	433	17066.6	21.1882	478004.8	295061		
	1116.6	1536	430528	1531	332	434	17097.6	21.1882	478035.6	295061		
	1085.6	1531	407464	1532.333	332	435	17128.6	21.1882	478066.4	295061		
	1041.8	1535	405542	1535.333	331	436	17172.4	21.1882	478097.2	295092		
	998	1540	390166	1539.333	330	437	17216.2	21.1882	478128	295123		
	954.2	1543	388244	1542	329	438	17260	26.0235	478158.8	295153		
	910.4	1543	369985	1544.333	330	439	17303.8	26.0235	478189.6	295123		
	879.4	1549	254665	1545.667	330	440	17334.8	26.0235	478220.4	295123		
	848.4	1547	253704	1551	330	441	17365.8	26.0235	478251.2	295123		
	817.4	1559	231601	1557.333	330	442	17396.8	26.0235	478282	295123		
	786.4	1566	227757	1564	330	443	17427.8	26.0235	478312.8	295123		
	742.6	1570	225835	1566.667	329	444	17471.6	26.0235	478343.6	295153		
	711.6	1568	221991	1567	329	445	17502.6	27.4444	478374.4	295153		
	680.6	1570	216225	1567	329	446	17533.6	27.4444	478405.2	295153		
	636.8	1570	199888	1567	328	447	17577.4	27.4444	478436	295184		
	593	1567	169136	1568	327	448	17621.2	27.4444	478466.8	295215		
	562	1570	156643	1571.667	327	449	17652.2	27.4444	478497.5	295215		
	531	1578	152799	1575.667	327	450	17683.2	27.4444	478528.3	295215		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12a												
	500	1579	148955	1579.667	327	451	17714.2	27.4444	478559.1	295215		
	456.2	1582	146072	1581.667	326	452	17758	25.853	478589.9	295246		
	412.4	1584	70153	1588.667	327	453	17801.8	25.853	478620.7	295215		
	368.6	1600	56699	1597.667	328	454	17845.6	25.853	478651.5	295184		
	324.8	1611	55738	1606	329	455	17889.4	25.853	478682.3	295153		
	281	1609	54777	1613	330	456	17933.2	25.853	478713.1	295123		
	250	1621	50933	1619.333	331	456	17964.2	25.853	478713.1	295092		
	206.2	1628	40362	1628	332	457	18008	20.2843	478743.9	295061		
	162.4	1635	39401	1633.333	333	458	18051.8	20.2843	478774.7	295030		
	118.6	1637	34596	1637	334	459	18095.6	20.2843	478805.5	295000		
	74.8	1641	29791	1638.333	335	460	18139.4	20.2843	478836.3	294969		
	43.8	1639	10571	1639.333	335	461	18170.4	20.2843	478867.1	294969		
	0	1640	8649	1640	335	462	18214.2	20.2843	478897.9	294969		
North 12b												
	18171.8	904	3844	897	419	5	0	0	464824.7	292382	891250.9	0.01509
	18140.8	900	9.1E+07	897	418	5	31	0	464824.7	292413	1122018	0.12082
	18097	902	9.1E+07	897	419	6	74.8	0	464855.5	292382	1412538	0.05808
	18066	903	9.1E+07	897	419	7	105.8	0	464886.2	292382	1778279	0.15551
	18022.2	901	9.1E+07	897	418	8	149.6	0	464917	292413	5623413	0.00271
	17991.2	901	9.1E+07	897	418	9	180.6	0	464947.8	292413	7079458	0.094
	17960.2	901	9.1E+07	897	418	10	211.6	0	464978.6	292413	8912509	0.08517
	17929.2	901	9.1E+07	897	418	11	242.6	0	465009.4	292413	17782794	0.09465
	17898.2	902	9.1E+07	897	418	12	273.6	0	465040.2	292413	28183829	0.12017
	17867.2	902	9.1E+07	897	418	13	304.6	0	465071	292413	35481339	0.15099
	17823.4	905	9.1E+07	897	419	14	348.4	0	465101.8	292382	89125094	0.0266
	17792.4	909	9.1E+07	897	419	15	379.4	0	465132.6	292382		
	17761.4	907	9.1E+07	897	419	16	410.4	64.4758	465163.4	292382		
	17730.4	906	9.1E+07	897	419	17	441.4	64.4758	465194.2	292382		
	17686.6	907	9.1E+07	897	420	18	485.2	64.4758	465225	292351		
	17642.8	907	9.1E+07	897	421	19	529	64.4758	465255.8	292320		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	17599	906	9.1E+07	897	422	20	572.8	64.4758	465286.6	292290		
	17555.2	906	9.1E+07	897	423	21	616.6	64.4758	465317.4	292259		
	17511.4	903	9E+07	897	424	22	660.4	64.4758	465348.2	292228		
	17480.4	902	9E+07	897	424	23	691.4	64.4758	465379	292228		
	17449.4	897	9E+07	897.3333	424	24	722.4	64.4758	465409.8	292228		
	17418.4	898	9E+07	898.6667	424	25	753.4	64.4758	465440.6	292228		
	17387.4	901	9E+07	901	424	26	784.4	64.4758	465471.3	292228		
	17356.4	904	9E+07	903.6667	424	27	815.4	64.4758	465502.1	292228		
	17325.4	906	9E+07	905.3333	424	28	846.4	64.4758	465532.9	292228		
	17294.4	909	9E+07	906	424	29	877.4	64.4758	465563.7	292228		
	17250.6	911	9E+07	906	425	30	921.2	64.4758	465594.5	292197		
	17206.8	907	9E+07	906	426	31	965	64.4758	465625.3	292166		
	17163	910	9E+07	906	427	32	1008.8	64.4758	465656.1	292136		
	17119.2	910	9E+07	906	428	33	1052.6	64.4758	465686.9	292105		
	17075.4	908	9E+07	906	429	34	1096.4	64.4758	465717.7	292074		
	17031.6	909	9E+07	906	430	35	1140.2	64.4758	465748.5	292043		
	16987.8	908	9E+07	906	431	36	1184	64.4758	465779.3	292012		
	16944	909	9E+07	906	432	37	1227.8	0	465810.1	291982		
	16900.2	911	9E+07	906	433	38	1271.6	0	465840.9	291951		
	16869.2	911	9E+07	906	433	39	1302.6	0	465871.7	291951		
	16838.2	912	9E+07	906	433	40	1333.6	0	465902.5	291951		
	16794.4	912	9E+07	906	432	41	1377.4	0	465933.3	291982		
	16763.4	911	9E+07	906	432	42	1408.4	0	465964.1	291982		
	16719.6	909	9E+07	906	433	43	1452.2	0	465994.9	291951		
	16688.6	907	9E+07	906	433	44	1483.2	0	466025.7	291951		
	16657.6	906	9E+07	907	433	45	1514.2	0	466056.4	291951		
	16626.6	909	9E+07	908	433	46	1545.2	0	466087.2	291951		
	16595.6	909	9E+07	909	433	47	1576.2	0	466118	291951		
	16564.6	910	9E+07	909	433	48	1607.2	0	466148.8	291951		
	16520.8	914	9E+07	909	434	49	1651	0	466179.6	291920		
	16489.8	917	9E+07	909	434	50	1682	478.089	466210.4	291920		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	16446	917	9E+07	909	435	51	1725.8	478.089	466241.2	291889		
	16415	913	9E+07	909	435	52	1756.8	478.089	466272	291889		
	16384	915	9E+07	909	435	53	1787.8	478.089	466302.8	291889		
	16353	917	9E+07	909	435	54	1818.8	478.089	466333.6	291889		
	16309.2	917	9E+07	909	436	55	1862.6	478.089	466364.4	291858		
	16265.4	918	9E+07	909	437	54	1906.4	478.089	466333.6	291828		
	16221.6	914	9E+07	909	438	55	1950.2	478.089	466364.4	291797		
	16190.6	915	9E+07	909	438	56	1981.2	478.089	466395.2	291797		
	16146.8	918	9E+07	909	439	57	2025	478.089	466426	291766		
	16115.8	915	9E+07	909	439	58	2056	478.089	466456.8	291766		
	16084.8	910	9E+07	909	439	59	2087	478.089	466487.6	291766		
	16053.8	909	9E+07	911.3333	439	60	2118	478.089	466518.4	291766		
	16022.8	916	9E+07	915.6667	439	61	2149	478.089	466549.2	291766		
	15991.8	925	9E+07	920	439	62	2180	478.089	466580	291766		
	15948	923	9E+07	922	440	63	2223.8	197.49	466610.8	291735		
	15904.2	922	9E+07	922	441	64	2267.6	197.49	466641.6	291704		
	15860.4	923	9E+07	922	442	65	2311.4	197.49	466672.3	291674		
	15829.4	922	9E+07	922.3333	442	66	2342.4	197.49	466703.1	291674		
	15798.4	923	9E+07	922.6667	442	67	2373.4	197.49	466733.9	291674		
	15767.4	924	9E+07	923	442	68	2404.4	197.49	466764.7	291674		
	15736.4	924	9E+07	923	442	69	2435.4	197.49	466795.5	291674		
	15692.6	927	9E+07	923	443	70	2479.2	81.5103	466826.3	291643		
	15648.8	927	9E+07	923	444	71	2523	81.5103	466857.1	291612		
	15617.8	925	9E+07	923	444	72	2554	81.5103	466887.9	291612		
	15586.8	926	9E+07	923	444	73	2585	81.5103	466918.7	291612		
	15543	928	8.9E+07	923	445	74	2628.8	81.5103	466949.5	291581		
	15512	925	8.9E+07	923	445	75	2659.8	81.5103	466980.3	291581		
	15481	923	8.7E+07	923.3333	445	76	2690.8	81.5103	467011.1	291581		
	15450	924	8.7E+07	924.3333	445	77	2721.8	81.5103	467041.9	291581		
	15419	935	8.7E+07	925.3333	445	78	2752.8	81.5103	467072.7	291581		
	15375.2	929	8.7E+07	926	446	79	2796.6	81.5103	467103.5	291550		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	15331.4	926	8.7E+07	926.6667	447	80	2840.4	81.5103	467134.3	291520		
	15287.6	928	8.7E+07	928	448	81	2884.2	81.5103	467165.1	291489		
	15243.8	930	8.7E+07	929.3333	449	82	2928	81.5103	467195.9	291458		
	15200	930	8.7E+07	930	450	83	2971.8	135.27	467226.7	291427		
	15156.2	930	8.7E+07	931	451	84	3015.6	135.27	467257.4	291397		
	15112.4	933	8.7E+07	934	452	85	3059.4	135.27	467288.2	291366		
	15081.4	939	8.7E+07	937	452	86	3090.4	135.27	467319	291366		
	15037.6	942	8.7E+07	939	453	87	3134.2	135.27	467349.8	291335		
	15006.6	939	8.7E+07	939.6667	453	88	3165.2	135.27	467380.6	291335		
	14962.8	943	8.7E+07	940.3333	454	89	3209	262.04	467411.4	291304		
	14919	944	8.7E+07	941	455	90	3252.8	262.04	467442.2	291273		
	14875.2	942	3.3E+07	941	454	91	3296.6	262.04	467473	291304		
	14844.2	941	3.3E+07	943.3333	454	92	3327.6	262.04	467503.8	291304		
	14813.2	948	3.3E+07	950.6667	454	93	3358.6	262.04	467534.6	291304		
	14769.4	965	3.3E+07	958	453	94	3402.4	262.04	467565.4	291335		
	14725.6	963	3.3E+07	963.3333	452	95	3446.2	235.844	467596.2	291366		
	14694.6	967	3.3E+07	963.6667	451	95	3477.2	235.844	467596.2	291397		
	14650.8	966	3.3E+07	964	450	94	3521	235.844	467565.4	291427		
	14607	964	3.3E+07	966	449	93	3564.8	235.844	467534.6	291458		
	14563.2	970	3.3E+07	968.6667	448	94	3608.6	235.844	467565.4	291489		
	14532.2	974	3.3E+07	971.3333	447	94	3639.6	235.844	467565.4	291520		
	14488.4	972	3.3E+07	975.3333	446	95	3683.4	235.844	467596.2	291550		
	14444.6	982	3.3E+07	980.6667	445	96	3727.2	285.636	467627	291581		
	14413.6	988	3.3E+07	988.3333	445	97	3758.2	285.636	467657.8	291581		
	14382.6	995	3.3E+07	995.3333	445	98	3789.2	285.636	467688.6	291581		
	14351.6	1003	3.3E+07	1002.333	445	99	3820.2	285.636	467719.4	291581		
	14320.6	1009	3.2E+07	1009.667	445	100	3851.2	285.636	467750.2	291581		
	14289.6	1018	3.2E+07	1014.333	445	101	3882.2	285.636	467781	291581		
	14258.6	1021	3.2E+07	1017	445	102	3913.2	285.636	467811.8	291581		
	14214.8	1023	3.2E+07	1017	446	103	3957	366.92	467842.5	291550		
	14183.8	1025	3.2E+07	1017	446	104	3988	366.92	467873.3	291550		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	14152.8	1023	3.2E+07	1017	446	105	4019	366.92	467904.1	291550		
	14109	1025	3.2E+07	1017	447	106	4062.8	366.92	467934.9	291520		
	14065.2	1024	3.2E+07	1017	448	107	4106.6	366.92	467965.7	291489		
	14021.4	1022	3.2E+07	1017	449	108	4150.4	366.92	467996.5	291458		
	13990.4	1017	3.2E+07	1018	449	109	4181.4	366.92	468027.3	291458		
	13959.4	1020	3.2E+07	1020	449	110	4212.4	82.6112	468058.1	291458		
	13915.6	1026	3.2E+07	1022	450	111	4256.2	82.6112	468088.9	291427		
	13884.6	1030	3.2E+07	1023	450	112	4287.2	82.6112	468119.7	291427		
	13840.8	1028	3.2E+07	1023	451	113	4331	82.6112	468150.5	291397		
	13809.8	1023	3.2E+07	1024	451	114	4362	82.6112	468181.3	291397		
	13778.8	1027	3.2E+07	1025	451	115	4393	82.6112	468212.1	291397		
	13747.8	1026	3.2E+07	1027	451	116	4424	82.6112	468242.9	291397		
	13716.8	1029	3.2E+07	1028.333	451	117	4455	305.548	468273.7	291397		
	13673	1034	3.2E+07	1029.667	450	118	4498.8	305.548	468304.5	291427		
	13629.2	1030	3.2E+07	1031.333	449	119	4542.6	305.548	468335.3	291458		
	13598.2	1034	3.2E+07	1036.667	449	120	4573.6	305.548	468366.1	291458		
	13567.2	1046	3.2E+07	1046	449	121	4604.6	305.548	468396.9	291458		
	13536.2	1058	3.2E+07	1055	449	122	4635.6	305.548	468427.6	291458		
	13492.4	1063	3.2E+07	1060	448	123	4679.4	305.548	468458.4	291489		
	13461.4	1061	3.2E+07	1063	448	124	4710.4	324.563	468489.2	291489		
	13430.4	1067	3.2E+07	1065.667	448	125	4741.4	324.563	468520	291489		
	13399.4	1071	3.2E+07	1068.333	448	126	4772.4	324.563	468550.8	291489		
	13355.6	1069	3.2E+07	1070.667	447	127	4816.2	324.563	468581.6	291520		
	13311.8	1074	3.2E+07	1073.333	448	128	4860	324.563	468612.4	291489		
	13280.8	1077	3.2E+07	1077	448	129	4891	324.563	468643.2	291489		
	13249.8	1081	3.2E+07	1079	448	130	4922	324.563	468674	291489		
	13218.8	1080	3.2E+07	1081	448	131	4953	266.657	468704.8	291489		
	13187.8	1083	3.2E+07	1084	448	132	4984	266.657	468735.6	291489		
	13156.8	1089	3.1E+07	1089.333	448	133	5015	266.657	468766.4	291489		
	13125.8	1096	3.1E+07	1094.667	448	134	5046	266.657	468797.2	291489		
	13094.8	1099	3.1E+07	1100.333	448	135	5077	266.657	468828	291489		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	13051	1106	3.1E+07	1105.333	449	136	5120.8	266.657	468858.8	291458		
	13020	1111	3.1E+07	1109.667	449	137	5151.8	266.657	468889.6	291458		
	12976.2	1115	3.1E+07	1111.667	448	138	5195.6	244.221	468920.4	291489		
	12932.4	1118	3.1E+07	1112	447	139	5239.4	244.221	468951.2	291520		
	12901.4	1118	3.1E+07	1112	447	140	5270.4	244.221	468982	291520		
	12857.6	1117	3.1E+07	1112	448	141	5314.2	244.221	469012.7	291489		
	12813.8	1112	3.1E+07	1112.333	449	142	5358	244.221	469043.5	291458		
	12782.8	1113	3.1E+07	1115.333	449	143	5389	244.221	469074.3	291458		
	12739	1121	3.1E+07	1118.667	450	144	5432.8	244.221	469105.1	291427		
	12695.2	1122	3.1E+07	1122.667	451	145	5476.6	123.35	469135.9	291397		
	12664.2	1125	3.1E+07	1124.333	451	146	5507.6	123.35	469166.7	291397		
	12633.2	1126	3.1E+07	1127.667	451	147	5538.6	123.35	469197.5	291397		
	12589.4	1132	3.1E+07	1130.667	452	148	5582.4	123.35	469228.3	291366		
	12545.6	1136	3.1E+07	1133.333	451	149	5626.2	123.35	469259.1	291397		
	12514.6	1136	3.1E+07	1134	450	149	5657.2	123.35	469259.1	291427		
	12470.8	1134	3.1E+07	1134.667	449	150	5701	126.295	469289.9	291458		
	12439.8	1136	3.1E+07	1135.333	449	151	5732	126.295	469320.7	291458		
	12408.8	1136	3.1E+07	1138	449	152	5763	126.295	469351.5	291458		
	12377.8	1142	3.1E+07	1140.333	449	153	5794	126.295	469382.3	291458		
	12334	1143	3.1E+07	1143.333	450	154	5837.8	126.295	469413.1	291427		
	12303	1145	3.1E+07	1145.333	450	155	5868.8	126.295	469443.9	291427		
	12272	1148	3.1E+07	1148.333	450	156	5899.8	126.295	469474.7	291427		
	12241	1160	3.1E+07	1150.667	450	157	5930.8	126.295	469505.5	291427		
	12197.2	1167	3.1E+07	1152	449	158	5974.6	115.436	469536.3	291458		
	12166.2	1166	3.1E+07	1152	449	159	6005.6	115.436	469567.1	291458		
	12135.2	1170	3.1E+07	1152	449	160	6036.6	115.436	469597.9	291458		
	12091.4	1162	3.1E+07	1152	448	161	6080.4	115.436	469628.6	291489		
	12047.6	1162	3.1E+07	1152	447	162	6124.2	115.436	469659.4	291520		
	12016.6	1161	3.1E+07	1152	447	163	6155.2	115.436	469690.2	291520		
	11985.6	1163	3.1E+07	1152	447	164	6186.2	115.436	469721	291520		
	11954.6	1159	3.1E+07	1152	447	165	6217.2	94.013	469751.8	291520		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	11923.6	1152	3.1E+07	1154	447	166	6248.2	94.013	469782.6	291520		
	11892.6	1158	3.1E+07	1157	447	167	6279.2	94.013	469813.4	291520		
	11861.6	1165	3.1E+07	1160	447	168	6310.2	94.013	469844.2	291520		
	11830.6	1166	3.1E+07	1161	447	169	6341.2	94.013	469875	291520		
	11799.6	1170	3.1E+07	1161	447	170	6372.2	94.013	469905.8	291520		
	11755.8	1169	3.1E+07	1161	446	171	6416	94.013	469936.6	291550		
	11724.8	1163	3.1E+07	1161	446	172	6447	89.0324	469967.4	291550		
	11681	1166	3.1E+07	1161	445	173	6490.8	89.0324	469998.2	291581		
	11637.2	1161	3E+07	1161	444	174	6534.6	89.0324	470029	291612		
	11606.2	1161	3E+07	1162.667	444	175	6565.6	89.0324	470059.8	291612		
	11575.2	1166	3E+07	1164.333	444	176	6596.6	89.0324	470090.6	291612		
	11544.2	1168	3E+07	1166	444	177	6627.6	89.0324	470121.4	291612		
	11500.4	1168	2.9E+07	1166	443	178	6671.4	89.0324	470152.2	291643		
	11456.6	1167	2.9E+07	1166	442	179	6715.2	112.035	470183	291674		
	11425.6	1166	2.9E+07	1169.333	442	180	6746.2	112.035	470213.7	291674		
	11381.8	1177	2.8E+07	1172.667	441	181	6790	112.035	470244.5	291704		
	11338	1179	2.8E+07	1176	440	182	6833.8	112.035	470275.3	291735		
	11294.2	1181	2.8E+07	1176	439	183	6877.6	112.035	470306.1	291766		
	11250.4	1176	2.8E+07	1178.667	438	184	6921.4	112.035	470336.9	291797		
	11206.6	1184	2.8E+07	1184.667	437	185	6965.2	351.968	470367.7	291828		
	11175.6	1194	2.8E+07	1192	437	186	6996.2	351.968	470398.5	291828		
	11131.8	1198	2.8E+07	1198.333	436	187	7040	351.968	470429.3	291858		
	11088	1203	2.8E+07	1205.333	435	188	7083.8	351.968	470460.1	291889		
	11057	1215	2.8E+07	1212.333	435	189	7114.8	351.968	470490.9	291889		
	11026	1219	2.8E+07	1219.667	435	190	7145.8	351.968	470521.7	291889		
	10995	1225	2.8E+07	1225.667	435	191	7176.8	351.968	470552.5	291889		
	10964	1233	2.8E+07	1231.667	435	192	7207.8	324.651	470583.3	291889		
	10933	1237	2.8E+07	1236	435	193	7238.8	324.651	470614.1	291889		
	10902	1238	2.8E+07	1242.333	435	194	7269.8	324.651	470644.9	291889		
	10858.2	1252	2.8E+07	1247.667	434	195	7313.6	324.651	470675.7	291920		
	10814.4	1262	2.8E+07	1252.667	433	196	7357.4	324.651	470706.5	291951		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	10770.6	1260	2.8E+07	1253	432	197	7401.2	324.651	470737.3	291982		
	10739.6	1263	2.8E+07	1253	432	198	7432.2	324.651	470768.1	291982		
	10695.8	1263	2.8E+07	1253	431	199	7476	186.983	470798.8	292012		
	10652	1260	2.8E+07	1253	430	200	7519.8	186.983	470829.6	292043		
	10608.2	1260	2.8E+07	1253	429	201	7563.6	186.983	470860.4	292074		
	10564.4	1260	2.8E+07	1253	428	202	7607.4	186.983	470891.2	292105		
	10520.6	1259	2.8E+07	1253	427	203	7651.2	186.983	470922	292136		
	10476.8	1264	2.8E+07	1253	426	204	7695	148.261	470952.8	292166		
	10445.8	1267	2.8E+07	1253	426	205	7726	148.261	470983.6	292166		
	10414.8	1270	1.9E+07	1253	426	206	7757	148.261	471014.4	292166		
	10371	1270	1.9E+07	1253	427	207	7800.8	148.261	471045.2	292136		
	10327.2	1268	1.9E+07	1253	428	208	7844.6	148.261	471076	292105		
	10283.4	1265	1.9E+07	1253	429	209	7888.4	148.261	471106.8	292074		
	10252.4	1264	1.9E+07	1253	429	210	7919.4	148.261	471137.6	292074		
	10221.4	1254	1.9E+07	1253	429	211	7950.4	148.261	471168.4	292074		
	10190.4	1253	1.9E+07	1255	429	212	7981.4	148.261	471199.2	292074		
	10159.4	1259	1.9E+07	1258	429	213	8012.4	148.261	471230	292074		
	10128.4	1262	1.9E+07	1261.667	429	214	8043.4	148.261	471260.8	292074		
	10097.4	1264	1.9E+07	1266	429	215	8074.4	148.261	471291.6	292074		
	10066.4	1272	1.9E+07	1271.667	429	216	8105.4	148.261	471322.4	292074		
	10035.4	1289	1.9E+07	1276.667	429	217	8136.4	148.261	471353.2	292074		
	9991.6	1296	1.9E+07	1279	430	218	8180.2	148.261	471383.9	292043		
	9947.8	1297	1.9E+07	1279	429	219	8224	148.261	471414.7	292074		
	9904	1299	1.9E+07	1279	428	220	8267.8	148.261	471445.5	292105		
	9860.2	1299	1.9E+07	1279	427	221	8311.6	148.261	471476.3	292136		
	9829.2	1296	1.8E+07	1279	427	222	8342.6	148.261	471507.1	292136		
	9798.2	1292	1.8E+07	1279	427	223	8373.6	148.261	471537.9	292136		
	9754.4	1297	1.8E+07	1279	428	224	8417.4	148.261	471568.7	292105		
	9710.6	1292	1.8E+07	1279	429	225	8461.2	118.738	471599.5	292074		
	9666.8	1303	1.8E+07	1279	430	224	8505	118.738	471568.7	292043		
	9623	1300	1.8E+07	1279	431	223	8548.8	118.738	471537.9	292012		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	9579.2	1293	1.8E+07	1279	432	224	8592.6	118.738	471568.7	291982		
	9535.4	1292	1.8E+07	1279	433	225	8636.4	118.738	471599.5	291951		
	9491.6	1298	1.8E+07	1279	434	226	8680.2	118.738	471630.3	291920		
	9447.8	1282	1.8E+07	1279	435	227	8724	118.738	471661.1	291889		
	9416.8	1284	1.7E+07	1279	435	228	8755	118.738	471691.9	291889		
	9385.8	1279	1.7E+07	1281.667	435	229	8786	118.738	471722.7	291889		
	9354.8	1287	1.7E+07	1284.667	435	230	8817	118.738	471753.5	291889		
	9323.8	1289	1.7E+07	1287.667	435	231	8848	118.738	471784.3	291889		
	9292.8	1291	1.7E+07	1288	435	232	8879	118.738	471815.1	291889		
	9261.8	1288	1.7E+07	1288.333	435	233	8910	118.738	471845.9	291889		
	9230.8	1289	1.7E+07	1291.333	435	234	8941	103.333	471876.7	291889		
	9199.8	1297	1.7E+07	1294.667	435	235	8972	103.333	471907.5	291889		
	9168.8	1303	1.7E+07	1297.667	435	236	9003	103.333	471938.3	291889		
	9137.8	1298	1.7E+07	1298.333	435	237	9034	103.333	471969.1	291889		
	9094	1299	1.7E+07	1301.333	434	238	9077.8	103.333	471999.8	291920		
	9050.2	1307	1.7E+07	1305	433	239	9121.6	103.333	472030.6	291951		
	9019.2	1317	1.7E+07	1308.333	432	239	9152.6	103.333	472030.6	291982		
	8975.4	1312	1.7E+07	1309	431	240	9196.4	96.3973	472061.4	292012		
	8931.6	1309	9501407	1309	430	241	9240.2	96.3973	472092.2	292043		
	8887.8	1318	9490836	1309	429	242	9284	96.3973	472123	292074		
	8856.8	1323	9489875	1309	428	242	9315	96.3973	472123	292105		
	8813	1318	9488914	1309	427	241	9358.8	96.3973	472092.2	292136		
	8769.2	1313	9469694	1309	426	242	9402.6	96.3973	472123	292166		
	8725.4	1309	9444708	1311.333	425	243	9446.4	105.034	472153.8	292197		
	8694.4	1316	9442786	1314.333	425	244	9477.4	105.034	472184.6	292197		
	8663.4	1318	9431254	1317.333	425	245	9508.4	105.034	472215.4	292197		
	8632.4	1323	9428371	1318	425	246	9539.4	105.034	472246.2	292197		
	8601.4	1318	9424527	1319.333	425	247	9570.4	105.034	472277	292197		
	8570.4	1322	9421644	1323	425	248	9601.4	105.034	472307.8	292197		
	8526.6	1329	8934417	1327.667	424	249	9645.2	105.034	472338.6	292228		
	8495.6	1336	8932495	1331	424	250	9676.2	105.034	472369.4	292228		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	8451.8	1333	8930573	1332	423	251	9720	92.2167	472400.2	292259		
	8420.8	1332	8923846	1333.667	423	252	9751	92.2167	472431	292259		
	8389.8	1337	8902704	1336.667	423	253	9782	92.2167	472461.8	292259		
	8358.8	1345	8895977	1339.667	423	254	9813	92.2167	472492.6	292259		
	8315	1349	8891172	1341	422	255	9856.8	92.2167	472523.4	292290		
	8271.2	1348	8873874	1341	421	256	9900.6	92.2167	472554.2	292320		
	8227.4	1344	8856576	1341	420	257	9944.4	72.9699	472584.9	292351		
	8196.4	1341	8845044	1342.667	420	258	9975.4	72.9699	472615.7	292351		
	8165.4	1346	8843122	1346.333	420	259	10006.4	72.9699	472646.5	292351		
	8121.6	1353	8831590	1350	419	260	10050.2	72.9699	472677.3	292382		
	8077.8	1355	8826785	1352	418	261	10094	72.9699	472708.1	292413		
	8034	1353	8814292	1352	417	262	10137.8	72.9699	472738.9	292444		
	8003	1352	8812370	1354	417	263	10168.8	72.9699	472769.7	292444		
	7959.2	1358	8774891	1359.333	416	264	10212.6	131.642	472800.5	292474		
	7915.4	1368	8772008	1367.333	415	265	10256.4	131.642	472831.3	292505		
	7884.4	1376	8770086	1374	415	266	10287.4	131.642	472862.1	292505		
	7840.6	1380	8766242	1377.333	414	267	10331.2	131.642	472892.9	292536		
	7796.8	1378	8757593	1380	413	268	10375	131.642	472923.7	292567		
	7753	1384	8747983	1382	412	269	10418.8	131.642	472954.5	292598		
	7722	1384	8746061	1384.333	412	270	10449.8	126.172	472985.3	292598		
	7678.2	1385	8733568	1385.667	411	271	10493.6	126.172	473016.1	292628		
	7647.2	1391	8729724	1387	411	272	10524.6	126.172	473046.9	292628		
	7603.4	1388	8723958	1388.667	410	273	10568.4	126.172	473077.7	292659		
	7559.6	1391	8710504	1389.333	409	274	10612.2	126.172	473108.5	292690		
	7515.8	1390	8703777	1390	408	275	10656	126.172	473139.3	292721		
	7472	1390	8686479	1390	407	276	10699.8	25.0124	473170	292751		
	7441	1390	8682635	1390.333	407	277	10730.8	25.0124	473200.8	292751		
	7410	1391	8674947	1393	407	278	10761.8	25.0124	473231.6	292751		
	7379	1406	8663415	1395.667	407	279	10792.8	25.0124	473262.4	292751		
	7348	1408	8661493	1398	407	280	10823.8	25.0124	473293.2	292751		
	7317	1410	8655727	1398	407	281	10854.8	25.0124	473324	292751		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	7273.2	1408	8634585	1398	406	282	10898.6	25.0124	473354.8	292782		
	7242.2	1407	8631702	1398	406	283	10929.6	25.0124	473385.6	292782		
	7198.4	1409	8625936	1398	405	284	10973.4	8.43847	473416.4	292813		
	7167.4	1409	8621131	1398	405	285	11004.4	8.43847	473447.2	292813		
	7123.6	1407	8606716	1398	404	286	11048.2	8.43847	473478	292844		
	7079.8	1403	8600950	1398	403	287	11092	8.43847	473508.8	292875		
	7036	1401	8340519	1398	402	288	11135.8	8.43847	473539.6	292905		
	7005	1400	8280937	1398	402	289	11166.8	8.43847	473570.4	292905		
	6974	1405	8279976	1398	402	290	11197.8	24.3305	473601.2	292905		
	6943	1401	8269405	1398	402	291	11228.8	24.3305	473632	292905		
	6912	1408	8268444	1398	402	292	11259.8	24.3305	473662.8	292905		
	6881	1408	8267483	1398	402	293	11290.8	24.3305	473693.6	292905		
	6850	1399	8222316	1398	402	294	11321.8	24.3305	473724.4	292905		
	6819	1399	8221355	1398	402	295	11352.8	24.3305	473755.1	292905		
	6788	1402	8220394	1398	402	296	11383.8	24.3305	473785.9	292905		
	6757	1409	8219433	1398	402	297	11414.8	24.3305	473816.7	292905		
	6726	1400	8218472	1398	402	298	11445.8	24.3305	473847.5	292905		
	6695	1399	8217511	1398	402	299	11476.8	24.3305	473878.3	292905		
	6664	1398	8216550	1398.667	402	300	11507.8	24.3305	473909.1	292905		
	6633	1404	8215589	1399.333	402	301	11538.8	24.3305	473939.9	292905		
	6602	1400	8212706	1400	402	302	11569.8	24.3305	473970.7	292905		
	6571	1402	8210784	1400	402	303	11600.8	24.3305	474001.5	292905		
	6540	1409	8208862	1400	402	304	11631.8	24.3305	474032.3	292905		
	6496.2	1412	8199252	1400	401	305	11675.6	24.3305	474063.1	292936		
	6465.2	1409	7998403	1400	400	305	11706.6	41.6224	474063.1	292967		
	6434.2	1400	7563070	1400.333	399	305	11737.6	41.6224	474063.1	292998		
	6403.2	1404	7562109	1400.667	398	305	11768.6	41.6224	474063.1	293029		
	6372.2	1401	7561148	1402.333	397	305	11799.6	41.6224	474063.1	293059		
	6341.2	1405	7560187	1404.667	396	305	11830.6	41.6224	474063.1	293090		
	6297.4	1408	7549616	1407.667	395	306	11874.4	41.6224	474093.9	293121		
	6266.4	1410	7546733	1409.333	394	306	11905.4	41.6224	474093.9	293152		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	6222.6	1410	7541928	1411	393	307	11949.2	93.4398	474124.7	293183		
	6178.8	1413	7506371	1412.667	392	308	11993	93.4398	474155.5	293213		
	6135	1415	7482346	1415.333	391	309	12036.8	93.4398	474186.3	293244		
	6091.2	1418	7477541	1417.333	390	310	12080.6	93.4398	474217.1	293275		
	6047.4	1419	7471775	1422.667	389	311	12124.4	93.4398	474247.9	293306		
	6003.6	1431	7441023	1427.667	388	312	12168.2	93.4398	474278.7	293337		
	5959.8	1434	7438140	1432.333	387	313	12212	81.5991	474309.5	293367		
	5928.8	1439	7428530	1433	387	314	12243	81.5991	474340.3	293367		
	5897.8	1433	7425647	1434.667	387	315	12274	81.5991	474371	293367		
	5854	1438	7417959	1436.667	386	316	12317.8	81.5991	474401.8	293398		
	5823	1440	7377597	1438.667	386	317	12348.8	81.5991	474432.6	293398		
	5792	1439	7376636	1439	386	318	12379.8	81.5991	474463.4	293398		
	5761	1439	7372792	1439.333	386	319	12410.8	81.5991	474494.2	293398		
	5730	1440	7366065	1441	386	320	12441.8	36.7745	474525	293398		
	5686.2	1445	7336274	1442.667	385	321	12485.6	36.7745	474555.8	293429		
	5655.2	1450	7334352	1444	385	322	12516.6	36.7745	474586.6	293429		
	5611.4	1452	7330508	1444	384	323	12560.4	36.7745	474617.4	293460		
	5580.4	1454	7324742	1444	384	324	12591.4	36.7745	474648.2	293460		
	5536.6	1454	7320898	1444	383	325	12635.2	36.7745	474679	293491		
	5492.8	1454	7033559	1444	382	326	12679	36.7745	474709.8	293521		
	5449	1451	7014339	1444	381	327	12722.8	34.7621	474740.6	293552		
	5405.2	1448	6971094	1444	380	328	12766.6	34.7621	474771.4	293583		
	5361.4	1444	6962445	1446	379	329	12810.4	34.7621	474802.2	293614		
	5317.6	1452	6933615	1448	378	330	12854.2	34.7621	474833	293645		
	5286.6	1450	6927849	1450.667	377	330	12885.2	34.7621	474833	293675		
	5242.8	1460	6896136	1451.333	376	331	12929	34.7621	474863.8	293706		
	5211.8	1458	6895175	1452	376	332	12960	55.6117	474894.6	293706		
	5168	1452	6861540	1452.333	375	333	13003.8	55.6117	474925.4	293737		
	5137	1453	6856735	1454.333	375	334	13034.8	55.6117	474956.1	293737		
	5106	1458	6852891	1458.667	375	335	13065.8	55.6117	474986.9	293737		
	5075	1465	6835593	1462.667	375	336	13096.8	55.6117	475017.7	293737		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	5031.2	1482	6827905	1465	374	337	13140.6	55.6117	475048.5	293768		
	4987.4	1484	6825983	1465	373	338	13184.4	55.6117	475079.3	293799		
	4943.6	1477	6803880	1465	372	339	13228.2	59.7585	475110.1	293829		
	4899.8	1474	6775050	1465	371	340	13272	59.7585	475140.9	293860		
	4856	1479	6763518	1465	370	341	13315.8	59.7585	475171.7	293891		
	4812.2	1484	6756791	1465	369	342	13359.6	59.7585	475202.5	293922		
	4768.4	1477	6750064	1465	368	343	13403.4	59.7585	475233.3	293952		
	4724.6	1479	6740454	1465	367	344	13447.2	5.86231	475264.1	293983		
	4693.6	1482	6737571	1465	367	345	13478.2	5.86231	475294.9	293983		
	4649.8	1465	6491555	1467.667	366	346	13522	5.86231	475325.7	294014		
	4606	1473	6349327	1470.333	365	347	13565.8	5.86231	475356.5	294045		
	4562.2	1475	6336834	1473	364	348	13609.6	5.86231	475387.3	294076		
	4531.2	1479	6323380	1473	364	349	13640.6	5.86231	475418.1	294076		
	4500.2	1481	6322419	1473	364	350	13671.6	5.86231	475448.9	294076		
	4469.2	1483	6321458	1473	364	351	13702.6	5.86231	475479.7	294076		
	4438.2	1483	6320497	1473	364	352	13733.6	5.86231	475510.5	294076		
	4407.2	1481	6316653	1473	364	353	13764.6	5.86231	475541.2	294076		
	4363.4	1492	6305121	1473	363	354	13808.4	5.86231	475572	294106		
	4319.6	1490	6303199	1473	362	355	13852.2	5.86231	475602.8	294137		
	4275.8	1493	6285901	1473	363	356	13896	5.86231	475633.6	294106		
	4232	1494	6278213	1473	364	357	13939.8	5.86231	475664.4	294076		
	4201	1486	6249383	1473	364	358	13970.8	0	475695.2	294076		
	4157.2	1488	6231124	1473	363	359	14014.6	0	475726	294106		
	4113.4	1486	6204216	1473	362	360	14058.4	0	475756.8	294137		
	4069.6	1489	5829426	1473	361	361	14102.2	0	475787.6	294168		
	4038.6	1486	5568034	1473	361	362	14133.2	0	475818.4	294168		
	4007.6	1487	5567073	1473	361	363	14164.2	11.4756	475849.2	294168		
	3976.6	1488	5566112	1473	361	364	14195.2	11.4756	475880	294168		
	3932.8	1488	5486349	1473	360	365	14239	11.4756	475910.8	294199		
	3889	1492	2849365	1473	359	366	14282.8	11.4756	475941.6	294230		
	3845.2	1486	2605271	1473	360	367	14326.6	11.4756	475972.4	294199		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	3814.2	1489	2604310	1473	360	368	14357.6	11.4756	476003.2	294199		
	3783.2	1485	2603349	1473	360	369	14388.6	11.4756	476034	294199		
	3752.2	1473	2602388	1473	360	370	14419.6	11.4756	476064.8	294199		
	3721.2	1473	2601427	1473.333	360	371	14450.6	11.4756	476095.6	294199		
	3690.2	1474	2600466	1474	360	372	14481.6	11.4756	476126.3	294199		
	3659.2	1479	2599505	1474.667	360	373	14512.6	11.4756	476157.1	294199		
	3628.2	1481	2598544	1475	360	374	14543.6	11.4756	476187.9	294199		
	3597.2	1485	2597583	1475	360	375	14574.6	11.4756	476218.7	294199		
	3566.2	1486	2596622	1475	360	376	14605.6	11.4756	476249.5	294199		
	3535.2	1490	2595661	1475	360	377	14636.6	11.4756	476280.3	294199		
	3504.2	1494	2594700	1475	360	378	14667.6	11.4756	476311.1	294199		
	3460.4	1492	2587973	1475	359	379	14711.4	7.75169	476341.9	294230		
	3416.6	1487	2093058	1475	358	380	14755.2	7.75169	476372.7	294260		
	3385.6	1478	2037320	1475	358	381	14786.2	7.75169	476403.5	294260		
	3354.6	1475	2036359	1476	358	382	14817.2	7.75169	476434.3	294260		
	3323.6	1478	2035398	1478	358	383	14848.2	7.75169	476465.1	294260		
	3292.6	1487	2034437	1480	358	384	14879.2	7.75169	476495.9	294260		
	3261.6	1483	2033476	1481	358	385	14910.2	7.75169	476526.7	294260		
	3230.6	1485	2032515	1481	358	386	14941.2	5.2362	476557.5	294260		
	3199.6	1481	2031554	1481	358	387	14972.2	5.2362	476588.3	294260		
	3168.6	1486	2030593	1481	358	388	15003.2	5.2362	476619.1	294260		
	3137.6	1492	2029632	1481	358	389	15034.2	5.2362	476649.9	294260		
	3106.6	1484	2027710	1481	358	390	15065.2	5.2362	476680.7	294260		
	3075.6	1481	2024827	1481.667	358	391	15096.2	5.2362	476711.5	294260		
	3031.8	1488	2016178	1482.333	357	392	15140	5.2362	476742.2	294291		
	3000.8	1484	2013295	1483	357	393	15171	5.2362	476773	294291		
	2957	1494	2000802	1483	356	394	15214.8	68.1299	476803.8	294322		
	2926	1483	1964284	1483	356	395	15245.8	68.1299	476834.6	294322		
	2882.2	1491	1955635	1483	355	396	15289.6	68.1299	476865.4	294353		
	2838.4	1488	1946986	1483	354	397	15333.4	68.1299	476896.2	294384		
	2807.4	1484	1846081	1483	354	398	15364.4	68.1299	476927	294384		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	2776.4	1483	1845120	1483.333	354	399	15395.4	68.1299	476957.8	294384		
	2745.4	1488	1844159	1483.667	354	400	15426.4	68.1299	476988.6	294384		
	2714.4	1490	1843198	1484	354	401	15457.4	68.1299	477019.4	294384		
	2683.4	1486	1842237	1484	354	402	15488.4	68.1299	477050.2	294384		
	2652.4	1487	1835510	1484	354	403	15519.4	68.1299	477081	294384		
	2621.4	1484	1834549	1485.667	354	404	15550.4	68.1299	477111.8	294384		
	2590.4	1489	1715385	1487.667	354	405	15581.4	68.1299	477142.6	294384		
	2559.4	1490	1714424	1491.333	354	406	15612.4	68.1299	477173.4	294384		
	2528.4	1495	1713463	1496	354	407	15643.4	68.1299	477204.2	294384		
	2484.6	1503	1710580	1500.667	355	408	15687.2	68.1299	477235	294353		
	2440.8	1504	1709619	1505	354	409	15731	81.0312	477265.8	294384		
	2409.8	1508	1704814	1507	354	410	15762	81.0312	477296.6	294384		
	2378.8	1510	1668296	1508.667	354	411	15793	81.0312	477327.3	294384		
	2347.8	1509	1667335	1509.667	354	412	15824	81.0312	477358.1	294384		
	2316.8	1511	1604870	1515	354	413	15855	81.0312	477388.9	294384		
	2285.8	1525	1601026	1521.333	354	414	15886	81.0312	477419.7	294384		
	2242	1528	1599104	1530	355	415	15929.8	81.0312	477450.5	294353		
	2198.2	1537	1579884	1534	356	416	15973.6	67.1991	477481.3	294322		
	2167.2	1539	1576040	1537	356	417	16004.6	67.1991	477512.1	294322		
	2123.4	1541	1526068	1537	357	418	16048.4	67.1991	477542.9	294291		
	2092.4	1538	1524146	1537	357	419	16079.4	67.1991	477573.7	294291		
	2061.4	1537	1518380	1537	357	420	16110.4	67.1991	477604.5	294291		
	2030.4	1537	1500121	1537.333	357	421	16141.4	67.1991	477635.3	294291		
	1999.4	1538	1488589	1539.333	357	422	16172.4	67.1991	477666.1	294291		
	1968.4	1544	1478979	1541.333	357	423	16203.4	19.7309	477696.9	294291		
	1937.4	1544	1477057	1543	357	424	16234.4	19.7309	477727.7	294291		
	1906.4	1543	1461681	1543.667	357	425	16265.4	19.7309	477758.5	294291		
	1875.4	1545	1452071	1545	357	426	16296.4	19.7309	477789.3	294291		
	1844.4	1552	1365581	1546.333	357	427	16327.4	19.7309	477820.1	294291		
	1800.6	1551	1364620	1547	358	428	16371.2	19.7309	477850.9	294260		
	1756.8	1551	1355971	1547	359	429	16415	19.7309	477881.7	294230		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	1725.8	1547	1305999	1549	359	430	16446	32.4273	477912.4	294230		
	1694.8	1553	1305038	1553	359	431	16477	32.4273	477943.2	294230		
	1651	1559	1288701	1557	360	432	16520.8	32.4273	477974	294199		
	1607.2	1560	1070554	1559	361	433	16564.6	32.4273	478004.8	294168		
	1563.4	1561	1064788	1559	362	434	16608.4	32.4273	478035.6	294137		
	1532.4	1559	1060944	1560	363	434	16639.4	32.4273	478035.6	294106		
	1501.4	1562	1044607	1563.333	364	434	16670.4	32.4273	478035.6	294076		
	1457.6	1569	1023465	1568.667	365	435	16714.2	36.7069	478066.4	294045		
	1426.6	1575	1021543	1573.667	366	435	16745.2	36.7069	478066.4	294014		
	1382.8	1583	1017699	1576.333	367	436	16789	36.7069	478097.2	293983		
	1339	1586	984064	1577	368	437	16832.8	36.7069	478128	293952		
	1295.2	1585	896613	1577	367	438	16876.6	36.7069	478158.8	293983		
	1251.4	1585	887003	1577	366	439	16920.4	36.7069	478189.6	294014		
	1207.6	1584	879315	1577	365	440	16964.2	19.4606	478220.4	294045		
	1176.6	1579	876432	1577	365	441	16995.2	19.4606	478251.2	294045		
	1145.6	1577	872588	1578.333	365	442	17026.2	19.4606	478282	294045		
	1114.6	1581	869705	1580.667	365	443	17057.2	19.4606	478312.8	294045		
	1083.6	1584	866822	1583	365	444	17088.2	19.4606	478343.6	294045		
	1039.8	1588	862978	1584	364	445	17132	19.4606	478374.4	294076		
	996	1593	857212	1584	365	446	17175.8	19.4606	478405.2	294045		
	952.2	1585	835109	1584	366	447	17219.6	4.23669	478436	294014		
	908.4	1585	827421	1584	367	448	17263.4	4.23669	478466.8	293983		
	877.4	1587	818772	1584	367	449	17294.4	4.23669	478497.5	293983		
	846.4	1585	817811	1584	367	450	17325.4	4.23669	478528.3	293983		
	802.6	1594	426684	1584	368	451	17369.2	4.23669	478559.1	293952		
	758.8	1593	417074	1584	369	452	17413	4.23669	478589.9	293922		
	715	1595	407464	1584	370	453	17456.8	2.37668	478620.7	293891		
	684	1598	260431	1584	370	454	17487.8	2.37668	478651.5	293891		
	653	1595	259470	1584	370	455	17518.8	2.37668	478682.3	293891		
	622	1591	239289	1584	370	456	17549.8	2.37668	478713.1	293891		
	591	1587	238328	1584	370	457	17580.8	2.37668	478743.9	293891		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12b												
	560	1584	237367	1585.333	370	458	17611.8	2.37668	478774.7	293891		
	529	1591	236406	1586.667	370	459	17642.8	2.37668	478805.5	293891		
	498	1597	235445	1588	370	460	17673.8	2.37668	478836.3	293891		
	467	1595	234484	1588	370	461	17704.8	2.37668	478867.1	293891		
	436	1591	211420	1588	370	462	17735.8	2.37668	478897.9	293891		
	405	1592	210459	1588	370	463	17766.8	2.37668	478928.7	293891		
	374	1593	209498	1588	370	464	17797.8	2.37668	478959.5	293891		
	343	1596	208537	1588	370	465	17828.8	2.37668	478990.3	293891		
	312	1600	207576	1588	370	466	17859.8	2.37668	479021.1	293891		
	268.2	1602	198927	1588	371	467	17903.6	2.37668	479051.9	293860		
	237.2	1603	197005	1588	371	468	17934.6	2.37668	479082.7	293860		
	206.2	1603	195083	1588	371	469	17965.6	0.78354	479113.4	293860		
	162.4	1606	102827	1588	370	470	18009.4	0.78354	479144.2	293891		
	118.6	1603	77841	1588	369	471	18053.2	0.78354	479175	293922		
	74.8	1594	45167	1588	368	472	18097	0.78354	479205.8	293952		
	31	1588	30752	1589	367	473	18140.8	0.78354	479236.6	293983		
	0	1591	9610	1591	366	473	18171.8	0.78354	479236.6	294014		
North 12c												
	23866	904	3844	897	419	5	0	0	464824.7	292382	11220.18	0.05099
	23835	900	9.1E+07	897	418	5	31	0	464824.7	292413	22387.21	0.05099
	23791.2	902	9.1E+07	897	419	6	74.8	0	464855.5	292382	35481.34	0.03957
	23760.2	903	9.1E+07	897	419	7	105.8	0	464886.2	292382	281838.3	0.05134
	23716.4	901	9.1E+07	897	418	8	149.6	0	464917	292413	354813.4	0.07704
	23685.4	901	9.1E+07	897	418	9	180.6	0	464947.8	292413	562341.3	0.01018
	23654.4	901	9.1E+07	897	418	10	211.6	0	464978.6	292413	707945.8	0.04066
	23623.4	901	9.1E+07	897	418	11	242.6	0	465009.4	292413	2238721	0.02179
	23592.4	902	9.1E+07	897	418	12	273.6	0	465040.2	292413	2818383	0.03619
	23561.4	902	9.1E+07	897	418	13	304.6	0	465071	292413	4466836	0.0511
	23517.6	905	9.1E+07	897	419	14	348.4	0	465101.8	292382	5623413	0.11811
	23486.6	909	9.1E+07	897	419	15	379.4	64.4758	465132.6	292382	7079458	0.01331

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	23455.6	907	9.1E+07	897	419	16	410.4	64.4758	465163.4	292382	8912509	0.05349
	23424.6	906	9.1E+07	897	419	17	441.4	64.4758	465194.2	292382	28183829	0.07844
	23380.8	907	9.1E+07	897	420	18	485.2	64.4758	465225	292351	35481339	0.21158
	23337	907	9.1E+07	897	421	19	529	64.4758	465255.8	292320	44668359	0.10273
	23293.2	906	9.1E+07	897	422	20	572.8	64.4758	465286.6	292290	56234133	0.04924
	23249.4	906	9.1E+07	897	423	21	616.6	64.4758	465317.4	292259	89125094	0.02483
	23205.6	903	9E+07	897	424	22	660.4	64.4758	465348.2	292228		
	23174.6	902	9E+07	897	424	23	691.4	64.4758	465379	292228		
	23143.6	897	9E+07	897.3333	424	24	722.4	64.4758	465409.8	292228		
	23112.6	898	9E+07	898.6667	424	25	753.4	64.4758	465440.6	292228		
	23081.6	901	9E+07	901	424	26	784.4	64.4758	465471.3	292228		
	23050.6	904	9E+07	903.6667	424	27	815.4	64.4758	465502.1	292228		
	23019.6	906	9E+07	905.3333	424	28	846.4	64.4758	465532.9	292228		
	22988.6	909	9E+07	906	424	29	877.4	64.4758	465563.7	292228		
	22944.8	911	9E+07	906	425	30	921.2	64.4758	465594.5	292197		
	22901	907	9E+07	906	426	31	965	64.4758	465625.3	292166		
	22857.2	910	9E+07	906	427	32	1008.8	64.4758	465656.1	292136		
	22813.4	910	9E+07	906	428	33	1052.6	64.4758	465686.9	292105		
	22769.6	908	9E+07	906	429	34	1096.4	64.4758	465717.7	292074		
	22725.8	909	9E+07	906	430	35	1140.2	0	465748.5	292043		
	22682	908	9E+07	906	431	36	1184	0	465779.3	292012		
	22638.2	909	9E+07	906	432	37	1227.8	0	465810.1	291982		
	22594.4	911	9E+07	906	433	38	1271.6	0	465840.9	291951		
	22563.4	911	9E+07	906	433	39	1302.6	0	465871.7	291951		
	22532.4	912	9E+07	906	433	40	1333.6	0	465902.5	291951		
	22488.6	912	9E+07	906	432	41	1377.4	0	465933.3	291982		
	22457.6	911	9E+07	906	432	42	1408.4	0	465964.1	291982		
	22413.8	909	9E+07	906	433	43	1452.2	0	465994.9	291951		
	22382.8	907	9E+07	906	433	44	1483.2	0	466025.7	291951		
	22351.8	906	9E+07	907	433	45	1514.2	0	466056.4	291951		
	22320.8	909	9E+07	908	433	46	1545.2	0	466087.2	291951		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	22289.8	909	9E+07	909	433	47	1576.2	0	466118	291951		
	22258.8	910	9E+07	909	433	48	1607.2	431.33	466148.8	291951		
	22215	914	9E+07	909	434	49	1651	431.33	466179.6	291920		
	22184	917	9E+07	909	434	50	1682	431.33	466210.4	291920		
	22140.2	917	9E+07	909	435	51	1725.8	431.33	466241.2	291889		
	22109.2	913	9E+07	909	435	52	1756.8	431.33	466272	291889		
	22078.2	915	9E+07	909	435	53	1787.8	431.33	466302.8	291889		
	22047.2	917	9E+07	909	435	54	1818.8	431.33	466333.6	291889		
	22003.4	917	9E+07	909	436	55	1862.6	431.33	466364.4	291858		
	21959.6	918	9E+07	909	437	54	1906.4	431.33	466333.6	291828		
	21915.8	914	9E+07	909	438	55	1950.2	431.33	466364.4	291797		
	21884.8	915	9E+07	909	438	56	1981.2	431.33	466395.2	291797		
	21841	918	9E+07	909	439	57	2025	431.33	466426	291766		
	21810	915	9E+07	909	439	58	2056	431.33	466456.8	291766		
	21779	910	9E+07	909	439	59	2087	431.33	466487.6	291766		
	21748	909	9E+07	911.3333	439	60	2118	431.33	466518.4	291766		
	21717	916	9E+07	915.6667	439	61	2149	197.49	466549.2	291766		
	21686	925	9E+07	920	439	62	2180	197.49	466580	291766		
	21642.2	923	9E+07	922	440	63	2223.8	197.49	466610.8	291735		
	21598.4	922	9E+07	922	441	64	2267.6	197.49	466641.6	291704		
	21554.6	923	9E+07	922	442	65	2311.4	197.49	466672.3	291674		
	21523.6	922	9E+07	922.3333	442	66	2342.4	197.49	466703.1	291674		
	21492.6	923	9E+07	922.6667	442	67	2373.4	197.49	466733.9	291674		
	21461.6	924	9E+07	923	442	68	2404.4	133.633	466764.7	291674		
	21430.6	924	9E+07	923	442	69	2435.4	133.633	466795.5	291674		
	21386.8	927	9E+07	923	443	70	2479.2	133.633	466826.3	291643		
	21343	927	9E+07	923	444	71	2523	133.633	466857.1	291612		
	21312	925	9E+07	923	444	72	2554	133.633	466887.9	291612		
	21281	926	9E+07	923	444	73	2585	133.633	466918.7	291612		
	21237.2	928	8.9E+07	923	445	74	2628.8	133.633	466949.5	291581		
	21206.2	925	8.9E+07	923	445	75	2659.8	81.5103	466980.3	291581		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	21175.2	923	8.7E+07	923.3333	445	76	2690.8	81.5103	467011.1	291581		
	21144.2	924	8.7E+07	924.3333	445	77	2721.8	81.5103	467041.9	291581		
	21113.2	935	8.7E+07	925.3333	445	78	2752.8	81.5103	467072.7	291581		
	21069.4	929	8.7E+07	926	446	79	2796.6	81.5103	467103.5	291550		
	21025.6	926	8.7E+07	926.6667	447	80	2840.4	81.5103	467134.3	291520		
	20981.8	928	8.7E+07	928	448	81	2884.2	81.5103	467165.1	291489		
	20938	930	8.7E+07	929.3333	449	82	2928	96.7815	467195.9	291458		
	20894.2	930	8.7E+07	930	450	83	2971.8	96.7815	467226.7	291427		
	20850.4	930	8.7E+07	931	451	84	3015.6	96.7815	467257.4	291397		
	20806.6	933	8.7E+07	933	452	85	3059.4	96.7815	467288.2	291366		
	20775.6	939	8.7E+07	935	452	86	3090.4	96.7815	467319	291366		
	20731.8	942	8.7E+07	936	453	87	3134.2	96.7815	467349.8	291335		
	20700.8	939	8.7E+07	936	453	88	3165.2	108.178	467380.6	291335		
	20657	943	8.7E+07	936	454	89	3209	108.178	467411.4	291304		
	20613.2	944	8.7E+07	936	455	90	3252.8	108.178	467442.2	291273		
	20569.4	936	5.4E+07	937.3333	456	91	3296.6	108.178	467473	291243		
	20525.6	940	5.4E+07	939.3333	457	92	3340.4	108.178	467503.8	291212		
	20481.8	942	5.4E+07	941.3333	458	93	3384.2	108.178	467534.6	291181		
	20438	942	5.4E+07	942	459	94	3428	150.566	467565.4	291150		
	20394.2	942	5.4E+07	944	460	95	3471.8	150.566	467596.2	291119		
	20363.2	949	5.4E+07	946	460	96	3502.8	150.566	467627	291119		
	20319.4	948	5.4E+07	948.3333	461	97	3546.6	150.566	467657.8	291089		
	20275.6	950	5.4E+07	948.6667	462	96	3590.4	150.566	467627	291058		
	20244.6	949	5.4E+07	951.3333	463	96	3621.4	150.566	467627	291027		
	20200.8	956	5.4E+07	954.6667	464	97	3665.2	141.36	467657.8	290996		
	20157	960	5.4E+07	958	465	98	3709	141.36	467688.6	290965		
	20126	959	5.4E+07	959.3333	465	99	3740	141.36	467719.4	290965		
	20095	960	5.4E+07	960	465	100	3771	141.36	467750.2	290965		
	20051.2	964	5.3E+07	960.6667	466	101	3814.8	141.36	467781	290935		
	20020.2	961	5.3E+07	961.3333	466	102	3845.8	141.36	467811.8	290935		
	19976.4	962	5.3E+07	962.3333	467	103	3889.6	86.9334	467842.5	290904		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	19945.4	964	5.3E+07	964.3333	467	104	3920.6	86.9334	467873.3	290904		
	19901.6	969	5.3E+07	966	468	105	3964.4	86.9334	467904.1	290873		
	19857.8	967	5.3E+07	968	469	106	4008.2	86.9334	467934.9	290842		
	19814	974	5.3E+07	969	470	107	4052	86.9334	467965.7	290811		
	19783	973	5.3E+07	970	471	107	4083	86.9334	467965.7	290781		
	19739.2	975	5.3E+07	970	472	108	4126.8	86.9334	467996.5	290750		
	19695.4	970	5.3E+07	970.3333	473	107	4170.6	65.4911	467965.7	290719		
	19664.4	971	5.3E+07	971.3333	474	107	4201.6	65.4911	467965.7	290688		
	19620.6	977	5.3E+07	972.3333	475	108	4245.4	65.4911	467996.5	290657		
	19576.8	979	5.2E+07	973	476	109	4289.2	65.4911	468027.3	290627		
	19533	976	5.2E+07	973	477	110	4333	65.4911	468058.1	290596		
	19489.2	973	5.2E+07	973.3333	478	111	4376.8	65.4911	468088.9	290565		
	19445.4	977	5.2E+07	973.6667	479	112	4420.6	161.564	468119.7	290534		
	19414.4	974	5.2E+07	975.3333	480	112	4451.6	161.564	468119.7	290503		
	19383.4	978	5.2E+07	979.6667	481	112	4482.6	161.564	468119.7	290473		
	19339.6	987	5.2E+07	984.3333	482	113	4526.4	161.564	468150.5	290442		
	19295.8	992	5.2E+07	987.6667	483	114	4570.2	161.564	468181.3	290411		
	19264.8	988	5.2E+07	988	484	114	4601.2	161.564	468181.3	290380		
	19221	995	5.2E+07	988	485	115	4645	161.564	468212.1	290350		
	19177.2	995	5.2E+07	988	486	116	4688.8	161.564	468242.9	290319		
	19133.4	994	5.2E+07	988	487	117	4732.6	161.564	468273.7	290288		
	19102.4	993	4.9E+07	988	488	117	4763.6	161.564	468273.7	290257		
	19071.4	994	4.9E+07	988	489	117	4794.6	161.564	468273.7	290226		
	19040.4	989	4.9E+07	988	490	117	4825.6	161.564	468273.7	290196		
	19009.4	988	4.9E+07	988	491	117	4856.6	161.564	468273.7	290165		
	18965.6	991	4.9E+07	988	492	118	4900.4	150.79	468304.5	290134		
	18934.6	988	4.9E+07	990.3333	493	118	4931.4	150.79	468304.5	290103		
	18890.8	995	4.9E+07	993	494	119	4975.2	150.79	468335.3	290072		
	18859.8	996	4.9E+07	996	495	119	5006.2	150.79	468335.3	290042		
	18828.8	997	4.9E+07	997.6667	496	119	5037.2	150.79	468335.3	290011		
	18797.8	1000	4.9E+07	1000	497	119	5068.2	150.79	468335.3	289980		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	18754	1004	4.9E+07	1002	498	120	5112	150.79	468366.1	289949		
	18710.2	1003	4.9E+07	1003.667	499	121	5155.8	183.074	468396.9	289918		
	18666.4	1009	4.9E+07	1004.333	500	122	5199.6	183.074	468427.6	289888		
	18622.6	1007	4.9E+07	1005	501	123	5243.4	183.074	468458.4	289857		
	18578.8	1005	4.9E+07	1006	502	124	5287.2	183.074	468489.2	289826		
	18547.8	1008	4.9E+07	1010	503	124	5318.2	183.074	468489.2	289795		
	18504	1017	4.9E+07	1014.667	504	125	5362	183.074	468520	289764		
	18473	1019	4.9E+07	1019	505	125	5393	146.453	468520	289734		
	18429.2	1032	4.9E+07	1020.333	506	126	5436.8	146.453	468550.8	289703		
	18385.4	1034	4.9E+07	1021	507	127	5480.6	146.453	468581.6	289672		
	18341.6	1028	4.9E+07	1021	508	128	5524.4	146.453	468612.4	289641		
	18310.6	1025	4.9E+07	1021	509	128	5555.4	146.453	468612.4	289610		
	18279.6	1025	4.9E+07	1021	510	128	5586.4	146.453	468612.4	289580		
	18235.8	1021	4.9E+07	1021	511	129	5630.2	146.453	468643.2	289549		
	18192	1021	4.8E+07	1021.667	512	130	5674	87.5761	468674	289518		
	18148.2	1033	4.8E+07	1022.333	513	131	5717.8	87.5761	468704.8	289487		
	18117.2	1026	4.8E+07	1023	514	131	5748.8	87.5761	468704.8	289456		
	18086.2	1025	4.8E+07	1023	515	131	5779.8	87.5761	468704.8	289426		
	18055.2	1031	4.8E+07	1023	516	131	5810.8	87.5761	468704.8	289395		
	18011.4	1023	4.8E+07	1024.333	517	132	5854.6	87.5761	468735.6	289364		
	17980.4	1027	4.8E+07	1026.333	518	132	5885.6	375.501	468735.6	289333		
	17949.4	1030	4.8E+07	1028.333	519	132	5916.6	375.501	468735.6	289302		
	17905.6	1029	4.8E+07	1031	520	133	5960.4	375.501	468766.4	289272		
	17861.8	1035	4.8E+07	1033	521	134	6004.2	375.501	468797.2	289241		
	17818	1035	4.8E+07	1038.333	522	135	6048	375.501	468828	289210		
	17787	1045	4.8E+07	1045.667	523	135	6079	375.501	468828	289179		
	17756	1057	4.8E+07	1053	524	135	6110	375.501	468828	289149		
	17712.2	1057	4.8E+07	1057.333	525	136	6153.8	272.423	468858.8	289118		
	17681.2	1058	4.8E+07	1059.667	525	137	6184.8	272.423	468889.6	289118		
	17650.2	1067	4.8E+07	1062	525	138	6215.8	272.423	468920.4	289118		
	17606.4	1069	4.8E+07	1064	526	139	6259.6	272.423	468951.2	289087		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	17562.6	1068	4.8E+07	1064	525	140	6303.4	272.423	468982	289118		
	17518.8	1067	4.6E+07	1064	524	141	6347.2	272.423	469012.7	289149		
	17475	1069	4.6E+07	1064	525	142	6391	172.586	469043.5	289118		
	17431.2	1064	4.6E+07	1064.333	524	143	6434.8	172.586	469074.3	289149		
	17387.4	1068	4.6E+07	1064.667	523	144	6478.6	172.586	469105.1	289179		
	17356.4	1069	4.6E+07	1065	523	145	6509.6	172.586	469135.9	289179		
	17325.4	1065	4.6E+07	1066.667	523	146	6540.6	172.586	469166.7	289179		
	17294.4	1070	4.6E+07	1070.667	523	147	6571.6	172.586	469197.5	289179		
	17263.4	1079	4.6E+07	1074.667	523	148	6602.6	172.586	469228.3	289179		
	17219.6	1078	4.6E+07	1077	522	149	6646.4	313.713	469259.1	289210		
	17188.6	1077	4.6E+07	1079	522	150	6677.4	313.713	469289.9	289210		
	17144.8	1083	4.6E+07	1084.667	521	151	6721.2	313.713	469320.7	289241		
	17113.8	1094	4.6E+07	1091.333	521	152	6752.2	313.713	469351.5	289241		
	17082.8	1097	4.6E+07	1097	521	153	6783.2	313.713	469382.3	289241		
	17051.8	1101	4.6E+07	1099	521	154	6814.2	313.713	469413.1	289241		
	17008	1101	4.6E+07	1100	522	155	6858	313.713	469443.9	289210		
	16977	1100	4.6E+07	1100	522	156	6889	207.037	469474.7	289210		
	16946	1100	4.6E+07	1102.333	522	157	6920	207.037	469505.5	289210		
	16902.2	1107	4.6E+07	1105	523	158	6963.8	207.037	469536.3	289179		
	16858.4	1111	4.6E+07	1107.667	522	159	7007.6	207.037	469567.1	289210		
	16827.4	1115	4.6E+07	1108	522	160	7038.6	207.037	469597.9	289210		
	16796.4	1119	4.6E+07	1108	522	161	7069.6	207.037	469628.6	289210		
	16752.6	1118	4.6E+07	1108	523	162	7113.4	207.037	469659.4	289179		
	16721.6	1119	4.6E+07	1108	523	163	7144.4	33.6751	469690.2	289179		
	16690.6	1116	4.6E+07	1108	523	164	7175.4	33.6751	469721	289179		
	16659.6	1116	4.6E+07	1108	523	165	7206.4	33.6751	469751.8	289179		
	16615.8	1118	4.6E+07	1108	524	166	7250.2	33.6751	469782.6	289149		
	16584.8	1111	4.6E+07	1108	524	167	7281.2	33.6751	469813.4	289149		
	16553.8	1108	4.6E+07	1108.333	524	168	7312.2	33.6751	469844.2	289149		
	16510	1109	4.6E+07	1108.667	525	169	7356	33.6751	469875	289118		
	16479	1109	4.6E+07	1110.333	525	170	7387	255.441	469905.8	289118		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	16448	1113	4.6E+07	1113.667	525	171	7418	255.441	469936.6	289118		
	16417	1119	4.6E+07	1119	525	172	7449	255.441	469967.4	289118		
	16386	1125	4.6E+07	1123	525	173	7480	255.441	469998.2	289118		
	16355	1130	4.6E+07	1125	525	174	7511	255.441	470029	289118		
	16311.2	1130	4.6E+07	1125	526	175	7554.8	255.441	470059.8	289087		
	16280.2	1125	4.6E+07	1125.667	526	176	7585.8	255.441	470090.6	289087		
	16249.2	1127	4.6E+07	1128.667	526	177	7616.8	255.441	470121.4	289087		
	16218.2	1141	4.6E+07	1131.667	526	178	7647.8	185.631	470152.2	289087		
	16174.4	1145	4.6E+07	1134	527	179	7691.6	185.631	470183	289056		
	16130.6	1154	4.6E+07	1134	526	180	7735.4	185.631	470213.7	289087		
	16086.8	1158	4.6E+07	1134	527	181	7779.2	185.631	470244.5	289056		
	16043	1157	4.5E+07	1134	528	182	7823	185.631	470275.3	289025		
	16012	1145	4.5E+07	1134	528	183	7854	185.631	470306.1	289025		
	15981	1142	4.5E+07	1134	528	184	7885	383.446	470336.9	289025		
	15950	1134	4.5E+07	1136	528	185	7916	383.446	470367.7	289025		
	15919	1140	4.5E+07	1139	528	186	7947	383.446	470398.5	289025		
	15888	1143	4.5E+07	1145.667	528	187	7978	383.446	470429.3	289025		
	15857	1154	4.5E+07	1153.333	528	188	8009	383.446	470460.1	289025		
	15826	1163	4.5E+07	1162.333	528	189	8040	383.446	470490.9	289025		
	15795	1173	4.5E+07	1167.667	528	190	8071	383.446	470521.7	289025		
	15751.2	1171	4.5E+07	1170	529	191	8114.8	383.446	470552.5	288995		
	15707.4	1170	4.5E+07	1170	530	192	8158.6	373.105	470583.3	288964		
	15663.6	1170	4.5E+07	1170.667	529	193	8202.4	373.105	470614.1	288995		
	15632.6	1172	4.5E+07	1173.333	529	194	8233.4	373.105	470644.9	288995		
	15588.8	1178	4.5E+07	1178.333	528	195	8277.2	373.105	470675.7	289025		
	15557.8	1185	4.5E+07	1184	527	195	8308.2	373.105	470675.7	289056		
	15514	1193	4.5E+07	1187.667	526	196	8352	373.105	470706.5	289087		
	15470.2	1193	4.5E+07	1189	525	197	8395.8	176.516	470737.3	289118		
	15439.2	1189	4.5E+07	1190.333	525	198	8426.8	176.516	470768.1	289118		
	15395.4	1197	4.4E+07	1191.667	524	199	8470.6	176.516	470798.8	289149		
	15351.6	1193	4.4E+07	1193.333	523	200	8514.4	176.516	470829.6	289179		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	15320.6	1200	4.4E+07	1193.667	523	201	8545.4	176.516	470860.4	289179		
	15276.8	1203	4.4E+07	1194	522	202	8589.2	176.516	470891.2	289210		
	15245.8	1200	4.4E+07	1194	522	203	8620.2	176.516	470922	289210		
	15214.8	1197	4.4E+07	1194	522	204	8651.2	206.832	470952.8	289210		
	15183.8	1198	4.4E+07	1194	522	205	8682.2	206.832	470983.6	289210		
	15152.8	1194	4.4E+07	1195	522	206	8713.2	206.832	471014.4	289210		
	15121.8	1201	4.4E+07	1196	522	207	8744.2	206.832	471045.2	289210		
	15090.8	1197	4.4E+07	1198.333	522	208	8775.2	206.832	471076	289210		
	15059.8	1201	4.4E+07	1202.333	522	209	8806.2	206.832	471106.8	289210		
	15028.8	1209	4.4E+07	1207.667	522	210	8837.2	206.832	471137.6	289210		
	14997.8	1214	4.4E+07	1211.667	522	211	8868.2	206.832	471168.4	289210		
	14954	1213	4.4E+07	1215.333	523	212	8912	204.991	471199.2	289179		
	14923	1220	4.4E+07	1218.667	523	213	8943	204.991	471230	289179		
	14879.2	1226	4.4E+07	1222	524	214	8986.8	204.991	471260.8	289149		
	14848.2	1234	4.4E+07	1223	524	215	9017.8	204.991	471291.6	289149		
	14804.4	1236	4.4E+07	1223	525	216	9061.6	204.991	471322.4	289118		
	14773.4	1232	4.4E+07	1223	525	217	9092.6	204.991	471353.2	289118		
	14742.4	1232	4.4E+07	1223	525	218	9123.6	204.991	471383.9	289118		
	14711.4	1236	4.4E+07	1223	525	219	9154.6	144.063	471414.7	289118		
	14667.6	1235	4.4E+07	1223	524	220	9198.4	144.063	471445.5	289149		
	14623.8	1227	4.4E+07	1223	523	221	9242.2	144.063	471476.3	289179		
	14580	1223	3.5E+07	1223	522	222	9286	144.063	471507.1	289210		
	14536.2	1223	3.5E+07	1223.333	521	223	9329.8	144.063	471537.9	289241		
	14492.4	1224	3.5E+07	1226.667	520	224	9373.6	144.063	471568.7	289272		
	14461.4	1233	3.5E+07	1233	520	225	9404.6	405.525	471599.5	289272		
	14430.4	1242	3.5E+07	1243	520	226	9435.6	405.525	471630.3	289272		
	14386.6	1254	3.5E+07	1251.667	519	227	9479.4	405.525	471661.1	289302		
	14342.8	1259	3.5E+07	1260.333	518	228	9523.2	405.525	471691.9	289333		
	14299	1268	3E+07	1269	517	229	9567	405.525	471722.7	289364		
	14268	1280	3E+07	1276.667	516	229	9598	405.525	471722.7	289395		
	14237	1289	3E+07	1281.333	515	229	9629	405.525	471722.7	289426		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	14206	1300	3E+07	1282	514	229	9660	413.833	471722.7	289456		
	14162.2	1302	3E+07	1282	513	230	9703.8	413.833	471753.5	289487		
	14118.4	1304	3E+07	1282	512	231	9747.6	413.833	471784.3	289518		
	14074.6	1305	2.9E+07	1282	511	230	9791.4	413.833	471753.5	289549		
	14030.8	1302	2.9E+07	1282	510	229	9835.2	413.833	471722.7	289580		
	13987	1303	2.9E+07	1282	509	228	9879	413.833	471691.9	289610		
	13943.2	1298	2.9E+07	1282	508	227	9922.8	26.8845	471661.1	289641		
	13912.2	1287	2.9E+07	1282	507	227	9953.8	26.8845	471661.1	289672		
	13881.2	1282	2.9E+07	1283.667	506	227	9984.8	26.8845	471661.1	289703		
	13850.2	1287	2.9E+07	1286	505	227	10015.8	26.8845	471661.1	289734		
	13819.2	1295	2.9E+07	1288.333	504	227	10046.8	26.8845	471661.1	289764		
	13788.2	1304	2.9E+07	1289	503	227	10077.8	26.8845	471661.1	289795		
	13744.4	1305	2.9E+07	1289	502	226	10121.6	26.8845	471630.3	289826		
	13700.6	1303	2.9E+07	1289	501	225	10165.4	26.8845	471599.5	289857		
	13669.6	1295	2.9E+07	1289	500	225	10196.4	26.8845	471599.5	289888		
	13638.6	1300	2.9E+07	1289	499	225	10227.4	26.8845	471599.5	289918		
	13594.8	1298	2.9E+07	1289	498	224	10271.2	26.8845	471568.7	289949		
	13551	1295	2.9E+07	1289	497	223	10315	26.8845	471537.9	289980		
	13520	1289	2.9E+07	1289	496	223	10346	26.8845	471537.9	290011		
	13489	1291	2.9E+07	1289	495	223	10377	26.8845	471537.9	290042		
	13458	1294	2.9E+07	1289	494	223	10408	77.4956	471537.9	290072		
	13427	1289	2.9E+07	1290.667	493	223	10439	77.4956	471537.9	290103		
	13396	1294	2.9E+07	1293.667	492	223	10470	77.4956	471537.9	290134		
	13365	1301	2.9E+07	1296.667	491	223	10501	77.4956	471537.9	290165		
	13334	1301	2.9E+07	1298	490	223	10532	77.4956	471537.9	290196		
	13303	1298	2.9E+07	1298.333	489	223	10563	77.4956	471537.9	290226		
	13272	1299	2.9E+07	1299.667	488	223	10594	77.4956	471537.9	290257		
	13228.2	1305	2.9E+07	1301	487	224	10637.8	77.4956	471568.7	290288		
	13184.4	1309	2.9E+07	1302	486	225	10681.6	77.4956	471599.5	290319		
	13140.6	1308	2.9E+07	1302	487	226	10725.4	77.4956	471630.3	290288		
	13109.6	1307	2.9E+07	1302	487	227	10756.4	77.4956	471661.1	290288		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	13078.6	1308	2.9E+07	1302	487	228	10787.4	77.4956	471691.9	290288		
	13047.6	1306	2.9E+07	1302	487	229	10818.4	77.4956	471722.7	290288		
	13016.6	1307	2.9E+07	1302	487	230	10849.4	77.4956	471753.5	290288		
	12985.6	1311	2.9E+07	1302	487	231	10880.4	77.4956	471784.3	290288		
	12954.6	1311	2.9E+07	1302	487	232	10911.4	189.167	471815.1	290288		
	12923.6	1311	2.9E+07	1302	487	233	10942.4	189.167	471845.9	290288		
	12892.6	1310	2.9E+07	1302	487	234	10973.4	189.167	471876.7	290288		
	12861.6	1305	2.9E+07	1302	487	235	11004.4	189.167	471907.5	290288		
	12830.6	1302	2.8E+07	1302.667	487	236	11035.4	189.167	471938.3	290288		
	12799.6	1304	2.8E+07	1305.667	487	237	11066.4	189.167	471969.1	290288		
	12768.6	1311	2.8E+07	1311.333	487	238	11097.4	189.167	471999.8	290288		
	12737.6	1319	2.8E+07	1316.333	487	239	11128.4	189.167	472030.6	290288		
	12693.8	1322	2.8E+07	1319	486	240	11172.2	189.167	472061.4	290319		
	12662.8	1326	2.8E+07	1319	485	240	11203.2	189.167	472061.4	290350		
	12619	1328	2.8E+07	1319	484	241	11247	189.167	472092.2	290380		
	12575.2	1326	2.8E+07	1319	483	242	11290.8	189.167	472123	290411		
	12544.2	1328	2.8E+07	1319	483	243	11321.8	189.167	472153.8	290411		
	12513.2	1319	2.8E+07	1320	483	244	11352.8	189.167	472184.6	290411		
	12482.2	1322	2.8E+07	1323.667	483	245	11383.8	118.836	472215.4	290411		
	12451.2	1330	2.8E+07	1328.333	483	246	11414.8	118.836	472246.2	290411		
	12420.2	1338	2.8E+07	1332	483	247	11445.8	118.836	472277	290411		
	12376.4	1341	2.8E+07	1333	482	248	11489.6	118.836	472307.8	290442		
	12332.6	1348	2.8E+07	1333	481	249	11533.4	118.836	472338.6	290473		
	12288.8	1344	2.8E+07	1333	480	250	11577.2	118.836	472369.4	290503		
	12257.8	1350	2.8E+07	1333	480	251	11608.2	118.836	472400.2	290503		
	12214	1347	2.8E+07	1333	479	252	11652	77.0097	472431	290534		
	12170.2	1347	2.8E+07	1333	478	253	11695.8	77.0097	472461.8	290565		
	12139.2	1344	2.8E+07	1333	478	254	11726.8	77.0097	472492.6	290565		
	12095.4	1345	2.8E+07	1333	477	255	11770.6	77.0097	472523.4	290596		
	12051.6	1350	2.8E+07	1333	476	256	11814.4	77.0097	472554.2	290627		
	12007.8	1344	2.8E+07	1333	475	257	11858.2	77.0097	472584.9	290657		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	11976.8	1348	2.8E+07	1333	475	258	11889.2	309.166	472615.7	290657		
	11945.8	1348	2.8E+07	1333	475	259	11920.2	309.166	472646.5	290657		
	11902	1338	2.8E+07	1333	474	260	11964	309.166	472677.3	290688		
	11871	1333	2.8E+07	1333.333	474	261	11995	309.166	472708.1	290688		
	11840	1334	2.8E+07	1335.333	474	262	12026	309.166	472738.9	290688		
	11809	1339	2.8E+07	1338.667	474	263	12057	309.166	472769.7	290688		
	11778	1343	2.8E+07	1343.667	474	264	12088	309.166	472800.5	290688		
	11747	1349	2.8E+07	1348.333	474	265	12119	309.166	472831.3	290688		
	11716	1353	2.8E+07	1352.667	474	266	12150	185.84	472862.1	290688		
	11685	1359	2.8E+07	1355	474	267	12181	185.84	472892.9	290688		
	11641.2	1363	2.8E+07	1356	473	268	12224.8	185.84	472923.7	290719		
	11610.2	1366	2.8E+07	1356	473	269	12255.8	185.84	472954.5	290719		
	11566.4	1366	2.8E+07	1356	472	270	12299.6	185.84	472985.3	290750		
	11522.6	1359	2.8E+07	1356	471	271	12343.4	185.84	473016.1	290781		
	11478.8	1362	2.7E+07	1356	470	272	12387.2	185.84	473046.9	290811		
	11447.8	1358	2.7E+07	1356	470	273	12418.2	91.2577	473077.7	290811		
	11404	1358	2.7E+07	1356	469	274	12462	91.2577	473108.5	290842		
	11360.2	1356	2.7E+07	1359	468	275	12505.8	91.2577	473139.3	290873		
	11329.2	1368	2.7E+07	1362	468	276	12536.8	91.2577	473170	290873		
	11285.4	1372	2.7E+07	1365	467	277	12580.6	91.2577	473200.8	290904		
	11254.4	1375	2.7E+07	1365	467	278	12611.6	91.2577	473231.6	290904		
	11223.4	1373	2.7E+07	1365	467	279	12642.6	102.045	473262.4	290904		
	11179.6	1370	2.7E+07	1365	466	280	12686.4	102.045	473293.2	290935		
	11148.6	1365	2.6E+07	1365	466	281	12717.4	102.045	473324	290935		
	11117.6	1365	2.6E+07	1367.333	466	282	12748.4	102.045	473354.8	290935		
	11086.6	1373	2.6E+07	1369.667	466	283	12779.4	102.045	473385.6	290935		
	11042.8	1372	2.6E+07	1372	465	284	12823.2	102.045	473416.4	290965		
	11011.8	1372	2.6E+07	1373	465	285	12854.2	102.045	473447.2	290965		
	10980.8	1375	2.6E+07	1375.333	465	286	12885.2	119.733	473478	290965		
	10937	1379	2.6E+07	1377.667	466	287	12929	119.733	473508.8	290935		
	10906	1379	2.6E+07	1379	466	288	12960	119.733	473539.6	290935		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	10875	1379	2.6E+07	1379	466	289	12991	119.733	473570.4	290935		
	10844	1382	2.6E+07	1379	466	290	13022	119.733	473601.2	290935		
	10813	1379	2.6E+07	1379.667	466	291	13053	119.733	473632	290935		
	10782	1381	2.6E+07	1382.333	466	292	13084	119.733	473662.8	290935		
	10751	1387	2.6E+07	1386	466	293	13115	119.733	473693.6	290935		
	10707.2	1391	2.6E+07	1389	465	294	13158.8	130.095	473724.4	290965		
	10676.2	1391	2.6E+07	1390	465	295	13189.8	130.095	473755.1	290965		
	10645.2	1390	2.6E+07	1390	465	296	13220.8	130.095	473785.9	290965		
	10614.2	1390	2.6E+07	1390.333	465	297	13251.8	130.095	473816.7	290965		
	10570.4	1391	2.6E+07	1393	466	298	13295.6	130.095	473847.5	290935		
	10539.4	1398	2.6E+07	1396.667	466	299	13326.6	130.095	473878.3	290935		
	10508.4	1401	2.6E+07	1400.333	466	300	13357.6	130.095	473909.1	290935		
	10477.4	1408	2.6E+07	1401.667	466	301	13388.6	111.166	473939.9	290935		
	10446.4	1402	2.6E+07	1403.333	466	302	13419.6	111.166	473970.7	290935		
	10402.6	1406	2.6E+07	1406	467	303	13463.4	111.166	474001.5	290904		
	10358.8	1410	2.6E+07	1411	468	304	13507.2	111.166	474032.3	290873		
	10327.8	1417	2.6E+07	1415.333	468	305	13538.2	111.166	474063.1	290873		
	10296.8	1419	2.6E+07	1418.333	468	306	13569.2	111.166	474093.9	290873		
	10253	1420	2.6E+07	1419	469	307	13613	111.166	474124.7	290842		
	10222	1423	2.6E+07	1419	469	308	13644	88.6276	474155.5	290842		
	10191	1430	2.6E+07	1419	469	309	13675	88.6276	474186.3	290842		
	10160	1431	2.6E+07	1419	469	310	13706	88.6276	474217.1	290842		
	10116.2	1431	2.6E+07	1419	470	311	13749.8	88.6276	474247.9	290811		
	10085.2	1423	2.6E+07	1419	470	312	13780.8	88.6276	474278.7	290811		
	10054.2	1425	2.6E+07	1419	470	313	13811.8	88.6276	474309.5	290811		
	10023.2	1430	2.6E+07	1419	470	314	13842.8	88.6276	474340.3	290811		
	9979.4	1434	2.6E+07	1419	471	315	13886.6	88.6276	474371	290781		
	9948.4	1429	2.6E+07	1419	471	316	13917.6	0	474401.8	290781		
	9917.4	1425	2.6E+07	1419	471	317	13948.6	0	474432.6	290781		
	9886.4	1425	2.6E+07	1419	471	318	13979.6	0	474463.4	290781		
	9855.4	1428	2.6E+07	1419	471	319	14010.6	0	474494.2	290781		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	9824.4	1430	2.6E+07	1419	471	320	14041.6	0	474525	290781		
	9793.4	1429	2.6E+07	1419	471	321	14072.6	0	474555.8	290781		
	9762.4	1431	2.6E+07	1419	471	322	14103.6	67.9186	474586.6	290781		
	9731.4	1434	2.6E+07	1419	471	323	14134.6	67.9186	474617.4	290781		
	9700.4	1433	2E+07	1419	471	324	14165.6	67.9186	474648.2	290781		
	9656.6	1432	2E+07	1419	472	325	14209.4	67.9186	474679	290750		
	9612.8	1425	2E+07	1419	473	326	14253.2	67.9186	474709.8	290719		
	9569	1425	2E+07	1419	474	327	14297	67.9186	474740.6	290688		
	9525.2	1420	2E+07	1419	475	328	14340.8	67.9186	474771.4	290657		
	9481.4	1429	2E+07	1419	476	329	14384.6	67.9186	474802.2	290627		
	9437.6	1433	2E+07	1419	477	330	14428.4	67.9186	474833	290596		
	9406.6	1420	2E+07	1419	478	330	14459.4	67.9186	474833	290565		
	9375.6	1419	2E+07	1419.667	479	330	14490.4	67.9186	474833	290534		
	9344.6	1421	2E+07	1421	480	330	14521.4	67.9186	474833	290503		
	9313.6	1423	2E+07	1422.333	481	330	14552.4	67.9186	474833	290473		
	9282.6	1427	2E+07	1423	482	330	14583.4	67.9186	474833	290442		
	9251.6	1425	2E+07	1423	483	330	14614.4	67.9186	474833	290411		
	9220.6	1423	2E+07	1425.333	484	330	14645.4	120.74	474833	290380		
	9189.6	1433	2E+07	1427.667	485	330	14676.4	120.74	474833	290350		
	9158.6	1432	2E+07	1430	486	330	14707.4	120.74	474833	290319		
	9127.6	1430	2E+07	1430.667	487	330	14738.4	120.74	474833	290288		
	9083.8	1432	9934818	1434.667	488	331	14782.2	120.74	474863.8	290257		
	9052.8	1442	9933857	1439	488	332	14813.2	120.74	474894.6	290257		
	9021.8	1443	9932896	1443.667	488	333	14844.2	120.74	474925.4	290257		
	8978	1448	9928091	1445	489	334	14888	87.3301	474956.1	290226		
	8934.2	1446	9919442	1446	490	335	14931.8	87.3301	474986.9	290196		
	8903.2	1446	9610961	1446	490	336	14962.8	87.3301	475017.7	290196		
	8872.2	1447	9609039	1446	490	337	14993.8	87.3301	475048.5	290196		
	8841.2	1447	9607117	1446	490	338	15024.8	87.3301	475079.3	290196		
	8810.2	1449	9605195	1446	490	339	15055.8	87.3301	475110.1	290196		
	8766.4	1448	9601351	1446	489	340	15099.6	87.3301	475140.9	290226		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	8735.4	1452	9564833	1446	488	340	15130.6	87.3301	475140.9	290257		
	8691.6	1453	9563872	1446	487	339	15174.4	13.445	475110.1	290288		
	8660.6	1454	9560989	1446	486	339	15205.4	13.445	475110.1	290319		
	8616.8	1452	9558106	1446	485	340	15249.2	13.445	475140.9	290350		
	8573	1446	9542730	1446.667	484	341	15293	13.445	475171.7	290380		
	8529.2	1448	9518705	1448	483	342	15336.8	13.445	475202.5	290411		
	8498.2	1451	9508134	1449.333	483	343	15367.8	13.445	475233.3	290411		
	8454.4	1453	9501407	1450	482	344	15411.6	45.6701	475264.1	290442		
	8423.4	1450	9499485	1450	482	345	15442.6	45.6701	475294.9	290442		
	8379.6	1450	9465850	1451.667	481	346	15486.4	45.6701	475325.7	290473		
	8348.6	1455	9453357	1455.667	481	347	15517.4	45.6701	475356.5	290473		
	8304.8	1463	9450474	1459.667	480	348	15561.2	45.6701	475387.3	290503		
	8261	1469	9446630	1462	479	349	15605	45.6701	475418.1	290534		
	8217.2	1465	9445669	1462	478	350	15648.8	45.6701	475448.9	290565		
	8173.4	1465	9368789	1462	477	351	15692.6	45.6701	475479.7	290596		
	8142.4	1465	9359179	1462	477	352	15723.6	45.6701	475510.5	290596		
	8111.4	1474	9353413	1462	477	353	15754.6	45.6701	475541.2	290596		
	8067.6	1480	9339959	1462	476	354	15798.4	45.6701	475572	290627		
	8036.6	1477	9338998	1462	476	355	15829.4	45.6701	475602.8	290627		
	7992.8	1477	9333232	1462	475	356	15873.2	45.6701	475633.6	290657		
	7949	1476	9327466	1462	474	357	15917	24.6569	475664.4	290688		
	7905.2	1474	9312090	1462	473	358	15960.8	24.6569	475695.2	290719		
	7861.4	1474	9303441	1462	472	359	16004.6	24.6569	475726	290750		
	7830.4	1473	9288065	1462	472	360	16035.6	24.6569	475756.8	290750		
	7799.4	1478	9287104	1462	472	361	16066.6	24.6569	475787.6	290750		
	7755.6	1469	9056464	1462	471	362	16110.4	24.6569	475818.4	290781		
	7724.6	1468	9021868	1462	471	363	16141.4	24.6569	475849.2	290781		
	7693.6	1462	9020907	1464	471	364	16172.4	24.6569	475880	290781		
	7662.6	1468	9019946	1466.333	471	365	16203.4	24.6569	475910.8	290781		
	7631.6	1475	9018985	1468.667	471	366	16234.4	24.6569	475941.6	290781		
	7600.6	1479	9018024	1469	471	367	16265.4	24.6569	475972.4	290781		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	7569.6	1479	9017063	1469	471	368	16296.4	24.6569	476003.2	290781		
	7538.6	1483	9009375	1469	471	369	16327.4	24.6569	476034	290781		
	7494.8	1486	9007453	1469	470	370	16371.2	24.6569	476064.8	290811		
	7463.8	1482	8994960	1469	470	371	16402.2	111.488	476095.6	290811		
	7420	1469	8984389	1469	471	372	16446	111.488	476126.3	290781		
	7376.2	1469	8956520	1472.333	472	373	16489.8	111.488	476157.1	290750		
	7332.4	1479	8922885	1476.333	473	374	16533.6	111.488	476187.9	290719		
	7301.4	1481	8902704	1482.667	474	374	16564.6	111.488	476187.9	290688		
	7270.4	1488	8901743	1487	475	374	16595.6	111.488	476187.9	290657		
	7226.6	1495	8895016	1490.667	476	375	16639.4	102.173	476218.7	290627		
	7182.8	1494	8894055	1492	477	376	16683.2	102.173	476249.5	290596		
	7139	1495	8889250	1492	478	377	16727	102.173	476280.3	290565		
	7095.2	1497	8885406	1492	479	378	16770.8	102.173	476311.1	290534		
	7051.4	1500	8387608	1492	478	379	16814.6	102.173	476341.9	290565		
	7007.6	1499	8385686	1492	477	380	16858.4	102.173	476372.7	290596		
	6963.8	1495	8377998	1492	476	381	16902.2	65.4722	476403.5	290627		
	6920	1493	7097946	1492	475	382	16946	65.4722	476434.3	290657		
	6876.2	1493	7078726	1492	474	383	16989.8	65.4722	476465.1	290688		
	6845.2	1492	7002807	1492.333	474	384	17020.8	65.4722	476495.9	290688		
	6814.2	1493	7001846	1495	474	385	17051.8	65.4722	476526.7	290688		
	6783.2	1500	7000885	1499.333	474	386	17082.8	65.4722	476557.5	290688		
	6752.2	1505	6998963	1503.333	474	387	17113.8	65.4722	476588.3	290688		
	6721.2	1505	6998002	1505	474	388	17144.8	43.9709	476619.1	290688		
	6690.2	1505	6995119	1505.667	474	389	17175.8	43.9709	476649.9	290688		
	6659.2	1507	6985509	1506.333	474	390	17206.8	43.9709	476680.7	290688		
	6615.4	1510	6976860	1507	475	391	17250.6	43.9709	476711.5	290657		
	6571.6	1510	6971094	1507	476	392	17294.4	43.9709	476742.2	290627		
	6540.6	1507	6968211	1507.333	476	393	17325.4	43.9709	476773	290627		
	6496.8	1512	6963406	1507.667	477	394	17369.2	43.9709	476803.8	290596		
	6453	1512	6880760	1508	476	395	17413	4.8285	476834.6	290627		
	6422	1511	6878838	1508	476	396	17444	4.8285	476865.4	290627		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	6378.2	1509	6873072	1508	475	397	17487.8	4.8285	476896.2	290657		
	6334.4	1512	6859618	1508	474	398	17531.6	4.8285	476927	290688		
	6303.4	1510	6857696	1508	473	398	17562.6	4.8285	476927	290719		
	6259.6	1509	6855774	1508	472	399	17606.4	4.8285	476957.8	290750		
	6215.8	1510	6811568	1508	471	400	17650.2	0	476988.6	290781		
	6172	1516	6809646	1508	472	401	17694	0	477019.4	290750		
	6128.2	1513	6806763	1508	471	402	17737.8	0	477050.2	290781		
	6097.2	1508	6547293	1508	471	403	17768.8	0	477081	290781		
	6066.2	1512	6546332	1508	471	404	17799.8	0	477111.8	290781		
	6022.4	1512	6535761	1508	470	405	17843.6	0	477142.6	290811		
	5991.4	1512	6532878	1508	470	406	17874.6	0	477173.4	290811		
	5947.6	1515	6520385	1508	469	407	17918.4	0	477204.2	290842		
	5903.8	1512	6514619	1508	468	408	17962.2	0	477235	290873		
	5872.8	1515	6406987	1508	468	409	17993.2	0	477265.8	290873		
	5829	1511	6390650	1508	467	410	18037	0	477296.6	290904		
	5785.2	1516	6386806	1508	466	411	18080.8	0	477327.3	290935		
	5754.2	1511	6382962	1508	466	412	18111.8	25.6616	477358.1	290935		
	5710.4	1511	6318575	1508	465	413	18155.6	25.6616	477388.9	290965		
	5666.6	1509	6306082	1508	464	414	18199.4	25.6616	477419.7	290996		
	5635.6	1508	6300316	1508.333	464	415	18230.4	25.6616	477450.5	290996		
	5604.6	1511	6299355	1508.667	464	416	18261.4	25.6616	477481.3	290996		
	5573.6	1513	6297433	1509	464	417	18292.4	25.6616	477512.1	290996		
	5529.8	1516	6291667	1509	463	418	18336.2	25.6616	477542.9	291027		
	5498.8	1512	6209021	1509	463	419	18367.2	25.6616	477573.7	291027		
	5467.8	1509	6208060	1510.333	463	420	18398.2	25.6616	477604.5	291027		
	5436.8	1515	6207099	1511.667	463	421	18429.2	25.6616	477635.3	291027		
	5393	1518	6202294	1513	464	422	18473	25.6616	477666.1	290996		
	5362	1516	6198450	1513	464	423	18504	25.6616	477696.9	290996		
	5331	1517	6193645	1513	464	424	18535	25.6616	477727.7	290996		
	5287.2	1520	6143673	1513	463	425	18578.8	25.6616	477758.5	291027		
	5256.2	1513	6092740	1514.667	462	425	18609.8	25.6616	477758.5	291058		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	5212.4	1518	6077364	1520	461	426	18653.6	114.954	477789.3	291089		
	5168.6	1529	6072559	1527	462	427	18697.4	114.954	477820.1	291058		
	5137.6	1534	6071598	1536.667	462	428	18728.4	114.954	477850.9	291058		
	5106.6	1552	6069676	1542.667	462	429	18759.4	114.954	477881.7	291058		
	5062.8	1556	6068715	1547	461	430	18803.2	114.954	477912.4	291089		
	5019	1547	6064871	1547.333	460	431	18847	114.954	477943.2	291119		
	4975.2	1551	6022587	1547.667	459	432	18890.8	142.416	477974	291150		
	4931.4	1556	6017782	1548	458	433	18934.6	142.416	478004.8	291181		
	4887.6	1550	5677588	1548	457	434	18978.4	142.416	478035.6	291212		
	4843.8	1549	5657407	1548	456	435	19022.2	142.416	478066.4	291243		
	4800	1553	5641070	1548	455	436	19066	142.416	478097.2	291273		
	4769	1555	5638187	1548	455	437	19097	142.416	478128	291273		
	4738	1551	5102910	1548	455	438	19128	142.416	478158.8	291273		
	4707	1549	5101949	1548	455	439	19159	38.0272	478189.6	291273		
	4676	1548	5100988	1550.667	455	440	19190	38.0272	478220.4	291273		
	4645	1556	5100027	1553.333	455	441	19221	38.0272	478251.2	291273		
	4614	1558	5091378	1556	455	442	19252	38.0272	478282	291273		
	4583	1559	5090417	1556	455	443	19283	38.0272	478312.8	291273		
	4552	1564	5083690	1556	455	444	19314	38.0272	478343.6	291273		
	4508.2	1565	5076002	1556	454	445	19357.8	38.0272	478374.4	291304		
	4477.2	1568	5071197	1556	453	445	19388.8	43.9359	478374.4	291335		
	4433.4	1567	5070236	1556	452	446	19432.6	43.9359	478405.2	291366		
	4389.6	1567	5048133	1556	451	447	19476.4	43.9359	478436	291397		
	4345.8	1556	5041406	1558	450	448	19520.2	43.9359	478466.8	291427		
	4302	1565	4973175	1560	449	449	19564	43.9359	478497.5	291458		
	4258.2	1566	4965487	1562	448	450	19607.8	43.9359	478528.3	291489		
	4227.2	1562	4963565	1564	448	451	19638.8	50.235	478559.1	291489		
	4183.4	1568	4958760	1567.333	447	452	19682.6	50.235	478589.9	291520		
	4139.6	1572	4934735	1571.667	446	453	19726.4	50.235	478620.7	291550		
	4108.6	1579	4929930	1574	446	454	19757.4	50.235	478651.5	291550		
	4064.8	1577	4928969	1575	445	455	19801.2	50.235	478682.3	291581		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	4021	1579	4915515	1575	444	456	19845	50.235	478713.1	291612		
	3977.2	1576	4908788	1575	443	457	19888.8	26.7796	478743.9	291643		
	3933.4	1578	4900139	1575	442	458	19932.6	26.7796	478774.7	291674		
	3902.4	1575	4891490	1576	442	459	19963.6	26.7796	478805.5	291674		
	3858.6	1578	2803237	1578.333	441	460	20007.4	26.7796	478836.3	291704		
	3814.8	1589	2789783	1580.667	440	459	20051.2	26.7796	478805.5	291735		
	3771	1590	2787861	1582	439	458	20095	26.7796	478774.7	291766		
	3727.2	1589	2782095	1582	438	459	20138.8	4.73652	478805.5	291797		
	3683.4	1591	2769602	1582	437	460	20182.6	4.73652	478836.3	291828		
	3639.6	1591	2763836	1582	436	461	20226.4	4.73652	478867.1	291858		
	3595.8	1591	2757109	1582	435	462	20270.2	4.73652	478897.9	291889		
	3552	1591	2742694	1582	434	463	20314	4.73652	478928.7	291920		
	3521	1593	2739811	1582	433	463	20345	4.73652	478928.7	291951		
	3477.2	1588	2735006	1582	432	464	20388.8	0	478959.5	291982		
	3433.4	1594	2711942	1582	431	463	20432.6	0	478928.7	292012		
	3389.6	1596	2707137	1582	430	462	20476.4	0	478897.9	292043		
	3345.8	1594	2700410	1582	429	463	20520.2	0	478928.7	292074		
	3302	1591	2692722	1582	428	462	20564	0	478897.9	292105		
	3271	1588	2678307	1582	427	462	20595	35.9337	478897.9	292136		
	3227.2	1600	2671580	1582	426	463	20638.8	35.9337	478928.7	292166		
	3196.2	1597	2665814	1582	425	463	20669.8	35.9337	478928.7	292197		
	3165.2	1599	2663892	1582	424	463	20700.8	35.9337	478928.7	292228		
	3121.4	1595	2503405	1582	423	464	20744.6	35.9337	478959.5	292259		
	3077.6	1588	2467848	1582	422	465	20788.4	35.9337	478990.3	292290		
	3033.8	1582	2370787	1583	421	466	20832.2	35.9337	479021.1	292320		
	3002.8	1585	2350606	1584.333	420	466	20863.2	35.9337	479021.1	292351		
	2971.8	1591	2349645	1585.667	419	466	20894.2	35.9337	479021.1	292382		
	2940.8	1589	2348684	1586	418	466	20925.2	35.9337	479021.1	292413		
	2909.8	1586	2347723	1588.333	417	466	20956.2	35.9337	479021.1	292444		
	2878.8	1593	2346762	1591	416	466	20987.2	35.9337	479021.1	292474		
	2847.8	1598	2335230	1593.667	415	466	21018.2	35.9337	479021.1	292505		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	2816.8	1594	2333308	1594	414	466	21049.2	35.9337	479021.1	292536		
	2785.8	1594	2326581	1595	413	466	21080.2	35.9337	479021.1	292567		
	2754.8	1598	2325620	1596	412	466	21111.2	35.9337	479021.1	292598		
	2723.8	1597	2290063	1597	411	466	21142.2	24.9379	479021.1	292628		
	2692.8	1597	2289102	1599.333	410	466	21173.2	24.9379	479021.1	292659		
	2649	1607	2284297	1601.667	409	467	21217	24.9379	479051.9	292690		
	2605.2	1610	2283336	1604	408	468	21260.8	24.9379	479082.7	292721		
	2561.4	1607	2247779	1604	407	469	21304.6	24.9379	479113.4	292751		
	2530.4	1608	2244896	1604	406	469	21335.6	24.9379	479113.4	292782		
	2499.4	1609	2242974	1604	405	469	21366.6	24.9379	479113.4	292813		
	2468.4	1609	2241052	1604	404	469	21397.6	8.33549	479113.4	292844		
	2437.4	1605	2240091	1604	403	469	21428.6	8.33549	479113.4	292875		
	2406.4	1608	2239130	1604	402	469	21459.6	8.33549	479113.4	292905		
	2362.6	1606	2235286	1604	401	470	21503.4	8.33549	479144.2	292936		
	2331.6	1604	1232963	1604.333	401	471	21534.4	8.33549	479175	292936		
	2287.8	1607	986947	1604.667	400	472	21578.2	8.33549	479205.8	292967		
	2244	1610	978298	1605	399	473	21622	8.33549	479236.6	292998		
	2213	1606	964844	1605	399	474	21653	5.76246	479267.4	292998		
	2169.2	1609	942741	1605	398	475	21696.8	5.76246	479298.2	293029		
	2125.4	1607	935053	1605	397	476	21740.6	5.76246	479329	293059		
	2081.6	1608	866822	1605	396	477	21784.4	5.76246	479359.8	293090		
	2037.8	1607	861056	1605	395	478	21828.2	5.76246	479390.6	293121		
	1994	1607	854329	1605	394	479	21872	5.76246	479421.4	293152		
	1950.2	1605	843758	1605.333	393	480	21915.8	11.7586	479452.2	293183		
	1919.2	1610	840875	1605.667	392	480	21946.8	11.7586	479452.2	293213		
	1875.4	1606	832226	1606.667	391	481	21990.6	11.7586	479483	293244		
	1844.4	1608	681349	1608.333	391	482	22021.6	11.7586	479513.8	293244		
	1813.4	1612	676544	1610	391	483	22052.6	11.7586	479544.6	293244		
	1782.4	1612	674622	1611	391	484	22083.6	11.7586	479575.4	293244		
	1751.4	1611	652519	1611	391	485	22114.6	11.7586	479606.2	293244		
	1720.4	1611	649636	1611.333	391	486	22145.6	6.61013	479637	293244		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	1689.4	1612	645792	1613	391	487	22176.6	6.61013	479667.8	293244		
	1645.6	1619	634260	1614.667	390	488	22220.4	6.61013	479698.5	293275		
	1601.8	1617	626572	1616	389	489	22264.2	6.61013	479729.3	293306		
	1558	1616	616001	1616	388	490	22308	6.61013	479760.1	293337		
	1527	1622	590054	1616	388	491	22339	6.61013	479790.9	293337		
	1483.2	1624	585249	1616	387	492	22382.8	6.61013	479821.7	293367		
	1439.4	1624	583327	1616	386	493	22426.6	3.71588	479852.5	293398		
	1408.4	1622	485305	1616	386	494	22457.6	3.71588	479883.3	293398		
	1364.6	1616	478578	1616.667	387	495	22501.4	3.71588	479914.1	293367		
	1320.8	1624	471851	1617.333	388	496	22545.2	3.71588	479944.9	293337		
	1289.8	1620	454553	1618	388	497	22576.2	3.71588	479975.7	293337		
	1258.8	1621	451670	1618	388	498	22607.2	3.71588	480006.5	293337		
	1227.8	1621	448787	1618	388	499	22638.2	28.3522	480037.3	293337		
	1196.8	1620	377673	1618	388	500	22669.2	28.3522	480068.1	293337		
	1153	1622	353648	1618	387	501	22713	28.3522	480098.9	293367		
	1109.2	1621	345960	1618	386	502	22756.8	28.3522	480129.7	293398		
	1078.2	1618	337311	1620.667	385	502	22787.8	28.3522	480129.7	293429		
	1034.4	1626	333467	1624.333	384	503	22831.6	28.3522	480160.5	293460		
	990.6	1629	331545	1629	383	504	22875.4	28.3522	480191.3	293491		
	946.8	1632	303676	1632.333	384	505	22919.2	25.0489	480222.1	293460		
	915.8	1636	298871	1636.333	384	506	22950.2	25.0489	480252.9	293460		
	884.8	1641	295027	1639.667	384	507	22981.2	25.0489	480283.6	293460		
	853.8	1642	294066	1643	384	508	23012.2	25.0489	480314.4	293460		
	822.8	1646	285417	1645	384	509	23043.2	25.0489	480345.2	293460		
	791.8	1647	283495	1647.333	384	510	23074.2	25.0489	480376	293460		
	748	1649	275807	1648.667	385	511	23118	25.0489	480406.8	293429		
	704.2	1650	266197	1650.333	386	512	23161.8	15.7036	480437.6	293398		
	673.2	1652	261392	1651.667	387	512	23192.8	15.7036	480437.6	293367		
	642.2	1653	254665	1652.667	388	512	23223.8	15.7036	480437.6	293337		
	611.2	1655	252743	1653	389	512	23254.8	15.7036	480437.6	293306		
	567.4	1654	226796	1653	390	513	23298.6	15.7036	480468.4	293275		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
North 12c												
	523.6	1657	211420	1653	391	514	23342.4	15.7036	480499.2	293244		
	492.6	1656	210459	1653	391	515	23373.4	15.7036	480530	293244		
	448.8	1656	202771	1653	392	516	23417.2	5.47737	480560.8	293213		
	405	1655	199888	1653	393	517	23461	5.47737	480591.6	293183		
	361.2	1657	95139	1653	394	518	23504.8	5.47737	480622.4	293152		
	317.4	1655	42284	1653	395	519	23548.6	5.47737	480653.2	293121		
	286.4	1653	38440	1653.333	396	519	23579.6	5.47737	480653.2	293090		
	255.4	1654	36518	1656	397	519	23610.6	5.47737	480653.2	293059		
	224.4	1661	30752	1659	398	519	23641.6	6.19461	480653.2	293029		
	180.6	1664	29791	1661.667	399	520	23685.4	6.19461	480684	292998		
	149.6	1662	28830	1663	400	520	23716.4	6.19461	480684	292967		
	105.8	1665	24986	1664	401	521	23760.2	6.19461	480714.8	292936		
	62	1667	16337	1665	402	522	23804	6.19461	480745.6	292905		
	31	1665	15376	1667	403	522	23835	6.19461	480745.6	292875		
	0	1671	8649	1671	404	522	23866	6.19461	480745.6	292844		
South 1												
	21802.6	901	4.6E+07	888	909	331	0	0	474863.8	277293	89125.09	0.02124
	21771.6	903	4.6E+07	888	909	332	31	96.3308	474894.6	277293	141253.8	0.02124
	21727.8	904	4.6E+07	888	908	331	74.8	96.3308	474863.8	277323	177827.9	0.04302
	21684	904	4.6E+07	888	907	330	118.6	96.3308	474833	277354	1412538	0.0116
	21653	907	4.6E+07	888	906	330	149.6	96.3308	474833	277385	1778279	0.05741
	21609.2	905	4.6E+07	888	905	329	193.4	96.3308	474802.2	277416	2238721	0.08034
	21565.4	906	4.6E+07	888	904	328	237.2	96.3308	474771.4	277446	2818383	0.03573
	21534.4	902	4.6E+07	888	904	327	268.2	96.3308	474740.6	277446	3548134	0.08818
	21490.6	906	4.5E+07	888	903	326	312	96.3308	474709.8	277477	8912509	0.00296
	21459.6	898	4.5E+07	888	903	325	343	96.3308	474679	277477	11220185	0.00633
	21415.8	895	4.5E+07	888	902	324	386.8	96.3308	474648.2	277508	17782794	0.03339
	21372	888	4.5E+07	888.6667	901	323	430.6	96.3308	474617.4	277539	22387211	0.03046
	21341	891	4.5E+07	889.3333	900	323	461.6	96.3308	474617.4	277570	28183829	0.15943
	21310	896	4.5E+07	890	899	323	492.6	96.3308	474617.4	277600	35481339	0.17878

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	21279	899	4.5E+07	890	898	323	523.6	96.3308	474617.4	277631	44668359	0.12218
	21248	903	4.5E+07	890	897	323	554.6	96.3308	474617.4	277662		
	21217	896	4.5E+07	890	896	323	585.6	180.721	474617.4	277693		
	21186	890	4.5E+07	892.3333	895	323	616.6	180.721	474617.4	277724		
	21155	897	4.5E+07	896.3333	894	323	647.6	180.721	474617.4	277754		
	21124	903	4.5E+07	900.3333	893	323	678.6	180.721	474617.4	277785		
	21093	902	4.5E+07	904.3333	892	323	709.6	180.721	474617.4	277816		
	21062	909	4.5E+07	906.6667	891	323	740.6	180.721	474617.4	277847		
	21031	915	4.5E+07	909	890	323	771.6	180.721	474617.4	277878		
	20987.2	909	4.5E+07	909.3333	889	324	815.4	180.721	474648.2	277908		
	20943.4	911	4.5E+07	909.6667	888	325	859.2	118.218	474679	277939		
	20912.4	910	4.5E+07	911	887	325	890.2	118.218	474679	277970		
	20881.4	913	4.5E+07	912.3333	886	325	921.2	118.218	474679	278001		
	20850.4	917	4.5E+07	913.6667	885	325	952.2	118.218	474679	278032		
	20819.4	923	4.5E+07	914	884	325	983.2	118.218	474679	278062		
	20775.6	920	4.5E+07	914	883	324	1027	118.218	474648.2	278093		
	20731.8	917	4.5E+07	914	882	323	1070.8	118.218	474617.4	278124		
	20688	918	4.5E+07	914	881	322	1114.6	17.6385	474586.6	278155		
	20657	919	4.5E+07	914	880	322	1145.6	17.6385	474586.6	278186		
	20613.2	916	4.5E+07	914	879	321	1189.4	17.6385	474555.8	278216		
	20569.4	920	4.5E+07	914	878	320	1233.2	17.6385	474525	278247		
	20525.6	927	4.5E+07	914	877	319	1277	17.6385	474494.2	278278		
	20494.6	924	4.5E+07	914	876	319	1308	17.6385	474494.2	278309		
	20450.8	925	4.5E+07	914	875	320	1351.8	246.187	474525	278340		
	20419.8	921	4.5E+07	914	874	320	1382.8	246.187	474525	278370		
	20388.8	927	4.5E+07	914	873	320	1413.8	246.187	474525	278401		
	20357.8	929	4.5E+07	914	872	320	1444.8	246.187	474525	278432		
	20326.8	929	4.5E+07	914	871	320	1475.8	246.187	474525	278463		
	20295.8	935	4.5E+07	914	870	320	1506.8	246.187	474525	278494		
	20252	934	4.5E+07	914	869	321	1550.6	246.187	474555.8	278524		
	20208.2	932	4.5E+07	914	868	320	1594.4	246.187	474525	278555		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	20177.2	922	4.5E+07	914	867	320	1625.4	246.187	474525	278586		
	20146.2	914	4.5E+07	915	866	320	1656.4	246.187	474525	278617		
	20115.2	917	4.5E+07	917	865	320	1687.4	246.187	474525	278647		
	20084.2	920	4.5E+07	922	864	320	1718.4	246.187	474525	278678		
	20053.2	935	4.5E+07	926	863	320	1749.4	246.187	474525	278709		
	20022.2	931	4.5E+07	929	862	320	1780.4	246.187	474525	278740		
	19991.2	930	4.5E+07	929	861	320	1811.4	246.187	474525	278771		
	19960.2	929	4.5E+07	930	860	320	1842.4	178.817	474525	278801		
	19929.2	932	4.5E+07	933.3333	859	320	1873.4	178.817	474525	278832		
	19898.2	940	4.5E+07	936.6667	858	320	1904.4	178.817	474525	278863		
	19867.2	939	4.5E+07	939	857	320	1935.4	178.817	474525	278894		
	19823.4	942	4.5E+07	939	856	319	1979.2	178.817	474494.2	278925		
	19779.6	943	4.5E+07	939	855	320	2023	178.817	474525	278955		
	19748.6	942	4.5E+07	939	854	320	2054	178.817	474525	278986		
	19704.8	942	4.5E+07	939	853	319	2097.8	112.393	474494.2	279017		
	19673.8	942	4.5E+07	939	852	319	2128.8	112.393	474494.2	279048		
	19630	946	4.5E+07	939	851	318	2172.6	112.393	474463.4	279079		
	19599	939	4.4E+07	939.6667	850	318	2203.6	112.393	474463.4	279109		
	19555.2	942	4.4E+07	940.3333	849	319	2247.4	112.393	474494.2	279140		
	19524.2	941	4.4E+07	941.6667	848	319	2278.4	112.393	474494.2	279171		
	19493.2	946	4.4E+07	942.3333	847	319	2309.4	112.393	474494.2	279202		
	19462.2	943	4.4E+07	944.6667	846	319	2340.4	190.862	474494.2	279233		
	19418.4	948	4.4E+07	948	845	320	2384.2	190.862	474525	279263		
	19387.4	953	4.4E+07	952.3333	844	320	2415.2	190.862	474525	279294		
	19356.4	957	4.4E+07	955	843	320	2446.2	190.862	474525	279325		
	19325.4	956	4.4E+07	957.3333	842	320	2477.2	190.862	474525	279356		
	19281.6	963	4.4E+07	958.6667	841	321	2521	190.862	474555.8	279387		
	19250.6	960	4.4E+07	961	840	321	2552	190.862	474555.8	279417		
	19206.8	963	4.4E+07	964	839	322	2595.8	212.606	474586.6	279448		
	19163	969	4.4E+07	967.3333	838	323	2639.6	212.606	474617.4	279479		
	19132	971	4.4E+07	969.6667	838	324	2670.6	212.606	474648.2	279479		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	19101	973	4.4E+07	970	838	325	2701.6	212.606	474679	279479		
	19057.2	970	4.4E+07	972	837	326	2745.4	212.606	474709.8	279510		
	19013.4	976	4.4E+07	975.6667	836	327	2789.2	212.606	474740.6	279541		
	18969.6	981	4.4E+07	981.6667	835	328	2833	270.038	474771.4	279571		
	18938.6	988	4.4E+07	986	834	328	2864	270.038	474771.4	279602		
	18894.8	990	4.4E+07	988.6667	833	329	2907.8	270.038	474802.2	279633		
	18851	989	4.4E+07	990.3333	832	330	2951.6	270.038	474833	279664		
	18820	993	4.4E+07	994.6667	831	330	2982.6	270.038	474833	279694		
	18789	1002	4.4E+07	1000.333	830	330	3013.6	270.038	474833	279725		
	18758	1006	4.4E+07	1005.667	829	330	3044.6	270.038	474833	279756		
	18727	1012	4.4E+07	1008	828	330	3075.6	257.538	474833	279787		
	18683.2	1009	4.4E+07	1010	827	331	3119.4	257.538	474863.8	279818		
	18639.4	1016	4.4E+07	1011	826	332	3163.2	257.538	474894.6	279848		
	18595.6	1012	4.4E+07	1014	825	333	3207	257.538	474925.4	279879		
	18551.8	1018	4.4E+07	1016.667	824	334	3250.8	257.538	474956.1	279910		
	18508	1020	4.4E+07	1019.667	823	335	3294.6	257.538	474986.9	279941		
	18464.2	1021	4.4E+07	1021.333	822	336	3338.4	188.302	475017.7	279972		
	18420.4	1028	4.4E+07	1022.333	821	337	3382.2	188.302	475048.5	280002		
	18376.6	1027	4.4E+07	1023	820	338	3426	188.302	475079.3	280033		
	18345.6	1023	4.4E+07	1023.667	819	338	3457	188.302	475079.3	280064		
	18301.8	1025	4.4E+07	1025	818	339	3500.8	188.302	475110.1	280095		
	18270.8	1027	4.4E+07	1029	817	339	3531.8	188.302	475110.1	280126		
	18239.8	1035	4.4E+07	1033.667	816	339	3562.8	188.302	475110.1	280156		
	18196	1039	4.4E+07	1040	815	340	3606.6	176.708	475140.9	280187		
	18165	1060	4.4E+07	1043.667	814	340	3637.6	176.708	475140.9	280218		
	18134	1071	4.4E+07	1046	813	340	3668.6	176.708	475140.9	280249		
	18103	1081	4.4E+07	1046	812	340	3699.6	176.708	475140.9	280280		
	18072	1099	4.4E+07	1046	811	340	3730.6	176.708	475140.9	280310		
	18041	1105	4.4E+07	1046	810	340	3761.6	176.708	475140.9	280341		
	17997.2	1113	4.4E+07	1046	809	341	3805.4	176.708	475171.7	280372		
	17953.4	1110	4.4E+07	1046	808	342	3849.2	143.061	475202.5	280403		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	17909.6	1095	4.2E+07	1046	807	343	3893	143.061	475233.3	280434		
	17865.8	1075	4.2E+07	1046	806	344	3936.8	143.061	475264.1	280464		
	17822	1068	4.2E+07	1046	805	345	3980.6	143.061	475294.9	280495		
	17778.2	1049	4.2E+07	1046	804	346	4024.4	143.061	475325.7	280526		
	17734.4	1046	4.2E+07	1046.667	803	347	4068.2	143.061	475356.5	280557		
	17690.6	1049	4.2E+07	1047.333	802	348	4112	273.171	475387.3	280588		
	17646.8	1056	4.2E+07	1048	801	349	4155.8	273.171	475418.1	280618		
	17603	1048	4.2E+07	1051.667	800	350	4199.6	273.171	475448.9	280649		
	17559.2	1059	4.2E+07	1057.333	799	351	4243.4	273.171	475479.7	280680		
	17515.4	1092	4.1E+07	1063	798	352	4287.2	273.171	475510.5	280711		
	17471.6	1093	4.1E+07	1065	797	353	4331	285.278	475541.2	280742		
	17440.6	1076	4.1E+07	1065	797	354	4362	285.278	475572	280742		
	17409.6	1065	4.1E+07	1066.667	797	355	4393	285.278	475602.8	280742		
	17378.6	1072	4.1E+07	1068.333	797	356	4424	285.278	475633.6	280742		
	17347.6	1070	4.1E+07	1070.667	797	357	4455	285.278	475664.4	280742		
	17316.6	1074	4.1E+07	1071.333	797	358	4486	285.278	475695.2	280742		
	17285.6	1072	4.1E+07	1076.333	797	359	4517	285.278	475726	280742		
	17254.6	1085	4.1E+07	1082.667	797	360	4548	285.278	475756.8	280742		
	17223.6	1091	4.1E+07	1090.333	797	361	4579	227.175	475787.6	280742		
	17192.6	1105	4.1E+07	1093.667	797	362	4610	227.175	475818.4	280742		
	17161.6	1111	4.1E+07	1095	797	363	4641	227.175	475849.2	280742		
	17117.8	1132	4.1E+07	1095	796	364	4684.8	227.175	475880	280772		
	17074	1138	4.1E+07	1095	795	365	4728.6	227.175	475910.8	280803		
	17043	1139	4.1E+07	1095	795	366	4759.6	227.175	475941.6	280803		
	17012	1137	4.1E+07	1095	795	367	4790.6	227.175	475972.4	280803		
	16968.2	1135	4.1E+07	1095	794	368	4834.4	160.564	476003.2	280834		
	16924.4	1126	4.1E+07	1095	793	369	4878.2	160.564	476034	280865		
	16880.6	1124	4.1E+07	1095	792	370	4922	160.564	476064.8	280895		
	16836.8	1115	4.1E+07	1095	791	371	4965.8	160.564	476095.6	280926		
	16793	1102	4.1E+07	1095	790	372	5009.6	160.564	476126.3	280957		
	16749.2	1095	4E+07	1097.333	789	373	5053.4	160.564	476157.1	280988		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	16705.4	1102	4E+07	1100.333	788	374	5097.2	97.8762	476187.9	281019		
	16661.6	1104	4E+07	1104.333	787	375	5141	97.8762	476218.7	281049		
	16617.8	1107	4E+07	1107.667	786	376	5184.8	97.8762	476249.5	281080		
	16574	1121	4E+07	1110.333	785	377	5228.6	97.8762	476280.3	281111		
	16543	1119	4E+07	1112	785	378	5259.6	97.8762	476311.1	281111		
	16512	1119	4E+07	1112	785	379	5290.6	97.8762	476341.9	281111		
	16468.2	1138	4E+07	1112	784	380	5334.4	97.8762	476372.7	281142		
	16424.4	1139	4E+07	1112	783	381	5378.2	97.8762	476403.5	281173		
	16380.6	1133	4E+07	1112	782	382	5422	97.8762	476434.3	281203		
	16336.8	1124	4E+07	1112	781	383	5465.8	97.8762	476465.1	281234		
	16293	1119	4E+07	1112	780	384	5509.6	97.8762	476495.9	281265		
	16262	1112	3.6E+07	1112	779	384	5540.6	97.8762	476495.9	281296		
	16231	1115	3.6E+07	1112	778	384	5571.6	410.605	476495.9	281327		
	16200	1117	3.6E+07	1112	777	384	5602.6	410.605	476495.9	281357		
	16169	1132	3.6E+07	1112	776	384	5633.6	410.605	476495.9	281388		
	16138	1125	3.6E+07	1112	775	384	5664.6	410.605	476495.9	281419		
	16094.2	1133	3.6E+07	1112	774	385	5708.4	410.605	476526.7	281450		
	16063.2	1130	3.6E+07	1112	773	385	5739.4	410.605	476526.7	281481		
	16032.2	1121	3.6E+07	1112	772	385	5770.4	410.605	476526.7	281511		
	16001.2	1112	3.6E+07	1113.333	771	385	5801.4	410.605	476526.7	281542		
	15970.2	1116	3.6E+07	1119.333	770	385	5832.4	410.605	476526.7	281573		
	15939.2	1130	3.6E+07	1127.333	769	385	5863.4	410.605	476526.7	281604		
	15908.2	1136	3.6E+07	1136.333	768	385	5894.4	410.605	476526.7	281635		
	15877.2	1143	3.6E+07	1141.667	767	385	5925.4	410.605	476526.7	281665		
	15846.2	1146	3.6E+07	1149	766	385	5956.4	410.605	476526.7	281696		
	15815.2	1167	3.6E+07	1154	765	385	5987.4	410.605	476526.7	281727		
	15784.2	1190	3.6E+07	1158	764	385	6018.4	410.605	476526.7	281758		
	15740.4	1187	3.6E+07	1158	763	384	6062.2	410.605	476495.9	281789		
	15696.6	1182	3.6E+07	1158	762	383	6106	410.605	476465.1	281819		
	15652.8	1184	3.6E+07	1158	761	382	6149.8	410.605	476434.3	281850		
	15609	1182	3.6E+07	1158	760	381	6193.6	410.605	476403.5	281881		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	15565.2	1181	3.6E+07	1158	759	380	6237.4	410.605	476372.7	281912		
	15521.4	1168	3.6E+07	1158	758	379	6281.2	410.605	476341.9	281943		
	15477.6	1158	3.6E+07	1158.667	757	378	6325	251.336	476311.1	281973		
	15433.8	1160	3.6E+07	1165	756	377	6368.8	251.336	476280.3	282004		
	15390	1177	3.6E+07	1173.333	755	376	6412.6	251.336	476249.5	282035		
	15359	1183	3.6E+07	1181.667	754	376	6443.6	251.336	476249.5	282066		
	15328	1199	3.6E+07	1184.333	753	376	6474.6	251.336	476249.5	282096		
	15297	1203	3.6E+07	1185	752	376	6505.6	251.336	476249.5	282127		
	15253.2	1210	3.6E+07	1185	751	375	6549.4	251.336	476218.7	282158		
	15209.4	1206	3.6E+07	1185	750	374	6593.2	251.336	476187.9	282189		
	15178.4	1219	3.6E+07	1185	749	374	6624.2	251.336	476187.9	282220		
	15134.6	1222	3.5E+07	1185	748	373	6668	251.336	476157.1	282250		
	15090.8	1224	3.5E+07	1185	747	372	6711.8	251.336	476126.3	282281		
	15047	1220	3.5E+07	1185	746	371	6755.6	251.336	476095.6	282312		
	15016	1222	3.5E+07	1185	746	370	6786.6	251.336	476064.8	282312		
	14972.2	1222	3.5E+07	1185	745	369	6830.4	445.048	476034	282343		
	14928.4	1220	3.5E+07	1185	744	368	6874.2	445.048	476003.2	282374		
	14897.4	1214	3.5E+07	1185	744	367	6905.2	445.048	475972.4	282374		
	14853.6	1215	3.5E+07	1185	743	366	6949	445.048	475941.6	282404		
	14822.6	1214	3.5E+07	1185	742	366	6980	445.048	475941.6	282435		
	14791.6	1192	3.5E+07	1185	741	366	7011	445.048	475941.6	282466		
	14760.6	1188	3.5E+07	1185	740	366	7042	445.048	475941.6	282497		
	14729.6	1185	3.5E+07	1193.333	739	366	7073	445.048	475941.6	282528		
	14685.8	1211	3.5E+07	1201.667	738	367	7116.8	445.048	475972.4	282558		
	14642	1216	3.5E+07	1210	737	368	7160.6	445.048	476003.2	282589		
	14611	1215	3.5E+07	1210	736	368	7191.6	445.048	476003.2	282620		
	14580	1210	3.5E+07	1212	735	368	7222.6	445.048	476003.2	282651		
	14549	1216	3.5E+07	1219.333	734	368	7253.6	445.048	476003.2	282682		
	14505.2	1232	3.4E+07	1228.667	733	369	7297.4	445.048	476034	282712		
	14461.4	1239	3.4E+07	1236	732	370	7341.2	350.737	476064.8	282743		
	14417.6	1238	3.4E+07	1239.667	731	371	7385	350.737	476095.6	282774		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	14386.6	1243	3.4E+07	1243.667	730	371	7416	350.737	476095.6	282805		
	14342.8	1250	3.4E+07	1248.667	729	372	7459.8	350.737	476126.3	282836		
	14311.8	1253	3.4E+07	1252	728	372	7490.8	350.737	476126.3	282866		
	14268	1256	3.4E+07	1253	727	371	7534.6	350.737	476095.6	282897		
	14224.2	1253	3.4E+07	1254.333	726	372	7578.4	198.661	476126.3	282928		
	14180.4	1258	3.4E+07	1255.667	725	373	7622.2	198.661	476157.1	282959		
	14136.6	1257	3.4E+07	1257.333	724	372	7666	198.661	476126.3	282990		
	14105.6	1259	3.4E+07	1257.667	723	372	7697	198.661	476126.3	283020		
	14061.8	1258	3.3E+07	1258.333	722	373	7740.8	198.661	476157.1	283051		
	14030.8	1259	3.3E+07	1260.333	721	373	7771.8	198.661	476157.1	283082		
	13987	1264	3.3E+07	1263	720	374	7815.6	198.661	476187.9	283113		
	13956	1266	3.3E+07	1270	719	374	7846.6	196.96	476187.9	283144		
	13912.2	1280	2.9E+07	1276.667	718	375	7890.4	196.96	476218.7	283174		
	13868.4	1284	2.9E+07	1284	719	376	7934.2	196.96	476249.5	283144		
	13824.6	1296	2.9E+07	1286.667	718	377	7978	196.96	476280.3	283174		
	13780.8	1302	2.9E+07	1288	717	378	8021.8	196.96	476311.1	283205		
	13737	1300	2.9E+07	1288	718	379	8065.6	196.96	476341.9	283174		
	13693.2	1303	2.9E+07	1288	719	380	8109.4	256.449	476372.7	283144		
	13662.2	1303	2.8E+07	1288	719	381	8140.4	256.449	476403.5	283144		
	13618.4	1304	2.8E+07	1288	718	382	8184.2	256.449	476434.3	283174		
	13574.6	1300	2.8E+07	1288	717	383	8228	256.449	476465.1	283205		
	13543.6	1296	2.8E+07	1288	717	384	8259	256.449	476495.9	283205		
	13512.6	1288	2.8E+07	1293	717	385	8290	256.449	476526.7	283205		
	13481.6	1303	2.8E+07	1298.667	717	386	8321	336.566	476557.5	283205		
	13437.8	1305	2.8E+07	1305.333	716	387	8364.8	336.566	476588.3	283236		
	13406.8	1311	2.8E+07	1307	716	388	8395.8	336.566	476619.1	283236		
	13363	1311	2.8E+07	1308	717	389	8439.6	336.566	476649.9	283205		
	13332	1308	2.8E+07	1310	717	390	8470.6	336.566	476680.7	283205		
	13301	1314	2.8E+07	1315	717	391	8501.6	336.566	476711.5	283205		
	13257.2	1323	2.8E+07	1324.667	716	392	8545.4	336.566	476742.2	283236		
	13226.2	1337	2.8E+07	1332.333	716	393	8576.4	291.861	476773	283236		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	13182.4	1347	2.8E+07	1337	715	394	8620.2	291.861	476803.8	283267		
	13138.6	1341	2.8E+07	1337	714	395	8664	291.861	476834.6	283297		
	13094.8	1343	2.8E+07	1337	713	396	8707.8	291.861	476865.4	283328		
	13063.8	1341	2.8E+07	1337	712	396	8738.8	291.861	476865.4	283359		
	13032.8	1337	2.8E+07	1339	711	396	8769.8	291.861	476865.4	283390		
	13001.8	1343	2.8E+07	1341.667	710	396	8800.8	291.861	476865.4	283421		
	12970.8	1345	2.8E+07	1348	709	396	8831.8	378.023	476865.4	283451		
	12927	1356	2.8E+07	1356	708	397	8875.6	378.023	476896.2	283482		
	12883.2	1367	2.8E+07	1367	707	398	8919.4	378.023	476927	283513		
	12852.2	1378	2.8E+07	1380.333	707	399	8950.4	378.023	476957.8	283513		
	12821.2	1400	2.8E+07	1390	707	400	8981.4	378.023	476988.6	283513		
	12777.4	1417	2.8E+07	1396	706	401	9025.2	378.023	477019.4	283544		
	12733.6	1413	2.8E+07	1396	705	402	9069	378.023	477050.2	283575		
	12689.8	1416	2.8E+07	1396	704	403	9112.8	443.689	477081	283605		
	12658.8	1415	2.8E+07	1396	704	404	9143.8	443.689	477111.8	283605		
	12615	1417	2.8E+07	1396	703	405	9187.6	443.689	477142.6	283636		
	12571.2	1414	2.8E+07	1396	702	406	9231.4	443.689	477173.4	283667		
	12527.4	1409	2.8E+07	1396	701	407	9275.2	443.689	477204.2	283698		
	12483.6	1411	2.8E+07	1396	700	408	9319	443.689	477235	283729		
	12439.8	1404	2.8E+07	1396	699	409	9362.8	28.705	477265.8	283759		
	12396	1396	2.7E+07	1396.667	698	410	9406.6	28.705	477296.6	283790		
	12352.2	1398	2.7E+07	1398.333	697	411	9450.4	28.705	477327.3	283821		
	12308.4	1401	2.7E+07	1400.667	696	412	9494.2	28.705	477358.1	283852		
	12277.4	1405	2.7E+07	1402.333	695	412	9525.2	28.705	477358.1	283883		
	12246.4	1412	2.7E+07	1403	694	412	9556.2	28.705	477358.1	283913		
	12215.4	1407	2.7E+07	1403	693	412	9587.2	28.705	477358.1	283944		
	12184.4	1415	2.7E+07	1403	692	412	9618.2	28.705	477358.1	283975		
	12153.4	1409	2.7E+07	1403	691	412	9649.2	28.705	477358.1	284006		
	12122.4	1413	2.7E+07	1403	690	412	9680.2	28.705	477358.1	284037		
	12091.4	1420	2.7E+07	1403	689	412	9711.2	28.705	477358.1	284067		
	12060.4	1416	2.7E+07	1403	688	412	9742.2	28.705	477358.1	284098		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	12016.6	1418	2.7E+07	1403	687	413	9786	28.705	477388.9	284129		
	11985.6	1412	2.7E+07	1403	686	413	9817	28.705	477388.9	284160		
	11954.6	1414	2.7E+07	1403	685	413	9848	413.939	477388.9	284191		
	11923.6	1403	2.7E+07	1406	684	413	9879	413.939	477388.9	284221		
	11892.6	1412	2.7E+07	1413	683	413	9910	413.939	477388.9	284252		
	11861.6	1424	2.7E+07	1422	682	413	9941	413.939	477388.9	284283		
	11830.6	1430	2.6E+07	1429.667	681	413	9972	413.939	477388.9	284314		
	11786.8	1438	2.6E+07	1433.333	680	414	10015.8	413.939	477419.7	284345		
	11743	1442	2.6E+07	1435	679	415	10059.6	413.939	477450.5	284375		
	11712	1435	2.6E+07	1436.667	678	415	10090.6	251.15	477450.5	284406		
	11668.2	1441	2.6E+07	1438.333	677	416	10134.4	251.15	477481.3	284437		
	11637.2	1442	2.6E+07	1440	676	416	10165.4	251.15	477481.3	284468		
	11606.2	1440	2.6E+07	1440	675	416	10196.4	251.15	477481.3	284498		
	11562.4	1440	2.6E+07	1441.333	674	415	10240.2	251.15	477450.5	284529		
	11531.4	1444	2.6E+07	1443.333	673	415	10271.2	251.15	477450.5	284560		
	11500.4	1446	2.6E+07	1445.667	672	415	10302.2	251.15	477450.5	284591		
	11469.4	1451	2.6E+07	1446.667	671	415	10333.2	84.1052	477450.5	284622		
	11425.6	1447	2.6E+07	1447.667	670	414	10377	84.1052	477419.7	284652		
	11381.8	1449	2.6E+07	1450.667	669	413	10420.8	84.1052	477388.9	284683		
	11338	1456	2.6E+07	1453.667	668	412	10464.6	84.1052	477358.1	284714		
	11294.2	1457	2.6E+07	1456	667	411	10508.4	84.1052	477327.3	284745		
	11250.4	1462	2.6E+07	1456	666	412	10552.2	84.1052	477358.1	284776		
	11206.6	1467	2.6E+07	1456	665	413	10596	62.9924	477388.9	284806		
	11162.8	1463	2.5E+07	1456	664	414	10639.8	62.9924	477419.7	284837		
	11119	1459	2.5E+07	1456	663	415	10683.6	62.9924	477450.5	284868		
	11088	1456	2.1E+07	1459.667	662	415	10714.6	62.9924	477450.5	284899		
	11044.2	1469	2.1E+07	1463.333	661	416	10758.4	62.9924	477481.3	284930		
	11000.4	1474	2.1E+07	1467	660	417	10802.2	62.9924	477512.1	284960		
	10969.4	1471	2.1E+07	1467	659	417	10833.2	49.3452	477512.1	284991		
	10925.6	1476	2.1E+07	1467	658	416	10877	49.3452	477481.3	285022		
	10881.8	1472	2.1E+07	1467	657	417	10920.8	49.3452	477512.1	285053		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	10850.8	1479	2.1E+07	1467	657	418	10951.8	49.3452	477542.9	285053		
	10807	1478	2.1E+07	1467	656	419	10995.6	49.3452	477573.7	285084		
	10776	1472	2.1E+07	1467	656	420	11026.6	49.3452	477604.5	285084		
	10732.2	1474	2.1E+07	1467	655	421	11070.4	49.3452	477635.3	285114		
	10688.4	1478	2.1E+07	1467	654	422	11114.2	103.308	477666.1	285145		
	10644.6	1484	2.1E+07	1467	653	423	11158	103.308	477696.9	285176		
	10613.6	1487	2.1E+07	1467	652	423	11189	103.308	477696.9	285207		
	10582.6	1489	2.1E+07	1467	651	423	11220	103.308	477696.9	285238		
	10551.6	1489	2.1E+07	1467	650	423	11251	103.308	477696.9	285268		
	10520.6	1488	2.1E+07	1467	649	423	11282	103.308	477696.9	285299		
	10489.6	1482	2.1E+07	1467	648	423	11313	103.308	477696.9	285330		
	10445.8	1482	2.1E+07	1467	647	424	11356.8	103.308	477727.7	285361		
	10414.8	1472	2E+07	1467	646	424	11387.8	103.308	477727.7	285392		
	10383.8	1467	2E+07	1467.333	645	424	11418.8	103.308	477727.7	285422		
	10352.8	1468	2E+07	1470	644	424	11449.8	103.308	477727.7	285453		
	10321.8	1475	2E+07	1472.667	643	424	11480.8	103.308	477727.7	285484		
	10290.8	1477	2E+07	1475	642	424	11511.8	103.308	477727.7	285515		
	10259.8	1477	2E+07	1475	641	424	11542.8	103.308	477727.7	285546		
	10228.8	1475	2E+07	1475	640	424	11573.8	106.266	477727.7	285576		
	10197.8	1475	2E+07	1477	639	424	11604.8	106.266	477727.7	285607		
	10166.8	1482	2E+07	1479	638	424	11635.8	106.266	477727.7	285638		
	10135.8	1488	2E+07	1481	637	424	11666.8	106.266	477727.7	285669		
	10104.8	1487	2E+07	1481	636	424	11697.8	106.266	477727.7	285699		
	10061	1483	2E+07	1481	635	423	11741.6	106.266	477696.9	285730		
	10030	1481	2E+07	1482.667	634	423	11772.6	106.266	477696.9	285761		
	9999	1486	2E+07	1485.667	633	423	11803.6	106.266	477696.9	285792		
	9955.2	1490	2E+07	1489.667	632	424	11847.4	94.3016	477727.7	285823		
	9924.2	1493	1.9E+07	1494	631	424	11878.4	94.3016	477727.7	285853		
	9880.4	1502	1.9E+07	1497	630	425	11922.2	94.3016	477758.5	285884		
	9836.6	1504	1.9E+07	1499	629	426	11966	94.3016	477789.3	285915		
	9792.8	1504	1.9E+07	1499	628	427	12009.8	94.3016	477820.1	285946		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	9761.8	1501	1.9E+07	1499	627	427	12040.8	94.3016	477820.1	285977		
	9730.8	1507	1.9E+07	1499	626	427	12071.8	35.2309	477820.1	286007		
	9687	1504	1.9E+07	1499	625	428	12115.6	35.2309	477850.9	286038		
	9656	1499	1.9E+07	1499.333	624	428	12146.6	35.2309	477850.9	286069		
	9625	1503	1.9E+07	1499.667	623	428	12177.6	35.2309	477850.9	286100		
	9594	1506	1.9E+07	1500	622	428	12208.6	35.2309	477850.9	286131		
	9550.2	1500	1.9E+07	1500.667	621	427	12252.4	35.2309	477820.1	286161		
	9506.4	1505	1.9E+07	1501.333	620	426	12296.2	35.2309	477789.3	286192		
	9475.4	1507	1.9E+07	1502	619	426	12327.2	6.60702	477789.3	286223		
	9431.6	1502	1.9E+07	1502.333	618	427	12371	6.60702	477820.1	286254		
	9400.6	1503	1.9E+07	1503	617	427	12402	6.60702	477820.1	286285		
	9356.8	1507	1.9E+07	1503.667	616	428	12445.8	6.60702	477850.9	286315		
	9325.8	1505	1.9E+07	1504	616	429	12476.8	6.60702	477881.7	286315		
	9282	1506	1.9E+07	1504	615	430	12520.6	6.60702	477912.4	286346		
	9251	1507	1.9E+07	1504	615	431	12551.6	6.60702	477943.2	286346		
	9207.2	1512	1.9E+07	1504	614	432	12595.4	0	477974	286377		
	9163.4	1515	1.9E+07	1504	613	433	12639.2	0	478004.8	286408		
	9119.6	1511	1.9E+07	1504	612	434	12683	0	478035.6	286439		
	9088.6	1515	1.9E+07	1504	612	435	12714	0	478066.4	286439		
	9057.6	1512	1.9E+07	1504	612	436	12745	0	478097.2	286439		
	9026.6	1516	1.9E+07	1504	612	437	12776	0	478128	286439		
	8982.8	1518	1.9E+07	1504	611	438	12819.8	0	478158.8	286469		
	8939	1514	1.9E+07	1504	610	439	12863.6	0	478189.6	286500		
	8908	1517	1.8E+07	1504	610	440	12894.6	0	478220.4	286500		
	8877	1515	1.8E+07	1504	610	441	12925.6	0	478251.2	286500		
	8846	1515	1.8E+07	1504	610	442	12956.6	0	478282	286500		
	8802.2	1521	1.8E+07	1504	609	443	13000.4	0	478312.8	286531		
	8758.4	1524	1.8E+07	1504	608	444	13044.2	0	478343.6	286562		
	8727.4	1521	1.8E+07	1504	608	445	13075.2	0	478374.4	286562		
	8683.6	1520	1.8E+07	1504	607	446	13119	0	478405.2	286593		
	8652.6	1516	1.8E+07	1504	606	446	13150	0	478405.2	286623		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	8621.6	1516	1.8E+07	1504	605	446	13181	0	478405.2	286654		
	8590.6	1521	1.8E+07	1504	604	446	13212	0	478405.2	286685		
	8546.8	1523	1.8E+07	1504	603	447	13255.8	0	478436	286716		
	8515.8	1524	1.1E+07	1504	602	447	13286.8	26.9193	478436	286747		
	8472	1520	1.1E+07	1504	601	446	13330.6	26.9193	478405.2	286777		
	8428.2	1524	1.1E+07	1504	600	445	13374.4	26.9193	478374.4	286808		
	8384.4	1519	1.1E+07	1504	599	444	13418.2	26.9193	478343.6	286839		
	8340.6	1515	1.1E+07	1504	598	443	13462	26.9193	478312.8	286870		
	8296.8	1505	1.1E+07	1504	597	442	13505.8	26.9193	478282	286900		
	8265.8	1511	1.1E+07	1504	596	442	13536.8	26.9193	478282	286931		
	8234.8	1512	1.1E+07	1504	595	442	13567.8	26.9193	478282	286962		
	8203.8	1507	1.1E+07	1504	594	442	13598.8	26.9193	478282	286993		
	8172.8	1504	1.1E+07	1505	593	442	13629.8	26.9193	478282	287024		
	8141.8	1515	1.1E+07	1506	592	442	13660.8	26.9193	478282	287054		
	8110.8	1515	1.1E+07	1507	591	442	13691.8	26.9193	478282	287085		
	8067	1514	1.1E+07	1507	590	443	13735.6	26.9193	478312.8	287116		
	8023.2	1512	1.1E+07	1507	589	444	13779.4	26.9193	478343.6	287147		
	7992.2	1512	1.1E+07	1507	588	444	13810.4	26.9193	478343.6	287178		
	7961.2	1507	1.1E+07	1508	587	444	13841.4	15.3496	478343.6	287208		
	7930.2	1515	1.1E+07	1509	586	444	13872.4	15.3496	478343.6	287239		
	7899.2	1517	1.1E+07	1510	585	444	13903.4	15.3496	478343.6	287270		
	7868.2	1520	1.1E+07	1510	584	444	13934.4	15.3496	478343.6	287301		
	7837.2	1522	1.1E+07	1510	583	444	13965.4	15.3496	478343.6	287332		
	7806.2	1518	1.1E+07	1510	582	444	13996.4	15.3496	478343.6	287362		
	7762.4	1524	1.1E+07	1510	581	445	14040.2	15.3496	478374.4	287393		
	7718.6	1525	1.1E+07	1510	580	446	14084	8.75245	478405.2	287424		
	7687.6	1525	1.1E+07	1510	580	447	14115	8.75245	478436	287424		
	7656.6	1516	1.1E+07	1510	580	448	14146	8.75245	478466.8	287424		
	7625.6	1514	1.1E+07	1510	580	449	14177	8.75245	478497.5	287424		
	7594.6	1523	1.1E+07	1510	580	450	14208	8.75245	478528.3	287424		
	7563.6	1522	1.1E+07	1510	580	451	14239	8.75245	478559.1	287424		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	7519.8	1519	1.1E+07	1510	579	452	14282.8	8.75245	478589.9	287455		
	7488.8	1524	1.1E+07	1510	578	452	14313.8	8.75245	478589.9	287486		
	7445	1523	1.1E+07	1510	577	451	14357.6	5.80399	478559.1	287516		
	7414	1526	1.1E+07	1510	576	451	14388.6	5.80399	478559.1	287547		
	7370.2	1527	1.1E+07	1510	575	450	14432.4	5.80399	478528.3	287578		
	7339.2	1527	1.1E+07	1510	574	450	14463.4	5.80399	478528.3	287609		
	7308.2	1522	1.1E+07	1510	573	450	14494.4	5.80399	478528.3	287640		
	7264.4	1529	1.1E+07	1510	572	449	14538.2	5.80399	478497.5	287670		
	7220.6	1525	1.1E+07	1510	571	448	14582	5.80399	478466.8	287701		
	7176.8	1520	9730125	1510	570	449	14625.8	5.80399	478497.5	287732		
	7133	1511	9711866	1510	569	450	14669.6	5.80399	478528.3	287763		
	7089.2	1510	9683036	1513	568	451	14713.4	5.80399	478559.1	287794		
	7045.4	1525	9659972	1516	567	452	14757.2	5.80399	478589.9	287824		
	7014.4	1526	9658050	1519	566	452	14788.2	5.80399	478589.9	287855		
	6983.4	1521	9655167	1519	565	452	14819.2	5.80399	478589.9	287886		
	6939.6	1527	9630181	1519	564	453	14863	5.80399	478620.7	287917		
	6895.8	1533	9605195	1519	565	454	14906.8	5.80399	478651.5	287886		
	6852	1531	9604234	1519	566	455	14950.6	5.80399	478682.3	287855		
	6808.2	1533	9585975	1519	565	456	14994.4	5.80399	478713.1	287886		
	6777.2	1530	9585014	1519	565	457	15025.4	5.80399	478743.9	287886		
	6733.4	1533	9575404	1519	564	458	15069.2	5.80399	478774.7	287917		
	6689.6	1527	9385126	1519	563	459	15113	0	478805.5	287948		
	6658.6	1529	9373594	1519	562	459	15144	0	478805.5	287978		
	6614.8	1533	9366867	1519	561	458	15187.8	0	478774.7	288009		
	6583.8	1533	9364945	1519	560	458	15218.8	0	478774.7	288040		
	6552.8	1531	9267884	1519	559	458	15249.8	0	478774.7	288071		
	6521.8	1532	9263079	1519	558	458	15280.8	0	478774.7	288101		
	6490.8	1523	9260196	1519	557	458	15311.8	0	478774.7	288132		
	6447	1529	9240015	1519	556	459	15355.6	0	478805.5	288163		
	6403.2	1524	9229444	1519	555	460	15399.4	0	478836.3	288194		
	6372.2	1533	9200614	1519	554	460	15430.4	0	478836.3	288225		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	6341.2	1533	9199653	1519	553	460	15461.4	0	478836.3	288255		
	6310.2	1529	9198692	1519	552	460	15492.4	0	478836.3	288286		
	6279.2	1528	9197731	1519	551	460	15523.4	0	478836.3	288317		
	6248.2	1528	9196770	1519	550	460	15554.4	54.5228	478836.3	288348		
	6217.2	1531	9194848	1519	549	460	15585.4	54.5228	478836.3	288379		
	6186.2	1532	9191965	1519	548	460	15616.4	54.5228	478836.3	288409		
	6142.4	1527	9175628	1519	547	461	15660.2	54.5228	478867.1	288440		
	6098.6	1522	9141032	1519	546	462	15704	54.5228	478897.9	288471		
	6067.6	1524	9110280	1519	545	462	15735	54.5228	478897.9	288502		
	6036.6	1533	9108358	1519	544	462	15766	54.5228	478897.9	288533		
	6005.6	1532	9104514	1519	543	462	15797	54.5228	478897.9	288563		
	5974.6	1528	9102592	1519	542	462	15828	54.5228	478897.9	288594		
	5943.6	1525	9100670	1519	541	462	15859	54.5228	478897.9	288625		
	5912.6	1519	9097787	1519.333	540	462	15890	54.5228	478897.9	288656		
	5868.8	1527	9095865	1519.667	539	463	15933.8	54.5228	478928.7	288687		
	5825	1520	9067996	1521.667	538	464	15977.6	54.5228	478959.5	288717		
	5781.2	1530	6396416	1523.333	537	465	16021.4	54.5228	478990.3	288748		
	5737.4	1525	6380079	1525	536	466	16065.2	54.5228	479021.1	288779		
	5693.6	1525	3721953	1525	535	467	16109	26.4749	479051.9	288810		
	5662.6	1530	3706577	1525	534	467	16140	26.4749	479051.9	288841		
	5631.6	1531	3705616	1525	533	467	16171	26.4749	479051.9	288871		
	5587.8	1532	3703694	1525	532	468	16214.8	26.4749	479082.7	288902		
	5544	1531	3692162	1525	531	469	16258.6	26.4749	479113.4	288933		
	5500.2	1533	3648917	1525	530	470	16302.4	26.4749	479144.2	288964		
	5469.2	1531	3646034	1525	529	470	16333.4	30.1474	479144.2	288995		
	5425.4	1528	3644112	1525	528	471	16377.2	30.1474	479175	289025		
	5381.6	1527	3618165	1525	527	472	16421	30.1474	479205.8	289056		
	5350.6	1525	3390408	1526.333	526	472	16452	30.1474	479205.8	289087		
	5319.6	1529	3389447	1527.667	525	472	16483	30.1474	479205.8	289118		
	5288.6	1529	3388486	1530	524	472	16514	30.1474	479205.8	289149		
	5257.6	1533	3386564	1531	523	472	16545	30.1474	479205.8	289179		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	5226.6	1537	3383681	1532	522	472	16576	108.247	479205.8	289210		
	5182.8	1539	3382720	1532	521	473	16619.8	108.247	479236.6	289241		
	5151.8	1532	3250102	1534	521	474	16650.8	108.247	479267.4	289241		
	5120.8	1538	3248180	1538.333	521	475	16681.8	108.247	479298.2	289241		
	5089.8	1545	3246258	1543.667	521	476	16712.8	108.247	479329	289241		
	5058.8	1548	3245297	1550.333	521	477	16743.8	108.247	479359.8	289241		
	5027.8	1558	3240492	1555.333	521	478	16774.8	108.247	479390.6	289241		
	4996.8	1560	3239531	1561	521	479	16805.8	108.247	479421.4	289241		
	4953	1565	3234726	1564.333	520	480	16849.6	86.7657	479452.2	289272		
	4922	1572	3230882	1567	520	481	16880.6	86.7657	479483	289272		
	4878.2	1568	3229921	1569	519	482	16924.4	86.7657	479513.8	289302		
	4847.2	1571	3211662	1570	519	483	16955.4	86.7657	479544.6	289302		
	4816.2	1576	3209740	1571	519	484	16986.4	86.7657	479575.4	289302		
	4772.4	1573	3206857	1571	520	485	17030.2	86.7657	479606.2	289272		
	4728.6	1579	3203013	1571	519	486	17074	86.7657	479637	289302		
	4697.6	1577	3201091	1571	519	487	17105	21.9644	479667.8	289302		
	4666.6	1580	3178027	1571	519	488	17136	21.9644	479698.5	289302		
	4622.8	1577	3163612	1571	518	489	17179.8	21.9644	479729.3	289333		
	4591.8	1571	3136704	1572.333	518	490	17210.8	21.9644	479760.1	289333		
	4560.8	1576	3135743	1573.667	518	491	17241.8	21.9644	479790.9	289333		
	4517	1584	3133821	1575	519	492	17285.6	21.9644	479821.7	289302		
	4486	1581	3131899	1575	519	493	17316.6	21.9644	479852.5	289302		
	4442.2	1579	3020423	1575	518	494	17360.4	57.6355	479883.3	289333		
	4411.2	1575	3018501	1576	518	495	17391.4	57.6355	479914.1	289333		
	4367.4	1586	2993515	1577	517	496	17435.2	57.6355	479944.9	289364		
	4336.4	1583	2992554	1578	516	496	17466.2	57.6355	479944.9	289395		
	4305.4	1578	2057501	1578.667	515	496	17497.2	57.6355	479944.9	289426		
	4274.4	1580	2053657	1583.667	514	496	17528.2	57.6355	479944.9	289456		
	4230.6	1593	2047891	1589.667	513	497	17572	57.6355	479975.7	289487		
	4186.8	1600	2045969	1595	512	498	17615.8	45.6259	480006.5	289518		
	4143	1597	2005607	1596	511	497	17659.6	45.6259	479975.7	289549		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	4112	1598	1999841	1596	510	497	17690.6	45.6259	479975.7	289580		
	4081	1600	1997919	1596	509	497	17721.6	45.6259	479975.7	289610		
	4050	1602	1988309	1596	508	497	17752.6	45.6259	479975.7	289641		
	4006.2	1604	1986387	1596	507	496	17796.4	45.6259	479944.9	289672		
	3962.4	1603	1981582	1596	506	495	17840.2	20.7687	479914.1	289703		
	3918.6	1606	1976777	1596	505	494	17884	20.7687	479883.3	289734		
	3874.8	1604	1975816	1596	504	495	17927.8	20.7687	479914.1	289764		
	3831	1599	1919117	1596	503	496	17971.6	20.7687	479944.9	289795		
	3787.2	1601	1908546	1596	502	497	18015.4	20.7687	479975.7	289826		
	3743.4	1604	1883560	1596	501	498	18059.2	20.7687	480006.5	289857		
	3712.4	1601	1881638	1596	500	498	18090.2	14.1443	480006.5	289888		
	3668.6	1600	1872028	1596	499	499	18134	14.1443	480037.3	289918		
	3624.8	1597	1804758	1596	498	500	18177.8	14.1443	480068.1	289949		
	3593.8	1598	1802836	1596	497	500	18208.8	14.1443	480068.1	289980		
	3562.8	1596	1800914	1597.667	496	500	18239.8	14.1443	480068.1	290011		
	3519	1604	1791304	1599.333	495	501	18283.6	14.1443	480098.9	290042		
	3488	1601	1778811	1602	494	501	18314.6	14.1443	480098.9	290072		
	3457	1607	1777850	1603	493	501	18345.6	30.1511	480098.9	290103		
	3426	1611	1775928	1604	492	501	18376.6	30.1511	480098.9	290134		
	3382.2	1610	1750942	1604	491	502	18420.4	30.1511	480129.7	290165		
	3351.2	1623	1745176	1604	491	503	18451.4	30.1511	480160.5	290165		
	3307.4	1619	1744215	1604	490	504	18495.2	30.1511	480191.3	290196		
	3263.6	1604	1626012	1605.667	489	505	18539	30.1511	480222.1	290226		
	3219.8	1609	1615441	1611.667	488	506	18582.8	54.3736	480252.9	290257		
	3188.8	1622	1611597	1620.333	488	507	18613.8	54.3736	480283.6	290257		
	3145	1633	1609675	1627.333	487	508	18657.6	54.3736	480314.4	290288		
	3114	1635	1603909	1630	487	509	18688.6	54.3736	480345.2	290288		
	3070.2	1635	1602948	1630	486	510	18732.4	54.3736	480376	290319		
	3026.4	1643	1600065	1630	485	511	18776.2	54.3736	480406.8	290350		
	2995.4	1640	1598143	1630	485	512	18807.2	54.3736	480437.6	290350		
	2964.4	1641	1596221	1630	485	513	18838.2	52.5849	480468.4	290350		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	2920.6	1641	1575079	1630	484	514	18882	52.5849	480499.2	290380		
	2876.8	1635	1536639	1630	483	515	18925.8	52.5849	480530	290411		
	2845.8	1640	1519341	1630	482	515	18956.8	52.5849	480530	290442		
	2814.8	1639	1517419	1630	481	515	18987.8	52.5849	480530	290473		
	2771	1639	1503004	1630	480	516	19031.6	52.5849	480560.8	290503		
	2740	1640	1494355	1630	479	516	19062.6	52.5849	480560.8	290534		
	2696.2	1642	1485706	1630	478	517	19106.4	0	480591.6	290565		
	2652.4	1639	1470330	1630	477	518	19150.2	0	480622.4	290596		
	2608.6	1641	1455915	1630	476	519	19194	0	480653.2	290627		
	2577.6	1637	1410748	1630	475	519	19225	0	480653.2	290657		
	2546.6	1633	1409787	1630	474	519	19256	0	480653.2	290688		
	2515.6	1634	1408826	1630	473	519	19287	0	480653.2	290719		
	2484.6	1635	1407865	1630	472	519	19318	0	480653.2	290750		
	2453.6	1639	1406904	1630	471	519	19349	0	480653.2	290781		
	2422.6	1643	1405943	1630	470	519	19380	0	480653.2	290811		
	2378.8	1645	1403060	1630	469	520	19423.8	0	480684	290842		
	2335	1643	1392489	1630	468	521	19467.6	0	480714.8	290873		
	2304	1642	1352127	1630	467	521	19498.6	0	480714.8	290904		
	2260.2	1647	1333868	1630	466	522	19542.4	7.81184	480745.6	290935		
	2229.2	1653	1332907	1630	466	523	19573.4	7.81184	480776.4	290935		
	2185.4	1654	1331946	1630	465	524	19617.2	7.81184	480807.2	290965		
	2154.4	1652	1330024	1630	464	524	19648.2	7.81184	480807.2	290996		
	2110.6	1650	1232963	1630	463	525	19692	7.81184	480838	291027		
	2066.8	1651	1173381	1630	462	526	19735.8	7.81184	480868.7	291058		
	2023	1653	1157044	1630	461	527	19779.6	7.81184	480899.5	291089		
	1992	1642	797630	1630	460	527	19810.6	7.81184	480899.5	291119		
	1961	1633	796669	1630	459	527	19841.6	7.81184	480899.5	291150		
	1930	1630	795708	1633	458	527	19872.6	7.81184	480899.5	291181		
	1899	1640	794747	1636	457	527	19903.6	7.81184	480899.5	291212		
	1868	1642	793786	1639	456	527	19934.6	7.81184	480899.5	291243		
	1837	1644	792825	1639	455	527	19965.6	7.81184	480899.5	291273		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	1806	1641	791864	1639	454	527	19996.6	7.81184	480899.5	291304		
	1775	1651	790903	1639	453	527	20027.6	7.81184	480899.5	291335		
	1744	1650	789942	1639	452	527	20058.6	7.81184	480899.5	291366		
	1713	1640	788981	1639	451	527	20089.6	5.03227	480899.5	291397		
	1682	1639	788020	1639.333	450	527	20120.6	5.03227	480899.5	291427		
	1651	1647	787059	1639.667	449	527	20151.6	5.03227	480899.5	291458		
	1620	1648	785137	1640	448	527	20182.6	5.03227	480899.5	291489		
	1589	1652	782254	1640	447	527	20213.6	5.03227	480899.5	291520		
	1558	1651	780332	1640	446	527	20244.6	5.03227	480899.5	291550		
	1514.2	1645	476656	1640	445	526	20288.4	5.03227	480868.7	291581		
	1470.4	1646	442060	1640	444	525	20332.2	3.24171	480838	291612		
	1439.4	1648	396893	1640	443	525	20363.2	3.24171	480838	291643		
	1408.4	1654	395932	1640	442	525	20394.2	3.24171	480838	291674		
	1377.4	1648	394971	1640	441	525	20425.2	3.24171	480838	291704		
	1346.4	1645	394010	1640	440	525	20456.2	3.24171	480838	291735		
	1315.4	1640	393049	1641.333	439	525	20487.2	3.24171	480838	291766		
	1284.4	1649	392088	1642.667	438	525	20518.2	3.24171	480838	291797		
	1253.4	1647	391127	1644	437	525	20549.2	3.24171	480838	291828		
	1209.6	1650	383439	1644	436	524	20593	12.0654	480807.2	291858		
	1178.6	1648	379595	1644	435	524	20624	12.0654	480807.2	291889		
	1147.6	1652	377673	1644	434	524	20655	12.0654	480807.2	291920		
	1103.8	1654	376712	1644	433	523	20698.8	12.0654	480776.4	291951		
	1060	1653	320013	1644	434	522	20742.6	12.0654	480745.6	291920		
	1029	1649	317130	1644	434	521	20773.6	12.0654	480714.8	291920		
	998	1648	207576	1644	434	520	20804.6	12.0654	480684	291920		
	967	1645	206615	1644	434	519	20835.6	12.0654	480653.2	291920		
	936	1645	205654	1644	434	518	20866.6	12.0654	480622.4	291920		
	905	1644	201810	1647.333	434	517	20897.6	12.0654	480591.6	291920		
	874	1654	199888	1650.667	434	516	20928.6	12.0654	480560.8	291920		
	830.2	1657	192200	1654	433	515	20972.4	12.0654	480530	291951		
	799.2	1660	189317	1654	432	515	21003.4	12.0654	480530	291982		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 1												
	768.2	1660	188356	1654	431	515	21034.4	12.0654	480530	292012		
	724.4	1656	172019	1654	430	516	21078.2	9.48861	480560.8	292043		
	680.6	1654	161448	1654.333	429	517	21122	9.48861	480591.6	292074		
	649.6	1655	153760	1655.333	428	517	21153	9.48861	480591.6	292105		
	618.6	1662	152799	1656.333	427	517	21184	9.48861	480591.6	292136		
	574.8	1665	149916	1657	426	518	21227.8	9.48861	480622.4	292166		
	531	1662	143189	1657	425	519	21271.6	9.48861	480653.2	292197		
	487.2	1657	136462	1659.333	424	520	21315.4	9.48861	480684	292228		
	443.4	1664	131657	1661.667	423	521	21359.2	6.36632	480714.8	292259		
	412.4	1664	119164	1665	423	522	21390.2	6.36632	480745.6	292259		
	368.6	1668	98022	1666	422	523	21434	6.36632	480776.4	292290		
	324.8	1671	96100	1667	421	524	21477.8	6.36632	480807.2	292320		
	281	1670	88412	1667	420	525	21521.6	6.36632	480838	292351		
	237.2	1667	59582	1667.667	419	526	21565.4	6.36632	480868.7	292382		
	206.2	1670	57660	1668.333	418	526	21596.4	3.69007	480868.7	292413		
	162.4	1671	32674	1669	417	527	21640.2	3.69007	480899.5	292444		
	131.4	1670	26908	1669	417	528	21671.2	3.69007	480930.3	292444		
	87.6	1671	22103	1669	416	529	21715	3.69007	480961.1	292474		
	43.8	1669	16337	1670.333	415	530	21758.8	3.69007	480991.9	292505		
	0	1673	5766	1673	414	531	21802.6	3.69007	481022.7	292536		
South 3												
	19975	905	0	893	970	412	0	0	477358.1	275414	446683.6	0.0244
	19931.2	902	4E+07	893	971	413	43.8	0	477388.9	275383	562341.3	0.0244
	19900.2	898	4E+07	893	971	414	74.8	0	477419.7	275383	891250.9	0.00893
	19856.4	903	4E+07	893	970	415	118.6	0	477450.5	275414	1778279	0.02195
	19825.4	903	3.9E+07	893	969	415	149.6	0	477450.5	275445	2238721	0.03831
	19781.6	903	3.9E+07	893	968	416	193.4	0	477481.3	275476	3548134	0.02267
	19737.8	904	3.9E+07	893	969	417	237.2	242.038	477512.1	275445	5623413	0.00321
	19694	904	3.9E+07	893	968	418	281	242.038	477542.9	275476	7079458	0.00412
	19663	904	3.9E+07	893	968	419	312	242.038	477573.7	275476	8912509	0.02137

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	19619.2	900	3.9E+07	893	967	420	355.8	242.038	477604.5	275506	14125375	0.20639
	19588.2	896	3.9E+07	893	967	421	386.8	242.038	477635.3	275506	28183829	0.15875
	19557.2	896	3.9E+07	893	967	422	417.8	242.038	477666.1	275506	35481339	0.07034
	19526.2	893	3.9E+07	894.6667	967	423	448.8	242.038	477696.9	275506		
	19495.2	898	3.9E+07	899.3333	967	424	479.8	242.038	477727.7	275506		
	19464.2	908	3.9E+07	904	967	425	510.8	242.038	477758.5	275506		
	19420.4	907	3.9E+07	907	966	426	554.6	242.038	477789.3	275537		
	19389.4	907	3.9E+07	908.3333	966	427	585.6	242.038	477820.1	275537		
	19358.4	911	3.9E+07	911.6667	966	428	616.6	242.038	477850.9	275537		
	19327.4	917	3.9E+07	916	966	429	647.6	242.038	477881.7	275537		
	19296.4	921	3.9E+07	919	966	430	678.6	242.038	477912.4	275537		
	19265.4	920	3.9E+07	920	966	431	709.6	242.038	477943.2	275537		
	19234.4	920	3.9E+07	920	966	432	740.6	154.237	477974	275537		
	19190.6	920	3.9E+07	921.3333	965	433	784.4	154.237	478004.8	275568		
	19146.8	924	3.9E+07	922.6667	966	434	828.2	154.237	478035.6	275537		
	19115.8	924	3.9E+07	924.3333	967	434	859.2	154.237	478035.6	275506		
	19072	929	3.9E+07	924.6667	968	435	903	154.237	478066.4	275476		
	19041	925	3.9E+07	925	968	436	934	154.237	478097.2	275476		
	19010	929	3.9E+07	925	968	437	965	154.237	478128	275476		
	18966.2	929	3.9E+07	925	967	438	1008.8	91.1206	478158.8	275506		
	18935.2	925	3.9E+07	926.6667	967	439	1039.8	91.1206	478189.6	275506		
	18891.4	932	3.9E+07	928.3333	966	440	1083.6	91.1206	478220.4	275537		
	18847.6	930	3.9E+07	930	965	441	1127.4	91.1206	478251.2	275568		
	18816.6	930	3.9E+07	931.6667	965	442	1158.4	91.1206	478282	275568		
	18772.8	936	3.9E+07	933.3333	964	443	1202.2	91.1206	478312.8	275599		
	18741.8	941	3.9E+07	935	963	443	1233.2	91.1206	478312.8	275630		
	18710.8	940	3.9E+07	935	962	443	1264.2	43.4792	478312.8	275660		
	18679.8	936	3.9E+07	935	961	443	1295.2	43.4792	478312.8	275691		
	18648.8	941	3.9E+07	935	960	443	1326.2	43.4792	478312.8	275722		
	18617.8	949	3.9E+07	935	959	443	1357.2	43.4792	478312.8	275753		
	18586.8	957	3.9E+07	935	958	443	1388.2	43.4792	478312.8	275784		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	18543	962	3.9E+07	935	957	444	1432	43.4792	478343.6	275814		
	18499.2	952	3.9E+07	935	956	445	1475.8	43.4792	478374.4	275845		
	18455.4	948	3.9E+07	935	955	446	1519.6	0	478405.2	275876		
	18411.6	941	3.9E+07	935	954	447	1563.4	0	478436	275907		
	18367.8	936	3.9E+07	935	953	448	1607.2	0	478466.8	275938		
	18324	954	3.9E+07	935	952	449	1651	0	478497.5	275968		
	18280.2	953	3.9E+07	935	951	450	1694.8	0	478528.3	275999		
	18236.4	945	3.9E+07	935	950	451	1738.6	370.48	478559.1	276030		
	18192.6	941	3.2E+07	935	949	452	1782.4	370.48	478589.9	276061		
	18148.8	942	3.2E+07	935	948	453	1826.2	370.48	478620.7	276092		
	18105	938	3.2E+07	935	947	454	1870	370.48	478651.5	276122		
	18061.2	936	3.2E+07	935	946	455	1913.8	370.48	478682.3	276153		
	18017.4	935	3.2E+07	935.6667	945	456	1957.6	370.48	478713.1	276184		
	17986.4	942	3.2E+07	936.3333	944	456	1988.6	370.48	478713.1	276215		
	17955.4	937	3.2E+07	938	943	456	2019.6	370.48	478713.1	276245		
	17924.4	942	3.2E+07	939	942	456	2050.6	370.48	478713.1	276276		
	17893.4	943	3.2E+07	940	941	456	2081.6	370.48	478713.1	276307		
	17862.4	944	3.2E+07	940	940	456	2112.6	370.48	478713.1	276338		
	17831.4	948	3.2E+07	940	939	456	2143.6	370.48	478713.1	276369		
	17800.4	940	3.2E+07	942	938	456	2174.6	370.48	478713.1	276399		
	17769.4	946	3.2E+07	947.3333	937	456	2205.6	370.48	478713.1	276430		
	17738.4	956	3.2E+07	955.6667	936	456	2236.6	370.48	478713.1	276461		
	17707.4	965	3.2E+07	962.6667	935	456	2267.6	257.223	478713.1	276492		
	17663.6	967	3.2E+07	966.3333	934	455	2311.4	257.223	478682.3	276523		
	17632.6	968	3.2E+07	967	933	455	2342.4	257.223	478682.3	276553		
	17588.8	968	3.2E+07	967	932	456	2386.2	257.223	478713.1	276584		
	17557.8	972	3.2E+07	967	931	456	2417.2	257.223	478713.1	276615		
	17514	967	3.2E+07	967.6667	930	457	2461	257.223	478743.9	276646		
	17470.2	969	3.1E+07	968.6667	929	456	2504.8	111.081	478713.1	276677		
	17439.2	970	3.1E+07	970.6667	928	456	2535.8	111.081	478713.1	276707		
	17408.2	973	3.1E+07	972.6667	927	456	2566.8	111.081	478713.1	276738		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	17364.4	975	3.1E+07	977	926	457	2610.6	111.081	478743.9	276769		
	17320.6	986	3.1E+07	980.3333	925	456	2654.4	111.081	478713.1	276800		
	17276.8	991	3.1E+07	983	924	455	2698.2	111.081	478682.3	276831		
	17233	993	3.1E+07	983	923	454	2742	111.081	478651.5	276861		
	17189.2	987	3.1E+07	983	922	455	2785.8	103.228	478682.3	276892		
	17145.4	989	3.1E+07	983	921	456	2829.6	103.228	478713.1	276923		
	17114.4	990	3.1E+07	983	920	456	2860.6	103.228	478713.1	276954		
	17083.4	989	3.1E+07	983	919	456	2891.6	103.228	478713.1	276985		
	17039.6	993	3.1E+07	983	918	457	2935.4	103.228	478743.9	277015		
	17008.6	984	3.1E+07	983	917	457	2966.4	103.228	478743.9	277046		
	16977.6	983	3.1E+07	984	916	457	2997.4	107.205	478743.9	277077		
	16946.6	988	3.1E+07	985	915	457	3028.4	107.205	478743.9	277108		
	16915.6	986	3.1E+07	987	914	457	3059.4	107.205	478743.9	277139		
	16884.6	989	3.1E+07	989.3333	913	457	3090.4	107.205	478743.9	277169		
	16853.6	993	3.1E+07	991.6667	912	457	3121.4	107.205	478743.9	277200		
	16822.6	993	3.1E+07	994	911	457	3152.4	107.205	478743.9	277231		
	16778.8	996	3.1E+07	995.3333	910	458	3196.2	107.205	478774.7	277262		
	16747.8	1002	3.1E+07	996.6667	909	458	3227.2	107.205	478774.7	277293		
	16716.8	1003	3.1E+07	997	908	458	3258.2	234.958	478774.7	277323		
	16673	997	3.1E+07	997	907	457	3302	234.958	478743.9	277354		
	16629.2	997	3E+07	997.3333	906	456	3345.8	234.958	478713.1	277385		
	16598.2	1002	3E+07	997.6667	905	456	3376.8	234.958	478713.1	277416		
	16567.2	998	3E+07	1001	904	456	3407.8	234.958	478713.1	277446		
	16523.4	1007	3E+07	1006.667	903	457	3451.6	234.958	478743.9	277477		
	16492.4	1015	3E+07	1015.667	902	457	3482.6	234.958	478743.9	277508		
	16448.6	1026	3E+07	1021.667	901	456	3526.4	239.511	478713.1	277539		
	16417.6	1025	3E+07	1026.667	900	456	3557.4	239.511	478713.1	277570		
	16386.6	1030	3E+07	1029.667	899	456	3588.4	239.511	478713.1	277600		
	16355.6	1035	3E+07	1032.667	898	456	3619.4	239.511	478713.1	277631		
	16311.8	1034	3E+07	1034.333	897	457	3663.2	239.511	478743.9	277662		
	16280.8	1035	3E+07	1035	897	458	3694.2	239.511	478774.7	277662		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	16249.8	1040	3E+07	1035.667	897	459	3725.2	239.511	478805.5	277662		
	16206	1041	3E+07	1036	896	460	3769	135.544	478836.3	277693		
	16162.2	1039	3E+07	1036	895	459	3812.8	135.544	478805.5	277724		
	16118.4	1046	3E+07	1036	894	460	3856.6	135.544	478836.3	277754		
	16087.4	1046	3E+07	1036	893	460	3887.6	135.544	478836.3	277785		
	16056.4	1042	3E+07	1036	892	460	3918.6	135.544	478836.3	277816		
	16012.6	1042	3E+07	1036	891	461	3962.4	135.544	478867.1	277847		
	15981.6	1036	3E+07	1036	890	461	3993.4	164.935	478867.1	277878		
	15950.6	1036	3E+07	1037.667	889	461	4024.4	164.935	478867.1	277908		
	15919.6	1041	3E+07	1040	888	461	4055.4	164.935	478867.1	277939		
	15888.6	1045	3E+07	1042.333	887	461	4086.4	164.935	478867.1	277970		
	15857.6	1044	3E+07	1043	886	461	4117.4	164.935	478867.1	278001		
	15826.6	1043	3E+07	1044	885	461	4148.4	164.935	478867.1	278032		
	15782.8	1046	3E+07	1046	884	462	4192.2	164.935	478897.9	278062		
	15739	1049	3E+07	1051	883	463	4236	164.935	478928.7	278093		
	15695.2	1067	3E+07	1055	882	464	4279.8	115.094	478959.5	278124		
	15651.4	1066	3E+07	1058	881	465	4323.6	115.094	478990.3	278155		
	15620.4	1066	3E+07	1058	880	465	4354.6	115.094	478990.3	278186		
	15576.6	1073	3E+07	1058	879	466	4398.4	115.094	479021.1	278216		
	15532.8	1073	3E+07	1058	878	467	4442.2	115.094	479051.9	278247		
	15489	1064	3E+07	1058	877	468	4486	115.094	479082.7	278278		
	15445.2	1066	3E+07	1058	876	469	4529.8	309.268	479113.4	278309		
	15414.2	1064	3E+07	1058	875	469	4560.8	309.268	479113.4	278340		
	15383.2	1058	2.9E+07	1062.333	874	469	4591.8	309.268	479113.4	278370		
	15352.2	1071	2.9E+07	1068.667	873	469	4622.8	309.268	479113.4	278401		
	15321.2	1077	2.9E+07	1075.667	872	469	4653.8	309.268	479113.4	278432		
	15277.4	1079	2.9E+07	1080.667	871	470	4697.6	309.268	479144.2	278463		
	15246.4	1086	2.9E+07	1087.333	870	470	4728.6	309.268	479144.2	278494		
	15215.4	1097	2.9E+07	1096.667	869	470	4759.6	427.331	479144.2	278524		
	15171.6	1107	2.9E+07	1103.667	868	471	4803.4	427.331	479175	278555		
	15140.6	1107	2.9E+07	1107.667	867	471	4834.4	427.331	479175	278586		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	15109.6	1112	2.9E+07	1108.333	866	471	4865.4	427.331	479175	278617		
	15078.6	1109	2.9E+07	1109.667	865	471	4896.4	427.331	479175	278647		
	15047.6	1111	2.9E+07	1112	864	471	4927.4	427.331	479175	278678		
	15016.6	1116	2.9E+07	1117	863	471	4958.4	427.331	479175	278709		
	14985.6	1124	2.9E+07	1126.333	862	471	4989.4	427.331	479175	278740		
	14954.6	1139	2.9E+07	1138	861	471	5020.4	375.108	479175	278771		
	14910.8	1161	2.9E+07	1147	860	472	5064.2	375.108	479205.8	278801		
	14867	1165	2.9E+07	1151	859	473	5108	375.108	479236.6	278832		
	14836	1167	2.9E+07	1151	858	473	5139	375.108	479236.6	278863		
	14792.2	1169	2.9E+07	1151	857	474	5182.8	375.108	479267.4	278894		
	14761.2	1172	2.9E+07	1151	856	474	5213.8	375.108	479267.4	278925		
	14717.4	1164	2.9E+07	1151	855	475	5257.6	362.991	479298.2	278955		
	14673.6	1165	2.9E+07	1151	854	476	5301.4	362.991	479329	278986		
	14642.6	1151	2.9E+07	1151.333	853	476	5332.4	362.991	479329	279017		
	14611.6	1152	2.9E+07	1154.333	852	476	5363.4	362.991	479329	279048		
	14580.6	1160	2.9E+07	1160.667	851	476	5394.4	362.991	479329	279079		
	14549.6	1170	2.9E+07	1169	850	476	5425.4	362.991	479329	279109		
	14505.8	1177	2.9E+07	1174.667	849	477	5469.2	362.991	479359.8	279140		
	14462	1179	2.9E+07	1177	848	478	5513	329.926	479390.6	279171		
	14418.2	1177	2.9E+07	1177.667	847	479	5556.8	329.926	479421.4	279202		
	14374.4	1179	2.9E+07	1181.667	846	480	5600.6	329.926	479452.2	279233		
	14330.6	1189	2.9E+07	1187	845	481	5644.4	329.926	479483	279263		
	14286.8	1193	2.9E+07	1194	844	482	5688.2	329.926	479513.8	279294		
	14255.8	1200	2.9E+07	1199.333	844	483	5719.2	329.926	479544.6	279294		
	14212	1205	2.9E+07	1209	843	484	5763	336.041	479575.4	279325		
	14168.2	1222	2.9E+07	1218.333	842	485	5806.8	336.041	479606.2	279356		
	14124.4	1232	2.9E+07	1226	841	486	5850.6	336.041	479637	279387		
	14080.6	1229	2.9E+07	1228	840	487	5894.4	336.041	479667.8	279417		
	14036.8	1228	2.9E+07	1229	839	488	5938.2	336.041	479698.5	279448		
	13993	1231	2.9E+07	1237.333	838	489	5982	336.041	479729.3	279479		
	13949.2	1253	2.9E+07	1249.667	837	490	6025.8	456.929	479760.1	279510		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	13905.4	1265	2.9E+07	1264.667	836	491	6069.6	456.929	479790.9	279541		
	13874.4	1276	2.9E+07	1274	836	492	6100.6	456.929	479821.7	279541		
	13843.4	1283	2.9E+07	1279.333	836	493	6131.6	456.929	479852.5	279541		
	13799.6	1282	2.9E+07	1281	835	494	6175.4	456.929	479883.3	279571		
	13755.8	1281	1.6E+07	1283.667	834	495	6219.2	456.929	479914.1	279602		
	13712	1289	1.6E+07	1292	833	494	6263	501.53	479883.3	279633		
	13668.2	1306	1.6E+07	1301.667	832	493	6306.8	501.53	479852.5	279664		
	13624.4	1311	1.6E+07	1308.667	831	492	6350.6	501.53	479821.7	279694		
	13580.6	1310	1.6E+07	1312.667	830	491	6394.4	501.53	479790.9	279725		
	13549.6	1318	1.6E+07	1320	829	491	6425.4	501.53	479790.9	279756		
	13518.6	1332	1.6E+07	1332	828	491	6456.4	501.53	479790.9	279787		
	13487.6	1346	1.6E+07	1349.333	827	491	6487.4	501.53	479790.9	279818		
	13456.6	1384	1.5E+07	1362	826	491	6518.4	430.861	479790.9	279848		
	13425.6	1387	1.5E+07	1370	825	491	6549.4	430.861	479790.9	279879		
	13381.8	1389	1.5E+07	1370	824	492	6593.2	430.861	479821.7	279910		
	13338	1388	1.5E+07	1370	823	493	6637	430.861	479852.5	279941		
	13307	1389	1.5E+07	1370	822	493	6668	430.861	479852.5	279972		
	13263.2	1385	1.5E+07	1370	821	494	6711.8	430.861	479883.3	280002		
	13219.4	1381	1.5E+07	1370	820	495	6755.6	250.353	479914.1	280033		
	13175.6	1370	1.5E+07	1370.333	819	496	6799.4	250.353	479944.9	280064		
	13144.6	1371	1.5E+07	1371.667	818	496	6830.4	250.353	479944.9	280095		
	13113.6	1374	1.5E+07	1374.333	817	496	6861.4	250.353	479944.9	280126		
	13082.6	1380	1.5E+07	1376.667	816	496	6892.4	250.353	479944.9	280156		
	13051.6	1378	1.5E+07	1381.667	815	496	6923.4	250.353	479944.9	280187		
	13007.8	1389	1.5E+07	1385.333	814	497	6967.2	250.353	479975.7	280218		
	12964	1389	1.5E+07	1389.333	813	498	7011	190.77	480006.5	280249		
	12920.2	1390	1.5E+07	1392.333	812	499	7054.8	190.77	480037.3	280280		
	12889.2	1398	1.5E+07	1397.333	811	499	7085.8	190.77	480037.3	280310		
	12845.4	1404	1.5E+07	1404.667	810	500	7129.6	190.77	480068.1	280341		
	12814.4	1413	1.5E+07	1409.333	809	500	7160.6	190.77	480068.1	280372		
	12783.4	1412	1.5E+07	1412	808	500	7191.6	190.77	480068.1	280403		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	12739.6	1412	1.5E+07	1413.667	807	501	7235.4	190.77	480098.9	280434		
	12708.6	1417	1.5E+07	1418	806	501	7266.4	312.253	480098.9	280464		
	12677.6	1425	1.5E+07	1428.333	805	501	7297.4	312.253	480098.9	280495		
	12633.8	1443	1.5E+07	1440.333	804	500	7341.2	312.253	480068.1	280526		
	12602.8	1453	1.5E+07	1451.333	803	500	7372.2	312.253	480068.1	280557		
	12559	1458	1.5E+07	1459	802	501	7416	312.253	480098.9	280588		
	12528	1467	1.5E+07	1463.333	801	501	7447	312.253	480098.9	280618		
	12484.2	1466	1.5E+07	1467.667	800	502	7490.8	312.253	480129.7	280649		
	12440.4	1471	1.5E+07	1471.667	799	503	7534.6	296.261	480160.5	280680		
	12409.4	1478	1.5E+07	1476	799	504	7565.6	296.261	480191.3	280680		
	12365.6	1483	1.5E+07	1478.667	798	505	7609.4	296.261	480222.1	280711		
	12321.8	1485	1.5E+07	1479	797	506	7653.2	296.261	480252.9	280742		
	12278	1485	1.5E+07	1479	796	507	7697	296.261	480283.6	280772		
	12247	1483	1.5E+07	1479	795	507	7728	296.261	480283.6	280803		
	12216	1481	1.5E+07	1479	794	507	7759	62.7678	480283.6	280834		
	12172.2	1480	1.5E+07	1479	793	506	7802.8	62.7678	480252.9	280865		
	12141.2	1479	1.5E+07	1479.333	792	506	7833.8	62.7678	480252.9	280895		
	12110.2	1480	1.5E+07	1480.333	791	506	7864.8	62.7678	480252.9	280926		
	12079.2	1483	1.5E+07	1481.333	790	506	7895.8	62.7678	480252.9	280957		
	12048.2	1484	1.5E+07	1482	789	506	7926.8	62.7678	480252.9	280988		
	12017.2	1485	1.5E+07	1482	788	506	7957.8	62.7678	480252.9	281019		
	11986.2	1484	1.5E+07	1482	787	506	7988.8	62.7678	480252.9	281049		
	11955.2	1482	1.5E+07	1482.333	786	506	8019.8	43.7071	480252.9	281080		
	11924.2	1483	1.5E+07	1485	785	506	8050.8	43.7071	480252.9	281111		
	11893.2	1490	1.5E+07	1488.333	784	506	8081.8	43.7071	480252.9	281142		
	11849.4	1492	1.5E+07	1491.333	783	507	8125.6	43.7071	480283.6	281173		
	11805.6	1502	1.4E+07	1492	782	508	8169.4	43.7071	480314.4	281203		
	11761.8	1499	1.4E+07	1492	781	509	8213.2	43.7071	480345.2	281234		
	11718	1502	1.4E+07	1492	780	510	8257	44.1432	480376	281265		
	11674.2	1501	1.4E+07	1492	779	511	8300.8	44.1432	480406.8	281296		
	11630.4	1500	1.4E+07	1492	778	512	8344.6	44.1432	480437.6	281327		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	11599.4	1500	1.4E+07	1492	777	512	8375.6	44.1432	480437.6	281357		
	11555.6	1512	1.4E+07	1492	776	513	8419.4	44.1432	480468.4	281388		
	11511.8	1517	1.4E+07	1492	775	514	8463.2	44.1432	480499.2	281419		
	11468	1515	1.4E+07	1492	774	515	8507	23.3302	480530	281450		
	11437	1512	1.4E+07	1492	774	516	8538	23.3302	480560.8	281450		
	11393.2	1507	1.4E+07	1492	773	517	8581.8	23.3302	480591.6	281481		
	11349.4	1498	1.4E+07	1492	772	518	8625.6	23.3302	480622.4	281511		
	11305.6	1492	1.4E+07	1492.333	771	519	8669.4	23.3302	480653.2	281542		
	11261.8	1493	1.4E+07	1493.667	770	520	8713.2	23.3302	480684	281573		
	11218	1499	1.4E+07	1495	769	521	8757	23.3302	480714.8	281604		
	11174.2	1508	1.4E+07	1496	768	522	8800.8	23.3302	480745.6	281635		
	11143.2	1507	1.4E+07	1496	767	522	8831.8	23.3302	480745.6	281665		
	11112.2	1502	1.4E+07	1496	766	522	8862.8	23.3302	480745.6	281696		
	11081.2	1513	1.4E+07	1496	765	522	8893.8	23.3302	480745.6	281727		
	11050.2	1513	1.4E+07	1496	764	522	8924.8	23.3302	480745.6	281758		
	11019.2	1510	1.4E+07	1496	763	522	8955.8	23.3302	480745.6	281789		
	10988.2	1506	1.4E+07	1496	762	522	8986.8	23.3302	480745.6	281819		
	10957.2	1507	1.4E+07	1496	761	522	9017.8	46.8258	480745.6	281850		
	10926.2	1502	1.4E+07	1496	760	522	9048.8	46.8258	480745.6	281881		
	10895.2	1496	1.4E+07	1496.333	759	522	9079.8	46.8258	480745.6	281912		
	10864.2	1497	1.4E+07	1500.667	758	522	9110.8	46.8258	480745.6	281943		
	10833.2	1510	1.4E+07	1505	757	522	9141.8	46.8258	480745.6	281973		
	10802.2	1512	1.4E+07	1509	756	522	9172.8	46.8258	480745.6	282004		
	10771.2	1514	1.4E+07	1509	755	522	9203.8	46.8258	480745.6	282035		
	10727.4	1514	1.4E+07	1509	754	523	9247.6	66.339	480776.4	282066		
	10696.4	1528	1.4E+07	1509	753	523	9278.6	66.339	480776.4	282096		
	10665.4	1530	1.4E+07	1509	752	523	9309.6	66.339	480776.4	282127		
	10621.6	1530	1.4E+07	1509	751	524	9353.4	66.339	480807.2	282158		
	10577.8	1522	1.4E+07	1509	750	523	9397.2	66.339	480776.4	282189		
	10534	1521	1.4E+07	1509	749	522	9441	66.339	480745.6	282220		
	10490.2	1523	1.4E+07	1509	748	521	9484.8	66.339	480714.8	282250		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	10446.4	1513	1.4E+07	1509	747	520	9528.6	16.1168	480684	282281		
	10402.6	1509	1.3E+07	1510.333	746	519	9572.4	16.1168	480653.2	282312		
	10358.8	1518	1.3E+07	1511.667	745	518	9616.2	16.1168	480622.4	282343		
	10327.8	1522	1.3E+07	1513	744	518	9647.2	16.1168	480622.4	282374		
	10284	1519	1.3E+07	1513	743	517	9691	16.1168	480591.6	282404		
	10253	1513	1.3E+07	1513	742	517	9722	16.1168	480591.6	282435		
	10222	1514	9534081	1513	741	517	9753	16.1168	480591.6	282466		
	10191	1519	9533120	1513	740	517	9784	16.1168	480591.6	282497		
	10160	1520	9532159	1513	739	517	9815	16.1168	480591.6	282528		
	10129	1518	9531198	1513	738	517	9846	16.1168	480591.6	282558		
	10098	1517	9530237	1513	737	517	9877	16.1168	480591.6	282589		
	10067	1521	9529276	1513	736	517	9908	16.1168	480591.6	282620		
	10036	1527	9528315	1513	735	517	9939	16.1168	480591.6	282651		
	10005	1515	9527354	1513	734	517	9970	16.1168	480591.6	282682		
	9974	1515	9526393	1513	733	517	10001	88.9065	480591.6	282712		
	9943	1516	9525432	1513	732	517	10032	88.9065	480591.6	282743		
	9912	1513	9524471	1515	731	517	10063	88.9065	480591.6	282774		
	9881	1519	9523510	1520.333	730	517	10094	88.9065	480591.6	282805		
	9850	1529	9522549	1527	729	517	10125	88.9065	480591.6	282836		
	9806.2	1533	9514861	1531.667	728	518	10168.8	88.9065	480622.4	282866		
	9762.4	1535	9512939	1533	727	519	10212.6	88.9065	480653.2	282897		
	9718.6	1533	9486031	1533	726	520	10256.4	88.9065	480684	282928		
	9687.6	1535	9483148	1533	725	520	10287.4	88.9065	480684	282959		
	9656.6	1533	9468733	1533.333	724	520	10318.4	88.9065	480684	282990		
	9625.6	1535	9463928	1533.667	723	520	10349.4	88.9065	480684	283020		
	9581.8	1537	9461045	1534	722	521	10393.2	88.9065	480714.8	283051		
	9538	1540	9453357	1534	721	522	10437	88.9065	480745.6	283082		
	9494.2	1540	9426449	1534	720	523	10480.8	88.9065	480776.4	283113		
	9463.2	1535	9347647	1534	720	524	10511.8	0	480807.2	283113		
	9419.4	1540	9341881	1534	719	525	10555.6	0	480838	283144		
	9375.6	1542	9336115	1534	718	526	10599.4	0	480868.7	283174		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	9331.8	1543	9330349	1534	717	527	10643.2	0	480899.5	283205		
	9288	1544	9321700	1534	716	528	10687	0	480930.3	283236		
	9257	1548	9308246	1534	715	528	10718	0	480930.3	283267		
	9213.2	1551	9301519	1534	714	529	10761.8	0	480961.1	283297		
	9182.2	1554	9296714	1534	714	530	10792.8	0	480991.9	283297		
	9138.4	1550	9294792	1534	713	531	10836.6	0	481022.7	283328		
	9094.6	1553	9247703	1534	712	532	10880.4	0	481053.5	283359		
	9050.8	1556	9244820	1534	711	533	10924.2	0	481084.3	283390		
	9007	1554	9241937	1534	710	534	10968	0	481115.1	283421		
	8963.2	1547	9225600	1534	709	535	11011.8	0	481145.9	283451		
	8919.4	1552	9217912	1534	708	536	11055.6	0	481176.7	283482		
	8875.6	1543	9209263	1534	707	537	11099.4	0	481207.5	283513		
	8831.8	1537	9169862	1534	706	538	11143.2	0	481238.3	283544		
	8788	1546	9162174	1534	705	539	11187	0	481269.1	283575		
	8744.2	1549	9152564	1534	704	540	11230.8	47.4298	481299.9	283605		
	8700.4	1549	9133344	1534	703	541	11274.6	47.4298	481330.7	283636		
	8656.6	1555	9127578	1534	702	542	11318.4	47.4298	481361.5	283667		
	8612.8	1555	9121812	1534	701	543	11362.2	47.4298	481392.3	283698		
	8569	1550	9108358	1534	700	544	11406	47.4298	481423.1	283729		
	8525.2	1553	9102592	1534	699	545	11449.8	47.4298	481453.9	283759		
	8481.4	1551	9063191	1534	698	546	11493.6	47.4298	481484.6	283790		
	8437.6	1546	9052620	1534	697	547	11537.4	47.4298	481515.4	283821		
	8393.8	1534	9045893	1535.333	696	548	11581.2	47.4298	481546.2	283852		
	8350	1538	9037244	1537.333	695	549	11625	47.4298	481577	283883		
	8306.2	1550	9029556	1539.333	694	550	11668.8	47.4298	481607.8	283913		
	8262.4	1550	7990715	1540	693	551	11712.6	47.4298	481638.6	283944		
	8231.4	1546	7988793	1540	692	551	11743.6	15.0384	481638.6	283975		
	8187.6	1545	7978222	1540	691	552	11787.4	15.0384	481669.4	284006		
	8143.8	1551	7966690	1540	690	553	11831.2	15.0384	481700.2	284037		
	8100	1546	7846565	1540	689	554	11875	15.0384	481731	284067		
	8069	1540	7702415	1540.333	688	554	11906	15.0384	481731	284098		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	8038	1541	7701454	1541.333	687	554	11937	15.0384	481731	284129		
	8007	1545	7700493	1542.333	686	554	11968	15.0384	481731	284160		
	7976	1551	7699532	1543	685	554	11999	0	481731	284191		
	7945	1552	7698571	1543	684	554	12030	0	481731	284221		
	7914	1550	7697610	1543	683	554	12061	0	481731	284252		
	7870.2	1553	7684156	1543	682	555	12104.8	0	481761.8	284283		
	7839.2	1553	7683195	1543	681	555	12135.8	0	481761.8	284314		
	7808.2	1555	7682234	1543	680	555	12166.8	0	481761.8	284345		
	7777.2	1551	7681273	1543	679	555	12197.8	0	481761.8	284375		
	7733.4	1556	7678390	1543	678	556	12241.6	0	481792.6	284406		
	7689.6	1553	7543850	1543	677	557	12285.4	0	481823.4	284437		
	7645.8	1548	7513098	1543	676	558	12329.2	0	481854.2	284468		
	7614.8	1550	7503488	1543	676	559	12360.2	0	481885	284468		
	7583.8	1560	7502527	1543	676	560	12391.2	0	481915.8	284468		
	7552.8	1557	7494839	1543	676	561	12422.2	0	481946.6	284468		
	7521.8	1555	7491956	1543	676	562	12453.2	0	481977.4	284468		
	7490.8	1559	7454477	1543	676	563	12484.2	0	482008.2	284468		
	7459.8	1556	7453516	1543	676	564	12515.2	0	482039	284468		
	7428.8	1558	7451594	1543	676	565	12546.2	0	482069.7	284468		
	7397.8	1560	7449672	1543	676	566	12577.2	0	482100.5	284468		
	7354	1558	7447750	1543	675	567	12621	0	482131.3	284498		
	7310.2	1558	7318976	1543	674	568	12664.8	0	482162.1	284529		
	7266.4	1551	7299756	1543	673	569	12708.6	12.545	482192.9	284560		
	7222.6	1548	7238252	1543	672	570	12752.4	12.545	482223.7	284591		
	7178.8	1557	7225759	1543	671	571	12796.2	12.545	482254.5	284622		
	7147.8	1552	7222876	1543	670	571	12827.2	12.545	482254.5	284652		
	7104	1557	7204617	1543	669	572	12871	12.545	482285.3	284683		
	7060.2	1555	7192124	1543	668	573	12914.8	12.545	482316.1	284714		
	7016.4	1548	7179631	1543	667	574	12958.6	12.545	482346.9	284745		
	6985.4	1543	7011456	1543.667	666	574	12989.6	12.545	482346.9	284776		
	6954.4	1546	7010495	1544.333	665	574	13020.6	12.545	482346.9	284806		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	6923.4	1545	7009534	1545	664	574	13051.6	12.545	482346.9	284837		
	6892.4	1551	7008573	1545	663	574	13082.6	12.545	482346.9	284868		
	6861.4	1553	7007612	1545	662	574	13113.6	12.545	482346.9	284899		
	6830.4	1549	7006651	1545	661	574	13144.6	12.545	482346.9	284930		
	6799.4	1553	7005690	1545	660	574	13175.6	12.545	482346.9	284960		
	6768.4	1545	7004729	1545.333	659	574	13206.6	12.545	482346.9	284991		
	6737.4	1546	7003768	1545.667	658	574	13237.6	12.545	482346.9	285022		
	6706.4	1557	7002807	1546	657	574	13268.6	12.545	482346.9	285053		
	6662.6	1556	6863462	1546	656	575	13312.4	12.545	482377.7	285084		
	6618.8	1555	6809646	1546	655	576	13356.2	12.545	482408.5	285114		
	6575	1546	6794270	1546	654	577	13400	12.545	482439.3	285145		
	6531.2	1546	6781777	1547.333	653	578	13443.8	12.545	482470.1	285176		
	6487.4	1560	6770245	1548.667	652	579	13487.6	12.545	482500.9	285207		
	6443.6	1558	5728521	1550	651	580	13531.4	3.58696	482531.7	285238		
	6412.6	1563	5716028	1550	651	581	13562.4	3.58696	482562.5	285238		
	6368.8	1565	5714106	1550	650	582	13606.2	3.58696	482593.3	285268		
	6337.8	1566	5624733	1550	649	582	13637.2	3.58696	482593.3	285299		
	6294	1566	5620889	1550	648	583	13681	3.58696	482624.1	285330		
	6250.2	1565	5416196	1550	647	584	13724.8	3.58696	482654.8	285361		
	6219.2	1564	5415235	1550	647	585	13755.8	3.58696	482685.6	285361		
	6175.4	1561	5400820	1550	646	586	13799.6	3.58696	482716.4	285392		
	6131.6	1557	5369107	1550	645	587	13843.4	3.58696	482747.2	285422		
	6100.6	1555	5357575	1550	644	587	13874.4	3.58696	482747.2	285453		
	6069.6	1555	5356614	1550	643	587	13905.4	3.58696	482747.2	285484		
	6038.6	1556	5355653	1550	642	587	13936.4	3.58696	482747.2	285515		
	5994.8	1564	5341238	1550	641	588	13980.2	3.58696	482778	285546		
	5951	1562	5328745	1550	640	589	14024	0	482808.8	285576		
	5907.2	1554	5314330	1550	639	590	14067.8	0	482839.6	285607		
	5876.2	1555	4788663	1550	638	590	14098.8	0	482839.6	285638		
	5845.2	1560	4787702	1550	637	590	14129.8	0	482839.6	285669		
	5814.2	1556	4786741	1550	636	590	14160.8	0	482839.6	285699		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	5783.2	1558	4784819	1550	635	590	14191.8	0	482839.6	285730		
	5739.4	1565	4777131	1550	634	591	14235.6	0	482870.4	285761		
	5708.4	1566	4772326	1550	633	591	14266.6	0	482870.4	285792		
	5664.6	1555	4767521	1550	632	592	14310.4	0	482901.2	285823		
	5633.6	1554	4709861	1550	631	592	14341.4	0	482901.2	285853		
	5602.6	1555	4708900	1550	630	592	14372.4	0	482901.2	285884		
	5571.6	1558	4707939	1550	629	592	14403.4	0	482901.2	285915		
	5540.6	1563	4582048	1550	628	592	14434.4	0	482901.2	285946		
	5509.6	1559	4581087	1550	627	592	14465.4	0	482901.2	285977		
	5465.8	1563	4572438	1550	626	593	14509.2	0	482932	286007		
	5434.8	1559	4568594	1550	625	593	14540.2	0	482932	286038		
	5403.8	1552	4558023	1550	624	593	14571.2	0	482932	286069		
	5360	1556	4552257	1550	623	594	14615	0	482962.8	286100		
	5316.2	1563	4540725	1550	622	595	14658.8	0	482993.6	286131		
	5272.4	1565	4525349	1550	621	596	14702.6	0	483024.4	286161		
	5241.4	1563	4186116	1550	620	596	14733.6	70.1603	483024.4	286192		
	5210.4	1562	4184194	1550	619	596	14764.6	70.1603	483024.4	286223		
	5179.4	1564	4145754	1550	618	596	14795.6	70.1603	483024.4	286254		
	5148.4	1565	4144793	1550	617	596	14826.6	70.1603	483024.4	286285		
	5104.6	1566	4140949	1550	616	595	14870.4	70.1603	482993.6	286315		
	5073.6	1563	4136144	1550	615	595	14901.4	70.1603	482993.6	286346		
	5042.6	1564	4134222	1550	614	595	14932.4	70.1603	482993.6	286377		
	4998.8	1566	4127495	1550	613	594	14976.2	70.1603	482962.8	286408		
	4955	1553	4078484	1550	612	593	15020	70.1603	482932	286439		
	4924	1550	3301035	1552.667	611	593	15051	70.1603	482932	286469		
	4893	1558	3300074	1558.333	610	593	15082	70.1603	482932	286500		
	4862	1569	3297191	1564	609	593	15113	70.1603	482932	286531		
	4818.2	1569	3295269	1567	608	594	15156.8	70.1603	482962.8	286562		
	4774.4	1574	3291425	1567	607	595	15200.6	70.1603	482993.6	286593		
	4730.6	1574	3233765	1567	606	596	15244.4	70.1603	483024.4	286623		
	4686.8	1574	3224155	1567	605	597	15288.2	51.3617	483055.2	286654		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	4643	1567	2216066	1568.333	604	598	15332	51.3617	483086	286685		
	4599.2	1571	2205495	1571.333	603	599	15375.8	51.3617	483116.8	286716		
	4568.2	1577	2187236	1574.333	602	599	15406.8	51.3617	483116.8	286747		
	4537.2	1579	2185314	1576	601	599	15437.8	51.3617	483116.8	286777		
	4506.2	1579	2183392	1576	600	599	15468.8	51.3617	483116.8	286808		
	4462.4	1579	2175704	1576	599	600	15512.6	34.7534	483147.6	286839		
	4418.6	1580	2168977	1576	598	599	15556.4	34.7534	483116.8	286870		
	4387.6	1576	2166094	1577	598	598	15587.4	34.7534	483086	286870		
	4356.6	1579	2160328	1580.333	598	597	15618.4	34.7534	483055.2	286870		
	4312.8	1587	2149757	1583.667	597	596	15662.2	34.7534	483024.4	286900		
	4281.8	1586	2105551	1586.333	596	596	15693.2	34.7534	483024.4	286931		
	4238	1587	2102668	1586.667	595	597	15737	34.7534	483055.2	286962		
	4207	1587	2098824	1588.333	594	597	15768	27.8979	483055.2	286993		
	4163.2	1593	2084409	1589.667	593	596	15811.8	27.8979	483024.4	287024		
	4132.2	1592	2083448	1591	592	596	15842.8	27.8979	483024.4	287054		
	4088.4	1597	2069994	1591	591	597	15886.6	27.8979	483055.2	287085		
	4044.6	1596	2069033	1591	590	596	15930.4	27.8979	483024.4	287116		
	4013.6	1591	1873950	1591	589	596	15961.4	27.8979	483024.4	287147		
	3969.8	1591	1868184	1592.667	588	597	16005.2	8.42513	483055.2	287178		
	3938.8	1596	1865301	1594.333	587	597	16036.2	8.42513	483055.2	287208		
	3895	1596	1862418	1597.333	586	598	16080	8.42513	483086	287239		
	3851.2	1608	1842237	1598.667	585	599	16123.8	8.42513	483116.8	287270		
	3807.4	1609	1841276	1600	584	600	16167.6	8.42513	483147.6	287301		
	3763.6	1608	1839354	1600	583	601	16211.4	8.42513	483178.4	287332		
	3719.8	1602	1794187	1600	582	600	16255.2	6.23078	483147.6	287362		
	3688.8	1600	1780733	1600	581	600	16286.2	6.23078	483147.6	287393		
	3657.8	1611	1779772	1600	580	600	16317.2	6.23078	483147.6	287424		
	3614	1611	1777850	1600	579	599	16361	6.23078	483116.8	287455		
	3583	1613	1692321	1600	578	599	16392	6.23078	483116.8	287486		
	3539.2	1610	1689438	1600	577	600	16435.8	6.23078	483147.6	287516		
	3495.4	1611	1677906	1600	576	601	16479.6	6.23078	483178.4	287547		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	3451.6	1605	1663491	1600	575	602	16523.4	0	483209.2	287578		
	3420.6	1608	1659647	1600	574	602	16554.4	0	483209.2	287609		
	3376.8	1614	1655803	1600	573	603	16598.2	0	483239.9	287640		
	3333	1610	1638505	1600	572	604	16642	0	483270.7	287670		
	3289.2	1608	1626012	1600	571	605	16685.8	0	483301.5	287701		
	3258.2	1604	1621207	1600	571	606	16716.8	0	483332.3	287701		
	3214.4	1604	1615441	1600	570	607	16760.6	0	483363.1	287732		
	3183.4	1611	1612558	1600	570	608	16791.6	0	483393.9	287732		
	3139.6	1615	1608714	1600	569	609	16835.4	0	483424.7	287763		
	3095.8	1616	1602948	1600	568	608	16879.2	0	483393.9	287794		
	3064.8	1616	1599104	1600	567	608	16910.2	0	483393.9	287824		
	3033.8	1612	1578923	1600	566	608	16941.2	0	483393.9	287855		
	2990	1616	1575079	1600	565	607	16985	0	483363.1	287886		
	2946.2	1613	1572196	1600	564	606	17028.8	0	483332.3	287917		
	2915.2	1616	1432851	1600	564	605	17059.8	0	483301.5	287917		
	2871.4	1612	1422280	1600	565	604	17103.6	0	483270.7	287886		
	2827.6	1604	1405943	1600	566	603	17147.4	0	483239.9	287855		
	2783.8	1606	1392489	1600	567	602	17191.2	0	483209.2	287824		
	2752.8	1605	1384801	1600	567	601	17222.2	0	483178.4	287824		
	2721.8	1610	1383840	1600	567	600	17253.2	0	483147.6	287824		
	2690.8	1606	1379035	1600	567	599	17284.2	0	483116.8	287824		
	2659.8	1608	1377113	1600	567	598	17315.2	0	483086	287824		
	2628.8	1606	1374230	1600	567	597	17346.2	0	483055.2	287824		
	2597.8	1603	1370386	1600	567	596	17377.2	0	483024.4	287824		
	2566.8	1613	1348283	1600	567	595	17408.2	0	482993.6	287824		
	2535.8	1605	1347322	1600	567	594	17439.2	0	482962.8	287824		
	2504.8	1609	1344439	1600	567	593	17470.2	0	482932	287824		
	2473.8	1613	1342517	1600	567	592	17501.2	0	482901.2	287824		
	2430	1617	1335790	1600	568	591	17545	0	482870.4	287794		
	2386.2	1617	1334829	1600	569	590	17588.8	0	482839.6	287763		
	2355.2	1613	1255066	1600	569	589	17619.8	0	482808.8	287763		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	2311.4	1610	1242573	1600	568	588	17663.6	0	482778	287794		
	2267.6	1603	1231041	1600	567	587	17707.4	0	482747.2	287824		
	2223.8	1600	1212782	1601.333	566	586	17751.2	0	482716.4	287855		
	2192.8	1614	1185874	1602.667	565	586	17782.2	0	482716.4	287886		
	2149	1616	1181069	1604	564	587	17826	0	482747.2	287917		
	2105.2	1616	1079203	1604	563	588	17869.8	0	482778	287948		
	2061.4	1613	1074398	1604	564	589	17913.6	0	482808.8	287917		
	2017.6	1616	1067671	1604	563	590	17957.4	0	482839.6	287948		
	1986.6	1614	1063827	1604	562	590	17988.4	0	482839.6	287978		
	1942.8	1615	1055178	1604	561	591	18032.2	0	482870.4	288009		
	1911.8	1615	1045568	1604	560	591	18063.2	0	482870.4	288040		
	1880.8	1614	817811	1604	559	591	18094.2	0	482870.4	288071		
	1849.8	1616	800513	1604	558	591	18125.2	0	482870.4	288101		
	1806	1620	797630	1604	557	590	18169	0	482839.6	288132		
	1775	1618	796669	1604	556	590	18200	0	482839.6	288163		
	1731.2	1617	794747	1604	555	589	18243.8	14.628	482808.8	288194		
	1687.4	1612	692881	1604	554	588	18287.6	14.628	482778	288225		
	1643.6	1612	674622	1604	553	587	18331.4	14.628	482747.2	288255		
	1599.8	1615	653480	1604	552	586	18375.2	14.628	482716.4	288286		
	1568.8	1611	533355	1604	551	586	18406.2	14.628	482716.4	288317		
	1537.8	1608	532394	1604	550	586	18437.2	14.628	482716.4	288348		
	1506.8	1604	531433	1604.667	549	586	18468.2	14.628	482716.4	288379		
	1475.8	1606	530472	1605.333	548	586	18499.2	14.628	482716.4	288409		
	1444.8	1606	529511	1606.333	547	586	18530.2	14.628	482716.4	288440		
	1413.8	1607	528550	1608.333	546	586	18561.2	14.628	482716.4	288471		
	1382.8	1613	527589	1610.333	545	586	18592.2	14.628	482716.4	288502		
	1351.8	1619	526628	1612	544	586	18623.2	14.628	482716.4	288533		
	1320.8	1612	525667	1612.333	543	586	18654.2	14.628	482716.4	288563		
	1289.8	1613	524706	1614.667	542	586	18685.2	14.628	482716.4	288594		
	1246	1625	517018	1617	541	587	18729	14.628	482747.2	288625		
	1202.2	1623	516057	1619	540	588	18772.8	12.3135	482778	288656		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	1158.4	1623	477617	1619	539	589	18816.6	12.3135	482808.8	288687		
	1127.4	1625	463202	1619	538	589	18847.6	12.3135	482808.8	288717		
	1096.4	1622	462241	1619	537	589	18878.6	12.3135	482808.8	288748		
	1065.4	1619	461280	1622.333	536	589	18909.6	12.3135	482808.8	288779		
	1021.6	1634	455514	1625.667	535	590	18953.4	12.3135	482839.6	288810		
	977.8	1634	453592	1629	534	591	18997.2	9.50988	482870.4	288841		
	934	1638	436294	1629	533	592	19041	9.50988	482901.2	288871		
	890.2	1634	433411	1629	532	593	19084.8	9.50988	482932	288902		
	859.2	1631	221030	1629	532	594	19115.8	9.50988	482962.8	288902		
	815.4	1638	209498	1629	533	595	19159.6	9.50988	482993.6	288871		
	771.6	1632	196044	1629	534	596	19203.4	9.50988	483024.4	288841		
	727.8	1634	169136	1629	535	597	19247.2	1.13541	483055.2	288810		
	696.8	1634	162409	1629	535	598	19278.2	1.13541	483086	288810		
	665.8	1633	161448	1629	535	599	19309.2	1.13541	483116.8	288810		
	622	1636	155682	1629	536	600	19353	1.13541	483147.6	288779		
	578.2	1630	86490	1629	537	601	19396.8	1.13541	483178.4	288748		
	534.4	1637	64387	1629	536	602	19440.6	1.13541	483209.2	288779		
	503.4	1631	63426	1629	536	603	19471.6	1.13541	483239.9	288779		
	472.4	1630	61504	1629	536	604	19502.6	1.13541	483270.7	288779		
	441.4	1630	58621	1629	536	605	19533.6	1.13541	483301.5	288779		
	410.4	1629	55738	1630.667	536	606	19564.6	1.13541	483332.3	288779		
	366.6	1637	47089	1632.333	535	607	19608.4	1.13541	483363.1	288810		
	335.6	1637	45167	1634	535	608	19639.4	1.13541	483393.9	288810		
	304.6	1638	43245	1634	535	609	19670.4	1.13541	483424.7	288810		
	273.6	1637	41323	1634	535	610	19701.4	1.13541	483455.5	288810		
	229.8	1636	35557	1634	534	611	19745.2	1.13541	483486.3	288841		
	198.8	1637	33635	1634	534	612	19776.2	1.13541	483517.1	288841		
	167.8	1638	31713	1634	534	613	19807.2	1.13541	483547.9	288841		
	136.8	1634	23064	1635	534	614	19838.2	1.13541	483578.7	288841		
	105.8	1639	21142	1636	534	615	19869.2	1.13541	483609.5	288841		
	74.8	1637	19220	1637.333	534	616	19900.2	1.13541	483640.3	288841		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 3												
	43.8	1640	11532	1637.667	534	617	19931.2	1.13541	483671.1	288841		
	0	1638	5766	1638	535	618	19975	1.13541	483701.9	288810		
South 5												
	21280.2	894	4805	894	1084	552	0	0	481669.4	271903	35481.34	0.45161
	21249.2	894	4.8E+07	895.6667	1084	553	31	13.1324	481700.2	271903	89125.09	0.07344
	21218.2	900	4.8E+07	897.3333	1083	553	62	13.1324	481700.2	271934	141253.8	0.03897
	21187.2	901	4.8E+07	899	1082	553	93	13.1324	481700.2	271965	223872.1	0.12869
	21156.2	899	4.8E+07	899.3333	1081	553	124	13.1324	481700.2	271996	707945.8	0.01086
	21125.2	900	4.8E+07	901	1080	553	155	13.1324	481700.2	272027	2818383	0.00303
	21094.2	906	4.8E+07	902.6667	1079	553	186	13.1324	481700.2	272057	4466836	0.0159
	21050.4	913	4.8E+07	904	1078	554	229.8	13.1324	481731	272088	7079458	0.00743
	21019.4	906	4.8E+07	904	1077	554	260.8	13.1324	481731	272119	8912509	0.02948
	20975.6	909	4.8E+07	904	1076	553	304.6	13.1324	481700.2	272150	11220185	0.05053
	20944.6	908	4.8E+07	904	1075	553	335.6	13.1324	481700.2	272181	14125375	0.0301
	20913.6	913	4.8E+07	904	1074	553	366.6	13.1324	481700.2	272211	17782794	0.03405
	20882.6	911	4.8E+07	904	1073	553	397.6	13.1324	481700.2	272242	22387211	0.0919
	20851.6	911	4.8E+07	904	1072	553	428.6	13.1324	481700.2	272273	28183829	0.54722
	20820.6	909	4.8E+07	904	1071	553	459.6	13.1324	481700.2	272304	35481339	0.15015
	20789.6	908	4.8E+07	904	1070	553	490.6	13.1324	481700.2	272335	44668359	0.02086
	20758.6	907	4.8E+07	904	1069	553	521.6	13.1324	481700.2	272365		
	20727.6	908	4.8E+07	904	1068	553	552.6	0	481700.2	272396		
	20683.8	917	4.8E+07	904	1067	552	596.4	0	481669.4	272427		
	20640	915	4.8E+07	904	1066	551	640.2	0	481638.6	272458		
	20596.2	907	4.8E+07	904	1065	550	684	0	481607.8	272489		
	20552.4	915	4.8E+07	904	1064	551	727.8	0	481638.6	272519		
	20508.6	915	4.8E+07	904	1063	552	771.6	89.7789	481669.4	272550		
	20477.6	913	4.8E+07	904	1062	552	802.6	89.7789	481669.4	272581		
	20433.8	917	4.8E+07	904	1061	551	846.4	89.7789	481638.6	272612		
	20402.8	912	4.8E+07	904	1060	551	877.4	89.7789	481638.6	272642		
	20371.8	918	4.8E+07	904	1059	551	908.4	89.7789	481638.6	272673		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	20340.8	917	4.8E+07	904	1058	551	939.4	89.7789	481638.6	272704		
	20309.8	919	4.8E+07	904	1057	551	970.4	89.7789	481638.6	272735		
	20266	920	4.5E+07	904	1056	550	1014.2	89.7789	481607.8	272766		
	20222.2	918	4.5E+07	904	1055	549	1058	89.7789	481577	272796		
	20178.4	906	4.5E+07	904	1054	548	1101.8	89.7789	481546.2	272827		
	20147.4	904	4.5E+07	904	1053	548	1132.8	89.7789	481546.2	272858		
	20116.4	904	4.5E+07	904.3333	1052	548	1163.8	89.7789	481546.2	272889		
	20085.4	906	4.5E+07	904.6667	1051	548	1194.8	89.7789	481546.2	272920		
	20054.4	907	4.5E+07	905	1050	548	1225.8	89.7789	481546.2	272950		
	20023.4	913	4.5E+07	905	1049	548	1256.8	89.7789	481546.2	272981		
	19992.4	919	4.5E+07	905	1048	548	1287.8	89.7789	481546.2	273012		
	19961.4	905	4.5E+07	905.3333	1047	548	1318.8	58.9406	481546.2	273043		
	19917.6	906	4.4E+07	908.3333	1046	547	1362.6	58.9406	481515.4	273074		
	19886.6	915	4.4E+07	911.3333	1046	546	1393.6	58.9406	481484.6	273074		
	19855.6	926	4.4E+07	914	1046	545	1424.6	58.9406	481453.9	273074		
	19811.8	926	4.4E+07	914	1045	544	1468.4	58.9406	481423.1	273104		
	19780.8	925	4.4E+07	914	1045	543	1499.4	58.9406	481392.3	273104		
	19737	924	4.4E+07	914	1044	542	1543.2	58.9406	481361.5	273135		
	19693.2	918	4.4E+07	914	1043	541	1587	34.6247	481330.7	273166		
	19649.4	914	4.4E+07	914	1042	540	1630.8	34.6247	481299.9	273197		
	19605.6	914	4.4E+07	914.3333	1041	539	1674.6	34.6247	481269.1	273228		
	19574.6	916	3.5E+07	914.6667	1040	539	1705.6	34.6247	481269.1	273258		
	19543.6	920	3.5E+07	915	1039	539	1736.6	34.6247	481269.1	273289		
	19512.6	915	3.5E+07	915.3333	1038	539	1767.6	34.6247	481269.1	273320		
	19481.6	920	3.5E+07	915.6667	1037	539	1798.6	30.9826	481269.1	273351		
	19450.6	921	3.5E+07	916	1036	539	1829.6	30.9826	481269.1	273382		
	19419.6	924	3.5E+07	916	1035	539	1860.6	30.9826	481269.1	273412		
	19388.6	924	3.5E+07	916	1034	539	1891.6	30.9826	481269.1	273443		
	19344.8	920	3.5E+07	916	1033	538	1935.4	30.9826	481238.3	273474		
	19301	925	3.5E+07	916	1032	539	1979.2	30.9826	481269.1	273505		
	19257.2	925	3.5E+07	916	1031	540	2023	30.9826	481299.9	273536		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	19213.4	923	3.5E+07	916	1030	541	2066.8	125.43	481330.7	273566		
	19169.6	916	3.5E+07	918	1029	542	2110.6	125.43	481361.5	273597		
	19125.8	922	3.5E+07	921.3333	1028	543	2154.4	125.43	481392.3	273628		
	19094.8	926	3.5E+07	926.3333	1027	543	2185.4	125.43	481392.3	273659		
	19051	932	3.5E+07	929.3333	1026	542	2229.2	125.43	481361.5	273690		
	19007.2	935	3.5E+07	931	1025	541	2273	125.43	481330.7	273720		
	18963.4	931	3.5E+07	931.3333	1024	542	2316.8	125.43	481361.5	273751		
	18919.6	933	3.5E+07	931.6667	1023	543	2360.6	125.43	481392.3	273782		
	18875.8	935	3.5E+07	932	1022	544	2404.4	125.43	481423.1	273813		
	18844.8	939	3.5E+07	932	1022	545	2435.4	125.43	481453.9	273813		
	18813.8	938	3.5E+07	932	1022	546	2466.4	125.43	481484.6	273813		
	18770	934	3.5E+07	932	1021	547	2510.2	125.43	481515.4	273843		
	18726.2	932	3.5E+07	933.3333	1020	548	2554	104.487	481546.2	273874		
	18695.2	937	3.5E+07	934.6667	1019	548	2585	104.487	481546.2	273905		
	18664.2	936	3.5E+07	936.6667	1018	548	2616	104.487	481546.2	273936		
	18633.2	938	3.5E+07	938	1017	548	2647	104.487	481546.2	273967		
	18602.2	940	3.5E+07	941.6667	1016	548	2678	104.487	481546.2	273997		
	18558.4	947	3.5E+07	944.6667	1015	549	2721.8	104.487	481577	274028		
	18514.6	949	3.5E+07	947	1014	550	2765.6	104.487	481607.8	274059		
	18483.6	954	3.5E+07	947	1013	550	2796.6	104.487	481607.8	274090		
	18439.8	962	3.5E+07	947	1012	551	2840.4	104.487	481638.6	274121		
	18408.8	962	3.5E+07	947	1011	551	2871.4	104.487	481638.6	274151		
	18365	962	3.4E+07	947	1010	552	2915.2	104.487	481669.4	274182		
	18321.2	955	3.4E+07	947	1009	553	2959	104.487	481700.2	274213		
	18277.4	950	3.4E+07	947	1008	554	3002.8	104.487	481731	274244		
	18246.4	947	3.4E+07	947.6667	1007	554	3033.8	104.487	481731	274275		
	18215.4	949	3.4E+07	949	1006	554	3064.8	255.124	481731	274305		
	18184.4	951	3.4E+07	951.6667	1005	554	3095.8	255.124	481731	274336		
	18153.4	957	3.4E+07	953.6667	1004	554	3126.8	255.124	481731	274367		
	18122.4	958	3.4E+07	955	1003	554	3157.8	255.124	481731	274398		
	18091.4	955	3.4E+07	955.3333	1002	554	3188.8	255.124	481731	274429		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	18060.4	956	3.4E+07	958.6667	1001	554	3219.8	255.124	481731	274459		
	18016.6	965	3.4E+07	965.6667	1000	555	3263.6	255.124	481761.8	274490		
	17972.8	976	3.4E+07	973	999	556	3307.4	195.775	481792.6	274521		
	17929	981	3.4E+07	977.3333	998	557	3351.2	195.775	481823.4	274552		
	17898	978	3.4E+07	978	997	557	3382.2	195.775	481823.4	274583		
	17867	978	3.4E+07	978	996	557	3413.2	195.775	481823.4	274613		
	17836	979	3.4E+07	978	995	557	3444.2	195.775	481823.4	274644		
	17805	983	3.4E+07	978	994	557	3475.2	195.775	481823.4	274675		
	17761.2	983	3.4E+07	978	993	558	3519	195.775	481854.2	274706		
	17717.4	978	3.4E+07	978.3333	992	559	3562.8	147.001	481885	274737		
	17673.6	979	3.4E+07	979	991	560	3606.6	147.001	481915.8	274767		
	17642.6	980	3.4E+07	980.6667	991	561	3637.6	147.001	481946.6	274767		
	17611.6	983	3.4E+07	982.3333	991	562	3668.6	147.001	481977.4	274767		
	17567.8	984	3.4E+07	988	990	563	3712.4	147.001	482008.2	274798		
	17524	997	3.4E+07	992.6667	989	562	3756.2	147.001	481977.4	274829		
	17493	1002	3.4E+07	997	988	562	3787.2	147.001	481977.4	274860		
	17462	1006	3.4E+07	997	987	562	3818.2	165.995	481977.4	274891		
	17418.2	1005	3.4E+07	997	986	561	3862	165.995	481946.6	274921		
	17387.2	1001	3.4E+07	997	985	561	3893	165.995	481946.6	274952		
	17343.4	1003	3.4E+07	997	984	562	3936.8	165.995	481977.4	274983		
	17312.4	1000	3.4E+07	997	983	562	3967.8	165.995	481977.4	275014		
	17281.4	997	3.4E+07	997	982	562	3998.8	165.995	481977.4	275044		
	17250.4	997	3.4E+07	999.3333	981	562	4029.8	165.995	481977.4	275075		
	17219.4	1004	3.4E+07	1002.333	980	562	4060.8	217.145	481977.4	275106		
	17188.4	1006	3.4E+07	1005.333	979	562	4091.8	217.145	481977.4	275137		
	17144.6	1011	3.4E+07	1006	978	561	4135.6	217.145	481946.6	275168		
	17113.6	1008	3.4E+07	1006	977	561	4166.6	217.145	481946.6	275198		
	17082.6	1006	3.4E+07	1007.333	976	561	4197.6	217.145	481946.6	275229		
	17038.8	1010	3.4E+07	1012.667	975	562	4241.4	217.145	481977.4	275260		
	16995	1022	3.4E+07	1018.333	974	563	4285.2	217.145	482008.2	275291		
	16951.2	1023	3.4E+07	1025	973	564	4329	270.016	482039	275322		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	16907.4	1030	3.4E+07	1028.333	972	565	4372.8	270.016	482069.7	275352		
	16863.6	1032	3.4E+07	1032	971	566	4416.6	270.016	482100.5	275383		
	16819.8	1037	3.3E+07	1033.333	970	567	4460.4	270.016	482131.3	275414		
	16776	1034	3.3E+07	1039.333	969	568	4504.2	270.016	482162.1	275445		
	16732.2	1050	3.3E+07	1047.667	968	569	4548	270.016	482192.9	275476		
	16701.2	1066	3.3E+07	1056	967	569	4579	268.105	482192.9	275506		
	16657.4	1075	3.3E+07	1059	966	570	4622.8	268.105	482223.7	275537		
	16626.4	1079	3.3E+07	1059	965	570	4653.8	268.105	482223.7	275568		
	16582.6	1073	3.3E+07	1059	964	571	4697.6	268.105	482254.5	275599		
	16538.8	1079	3.3E+07	1059	963	572	4741.4	268.105	482285.3	275630		
	16495	1071	3.3E+07	1059	962	573	4785.2	268.105	482316.1	275660		
	16451.2	1072	3.3E+07	1059	961	574	4829	321.397	482346.9	275691		
	16407.4	1059	3.3E+07	1061	960	575	4872.8	321.397	482377.7	275722		
	16376.4	1065	3.3E+07	1068.667	959	575	4903.8	321.397	482377.7	275753		
	16332.6	1082	3.3E+07	1078.667	958	576	4947.6	321.397	482408.5	275784		
	16288.8	1092	3.3E+07	1086.667	957	577	4991.4	321.397	482439.3	275814		
	16245	1095	3.3E+07	1089	956	578	5035.2	321.397	482470.1	275845		
	16214	1089	3.3E+07	1090.667	956	579	5066.2	345.437	482500.9	275845		
	16183	1094	3.3E+07	1092.333	956	580	5097.2	345.437	482531.7	275845		
	16139.2	1098	3.3E+07	1094	955	581	5141	345.437	482562.5	275876		
	16095.4	1097	3.2E+07	1094	954	580	5184.8	345.437	482531.7	275907		
	16064.4	1094	3.2E+07	1099.333	953	580	5215.8	345.437	482531.7	275938		
	16033.4	1114	3.2E+07	1104.667	952	580	5246.8	345.437	482531.7	275968		
	16002.4	1129	3.2E+07	1110	951	580	5277.8	345.437	482531.7	275999		
	15971.4	1125	3.2E+07	1110	950	580	5308.8	180.884	482531.7	276030		
	15927.6	1130	3.2E+07	1110	949	581	5352.6	180.884	482562.5	276061		
	15883.8	1131	3.2E+07	1110	948	582	5396.4	180.884	482593.3	276092		
	15852.8	1124	3.2E+07	1110	947	582	5427.4	180.884	482593.3	276122		
	15809	1120	3.2E+07	1110	946	583	5471.2	180.884	482624.1	276153		
	15765.2	1121	3.2E+07	1110	945	584	5515	180.884	482654.8	276184		
	15721.4	1122	3.2E+07	1110	944	585	5558.8	159.775	482685.6	276215		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	15677.6	1113	3.2E+07	1110	943	586	5602.6	159.775	482716.4	276245		
	15633.8	1110	3.2E+07	1113.667	942	587	5646.4	159.775	482747.2	276276		
	15602.8	1121	3.2E+07	1118.333	941	587	5677.4	159.775	482747.2	276307		
	15571.8	1129	3.2E+07	1123	940	587	5708.4	159.775	482747.2	276338		
	15540.8	1130	3.2E+07	1124	939	587	5739.4	159.775	482747.2	276369		
	15509.8	1130	3.2E+07	1124	938	587	5770.4	159.775	482747.2	276399		
	15478.8	1126	3.2E+07	1124	937	587	5801.4	772.515	482747.2	276430		
	15435	1124	3.2E+07	1124.333	936	586	5845.2	772.515	482716.4	276461		
	15404	1125	3.2E+07	1126.333	935	586	5876.2	772.515	482716.4	276492		
	15373	1130	3.2E+07	1128.333	934	586	5907.2	772.515	482716.4	276523		
	15342	1130	3.2E+07	1136.333	933	586	5938.2	772.515	482716.4	276553		
	15311	1149	3.2E+07	1150	932	586	5969.2	772.515	482716.4	276584		
	15280	1171	3.2E+07	1171.333	931	586	6000.2	772.515	482716.4	276615		
	15249	1194	3.2E+07	1186.667	930	586	6031.2	772.515	482716.4	276646		
	15205.2	1225	3.2E+07	1194.667	929	587	6075	712.162	482747.2	276677		
	15174.2	1240	3.2E+07	1195	928	587	6106	712.162	482747.2	276707		
	15130.4	1273	3.2E+07	1195	927	588	6149.8	712.162	482778	276738		
	15086.6	1294	3.2E+07	1195	926	589	6193.6	712.162	482808.8	276769		
	15042.8	1290	3.2E+07	1195	925	590	6237.4	712.162	482839.6	276800		
	14999	1266	2.7E+07	1195	924	591	6281.2	712.162	482870.4	276831		
	14955.2	1241	2.7E+07	1195	923	592	6325	241.626	482901.2	276861		
	14911.4	1209	2.7E+07	1195	922	593	6368.8	241.626	482932	276892		
	14867.6	1195	2.7E+07	1197	921	594	6412.6	241.626	482962.8	276923		
	14823.8	1201	2.7E+07	1202.667	920	595	6456.4	241.626	482993.6	276954		
	14780	1212	2.7E+07	1208.667	919	596	6500.2	241.626	483024.4	276985		
	14749	1213	2.4E+07	1217.333	919	597	6531.2	241.626	483055.2	276985		
	14718	1227	2.4E+07	1222.333	919	598	6562.2	399.348	483086	276985		
	14687	1227	2.4E+07	1232	919	599	6593.2	399.348	483116.8	276985		
	14656	1242	2.4E+07	1241.333	919	600	6624.2	399.348	483147.6	276985		
	14625	1256	2.4E+07	1250.667	919	601	6655.2	399.348	483178.4	276985		
	14594	1255	2.4E+07	1257.333	919	602	6686.2	399.348	483209.2	276985		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	14563	1262	2.4E+07	1262.667	919	603	6717.2	399.348	483239.9	276985		
	14532	1271	2.4E+07	1268.667	919	604	6748.2	399.348	483270.7	276985		
	14501	1278	2.4E+07	1272.333	919	605	6779.2	399.348	483301.5	276985		
	14470	1290	2.4E+07	1273	919	606	6810.2	397.983	483332.3	276985		
	14439	1294	2.4E+07	1273	919	607	6841.2	397.983	483363.1	276985		
	14408	1291	2.4E+07	1273	919	608	6872.2	397.983	483393.9	276985		
	14377	1288	2.4E+07	1273	919	609	6903.2	397.983	483424.7	276985		
	14333.2	1291	2.4E+07	1273	918	610	6947	397.983	483455.5	277015		
	14289.4	1286	2.4E+07	1273	917	611	6990.8	397.983	483486.3	277046		
	14245.6	1277	2.4E+07	1273	916	612	7034.6	397.983	483517.1	277077		
	14201.8	1273	2.4E+07	1276.333	915	613	7078.4	142.702	483547.9	277108		
	14158	1294	2.4E+07	1279.667	914	614	7122.2	142.702	483578.7	277139		
	14127	1289	2.4E+07	1283	914	615	7153.2	142.702	483609.5	277139		
	14096	1288	2.4E+07	1283	914	616	7184.2	142.702	483640.3	277139		
	14052.2	1290	2.4E+07	1283	913	617	7228	142.702	483671.1	277169		
	14021.2	1283	2.4E+07	1286.667	913	618	7259	142.702	483701.9	277169		
	13977.4	1294	2.4E+07	1290.667	912	619	7302.8	220.522	483732.7	277200		
	13946.4	1295	2.4E+07	1295.333	911	619	7333.8	220.522	483732.7	277231		
	13915.4	1300	2.4E+07	1296.333	910	619	7364.8	220.522	483732.7	277262		
	13884.4	1297	2.4E+07	1298	909	619	7395.8	220.522	483732.7	277293		
	13840.6	1300	2.4E+07	1302.333	908	620	7439.6	220.522	483763.5	277323		
	13796.8	1310	2.4E+07	1308.333	907	621	7483.4	220.522	483794.3	277354		
	13753	1315	2.4E+07	1317	906	622	7527.2	220.522	483825.1	277385		
	13722	1326	2.4E+07	1322.333	905	622	7558.2	175.569	483825.1	277416		
	13678.2	1328	2.4E+07	1326	904	621	7602	175.569	483794.3	277446		
	13634.4	1327	2.4E+07	1326	903	622	7645.8	175.569	483825.1	277477		
	13590.6	1331	2.4E+07	1326	902	623	7689.6	175.569	483855.8	277508		
	13559.6	1330	2.4E+07	1326	902	624	7720.6	175.569	483886.6	277508		
	13515.8	1329	2.4E+07	1326	901	625	7764.4	175.569	483917.4	277539		
	13484.8	1330	2.3E+07	1326	900	625	7795.4	175.569	483917.4	277570		
	13453.8	1331	2.3E+07	1326	899	625	7826.4	46.122	483917.4	277600		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	13410	1330	2.3E+07	1326	898	626	7870.2	46.122	483948.2	277631		
	13379	1330	2.3E+07	1326	897	626	7901.2	46.122	483948.2	277662		
	13335.2	1329	2.3E+07	1326	896	627	7945	46.122	483979	277693		
	13291.4	1339	2.3E+07	1326	895	628	7988.8	46.122	484009.8	277724		
	13247.6	1341	2.3E+07	1326	894	629	8032.6	46.122	484040.6	277754		
	13203.8	1349	2.3E+07	1326	893	630	8076.4	0	484071.4	277785		
	13160	1351	2.3E+07	1326	892	631	8120.2	0	484102.2	277816		
	13116.2	1355	2.3E+07	1326	891	632	8164	0	484133	277847		
	13072.4	1349	2.3E+07	1326	890	633	8207.8	0	484163.8	277878		
	13028.6	1351	2.3E+07	1326	889	634	8251.6	0	484194.6	277908		
	12984.8	1354	2.3E+07	1326	888	635	8295.4	131.882	484225.4	277939		
	12941	1348	2.3E+07	1326	887	636	8339.2	131.882	484256.2	277970		
	12897.2	1349	2.3E+07	1326	886	637	8383	131.882	484287	278001		
	12853.4	1345	2.3E+07	1326	885	638	8426.8	131.882	484317.8	278032		
	12809.6	1348	2.3E+07	1326	884	639	8470.6	131.882	484348.6	278062		
	12778.6	1347	2.3E+07	1326	884	640	8501.6	131.882	484379.4	278062		
	12747.6	1335	2.3E+07	1326	884	641	8532.6	131.882	484410.2	278062		
	12703.8	1329	2.3E+07	1326	883	642	8576.4	131.882	484440.9	278093		
	12660	1330	2.3E+07	1326	882	643	8620.2	131.882	484471.7	278124		
	12629	1337	2.2E+07	1326	882	644	8651.2	131.882	484502.5	278124		
	12598	1331	2.2E+07	1326	882	645	8682.2	131.882	484533.3	278124		
	12567	1326	2.2E+07	1331	882	646	8713.2	131.882	484564.1	278124		
	12523.2	1345	2.2E+07	1336	881	647	8757	131.882	484594.9	278155		
	12492.2	1349	2.2E+07	1341	881	648	8788	131.882	484625.7	278155		
	12461.2	1350	2.2E+07	1341	881	649	8819	131.882	484656.5	278155		
	12430.2	1350	2.2E+07	1341	881	650	8850	131.882	484687.3	278155		
	12386.4	1355	2.2E+07	1341	880	651	8893.8	131.882	484718.1	278186		
	12342.6	1349	2.2E+07	1341	879	652	8937.6	131.882	484748.9	278216		
	12298.8	1349	2.2E+07	1341	878	653	8981.4	131.882	484779.7	278247		
	12255	1355	2.2E+07	1341	877	654	9025.2	131.882	484810.5	278278		
	12211.2	1341	2.2E+07	1341.667	876	655	9069	298.113	484841.3	278309		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	12167.4	1343	2.2E+07	1345.667	875	656	9112.8	298.113	484872.1	278340		
	12136.4	1353	2.2E+07	1355.333	874	656	9143.8	298.113	484872.1	278370		
	12092.6	1376	2.2E+07	1364.333	873	657	9187.6	298.113	484902.9	278401		
	12048.8	1374	2.2E+07	1370	872	658	9231.4	298.113	484933.7	278432		
	12005	1376	2.2E+07	1370	871	659	9275.2	298.113	484964.5	278463		
	11961.2	1376	2.2E+07	1370	870	660	9319	202.911	484995.3	278494		
	11930.2	1374	2.2E+07	1370	869	660	9350	202.911	484995.3	278524		
	11886.4	1370	2.2E+07	1374	868	661	9393.8	202.911	485026	278555		
	11842.6	1387	2.2E+07	1378	867	662	9437.6	202.911	485056.8	278586		
	11798.8	1389	2.2E+07	1382	866	663	9481.4	202.911	485087.6	278617		
	11755	1392	2.1E+07	1382	865	664	9525.2	202.911	485118.4	278647		
	11711.2	1398	1.9E+07	1382	864	665	9569	63.9847	485149.2	278678		
	11680.2	1394	1.9E+07	1382	863	665	9600	63.9847	485149.2	278709		
	11649.2	1392	1.9E+07	1382	862	665	9631	63.9847	485149.2	278740		
	11618.2	1383	1.9E+07	1382	861	665	9662	63.9847	485149.2	278771		
	11574.4	1398	1.9E+07	1382	860	666	9705.8	63.9847	485180	278801		
	11543.4	1390	1.9E+07	1382	859	666	9736.8	63.9847	485180	278832		
	11499.6	1391	1.9E+07	1382	858	667	9780.6	63.9847	485210.8	278863		
	11455.8	1390	1.9E+07	1382	857	668	9824.4	23.2789	485241.6	278894		
	11412	1382	1.9E+07	1383.667	856	669	9868.2	23.2789	485272.4	278925		
	11368.2	1389	1.9E+07	1385.333	855	670	9912	23.2789	485303.2	278955		
	11324.4	1396	1.9E+07	1387	854	671	9955.8	23.2789	485334	278986		
	11280.6	1393	1.9E+07	1387	853	672	9999.6	23.2789	485364.8	279017		
	11236.8	1391	1.9E+07	1387	852	673	10043.4	23.2789	485395.6	279048		
	11193	1395	1.9E+07	1387	851	674	10087.2	23.2789	485426.4	279079		
	11149.2	1394	1.9E+07	1387	850	675	10131	23.2789	485457.2	279109		
	11105.4	1390	1.9E+07	1387	849	676	10174.8	23.2789	485488	279140		
	11061.6	1387	1.8E+07	1388	848	677	10218.6	23.2789	485518.8	279171		
	11017.8	1391	1.8E+07	1389	847	678	10262.4	23.2789	485549.6	279202		
	10974	1396	1.8E+07	1390	846	679	10306.2	7.89618	485580.4	279233		
	10943	1395	1.8E+07	1390	846	680	10337.2	7.89618	485611.1	279233		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	10912	1395	1.8E+07	1390	846	681	10368.2	7.89618	485641.9	279233		
	10868.2	1397	1.8E+07	1390	845	682	10412	7.89618	485672.7	279263		
	10824.4	1395	1.8E+07	1390	844	683	10455.8	7.89618	485703.5	279294		
	10780.6	1390	1.8E+07	1390	843	684	10499.6	7.89618	485734.3	279325		
	10736.8	1394	1.8E+07	1390	842	685	10543.4	7.89618	485765.1	279356		
	10693	1392	1.8E+07	1390	841	686	10587.2	7.89618	485795.9	279387		
	10649.2	1395	1.8E+07	1390	840	687	10631	7.89618	485826.7	279417		
	10618.2	1393	1.8E+07	1390	840	688	10662	7.89618	485857.5	279417		
	10587.2	1392	1.8E+07	1390	840	689	10693	7.89618	485888.3	279417		
	10556.2	1394	1.8E+07	1390	840	690	10724	7.89618	485919.1	279417		
	10512.4	1396	1.8E+07	1390	839	691	10767.8	7.89618	485949.9	279448		
	10468.6	1393	1.8E+07	1390	838	692	10811.6	0	485980.7	279479		
	10424.8	1391	1.8E+07	1390	837	693	10855.4	0	486011.5	279510		
	10381	1390	1.8E+07	1390.333	836	694	10899.2	0	486042.3	279541		
	10337.2	1392	1.8E+07	1390.667	835	695	10943	0	486073.1	279571		
	10306.2	1391	1.8E+07	1392	835	696	10974	0	486103.9	279571		
	10275.2	1396	1.8E+07	1393	835	697	11005	0	486134.7	279571		
	10244.2	1398	1.8E+07	1394	835	698	11036	46.5255	486165.5	279571		
	10200.4	1405	1.8E+07	1394	834	699	11079.8	46.5255	486196.3	279602		
	10156.6	1407	1.8E+07	1394	833	700	11123.6	46.5255	486227	279633		
	10125.6	1410	1.8E+07	1394	832	700	11154.6	46.5255	486227	279664		
	10094.6	1407	1.7E+07	1394	831	700	11185.6	46.5255	486227	279694		
	10063.6	1405	1.7E+07	1394	830	700	11216.6	46.5255	486227	279725		
	10019.8	1407	1.7E+07	1394	829	701	11260.4	46.5255	486257.8	279756		
	9976	1401	1.7E+07	1394	828	702	11304.2	46.5255	486288.6	279787		
	9932.2	1397	1.7E+07	1394	827	703	11348	46.5255	486319.4	279818		
	9888.4	1397	1.7E+07	1394	826	704	11391.8	46.5255	486350.2	279848		
	9844.6	1396	1.7E+07	1394	825	705	11435.6	46.5255	486381	279879		
	9800.8	1394	1.7E+07	1395	824	706	11479.4	46.5255	486411.8	279910		
	9757	1397	1.7E+07	1396.333	823	707	11523.2	46.5255	486442.6	279941		
	9726	1402	1.7E+07	1397.667	822	707	11554.2	25.0342	486442.6	279972		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	9695	1398	1.7E+07	1398.667	821	707	11585.2	25.0342	486442.6	280002		
	9651.2	1406	1.7E+07	1399.333	820	708	11629	25.0342	486473.4	280033		
	9607.4	1410	1.7E+07	1400	819	709	11672.8	25.0342	486504.2	280064		
	9563.6	1406	1.7E+07	1400	818	710	11716.6	25.0342	486535	280095		
	9519.8	1403	1.7E+07	1400	817	711	11760.4	25.0342	486565.8	280126		
	9476	1400	1.7E+07	1400.667	816	712	11804.2	13.4703	486596.6	280156		
	9432.2	1405	1.5E+07	1401.333	815	713	11848	13.4703	486627.4	280187		
	9388.4	1405	1.5E+07	1402	814	714	11891.8	13.4703	486658.2	280218		
	9344.6	1402	1.5E+07	1402	813	715	11935.6	13.4703	486689	280249		
	9300.8	1409	1.5E+07	1402	812	716	11979.4	13.4703	486719.8	280280		
	9257	1408	1.5E+07	1402	811	717	12023.2	13.4703	486750.6	280310		
	9213.2	1410	1.5E+07	1402	810	718	12067	84.773	486781.4	280341		
	9169.4	1406	1.5E+07	1402	809	719	12110.8	84.773	486812.1	280372		
	9138.4	1402	1.5E+07	1402.333	809	720	12141.8	84.773	486842.9	280372		
	9094.6	1406	1.5E+07	1402.667	808	721	12185.6	84.773	486873.7	280403		
	9050.8	1410	1.5E+07	1403	807	722	12229.4	84.773	486904.5	280434		
	9007	1409	1.5E+07	1403	806	723	12273.2	84.773	486935.3	280464		
	8963.2	1403	1.5E+07	1403.333	805	724	12317	84.773	486966.1	280495		
	8919.4	1404	1.4E+07	1406.667	804	725	12360.8	84.773	486996.9	280526		
	8875.6	1414	1.4E+07	1410	803	726	12404.6	84.773	487027.7	280557		
	8831.8	1414	1.4E+07	1413	802	727	12448.4	84.773	487058.5	280588		
	8788	1413	1.4E+07	1414	801	728	12492.2	84.773	487089.3	280618		
	8757	1416	1.4E+07	1415.333	801	729	12523.2	84.773	487120.1	280618		
	8713.2	1420	1.4E+07	1416.667	800	730	12567	87.974	487150.9	280649		
	8669.4	1422	1.4E+07	1417	799	731	12610.8	87.974	487181.7	280680		
	8625.6	1417	1.4E+07	1420.667	798	732	12654.6	87.974	487212.5	280711		
	8581.8	1429	1.4E+07	1424.333	799	733	12698.4	87.974	487243.3	280680		
	8538	1428	1.4E+07	1429.333	800	734	12742.2	87.974	487274.1	280649		
	8494.2	1432	1.4E+07	1430.667	801	735	12786	87.974	487304.9	280618		
	8463.2	1433	1.4E+07	1432	801	736	12817	77.1165	487335.7	280618		
	8419.4	1433	1.4E+07	1432	802	737	12860.8	77.1165	487366.5	280588		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	8388.4	1432	1.4E+07	1432.333	802	738	12891.8	77.1165	487397.2	280588		
	8357.4	1434	1.4E+07	1432.667	802	739	12922.8	77.1165	487428	280588		
	8326.4	1433	1.4E+07	1434	802	740	12953.8	77.1165	487458.8	280588		
	8295.4	1436	1.4E+07	1435.667	802	741	12984.8	77.1165	487489.6	280588		
	8264.4	1440	1.4E+07	1437.333	802	742	13015.8	77.1165	487520.4	280588		
	8220.6	1440	1.4E+07	1438	801	743	13059.6	29.1298	487551.2	280618		
	8176.8	1438	1.4E+07	1439	800	744	13103.4	29.1298	487582	280649		
	8133	1445	1.4E+07	1440	799	745	13147.2	29.1298	487612.8	280680		
	8102	1447	1.4E+07	1441	798	745	13178.2	29.1298	487612.8	280711		
	8058.2	1442	1.4E+07	1441	797	746	13222	29.1298	487643.6	280742		
	8014.4	1444	1.4E+07	1441	796	747	13265.8	29.1298	487674.4	280772		
	7970.6	1444	1.3E+07	1441	795	748	13309.6	18.2573	487705.2	280803		
	7926.8	1447	1.3E+07	1441	794	749	13353.4	18.2573	487736	280834		
	7895.8	1447	1.3E+07	1441	793	749	13384.4	18.2573	487736	280865		
	7864.8	1446	1.3E+07	1441	792	749	13415.4	18.2573	487736	280895		
	7821	1449	1.3E+07	1441	791	750	13459.2	18.2573	487766.8	280926		
	7777.2	1441	1.3E+07	1441	790	751	13503	18.2573	487797.6	280957		
	7733.4	1441	1.3E+07	1443	789	752	13546.8	18.2573	487828.4	280988		
	7689.6	1448	1.3E+07	1445	788	753	13590.6	11.2334	487859.2	281019		
	7658.6	1449	1.3E+07	1447	787	753	13621.6	11.2334	487859.2	281049		
	7614.8	1450	1.3E+07	1447	786	754	13665.4	11.2334	487890	281080		
	7571	1451	1.3E+07	1447	785	755	13709.2	11.2334	487920.8	281111		
	7540	1449	1.3E+07	1447	784	755	13740.2	11.2334	487920.8	281142		
	7509	1449	1.3E+07	1447	783	755	13771.2	11.2334	487920.8	281173		
	7478	1449	1.3E+07	1447	782	755	13802.2	11.2334	487920.8	281203		
	7447	1452	1.3E+07	1447	781	755	13833.2	11.2334	487920.8	281234		
	7403.2	1451	1.3E+07	1447	780	756	13877	11.2334	487951.6	281265		
	7359.4	1449	1.3E+07	1447	779	757	13920.8	11.2334	487982.3	281296		
	7328.4	1457	1.3E+07	1447	778	757	13951.8	11.2334	487982.3	281327		
	7297.4	1454	1.3E+07	1447	777	757	13982.8	11.2334	487982.3	281357		
	7253.6	1458	1.3E+07	1447	776	756	14026.6	11.2334	487951.6	281388		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	7222.6	1454	1.3E+07	1447	775	756	14057.6	11.7577	487951.6	281419		
	7178.8	1460	1.3E+07	1447	774	755	14101.4	11.7577	487920.8	281450		
	7135	1459	1.3E+07	1447	773	754	14145.2	11.7577	487890	281481		
	7091.2	1455	1.3E+07	1447	772	753	14189	11.7577	487859.2	281511		
	7047.4	1447	1.3E+07	1448	771	752	14232.8	11.7577	487828.4	281542		
	7003.6	1451	1.3E+07	1449	770	751	14276.6	11.7577	487797.6	281573		
	6972.6	1458	1.2E+07	1450	769	751	14307.6	11.7577	487797.6	281604		
	6941.6	1461	1.2E+07	1450	768	751	14338.6	11.7577	487797.6	281635		
	6910.6	1459	1.2E+07	1450	767	751	14369.6	11.7577	487797.6	281665		
	6879.6	1460	1.2E+07	1450	766	751	14400.6	11.7577	487797.6	281696		
	6835.8	1462	1.2E+07	1450	765	750	14444.4	11.7577	487766.8	281727		
	6804.8	1460	1.2E+07	1450	765	749	14475.4	11.7577	487736	281727		
	6773.8	1457	1.2E+07	1450	765	748	14506.4	11.7577	487705.2	281727		
	6742.8	1456	1.2E+07	1450	765	747	14537.4	11.7577	487674.4	281727		
	6711.8	1456	1.2E+07	1450	765	746	14568.4	11.7577	487643.6	281727		
	6680.8	1454	1.2E+07	1450	765	745	14599.4	11.7577	487612.8	281727		
	6649.8	1459	1.2E+07	1450	765	744	14630.4	11.7577	487582	281727		
	6618.8	1457	1.2E+07	1450	765	743	14661.4	11.7577	487551.2	281727		
	6575	1461	1.2E+07	1450	764	742	14705.2	11.7577	487520.4	281758		
	6544	1456	1.2E+07	1450	764	741	14736.2	11.7577	487489.6	281758		
	6513	1456	1.2E+07	1450	764	740	14767.2	11.7577	487458.8	281758		
	6482	1455	1.2E+07	1450	764	739	14798.2	64.2744	487428	281758		
	6451	1453	1.2E+07	1450	764	738	14829.2	64.2744	487397.2	281758		
	6407.2	1457	1.2E+07	1450	763	737	14873	64.2744	487366.5	281789		
	6376.2	1450	1.2E+07	1451.333	763	736	14904	64.2744	487335.7	281789		
	6345.2	1454	1.2E+07	1453.333	763	735	14935	64.2744	487304.9	281789		
	6301.4	1460	1.2E+07	1455.333	762	734	14978.8	64.2744	487274.1	281819		
	6270.4	1461	1.2E+07	1456	762	733	15009.8	64.2744	487243.3	281819		
	6226.6	1456	1.1E+07	1457.333	761	732	15053.6	62.8471	487212.5	281850		
	6182.8	1460	1.1E+07	1460.667	760	731	15097.4	62.8471	487181.7	281881		
	6151.8	1466	1.1E+07	1464.333	759	731	15128.4	62.8471	487181.7	281912		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	6120.8	1467	1.1E+07	1466.667	758	731	15159.4	62.8471	487181.7	281943		
	6089.8	1468	1.1E+07	1467	757	731	15190.4	62.8471	487181.7	281973		
	6046	1471	8407789	1467	756	730	15234.2	62.8471	487150.9	282004		
	6015	1469	8405867	1467	755	730	15265.2	62.8471	487150.9	282035		
	5984	1467	8402984	1467.667	754	730	15296.2	63.8758	487150.9	282066		
	5940.2	1471	8397218	1468.333	753	729	15340	63.8758	487120.1	282096		
	5896.4	1473	8392413	1469	752	728	15383.8	63.8758	487089.3	282127		
	5865.4	1472	8389530	1469	752	727	15414.8	63.8758	487058.5	282127		
	5821.6	1469	8386647	1471	753	726	15458.6	63.8758	487027.7	282096		
	5777.8	1476	8261717	1473	752	725	15502.4	63.8758	486996.9	282127		
	5746.8	1475	8260756	1475	752	724	15533.4	63.8758	486966.1	282127		
	5703	1475	8253068	1475.333	751	723	15577.2	35.6781	486935.3	282158		
	5659.2	1478	8242497	1475.667	750	722	15621	35.6781	486904.5	282189		
	5615.4	1482	8236731	1476	749	721	15664.8	35.6781	486873.7	282220		
	5584.4	1479	8192525	1476	748	721	15695.8	35.6781	486873.7	282250		
	5540.6	1484	8189642	1476	747	722	15739.6	35.6781	486904.5	282281		
	5509.6	1482	8183876	1476	746	722	15770.6	35.6781	486904.5	282312		
	5465.8	1484	8181954	1476	745	721	15814.4	46.5439	486873.7	282343		
	5422	1476	8172344	1478	744	720	15858.2	46.5439	486842.9	282374		
	5378.2	1482	8163695	1482.667	743	719	15902	46.5439	486812.1	282404		
	5334.4	1490	8155046	1487.333	742	718	15945.8	46.5439	486781.4	282435		
	5290.6	1494	8152163	1490	741	717	15989.6	46.5439	486750.6	282466		
	5246.8	1494	8149280	1490	742	716	16033.4	46.5439	486719.8	282435		
	5203	1490	8106996	1490.667	741	715	16077.2	46.5439	486689	282466		
	5159.2	1497	8103152	1491.333	740	714	16121	46.5439	486658.2	282497		
	5128.2	1498	8098347	1492	739	714	16152	46.5439	486658.2	282528		
	5084.4	1496	8092581	1492	738	713	16195.8	46.5439	486627.4	282558		
	5053.4	1496	7922484	1492	737	713	16226.8	46.5439	486627.4	282589		
	5009.6	1496	7921523	1492	736	712	16270.6	46.5439	486596.6	282620		
	4978.6	1492	7800437	1492.667	735	712	16301.6	0	486596.6	282651		
	4934.8	1494	7794671	1493.333	734	711	16345.4	0	486565.8	282682		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	4891	1496	7784100	1494	733	710	16389.2	0	486535	282712		
	4860	1498	7781217	1494	733	709	16420.2	0	486504.2	282712		
	4816.2	1497	7779295	1494	732	708	16464	0	486473.4	282743		
	4785.2	1500	7764880	1494	732	707	16495	0	486442.6	282743		
	4741.4	1504	7758153	1494	731	706	16538.8	27.8846	486411.8	282774		
	4697.6	1502	7757192	1494	730	705	16582.6	27.8846	486381	282805		
	4653.8	1504	7734128	1494	729	704	16626.4	27.8846	486350.2	282836		
	4622.8	1504	7470814	1494	729	703	16657.4	27.8846	486319.4	282836		
	4591.8	1502	7469853	1494	729	702	16688.4	27.8846	486288.6	282836		
	4560.8	1502	7468892	1494	729	701	16719.4	27.8846	486257.8	282836		
	4517	1503	7466970	1494	728	700	16763.2	27.8846	486227	282866		
	4473.2	1502	4888607	1494	727	699	16807	27.8846	486196.3	282897		
	4429.4	1494	4874192	1495	726	698	16850.8	27.8846	486165.5	282928		
	4385.6	1500	4863621	1496	725	697	16894.6	27.8846	486134.7	282959		
	4354.6	1498	4827103	1497	725	696	16925.6	27.8846	486103.9	282959		
	4323.6	1497	4826142	1497.333	725	695	16956.6	27.8846	486073.1	282959		
	4292.6	1498	4825181	1498	725	694	16987.6	27.8846	486042.3	282959		
	4261.6	1499	4824220	1499	725	693	17018.6	27.8846	486011.5	282959		
	4230.6	1500	4823259	1501	725	692	17049.6	25.2301	485980.7	282959		
	4199.6	1504	4822298	1502.667	725	691	17080.6	25.2301	485949.9	282959		
	4155.8	1504	4820376	1504.333	724	690	17124.4	25.2301	485919.1	282990		
	4112	1505	4815571	1505.333	723	689	17168.2	25.2301	485888.3	283020		
	4068.2	1507	4744457	1506.667	722	688	17212	25.2301	485857.5	283051		
	4024.4	1510	4742535	1507.667	721	687	17255.8	25.2301	485826.7	283082		
	3993.4	1510	4741574	1508	721	686	17286.8	25.2301	485795.9	283082		
	3962.4	1509	4738691	1508	721	685	17317.8	23.9992	485765.1	283082		
	3931.4	1508	4730042	1508	721	684	17348.8	23.9992	485734.3	283082		
	3900.4	1508	4728120	1508.333	721	683	17379.8	23.9992	485703.5	283082		
	3856.6	1509	4717549	1508.667	720	682	17423.6	23.9992	485672.7	283113		
	3825.6	1509	4713705	1509.333	720	681	17454.6	23.9992	485641.9	283113		
	3781.8	1514	4683914	1509.667	719	680	17498.4	23.9992	485611.1	283144		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	3750.8	1514	4682953	1510	719	679	17529.4	23.9992	485580.4	283144		
	3707	1510	4680070	1510	720	678	17573.2	2.67391	485549.6	283113		
	3663.2	1512	4665655	1510	719	677	17617	2.67391	485518.8	283144		
	3619.4	1510	4627215	1510	718	676	17660.8	2.67391	485488	283174		
	3588.4	1511	4623371	1510	717	676	17691.8	2.67391	485488	283205		
	3557.4	1511	4622410	1510	716	676	17722.8	2.67391	485488	283236		
	3526.4	1510	4610878	1510.333	715	676	17753.8	2.67391	485488	283267		
	3495.4	1513	4608956	1510.667	714	676	17784.8	2.67391	485488	283297		
	3451.6	1518	4544569	1511	713	675	17828.6	0	485457.2	283328		
	3407.8	1516	4543608	1511	712	674	17872.4	0	485426.4	283359		
	3364	1511	4488831	1511	711	673	17916.2	0	485395.6	283390		
	3320.2	1517	4473455	1511	710	672	17960	0	485364.8	283421		
	3276.4	1518	4462884	1511	709	671	18003.8	0	485334	283451		
	3232.6	1518	4456157	1511	708	670	18047.6	0	485303.2	283482		
	3201.6	1518	4452313	1511	708	669	18078.6	0	485272.4	283482		
	3157.8	1519	4450391	1511	707	668	18122.4	0	485241.6	283513		
	3114	1511	2697527	1511	706	669	18166.2	0	485272.4	283544		
	3070.2	1513	2691761	1511	705	670	18210	0	485303.2	283575		
	3026.4	1516	2634101	1511	704	671	18253.8	0	485334	283605		
	2995.4	1514	2632179	1511	703	671	18284.8	0	485334	283636		
	2951.6	1518	2629296	1511	702	672	18328.6	0	485364.8	283667		
	2920.6	1519	2627374	1511	701	672	18359.6	0	485364.8	283698		
	2889.6	1512	2557221	1511	700	672	18390.6	0	485364.8	283729		
	2858.6	1511	2556260	1511.333	699	672	18421.6	0	485364.8	283759		
	2827.6	1520	2555299	1511.667	698	672	18452.6	0	485364.8	283790		
	2783.8	1521	2553377	1512	697	671	18496.4	0	485334	283821		
	2740	1521	2515898	1512	696	672	18540.2	0	485364.8	283852		
	2709	1518	2513976	1512	695	672	18571.2	0	485364.8	283883		
	2665.2	1517	2451511	1512	694	673	18615	0	485395.6	283913		
	2621.4	1521	2425564	1512	693	674	18658.8	0	485426.4	283944		
	2590.4	1518	2423642	1512	692	674	18689.8	0	485426.4	283975		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	2559.4	1514	2419798	1512	691	674	18720.8	0	485426.4	284006		
	2528.4	1517	2418837	1512	690	674	18751.8	0	485426.4	284037		
	2497.4	1520	2416915	1512	689	674	18782.8	0	485426.4	284067		
	2453.6	1521	2384241	1512	688	675	18826.6	0	485457.2	284098		
	2409.8	1520	2119005	1512	687	676	18870.4	0	485488	284129		
	2366	1520	2077682	1512	686	677	18914.2	0	485518.8	284160		
	2322.2	1519	1922000	1512	685	678	18958	0	485549.6	284191		
	2278.4	1520	1917195	1512	684	679	19001.8	0	485580.4	284221		
	2234.6	1518	1914312	1512	683	680	19045.6	2.23394	485611.1	284252		
	2190.8	1514	1893170	1512	682	681	19089.4	2.23394	485641.9	284283		
	2147	1518	1861457	1512	681	682	19133.2	2.23394	485672.7	284314		
	2103.2	1512	936975	1512.333	680	683	19177	2.23394	485703.5	284345		
	2059.4	1513	917755	1512.667	679	682	19220.8	2.23394	485672.7	284375		
	2028.4	1516	916794	1513	678	682	19251.8	2.23394	485672.7	284406		
	1997.4	1514	915833	1513	677	682	19282.8	2.23394	485672.7	284437		
	1966.4	1518	914872	1513	676	682	19313.8	2.23394	485672.7	284468		
	1935.4	1514	913911	1513	675	682	19344.8	2.23394	485672.7	284498		
	1904.4	1513	912950	1514	674	682	19375.8	2.23394	485672.7	284529		
	1873.4	1516	911989	1515	673	682	19406.8	2.23394	485672.7	284560		
	1842.4	1516	911028	1516	672	682	19437.8	2.23394	485672.7	284591		
	1811.4	1519	910067	1516	671	682	19468.8	2.23394	485672.7	284622		
	1767.6	1519	902379	1516	670	683	19512.6	2.23394	485703.5	284652		
	1736.6	1518	901418	1516	669	683	19543.6	2.23394	485703.5	284683		
	1705.6	1518	900457	1516	668	683	19574.6	2.23394	485703.5	284714		
	1674.6	1518	899496	1516	667	683	19605.6	2.23394	485703.5	284745		
	1643.6	1518	898535	1516	666	683	19636.6	2.23394	485703.5	284776		
	1612.6	1516	897574	1516	665	683	19667.6	2.23394	485703.5	284806		
	1581.6	1521	896613	1516	664	683	19698.6	2.23394	485703.5	284837		
	1550.6	1520	893730	1516	663	683	19729.6	2.23394	485703.5	284868		
	1506.8	1521	888925	1516	662	682	19773.4	2.23394	485672.7	284899		
	1463	1520	883159	1516	661	681	19817.2	0	485641.9	284930		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	1432	1519	877393	1516	661	680	19848.2	0	485611.1	284930		
	1388.2	1517	845680	1516	660	679	19892	0	485580.4	284960		
	1357.2	1518	678466	1516	659	679	19923	0	485580.4	284991		
	1326.2	1520	671739	1516	658	679	19954	0	485580.4	285022		
	1295.2	1521	670778	1516	657	679	19985	0	485580.4	285053		
	1264.2	1521	669817	1516	656	679	20016	28.9676	485580.4	285084		
	1233.2	1518	652519	1516	655	679	20047	28.9676	485580.4	285114		
	1202.2	1520	648675	1516	654	679	20078	28.9676	485580.4	285145		
	1171.2	1526	640987	1516	653	679	20109	28.9676	485580.4	285176		
	1127.4	1520	640026	1516	652	678	20152.8	28.9676	485549.6	285207		
	1083.6	1518	474734	1516	651	679	20196.6	28.9676	485580.4	285238		
	1039.8	1516	452631	1516.333	650	680	20240.4	28.9676	485611.1	285268		
	996	1520	423801	1516.667	649	681	20284.2	28.9676	485641.9	285299		
	952.2	1519	254665	1517	648	682	20328	28.9676	485672.7	285330		
	921.2	1521	221030	1517	647	682	20359	28.9676	485672.7	285361		
	890.2	1521	220069	1517	646	682	20390	28.9676	485672.7	285392		
	859.2	1522	219108	1517	645	682	20421	28.9676	485672.7	285422		
	828.2	1517	218147	1517.333	644	682	20452	28.9676	485672.7	285453		
	797.2	1518	217186	1520	643	682	20483	28.9676	485672.7	285484		
	766.2	1525	216225	1523.667	642	682	20514	28.9676	485672.7	285515		
	722.4	1528	209498	1528.333	641	681	20557.8	14.2095	485641.9	285546		
	678.6	1544	203732	1530.667	640	682	20601.6	14.2095	485672.7	285576		
	647.6	1542	202771	1532	639	682	20632.6	14.2095	485672.7	285607		
	603.8	1544	191239	1532	638	681	20676.4	14.2095	485641.9	285638		
	572.8	1544	188356	1532	637	681	20707.4	14.2095	485641.9	285669		
	541.8	1543	180668	1532	636	681	20738.4	14.2095	485641.9	285699		
	510.8	1540	177785	1532	635	681	20769.4	14.2095	485641.9	285730		
	479.8	1539	162409	1532	634	681	20800.4	13.6715	485641.9	285761		
	448.8	1532	148955	1534.333	633	681	20831.4	13.6715	485641.9	285792		
	417.8	1539	147994	1537.667	632	681	20862.4	13.6715	485641.9	285823		
	386.8	1542	147033	1542.333	631	681	20893.4	13.6715	485641.9	285853		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 5												
	355.8	1547	141267	1544.667	630	681	20924.4	13.6715	485641.9	285884		
	324.8	1547	140306	1546	629	681	20955.4	13.6715	485641.9	285915		
	281	1546	113398	1547.667	628	680	20999.2	13.6715	485611.1	285946		
	237.2	1551	91295	1550	627	679	21043	13.6715	485580.4	285977		
	193.4	1556	89373	1552.333	626	678	21086.8	15.7533	485549.6	286007		
	149.6	1553	75919	1554.667	625	677	21130.6	15.7533	485518.8	286038		
	105.8	1558	37479	1560.667	624	676	21174.4	15.7533	485488	286069		
	74.8	1572	36518	1566.667	624	675	21205.4	15.7533	485457.2	286069		
	31	1574	35557	1571	625	674	21249.2	15.7533	485426.4	286038		
	0	1571	8649	1571	625	673	21280.2	15.7533	485395.6	286038		
South 8												
	17171	897	104749	896	1177	774	0	0	488505.9	269039	70794.58	0.04291
	17140	897	3.2E+07	896	1178	774	31	0	488505.9	269009	89125.09	0.04291
	17109	897	3.2E+07	896	1178	773	62	0	488475.1	269009	112201.8	0.06659
	17078	897	3.2E+07	896	1178	772	93	0	488444.3	269009	141253.8	0.07991
	17034.2	897	3.2E+07	896	1179	771	136.8	0	488413.5	268978	223872.1	0.02201
	16990.4	896	3.2E+07	896.3333	1180	770	180.6	0	488382.7	268947	562341.3	0.04115
	16946.6	897	3.2E+07	896.6667	1181	769	224.4	0	488351.9	268916	891250.9	0.17899
	16915.6	898	3.2E+07	897	1181	768	255.4	0	488321.1	268916	1412538	0.06728
	16884.6	897	3.2E+07	897	1181	767	286.4	0	488290.3	268916	1778279	0.02498
	16840.8	898	3.2E+07	897	1180	766	330.2	0	488259.5	268947	2238721	0.00674
	16797	898	3.2E+07	897	1179	765	374	0	488228.7	268978	2818383	0.02738
	16753.2	903	3.2E+07	897	1178	764	417.8	0	488197.9	269009	3548134	0.02361
	16709.4	901	3.2E+07	897	1177	763	461.6	0	488167.1	269039	7079458	0.00488
	16678.4	901	3.2E+07	897	1176	763	492.6	0	488167.1	269070	8912509	0.11743
	16634.6	903	3.2E+07	897	1175	762	536.4	0	488136.3	269101	11220185	0.2193
	16603.6	901	3.2E+07	897	1174	762	567.4	0	488136.3	269132	14125375	0.06048
	16559.8	902	3.2E+07	897	1173	761	611.2	0	488105.5	269163	17782794	0.16873
	16528.8	904	3.2E+07	897	1173	760	642.2	0	488074.7	269163	28183829	0.04694
	16485	904	3.2E+07	897	1172	759	686	9.36745	488043.9	269193		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	16454	904	3.1E+07	897	1171	759	717	9.36745	488043.9	269224		
	16410.2	902	3.1E+07	897	1170	758	760.8	9.36745	488013.1	269255		
	16379.2	903	3.1E+07	897	1169	758	791.8	9.36745	488013.1	269286		
	16335.4	902	3.1E+07	897	1168	757	835.6	9.36745	487982.3	269317		
	16304.4	900	3.1E+07	897	1168	756	866.6	9.36745	487951.6	269317		
	16273.4	897	3.1E+07	898	1168	755	897.6	9.36745	487920.8	269317		
	16242.4	900	3.1E+07	899	1168	754	928.6	9.36745	487890	269317		
	16211.4	903	3.1E+07	900	1168	753	959.6	9.36745	487859.2	269317		
	16167.6	903	3.1E+07	900	1167	752	1003.4	9.36745	487828.4	269347		
	16123.8	905	3.1E+07	900	1166	751	1047.2	9.36745	487797.6	269378		
	16092.8	906	3.1E+07	900	1165	751	1078.2	9.36745	487797.6	269409		
	16061.8	908	3.1E+07	900	1164	751	1109.2	9.36745	487797.6	269440		
	16030.8	906	3.1E+07	900	1163	751	1140.2	9.36745	487797.6	269471		
	15987	905	3.1E+07	900	1162	752	1184	9.36745	487828.4	269501		
	15943.2	903	3.1E+07	900	1161	753	1227.8	9.36745	487859.2	269532		
	15899.4	900	3.1E+07	900	1160	754	1271.6	9.36745	487890	269563		
	15868.4	906	3.1E+07	900	1159	754	1302.6	9.36745	487890	269594		
	15824.6	904	3.1E+07	900	1158	755	1346.4	9.36745	487920.8	269625		
	15793.6	904	3.1E+07	900	1157	755	1377.4	9.36745	487920.8	269655		
	15762.6	907	3.1E+07	900	1156	755	1408.4	9.36745	487920.8	269686		
	15731.6	908	3.1E+07	900	1155	755	1439.4	0	487920.8	269717		
	15687.8	907	3.1E+07	900	1154	756	1483.2	0	487951.6	269748		
	15644	907	3.1E+07	900	1153	757	1527	0	487982.3	269779		
	15600.2	906	3.1E+07	900	1152	758	1570.8	0	488013.1	269809		
	15569.2	908	3.1E+07	900	1152	759	1601.8	0	488043.9	269809		
	15538.2	910	3.1E+07	900	1152	760	1632.8	0	488074.7	269809		
	15507.2	907	3.1E+07	900	1152	761	1663.8	0	488105.5	269809		
	15463.4	909	3.1E+07	900	1153	762	1707.6	0	488136.3	269779		
	15432.4	909	3.1E+07	900	1153	763	1738.6	0	488167.1	269779		
	15401.4	905	3.1E+07	900	1153	764	1769.6	0	488197.9	269779		
	15357.6	903	3.1E+07	900	1152	765	1813.4	0	488228.7	269809		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	15326.6	900	3.1E+07	900.3333	1152	766	1844.4	0	488259.5	269809		
	15282.8	907	3.1E+07	900.6667	1151	767	1888.2	0	488290.3	269840		
	15239	907	3.1E+07	901	1150	768	1932	119.781	488321.1	269871		
	15195.2	903	3.1E+07	901	1149	769	1975.8	119.781	488351.9	269902		
	15164.2	906	3E+07	901	1148	769	2006.8	119.781	488351.9	269933		
	15133.2	907	3E+07	901	1147	769	2037.8	119.781	488351.9	269963		
	15102.2	907	3E+07	901	1146	769	2068.8	119.781	488351.9	269994		
	15071.2	908	3E+07	901	1145	769	2099.8	119.781	488351.9	270025		
	15040.2	902	3E+07	901	1144	769	2130.8	119.781	488351.9	270056		
	15009.2	908	3E+07	901	1143	769	2161.8	119.781	488351.9	270087		
	14978.2	901	3E+07	902	1142	769	2192.8	119.781	488351.9	270117		
	14947.2	904	3E+07	905.3333	1141	769	2223.8	119.781	488351.9	270148		
	14916.2	911	3E+07	908.6667	1140	769	2254.8	119.781	488351.9	270179		
	14885.2	911	3E+07	911.3333	1139	769	2285.8	119.781	488351.9	270210		
	14841.4	912	3E+07	913.3333	1138	770	2329.6	119.781	488382.7	270240		
	14810.4	917	3E+07	916	1137	770	2360.6	119.781	488382.7	270271		
	14766.6	920	3E+07	918.3333	1136	771	2404.4	119.781	488413.5	270302		
	14735.6	924	3E+07	919	1135	771	2435.4	119.781	488413.5	270333		
	14704.6	923	3E+07	919	1134	771	2466.4	106.802	488413.5	270364		
	14660.8	924	3E+07	919	1133	772	2510.2	106.802	488444.3	270394		
	14617	923	3E+07	919	1132	773	2554	106.802	488475.1	270425		
	14586	919	3E+07	920	1132	774	2585	106.802	488505.9	270425		
	14555	923	3E+07	921	1132	775	2616	106.802	488536.7	270425		
	14524	923	3E+07	922	1132	776	2647	106.802	488567.5	270425		
	14480.2	924	3E+07	922	1131	777	2690.8	106.802	488598.2	270456		
	14436.4	922	2.9E+07	924.6667	1130	778	2734.6	173.141	488629	270487		
	14392.6	930	2.9E+07	928.3333	1129	779	2778.4	173.141	488659.8	270518		
	14348.8	933	2.9E+07	933.3333	1128	778	2822.2	173.141	488629	270548		
	14317.8	937	2.9E+07	936	1127	778	2853.2	173.141	488629	270579		
	14286.8	938	2.9E+07	939.3333	1126	778	2884.2	173.141	488629	270610		
	14243	943	2.9E+07	942	1125	779	2928	173.141	488659.8	270641		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	14212	945	2.9E+07	945.6667	1124	779	2959	162.053	488659.8	270672		
	14181	949	2.9E+07	948	1123	779	2990	162.053	488659.8	270702		
	14137.2	951	2.9E+07	949.6667	1122	778	3033.8	162.053	488629	270733		
	14093.4	952	2.9E+07	950	1121	777	3077.6	162.053	488598.2	270764		
	14062.4	950	2.9E+07	951.6667	1120	777	3108.6	162.053	488598.2	270795		
	14018.6	960	2.9E+07	953.3333	1119	776	3152.4	162.053	488567.5	270826		
	13974.8	959	2.9E+07	955	1118	775	3196.2	55.5724	488536.7	270856		
	13931	960	2.9E+07	955	1117	776	3240	55.5724	488567.5	270887		
	13900	959	2.9E+07	955	1116	776	3271	55.5724	488567.5	270918		
	13869	957	2.9E+07	955	1115	776	3302	55.5724	488567.5	270949		
	13825.2	960	2.9E+07	955	1114	777	3345.8	55.5724	488598.2	270980		
	13794.2	956	2.9E+07	955	1113	777	3376.8	55.5724	488598.2	271010		
	13763.2	955	2.9E+07	955.3333	1112	777	3407.8	55.5724	488598.2	271041		
	13719.4	956	2.9E+07	955.6667	1111	778	3451.6	19.4756	488629	271072		
	13675.6	956	2.9E+07	956	1110	779	3495.4	19.4756	488659.8	271103		
	13644.6	956	2.9E+07	956.3333	1109	779	3526.4	19.4756	488659.8	271134		
	13613.6	959	2.9E+07	956.6667	1108	779	3557.4	19.4756	488659.8	271164		
	13569.8	966	2.9E+07	957	1107	780	3601.2	19.4756	488690.6	271195		
	13538.8	967	2.9E+07	957	1106	780	3632.2	19.4756	488690.6	271226		
	13495	967	2.9E+07	957	1105	781	3676	19.4756	488721.4	271257		
	13464	967	2.9E+07	957	1104	781	3707	243.074	488721.4	271288		
	13433	957	2.9E+07	958	1103	781	3738	243.074	488721.4	271318		
	13402	962	2.8E+07	959	1102	781	3769	243.074	488721.4	271349		
	13371	960	2.8E+07	961.6667	1101	781	3800	243.074	488721.4	271380		
	13340	966	2.8E+07	963.3333	1100	781	3831	243.074	488721.4	271411		
	13296.2	965	2.8E+07	966.3333	1099	782	3874.8	243.074	488752.2	271441		
	13265.2	969	2.8E+07	972	1098	782	3905.8	243.074	488752.2	271472		
	13221.4	982	2.8E+07	977.6667	1097	781	3949.6	157.201	488721.4	271503		
	13177.6	983	2.8E+07	982	1096	780	3993.4	157.201	488690.6	271534		
	13146.6	984	2.8E+07	982	1095	780	4024.4	157.201	488690.6	271565		
	13115.6	991	2.8E+07	982	1094	780	4055.4	157.201	488690.6	271595		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	13084.6	989	2.8E+07	982	1093	780	4086.4	157.201	488690.6	271626		
	13040.8	985	2.8E+07	982	1092	781	4130.2	157.201	488721.4	271657		
	13009.8	991	2.8E+07	982	1091	781	4161.2	157.201	488721.4	271688		
	12978.8	994	2.8E+07	982	1090	781	4192.2	117.081	488721.4	271719		
	12935	990	2.8E+07	982	1089	782	4236	117.081	488752.2	271749		
	12891.2	987	2.8E+07	982	1088	783	4279.8	117.081	488783	271780		
	12847.4	985	2.8E+07	982	1087	784	4323.6	117.081	488813.8	271811		
	12803.6	982	2.8E+07	982.6667	1086	785	4367.4	117.081	488844.6	271842		
	12759.8	984	2.8E+07	985.3333	1085	786	4411.2	117.081	488875.4	271873		
	12728.8	990	2.8E+07	989	1084	786	4442.2	65.2397	488875.4	271903		
	12697.8	998	2.8E+07	992	1083	786	4473.2	65.2397	488875.4	271934		
	12654	1001	2.8E+07	993	1082	787	4517	65.2397	488906.2	271965		
	12610.2	1006	2.8E+07	993	1081	788	4560.8	65.2397	488937	271996		
	12566.4	1003	2.8E+07	993	1080	789	4604.6	65.2397	488967.8	272027		
	12535.4	1000	2.8E+07	993	1079	789	4635.6	65.2397	488967.8	272057		
	12504.4	1006	2.8E+07	993	1078	789	4666.6	65.2397	488967.8	272088		
	12473.4	999	2.8E+07	993	1077	789	4697.6	17.7266	488967.8	272119		
	12429.6	1004	2.8E+07	993	1076	790	4741.4	17.7266	488998.6	272150		
	12385.8	1006	2.8E+07	993	1077	791	4785.2	17.7266	489029.4	272119		
	12354.8	1006	2.8E+07	993	1077	792	4816.2	17.7266	489060.2	272119		
	12323.8	1001	2.8E+07	993	1077	793	4847.2	17.7266	489091	272119		
	12280	1002	2.8E+07	993	1076	794	4891	17.7266	489121.8	272150		
	12249	1001	2.8E+07	993	1075	794	4922	17.7266	489121.8	272181		
	12218	999	2.8E+07	993	1074	794	4953	95.0964	489121.8	272211		
	12174.2	1003	2.8E+07	993	1073	793	4996.8	95.0964	489091	272242		
	12130.4	994	2.8E+07	993	1072	792	5040.6	95.0964	489060.2	272273		
	12099.4	993	2.8E+07	993.3333	1071	792	5071.6	95.0964	489060.2	272304		
	12068.4	994	2.8E+07	997	1070	792	5102.6	95.0964	489060.2	272335		
	12024.6	1013	2.8E+07	1000.667	1069	793	5146.4	95.0964	489091	272365		
	11993.6	1018	2.8E+07	1004	1068	793	5177.4	95.0964	489091	272396		
	11962.6	1014	2.8E+07	1004	1067	793	5208.4	108.365	489091	272427		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	11918.8	1012	2.8E+07	1004	1066	792	5252.2	108.365	489060.2	272458		
	11875	1008	2E+07	1004	1065	791	5296	108.365	489029.4	272489		
	11831.2	1006	2E+07	1004	1064	790	5339.8	108.365	488998.6	272519		
	11787.4	1006	2E+07	1004	1063	789	5383.6	108.365	488967.8	272550		
	11756.4	1004	2E+07	1006	1063	788	5414.6	108.365	488937	272550		
	11712.6	1010	2E+07	1009.333	1062	787	5458.4	73.7658	488906.2	272581		
	11668.8	1017	2E+07	1012.667	1061	786	5502.2	73.7658	488875.4	272612		
	11625	1016	2E+07	1014	1060	785	5546	73.7658	488844.6	272642		
	11581.2	1014	2E+07	1015	1059	784	5589.8	73.7658	488813.8	272673		
	11537.4	1017	2E+07	1017.667	1058	783	5633.6	73.7658	488783	272704		
	11506.4	1029	2E+07	1020.333	1058	782	5664.6	73.7658	488752.2	272704		
	11475.4	1039	2E+07	1022	1058	781	5695.6	59.4783	488721.4	272704		
	11431.6	1038	2E+07	1022	1057	780	5739.4	59.4783	488690.6	272735		
	11387.8	1029	1.9E+07	1022	1056	779	5783.2	59.4783	488659.8	272766		
	11344	1033	1.9E+07	1022	1055	778	5827	59.4783	488629	272796		
	11300.2	1037	1.9E+07	1022	1054	777	5870.8	59.4783	488598.2	272827		
	11269.2	1035	1.9E+07	1022	1053	777	5901.8	59.4783	488598.2	272858		
	11225.4	1037	1.9E+07	1022	1052	776	5945.6	252.69	488567.5	272889		
	11181.6	1029	1.9E+07	1022	1051	775	5989.4	252.69	488536.7	272920		
	11150.6	1032	1.9E+07	1022	1050	775	6020.4	252.69	488536.7	272950		
	11119.6	1031	1.9E+07	1022	1049	775	6051.4	252.69	488536.7	272981		
	11088.6	1024	1.9E+07	1022	1048	775	6082.4	252.69	488536.7	273012		
	11057.6	1022	1.9E+07	1022.333	1047	775	6113.4	252.69	488536.7	273043		
	11026.6	1023	1.9E+07	1025.667	1046	775	6144.4	252.69	488536.7	273074		
	10995.6	1032	1.9E+07	1030	1045	775	6175.4	252.69	488536.7	273104		
	10964.6	1038	1.9E+07	1034	1044	775	6206.4	286.797	488536.7	273135		
	10933.6	1035	1.9E+07	1035	1043	775	6237.4	286.797	488536.7	273166		
	10889.8	1035	1.9E+07	1036.333	1042	776	6281.2	286.797	488567.5	273197		
	10846	1039	1.9E+07	1040.333	1041	777	6325	286.797	488598.2	273228		
	10802.2	1047	1.9E+07	1048.667	1040	778	6368.8	286.797	488629	273258		
	10771.2	1060	1.9E+07	1058	1039	778	6399.8	286.797	488629	273289		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	10740.2	1067	1.9E+07	1066	1038	778	6430.8	286.797	488629	273320		
	10696.4	1073	1.9E+07	1069.667	1037	777	6474.6	211.078	488598.2	273351		
	10652.6	1072	1.9E+07	1071	1036	776	6518.4	211.078	488567.5	273382		
	10621.6	1071	1.9E+07	1071	1035	776	6549.4	211.078	488567.5	273412		
	10590.6	1073	1.5E+07	1071	1034	776	6580.4	211.078	488567.5	273443		
	10559.6	1075	1.5E+07	1071	1033	776	6611.4	211.078	488567.5	273474		
	10515.8	1076	1.5E+07	1071	1032	775	6655.2	211.078	488536.7	273505		
	10484.8	1075	1.5E+07	1071	1032	774	6686.2	211.078	488505.9	273505		
	10441	1078	1.5E+07	1071	1031	773	6730	11.4999	488475.1	273536		
	10397.2	1080	1.5E+07	1071	1030	772	6773.8	11.4999	488444.3	273566		
	10366.2	1086	1.5E+07	1071	1030	771	6804.8	11.4999	488413.5	273566		
	10322.4	1082	1.5E+07	1071	1029	770	6848.6	11.4999	488382.7	273597		
	10291.4	1081	1.5E+07	1071	1028	770	6879.6	11.4999	488382.7	273628		
	10260.4	1084	1.5E+07	1071	1027	770	6910.6	11.4999	488382.7	273659		
	10216.6	1086	1.5E+07	1071	1026	769	6954.4	194.469	488351.9	273690		
	10172.8	1085	1.5E+07	1071	1025	768	6998.2	194.469	488321.1	273720		
	10129	1085	1.5E+07	1071	1024	767	7042	194.469	488290.3	273751		
	10085.2	1086	1.5E+07	1071	1023	766	7085.8	194.469	488259.5	273782		
	10041.4	1088	1.5E+07	1071	1022	765	7129.6	194.469	488228.7	273813		
	9997.6	1093	1.5E+07	1071	1021	764	7173.4	194.469	488197.9	273843		
	9953.8	1088	1.5E+07	1071	1020	763	7217.2	194.469	488167.1	273874		
	9910	1071	1.5E+07	1071.333	1019	762	7261	194.469	488136.3	273905		
	9866.2	1072	1.5E+07	1075.333	1018	761	7304.8	194.469	488105.5	273936		
	9822.4	1088	1.4E+07	1079.333	1017	760	7348.6	194.469	488074.7	273967		
	9791.4	1083	1.4E+07	1085.333	1016	760	7379.6	194.469	488074.7	273997		
	9760.4	1093	1.4E+07	1087.667	1015	760	7410.6	194.469	488074.7	274028		
	9729.4	1090	1.4E+07	1090.333	1014	760	7441.6	121.189	488074.7	274059		
	9685.6	1094	1.4E+07	1090.667	1013	759	7485.4	121.189	488043.9	274090		
	9654.6	1092	1.4E+07	1091	1012	759	7516.4	121.189	488043.9	274121		
	9623.6	1094	1.4E+07	1091	1011	759	7547.4	121.189	488043.9	274151		
	9579.8	1102	1.4E+07	1091	1010	758	7591.2	121.189	488013.1	274182		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	9536	1094	1.4E+07	1091	1009	757	7635	121.189	487982.3	274213		
	9492.2	1091	1.4E+07	1091.667	1008	756	7678.8	121.189	487951.6	274244		
	9461.2	1093	1.4E+07	1094	1007	756	7709.8	130.348	487951.6	274275		
	9430.2	1098	1.4E+07	1096.667	1006	756	7740.8	130.348	487951.6	274305		
	9399.2	1099	1.4E+07	1100.333	1005	756	7771.8	130.348	487951.6	274336		
	9368.2	1104	1.4E+07	1105.667	1004	756	7802.8	130.348	487951.6	274367		
	9324.4	1115	1.4E+07	1110.667	1003	755	7846.6	130.348	487920.8	274398		
	9280.6	1114	1.4E+07	1114.333	1002	754	7890.4	130.348	487890	274429		
	9236.8	1115	1.4E+07	1116.667	1001	753	7934.2	130.348	487859.2	274459		
	9193	1121	9672465	1121.667	1000	752	7978	192.907	487828.4	274490		
	9162	1129	9669582	1130	999	752	8009	192.907	487828.4	274521		
	9118.2	1140	9659011	1137.667	998	753	8052.8	192.907	487859.2	274552		
	9074.4	1144	9642674	1143.667	997	754	8096.6	192.907	487890	274583		
	9030.6	1147	9639791	1147.333	996	755	8140.4	192.907	487920.8	274613		
	8986.8	1151	9631142	1149.667	995	754	8184.2	192.907	487890	274644		
	8955.8	1151	9630181	1154.333	994	754	8215.2	152.142	487890	274675		
	8912	1165	9608078	1157.667	993	755	8259	152.142	487920.8	274706		
	8868.2	1166	9607117	1161	992	756	8302.8	152.142	487951.6	274737		
	8824.4	1165	9600390	1161	991	757	8346.6	152.142	487982.3	274767		
	8780.6	1168	9589819	1161	990	756	8390.4	152.142	487951.6	274798		
	8736.8	1161	9543691	1161.333	989	755	8434.2	152.142	487920.8	274829		
	8693	1168	9537925	1161.667	988	754	8478	88.7843	487890	274860		
	8662	1162	9533120	1162.667	987	754	8509	88.7843	487890	274891		
	8631	1164	9514861	1164.667	986	754	8540	88.7843	487890	274921		
	8600	1168	9510056	1166.667	985	754	8571	88.7843	487890	274952		
	8556.2	1168	9500446	1169.667	984	755	8614.8	88.7843	487920.8	274983		
	8512.4	1173	9428371	1171.667	983	756	8658.6	88.7843	487951.6	275014		
	8468.6	1174	9418761	1178	982	755	8702.4	149.427	487920.8	275044		
	8437.6	1187	9410112	1186	981	755	8733.4	149.427	487920.8	275075		
	8393.8	1197	9373594	1197.333	980	756	8777.2	149.427	487951.6	275106		
	8350	1209	9372633	1204.333	979	757	8821	149.427	487982.3	275137		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	8306.2	1213	9371672	1208	978	758	8864.8	149.427	488013.1	275168		
	8275.2	1214	9367828	1208	977	758	8895.8	149.427	488013.1	275198		
	8231.4	1217	9347647	1208	976	759	8939.6	149.427	488043.9	275229		
	8187.6	1229	9338037	1208	975	760	8983.4	166.666	488074.7	275260		
	8156.6	1233	9331310	1208	975	761	9014.4	166.666	488105.5	275260		
	8125.6	1233	9330349	1208	975	762	9045.4	166.666	488136.3	275260		
	8094.6	1241	9299597	1208	975	763	9076.4	166.666	488167.1	275260		
	8050.8	1240	9181394	1208	974	764	9120.2	166.666	488197.9	275291		
	8019.8	1249	9178511	1208	973	764	9151.2	166.666	488197.9	275322		
	7976	1253	9177550	1208	972	765	9195	0	488228.7	275352		
	7945	1254	9176589	1208	971	765	9226	0	488228.7	275383		
	7914	1257	9172745	1208	970	765	9257	0	488228.7	275414		
	7883	1250	9170823	1208	969	765	9288	0	488228.7	275445		
	7852	1253	9072801	1208	968	765	9319	0	488228.7	275476		
	7821	1247	9071840	1208	967	765	9350	0	488228.7	275506		
	7790	1239	9070879	1208	966	765	9381	0	488228.7	275537		
	7759	1231	9069918	1208	965	765	9412	0	488228.7	275568		
	7728	1232	9068957	1208	964	765	9443	0	488228.7	275599		
	7697	1250	9067996	1208	963	765	9474	0	488228.7	275630		
	7653.2	1264	9006492	1208	962	766	9517.8	0	488259.5	275660		
	7622.2	1267	9005531	1208	961	766	9548.8	0	488259.5	275691		
	7591.2	1274	9002648	1208	960	766	9579.8	0	488259.5	275722		
	7547.4	1271	9000726	1208	959	765	9623.6	0	488228.7	275753		
	7503.6	1270	8699933	1208	958	766	9667.4	495.654	488259.5	275784		
	7459.8	1270	8687440	1208	957	767	9711.2	495.654	488290.3	275814		
	7416	1265	8667259	1208	956	768	9755	495.654	488321.1	275845		
	7385	1254	8557705	1208	955	768	9786	495.654	488321.1	275876		
	7354	1247	8556744	1208	954	768	9817	495.654	488321.1	275907		
	7323	1239	8555783	1208	953	768	9848	495.654	488321.1	275938		
	7292	1212	8554822	1208	952	768	9879	495.654	488321.1	275968		
	7261	1208	8553861	1209.333	951	768	9910	495.654	488321.1	275999		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	7230	1212	8552900	1215.333	950	768	9941	495.654	488321.1	276030		
	7199	1226	8551939	1232	949	768	9972	495.654	488321.1	276061		
	7168	1258	8550978	1255	948	768	10003	495.654	488321.1	276092		
	7124.2	1281	8550017	1273.667	947	769	10046.8	495.654	488351.9	276122		
	7093.2	1287	8549056	1281.667	946	769	10077.8	495.654	488351.9	276153		
	7049.4	1285	8548095	1282	945	770	10121.6	495.654	488382.7	276184		
	7018.4	1294	8515421	1282	944	770	10152.6	495.654	488382.7	276215		
	6987.4	1296	8514460	1282	943	770	10183.6	495.654	488382.7	276245		
	6956.4	1301	8507733	1282	942	770	10214.6	495.654	488382.7	276276		
	6925.4	1301	8481786	1282	941	770	10245.6	495.654	488382.7	276307		
	6894.4	1301	8480825	1282	940	770	10276.6	495.654	488382.7	276338		
	6850.6	1301	8478903	1282	939	769	10320.4	495.654	488351.9	276369		
	6806.8	1289	8459683	1282	938	768	10364.2	495.654	488321.1	276399		
	6775.8	1293	8382803	1282	938	767	10395.2	495.654	488290.3	276399		
	6732	1300	8375115	1282	937	766	10439	495.654	488259.5	276430		
	6688.2	1298	8365505	1282	936	765	10482.8	100.362	488228.7	276461		
	6644.4	1282	8353012	1286.667	935	764	10526.6	100.362	488197.9	276492		
	6600.6	1299	8106996	1291.333	934	765	10570.4	100.362	488228.7	276523		
	6569.6	1299	8105074	1296	933	765	10601.4	100.362	488228.7	276553		
	6538.6	1296	8103152	1296.333	932	765	10632.4	100.362	488228.7	276584		
	6507.6	1297	8101230	1296.667	931	765	10663.4	100.362	488228.7	276615		
	6476.6	1297	8090659	1298.333	930	765	10694.4	64.4562	488228.7	276646		
	6432.8	1303	8082971	1299.667	929	766	10738.2	64.4562	488259.5	276677		
	6389	1310	8080088	1301	928	767	10782	64.4562	488290.3	276707		
	6345.2	1307	8078166	1301	927	768	10825.8	64.4562	488321.1	276738		
	6301.4	1310	7945548	1301	926	767	10869.6	64.4562	488290.3	276769		
	6257.6	1308	7939782	1301	925	766	10913.4	64.4562	488259.5	276800		
	6226.6	1301	7937860	1301	924	766	10944.4	10.0172	488259.5	276831		
	6182.8	1309	7928250	1301	923	765	10988.2	10.0172	488228.7	276861		
	6151.8	1305	7925367	1301	922	765	11019.2	10.0172	488228.7	276892		
	6120.8	1301	7919601	1301.667	921	765	11050.2	10.0172	488228.7	276923		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	6089.8	1303	7918640	1303.333	920	765	11081.2	10.0172	488228.7	276954		
	6046	1308	7901342	1305	919	764	11125	10.0172	488197.9	276985		
	6015	1310	7898459	1306	918	764	11156	10.0172	488197.9	277015		
	5971.2	1314	7895576	1306	917	763	11199.8	5.87692	488167.1	277046		
	5927.4	1315	7710103	1306	916	764	11243.6	5.87692	488197.9	277077		
	5883.6	1309	7701454	1306	915	765	11287.4	5.87692	488228.7	277108		
	5852.6	1312	7691844	1306	914	765	11318.4	5.87692	488228.7	277139		
	5821.6	1313	7689922	1306	913	765	11349.4	5.87692	488228.7	277169		
	5790.6	1312	7684156	1306	912	765	11380.4	5.87692	488228.7	277200		
	5746.8	1314	7683195	1306	911	764	11424.2	5.87692	488197.9	277231		
	5703	1317	7670702	1306	910	765	11468	0	488228.7	277262		
	5659.2	1315	4079445	1306	909	766	11511.8	0	488259.5	277293		
	5615.4	1317	4067913	1306	908	767	11555.6	0	488290.3	277323		
	5571.6	1316	4045810	1306	907	768	11599.4	0	488321.1	277354		
	5527.8	1310	4001604	1306	906	769	11643.2	0	488351.9	277385		
	5484	1315	3970852	1306	905	770	11687	0	488382.7	277416		
	5453	1316	3963164	1306	904	770	11718	0	488382.7	277446		
	5422	1312	3960281	1306	903	770	11749	0	488382.7	277477		
	5391	1315	3958359	1306	902	770	11780	0	488382.7	277508		
	5360	1312	3930490	1306	901	770	11811	0	488382.7	277539		
	5329	1309	3924724	1306	900	770	11842	0	488382.7	277570		
	5298	1308	3921841	1306	899	770	11873	0	488382.7	277600		
	5267	1306	3918958	1307	898	770	11904	16.3092	488382.7	277631		
	5223.2	1317	3912231	1308	897	771	11947.8	16.3092	488413.5	277662		
	5192.2	1314	3906465	1309	896	771	11978.8	16.3092	488413.5	277693		
	5148.4	1316	3864181	1309	895	772	12022.6	16.3092	488444.3	277724		
	5117.4	1319	3857454	1309	894	772	12053.6	16.3092	488444.3	277754		
	5073.6	1309	3739251	1309	893	773	12097.4	16.3092	488475.1	277785		
	5042.6	1315	3686396	1309	892	773	12128.4	16.3092	488475.1	277816		
	5011.6	1311	3685435	1309	891	773	12159.4	16.3092	488475.1	277847		
	4980.6	1309	3684474	1309.333	890	773	12190.4	16.3092	488475.1	277878		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	4949.6	1310	3683513	1310.667	889	773	12221.4	16.3092	488475.1	277908		
	4918.6	1317	3682552	1312	888	773	12252.4	16.3092	488475.1	277939		
	4887.6	1321	3671981	1313	887	773	12283.4	16.3092	488475.1	277970		
	4856.6	1321	3670059	1313	886	773	12314.4	16.3092	488475.1	278001		
	4825.6	1320	3663332	1313	885	773	12345.4	16.3092	488475.1	278032		
	4781.8	1320	3559544	1313	884	772	12389.2	16.3092	488444.3	278062		
	4750.8	1317	3552817	1313	883	772	12420.2	16.3092	488444.3	278093		
	4719.8	1313	3550895	1314	882	772	12451.2	21.0184	488444.3	278124		
	4688.8	1316	3548973	1315	881	772	12482.2	21.0184	488444.3	278155		
	4645	1316	3548012	1317	880	771	12526	21.0184	488413.5	278186		
	4601.2	1319	3530714	1318.333	879	770	12569.8	21.0184	488382.7	278216		
	4557.4	1320	3523026	1320	878	769	12613.6	21.0184	488351.9	278247		
	4526.4	1321	3469210	1321	877	769	12644.6	21.0184	488351.9	278278		
	4482.6	1327	3462483	1321.667	876	768	12688.4	21.0184	488321.1	278309		
	4451.6	1325	3459600	1322	875	768	12719.4	22.7426	488321.1	278340		
	4407.8	1328	3452873	1322	874	767	12763.2	22.7426	488290.3	278370		
	4364	1322	3378876	1322	873	768	12807	22.7426	488321.1	278401		
	4333	1322	3373110	1323	872	768	12838	22.7426	488321.1	278432		
	4302	1325	3355812	1324.667	871	768	12869	22.7426	488321.1	278463		
	4271	1329	3350046	1326.333	870	768	12900	22.7426	488321.1	278494		
	4227.2	1330	3341397	1327	869	769	12943.8	22.2074	488351.9	278524		
	4183.4	1327	3242414	1327.667	868	770	12987.6	22.2074	488382.7	278555		
	4139.6	1329	3232804	1328.333	867	771	13031.4	22.2074	488413.5	278586		
	4108.6	1329	3224155	1329.333	866	771	13062.4	22.2074	488413.5	278617		
	4064.8	1330	3216467	1330.667	865	772	13106.2	22.2074	488444.3	278647		
	4021	1334	3178988	1332	864	771	13150	22.2074	488413.5	278678		
	3990	1337	3176105	1333	863	771	13181	22.2074	488413.5	278709		
	3946.2	1340	3171300	1333	862	770	13224.8	18.9057	488382.7	278740		
	3915.2	1333	3124211	1334.667	861	770	13255.8	18.9057	488382.7	278771		
	3884.2	1339	3122289	1336.333	860	770	13286.8	18.9057	488382.7	278801		
	3853.2	1343	3119406	1338	859	770	13317.8	18.9057	488382.7	278832		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	3809.4	1338	3072317	1339	858	771	13361.6	18.9057	488413.5	278863		
	3778.4	1341	3024267	1340	857	771	13392.6	18.9057	488413.5	278894		
	3747.4	1342	3023306	1341	856	771	13423.6	18.9057	488413.5	278925		
	3716.4	1343	3022345	1341	855	771	13454.6	16.8256	488413.5	278955		
	3685.4	1343	3020423	1341	854	771	13485.6	16.8256	488413.5	278986		
	3641.6	1348	2948348	1341	853	772	13529.4	16.8256	488444.3	279017		
	3597.8	1347	2945465	1341	852	773	13573.2	16.8256	488475.1	279048		
	3554	1350	2874351	1341	851	772	13617	16.8256	488444.3	279079		
	3523	1346	2872429	1341	850	772	13648	16.8256	488444.3	279109		
	3479.2	1347	2844560	1341	849	773	13691.8	16.8256	488475.1	279140		
	3448.2	1349	2843599	1341	848	773	13722.8	20.5321	488475.1	279171		
	3417.2	1349	2840716	1341	847	773	13753.8	20.5321	488475.1	279202		
	3386.2	1343	2780173	1341	846	773	13784.8	20.5321	488475.1	279233		
	3355.2	1341	2779212	1342.667	845	773	13815.8	20.5321	488475.1	279263		
	3324.2	1346	2778251	1344.333	844	773	13846.8	20.5321	488475.1	279294		
	3293.2	1348	2777290	1346	843	773	13877.8	20.5321	488475.1	279325		
	3262.2	1346	2774407	1346	842	773	13908.8	20.5321	488475.1	279356		
	3231.2	1347	2661970	1346	841	773	13939.8	26.485	488475.1	279387		
	3200.2	1348	2660048	1346	840	773	13970.8	26.485	488475.1	279417		
	3169.2	1346	2557221	1347	839	773	14001.8	26.485	488475.1	279448		
	3125.4	1349	2547611	1349.333	838	774	14045.6	26.485	488505.9	279479		
	3094.4	1353	2543767	1352.333	837	774	14076.6	26.485	488505.9	279510		
	3050.6	1359	2538001	1354.333	836	775	14120.4	26.485	488536.7	279541		
	3006.8	1356	2518781	1355	835	776	14164.2	26.485	488567.5	279571		
	2975.8	1356	2513015	1355	834	776	14195.2	13.025	488567.5	279602		
	2932	1364	2496678	1355	833	777	14239	13.025	488598.2	279633		
	2901	1359	2495717	1355	832	777	14270	13.025	488598.2	279664		
	2870	1359	2490912	1355	831	777	14301	13.025	488598.2	279694		
	2826.2	1355	2413071	1355	830	778	14344.8	13.025	488629	279725		
	2782.4	1357	2404422	1355	829	779	14388.6	13.025	488659.8	279756		
	2738.6	1358	2395773	1355	828	780	14432.4	13.025	488690.6	279787		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	2694.8	1362	2389046	1355	827	781	14476.2	0	488721.4	279818		
	2651	1361	2159367	1355	826	782	14520	0	488752.2	279848		
	2607.2	1363	2131498	1355	825	783	14563.8	0	488783	279879		
	2576.2	1364	2127654	1355	824	783	14594.8	0	488783	279910		
	2532.4	1364	2124771	1355	823	784	14638.6	0	488813.8	279941		
	2501.4	1358	2119005	1355	822	784	14669.6	22.8195	488813.8	279972		
	2457.6	1362	2107473	1355	821	785	14713.4	22.8195	488844.6	280002		
	2426.6	1363	2085370	1355	820	785	14744.4	22.8195	488844.6	280033		
	2382.8	1362	2078643	1355	819	786	14788.2	22.8195	488875.4	280064		
	2339	1355	1963323	1355.333	818	787	14832	22.8195	488906.2	280095		
	2295.2	1356	1953713	1356.333	817	788	14875.8	22.8195	488937	280126		
	2264.2	1358	1929688	1358.333	816	788	14906.8	22.8195	488937	280156		
	2233.2	1361	1926805	1360.667	815	788	14937.8	22.8195	488937	280187		
	2202.2	1368	1645232	1362.333	814	788	14968.8	22.8195	488937	280218		
	2171.2	1366	1588533	1363	813	788	14999.8	22.8195	488937	280249		
	2140.2	1364	1587572	1363	812	788	15030.8	22.8195	488937	280280		
	2109.2	1363	1586611	1364.333	811	788	15061.8	22.8195	488937	280310		
	2078.2	1367	1585650	1366.333	810	788	15092.8	22.8195	488937	280341		
	2047.2	1369	1584689	1368.667	809	788	15123.8	22.8195	488937	280372		
	2003.4	1371	1562586	1369.667	808	789	15167.6	22.8195	488967.8	280403		
	1959.6	1371	1560664	1370	807	790	15211.4	41.3062	488998.6	280434		
	1928.6	1370	1526068	1371.333	806	790	15242.4	41.3062	488998.6	280464		
	1884.8	1374	1396333	1373.333	805	789	15286.2	41.3062	488967.8	280495		
	1841	1376	1393450	1376.667	804	790	15330	41.3062	488998.6	280526		
	1810	1380	1388645	1380	803	790	15361	41.3062	488998.6	280557		
	1766.2	1384	832226	1386.333	802	791	15404.8	41.3062	489029.4	280588		
	1722.4	1395	829343	1392	801	792	15448.6	55.1665	489060.2	280618		
	1691.4	1397	818772	1396.667	800	792	15479.6	55.1665	489060.2	280649		
	1660.4	1398	809162	1400.333	799	792	15510.6	55.1665	489060.2	280680		
	1629.4	1406	808201	1407.667	798	792	15541.6	55.1665	489060.2	280711		
	1585.6	1423	802435	1414.667	797	793	15585.4	55.1665	489091	280742		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	1541.8	1421	800513	1419	796	794	15629.2	55.1665	489121.8	280772		
	1498	1423	787059	1419	795	795	15673	55.1665	489152.6	280803		
	1454.2	1420	781293	1419	794	796	15716.8	41.3709	489183.3	280834		
	1423.2	1420	773605	1419	793	796	15747.8	41.3709	489183.3	280865		
	1392.2	1419	769761	1419.667	792	796	15778.8	41.3709	489183.3	280895		
	1361.2	1421	603508	1421.333	791	796	15809.8	41.3709	489183.3	280926		
	1330.2	1424	597742	1423.333	790	796	15840.8	41.3709	489183.3	280957		
	1299.2	1425	595820	1425.667	789	796	15871.8	41.3709	489183.3	280988		
	1255.4	1432	587171	1427	788	797	15915.6	41.3709	489214.1	281019		
	1211.6	1433	584288	1428	787	796	15959.4	11.1415	489183.3	281049		
	1167.8	1431	582366	1428	786	797	16003.2	11.1415	489214.1	281080		
	1136.8	1428	537199	1429.667	785	797	16034.2	11.1415	489214.1	281111		
	1105.8	1433	536238	1431.333	784	797	16065.2	11.1415	489214.1	281142		
	1062	1436	532394	1433	783	796	16109	11.1415	489183.3	281173		
	1031	1434	287339	1433	782	796	16140	11.1415	489183.3	281203		
	987.2	1434	271963	1433	781	797	16183.8	11.1415	489214.1	281234		
	943.4	1434	264275	1433	780	798	16227.6	4.41111	489244.9	281265		
	899.6	1434	252743	1433	779	799	16271.4	4.41111	489275.7	281296		
	855.8	1433	230640	1433	778	800	16315.2	4.41111	489306.5	281327		
	812	1433	227757	1433.333	777	801	16359	4.41111	489337.3	281357		
	768.2	1441	217186	1433.667	776	800	16402.8	4.41111	489306.5	281388		
	724.4	1440	216225	1434	775	801	16446.6	12.6428	489337.3	281419		
	693.4	1434	172019	1435.333	774	801	16477.6	12.6428	489337.3	281450		
	662.4	1438	171058	1437	773	801	16508.6	12.6428	489337.3	281481		
	618.6	1439	158565	1438.667	772	800	16552.4	12.6428	489306.5	281511		
	574.8	1439	143189	1442	771	799	16596.2	12.6428	489275.7	281542		
	531	1448	126852	1445	770	798	16640	12.6428	489244.9	281573		
	487.2	1450	124930	1448	769	797	16683.8	12.6428	489214.1	281604		
	443.4	1448	110515	1450	768	796	16727.6	10.5395	489183.3	281635		
	399.6	1457	90334	1452	767	795	16771.4	10.5395	489152.6	281665		
	355.8	1454	88412	1455.333	766	796	16815.2	10.5395	489183.3	281696		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 8												
	324.8	1458	85529	1457	765	796	16846.2	10.5395	489183.3	281727		
	281	1461	71114	1458.667	764	795	16890	10.5395	489152.6	281758		
	237.2	1459	57660	1459	763	794	16933.8	10.5395	489121.8	281789		
	206.2	1459	50933	1460.333	762	794	16964.8	6.64254	489121.8	281819		
	162.4	1466	48050	1461.667	761	795	17008.6	6.64254	489152.6	281850		
	118.6	1466	44206	1463	760	794	17052.4	6.64254	489121.8	281881		
	74.8	1467	41323	1463	759	793	17096.2	6.64254	489091	281912		
	43.8	1463	18259	1463.333	758	793	17127.2	6.64254	489091	281943		
	0	1464	8649	1464	757	792	17171	6.64254	489060.2	281973		
South 9												
	14917	895	961	895	1168	825	0	0	490076.4	269317	14125.38	0.01016
	14873.2	895	1.1E+07	895	1169	824	43.8	0	490045.6	269286	177827.9	0.06527
	14829.4	896	1.1E+07	895	1168	823	87.6	0	490014.8	269317	354813.4	0.12182
	14798.4	895	1E+07	896.6667	1168	822	118.6	0	489984	269317	446683.6	0.12385
	14754.6	900	1E+07	898.3333	1167	821	162.4	28.7921	489953.2	269347	562341.3	0.16708
	14723.6	900	1E+07	900	1167	820	193.4	28.7921	489922.4	269347	891250.9	0.01264
	14679.8	900	1E+07	900.3333	1166	819	237.2	28.7921	489891.6	269378	1778279	0.03133
	14636	902	1E+07	900.6667	1165	818	281	28.7921	489860.8	269409	2238721	0.07338
	14592.2	901	1E+07	901.6667	1164	819	324.8	28.7921	489891.6	269440	2818383	0.08789
	14561.2	905	1E+07	902.3333	1163	819	355.8	28.7921	489891.6	269471	3548134	0.07087
	14530.2	904	1E+07	903	1162	819	386.8	28.7921	489891.6	269501	4466836	0.06923
	14499.2	903	1E+07	903.6667	1161	819	417.8	28.7921	489891.6	269532	5623413	0.07442
	14455.4	905	1E+07	905	1160	820	461.6	28.7921	489922.4	269563	7079458	0.05911
	14411.6	907	1E+07	906.3333	1159	821	505.4	28.7921	489953.2	269594	8912509	0.06857
	14367.8	911	1E+07	907	1158	822	549.2	28.7921	489984	269625	11220185	0.05911
	14324	912	1E+07	907	1157	823	593	28.7921	490014.8	269655		
	14280.2	908	1E+07	907	1156	824	636.8	28.7921	490045.6	269686		
	14249.2	907	1E+07	908	1155	824	667.8	28.7921	490045.6	269717		
	14218.2	910	1E+07	910.3333	1154	824	698.8	46.3363	490045.6	269748		
	14187.2	914	1E+07	913.6667	1153	824	729.8	46.3363	490045.6	269779		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	14143.4	919	1E+07	916	1152	823	773.6	46.3363	490014.8	269809		
	14112.4	917	1E+07	917	1151	823	804.6	46.3363	490014.8	269840		
	14068.6	919	1E+07	917	1150	822	848.4	46.3363	489984	269871		
	14037.6	919	1E+07	917	1149	822	879.4	46.3363	489984	269902		
	13993.8	918	1E+07	917	1148	821	923.2	46.3363	489953.2	269933		
	13962.8	917	1E+07	917.6667	1147	821	954.2	102.818	489953.2	269963		
	13931.8	919	1E+07	919	1146	821	985.2	102.818	489953.2	269994		
	13888	923	1E+07	920.3333	1145	820	1029	102.818	489922.4	270025		
	13857	922	1E+07	921	1144	820	1060	102.818	489922.4	270056		
	13813.2	921	1E+07	924	1143	821	1103.8	102.818	489953.2	270087		
	13782.2	930	1E+07	929.3333	1142	821	1134.8	102.818	489953.2	270117		
	13738.4	937	1E+07	935.3333	1141	822	1178.6	102.818	489984	270148		
	13694.6	945	1E+07	938.3333	1140	823	1222.4	126.35	490014.8	270179		
	13663.6	939	1E+07	940.6667	1139	823	1253.4	126.35	490014.8	270210		
	13632.6	944	1E+07	943.6667	1138	823	1284.4	126.35	490014.8	270240		
	13601.6	948	9994400	946.6667	1137	823	1315.4	126.35	490014.8	270271		
	13570.6	948	9993439	948.3333	1136	823	1346.4	126.35	490014.8	270302		
	13539.6	949	9991517	950.3333	1135	823	1377.4	126.35	490014.8	270333		
	13508.6	954	9961726	952.6667	1134	823	1408.4	126.35	490014.8	270364		
	13477.6	955	9960765	955.3333	1133	823	1439.4	100.879	490014.8	270394		
	13433.8	959	9956921	956.3333	1132	824	1483.2	100.879	490045.6	270425		
	13402.8	960	9954038	957	1131	824	1514.2	100.879	490045.6	270456		
	13359	957	9914637	960	1130	823	1558	100.879	490014.8	270487		
	13315.2	966	9687841	965.6667	1129	824	1601.8	100.879	490045.6	270518		
	13284.2	974	9684958	972	1128	824	1632.8	100.879	490045.6	270548		
	13240.4	981	9643635	975.3333	1127	825	1676.6	100.879	490076.4	270579		
	13196.6	993	9642674	976	1126	826	1720.4	94.7831	490107.2	270610		
	13152.8	988	9641713	976	1125	827	1764.2	94.7831	490138	270641		
	13121.8	992	9635947	976	1124	827	1795.2	94.7831	490138	270672		
	13078	992	9633064	976	1123	828	1839	94.7831	490168.8	270702		
	13047	982	9445669	976	1122	828	1870	94.7831	490168.8	270733		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	13016	980	9443747	976	1121	828	1901	94.7831	490168.8	270764		
	12985	980	9412034	976	1120	828	1932	94.7831	490168.8	270795		
	12954	981	9411073	976	1119	828	1963	109.771	490168.8	270826		
	12923	988	9410112	976	1118	828	1994	109.771	490168.8	270856		
	12892	976	9408190	979.6667	1117	828	2025	109.771	490168.8	270887		
	12848.2	987	9398580	984	1116	827	2068.8	109.771	490138	270918		
	12804.4	991	9392814	988.3333	1115	826	2112.6	109.771	490107.2	270949		
	12760.6	989	9387048	990	1114	825	2156.4	109.771	490076.4	270980		
	12716.8	992	9345725	991.3333	1113	824	2200.2	53.8541	490045.6	271010		
	12685.8	996	9329388	992.6667	1112	824	2231.2	53.8541	490045.6	271041		
	12654.8	997	9326505	993	1111	824	2262.2	53.8541	490045.6	271072		
	12611	999	9324583	993	1110	823	2306	53.8541	490014.8	271103		
	12580	998	9171784	993	1109	823	2337	53.8541	490014.8	271134		
	12536.2	1001	9163135	993	1108	822	2380.8	53.8541	489984	271164		
	12492.4	995	9157369	993	1107	823	2424.6	53.8541	490014.8	271195		
	12461.4	993	9146798	993.3333	1106	823	2455.6	42.3316	490014.8	271226		
	12430.4	1000	9108358	993.6667	1105	823	2486.6	42.3316	490014.8	271257		
	12399.4	995	9105475	994	1104	823	2517.6	42.3316	490014.8	271288		
	12368.4	996	9099709	994	1103	823	2548.6	42.3316	490014.8	271318		
	12337.4	999	9097787	994	1102	823	2579.6	42.3316	490014.8	271349		
	12293.6	998	9067996	994	1101	824	2623.4	42.3316	490045.6	271380		
	12249.8	1003	9065113	994	1100	825	2667.2	42.3316	490076.4	271411		
	12206	994	9035322	996.3333	1099	826	2711	42.3316	490107.2	271441		
	12162.2	1002	8991116	998.6667	1098	827	2754.8	42.3316	490138	271472		
	12131.2	1004	8989194	1001	1098	828	2785.8	42.3316	490168.8	271472		
	12100.2	1004	8987272	1001	1098	829	2816.8	42.3316	490199.6	271472		
	12056.4	1003	8969974	1001	1097	830	2860.6	42.3316	490230.4	271503		
	12025.4	1004	8946910	1001	1096	830	2891.6	42.3316	490230.4	271534		
	11981.6	1003	8942105	1001	1095	829	2935.4	42.3316	490199.6	271565		
	11950.6	1004	8729724	1001	1095	828	2966.4	83.4115	490168.8	271565		
	11906.8	1006	8722036	1001	1094	827	3010.2	83.4115	490138	271595		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	11863	1001	8705699	1003.667	1093	828	3054	83.4115	490168.8	271626		
	11819.2	1009	8686479	1008.667	1092	827	3097.8	83.4115	490138	271657		
	11788.2	1016	8683596	1014.333	1091	827	3128.8	83.4115	490138	271688		
	11744.4	1018	8673986	1017.667	1090	826	3172.6	83.4115	490107.2	271719		
	11713.4	1024	8663415	1018.667	1090	825	3203.6	90.3307	490076.4	271719		
	11669.6	1019	8662454	1020.333	1089	824	3247.4	90.3307	490045.6	271749		
	11638.6	1023	8654766	1021.667	1088	824	3278.4	90.3307	490045.6	271780		
	11594.8	1023	8650922	1023.333	1087	823	3322.2	90.3307	490014.8	271811		
	11563.8	1024	8561549	1024.667	1086	823	3353.2	90.3307	490014.8	271842		
	11532.8	1027	8535602	1028	1085	823	3384.2	90.3307	490014.8	271873		
	11489	1035	8532719	1031	1084	824	3428	90.3307	490045.6	271903		
	11458	1037	8531758	1033	1083	824	3459	63.163	490045.6	271934		
	11414.2	1034	8530797	1033	1082	825	3502.8	63.163	490076.4	271965		
	11370.4	1033	8516382	1034	1081	824	3546.6	63.163	490045.6	271996		
	11326.6	1042	8458722	1035	1080	823	3590.4	63.163	490014.8	272027		
	11282.8	1036	8446229	1036.333	1079	822	3634.2	63.163	489984	272057		
	11239	1037	8422204	1039	1078	821	3678	63.163	489953.2	272088		
	11208	1047	8338597	1041.667	1077	821	3709	64.6469	489953.2	272119		
	11164.2	1045	8337636	1044	1076	820	3752.8	64.6469	489922.4	272150		
	11120.4	1048	8320338	1044	1075	819	3796.6	64.6469	489891.6	272181		
	11089.4	1044	8318416	1044	1074	819	3827.6	64.6469	489891.6	272211		
	11045.6	1044	8310728	1046.667	1073	818	3871.4	64.6469	489860.8	272242		
	11014.6	1052	8289586	1049.333	1073	817	3902.4	64.6469	489830	272242		
	10970.8	1052	8257873	1052.667	1072	816	3946.2	42.2371	489799.2	272273		
	10939.8	1057	8246341	1053.333	1071	816	3977.2	42.2371	489799.2	272304		
	10908.8	1062	8244419	1054	1070	816	4008.2	42.2371	489799.2	272335		
	10877.8	1065	8238653	1054	1069	816	4039.2	42.2371	489799.2	272365		
	10834	1068	8235770	1054	1068	817	4083	42.2371	489830	272396		
	10803	1064	8089698	1054	1067	817	4114	42.2371	489830	272427		
	10772	1058	8087776	1054	1066	817	4145	42.2371	489830	272458		
	10728.2	1054	8077205	1054	1065	818	4188.8	42.2371	489860.8	272489		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	10684.4	1056	8009935	1054	1064	819	4232.6	41.8702	489891.6	272519		
	10653.4	1054	8003208	1055	1063	819	4263.6	41.8702	489891.6	272550		
	10622.4	1057	8002247	1056.333	1062	819	4294.6	41.8702	489891.6	272581		
	10578.6	1068	7988793	1057.667	1061	820	4338.4	41.8702	489922.4	272612		
	10547.6	1058	7986871	1058.333	1060	820	4369.4	41.8702	489922.4	272642		
	10503.8	1059	7952275	1060.667	1059	821	4413.2	41.8702	489953.2	272673		
	10472.8	1065	7939782	1063	1059	822	4444.2	38.2305	489984	272673		
	10441.8	1066	7937860	1065	1059	823	4475.2	38.2305	490014.8	272673		
	10410.8	1067	7934016	1065	1059	824	4506.2	38.2305	490045.6	272673		
	10367	1067	7873473	1065	1058	825	4550	38.2305	490076.4	272704		
	10323.2	1068	7861941	1065	1057	826	4593.8	38.2305	490107.2	272735		
	10279.4	1070	7829267	1065	1056	825	4637.6	38.2305	490076.4	272766		
	10248.4	1067	7813891	1065	1055	825	4668.6	38.2305	490076.4	272796		
	10217.4	1067	7811969	1065	1054	825	4699.6	14.0149	490076.4	272827		
	10186.4	1069	7798515	1065	1053	825	4730.6	14.0149	490076.4	272858		
	10155.4	1068	7795632	1065	1052	825	4761.6	14.0149	490076.4	272889		
	10124.4	1065	7710103	1065.333	1051	825	4792.6	14.0149	490076.4	272920		
	10093.4	1066	7702415	1066	1050	825	4823.6	14.0149	490076.4	272950		
	10062.4	1067	7699532	1067.667	1049	825	4854.6	14.0149	490076.4	272981		
	10018.6	1072	7695688	1069	1048	824	4898.4	14.0149	490045.6	273012		
	9987.6	1072	7661092	1070	1047	824	4929.4	14.0149	490045.6	273043		
	9943.8	1073	7654365	1070	1046	825	4973.2	15.2649	490076.4	273074		
	9912.8	1075	7651482	1070	1045	825	5004.2	15.2649	490076.4	273104		
	9869	1080	7646677	1070	1044	826	5048	15.2649	490107.2	273135		
	9825.2	1079	7415076	1070	1043	825	5091.8	15.2649	490076.4	273166		
	9794.2	1077	7313210	1070	1042	825	5122.8	15.2649	490076.4	273197		
	9763.2	1072	7312249	1070	1041	825	5153.8	15.2649	490076.4	273228		
	9732.2	1070	7311288	1070	1040	825	5184.8	25.2768	490076.4	273258		
	9701.2	1071	7310327	1070	1039	825	5215.8	25.2768	490076.4	273289		
	9670.2	1070	7309366	1071	1038	825	5246.8	25.2768	490076.4	273320		
	9639.2	1073	7308405	1072.667	1037	825	5277.8	25.2768	490076.4	273351		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	9608.2	1076	7307444	1074.333	1036	825	5308.8	25.2768	490076.4	273382		
	9577.2	1078	7305522	1075	1035	825	5339.8	25.2768	490076.4	273412		
	9546.2	1078	7223837	1075	1034	825	5370.8	25.2768	490076.4	273443		
	9515.2	1075	7222876	1075.667	1033	825	5401.8	25.2768	490076.4	273474		
	9484.2	1077	7221915	1077	1032	825	5432.8	27.3929	490076.4	273505		
	9453.2	1080	7220954	1078.333	1031	825	5463.8	27.3929	490076.4	273536		
	9409.4	1079	7216149	1079.333	1030	826	5507.6	27.3929	490107.2	273566		
	9378.4	1083	7138308	1079.667	1030	827	5538.6	27.3929	490138	273566		
	9334.6	1085	7136386	1080	1029	828	5582.4	27.3929	490168.8	273597		
	9290.8	1085	7124854	1080	1028	829	5626.2	27.3929	490199.6	273628		
	9247	1083	7100829	1080	1027	830	5670	27.3929	490230.4	273659		
	9203.2	1080	7004729	1080	1026	831	5713.8	54.859	490261.2	273690		
	9159.4	1080	6942264	1081.667	1025	832	5757.6	54.859	490292	273720		
	9115.6	1085	6924005	1086.667	1024	833	5801.4	54.859	490322.8	273751		
	9084.6	1101	6917278	1091.667	1024	834	5832.4	54.859	490353.5	273751		
	9040.8	1103	6916317	1095	1023	835	5876.2	54.859	490384.3	273782		
	9009.8	1104	6910551	1095	1022	835	5907.2	54.859	490384.3	273813		
	8966	1102	6882682	1095	1021	836	5951	67.3203	490415.1	273843		
	8935	1100	6823100	1095	1020	836	5982	67.3203	490415.1	273874		
	8904	1103	6822139	1095	1019	836	6013	67.3203	490415.1	273905		
	8860.2	1100	6819256	1095	1018	837	6056.8	67.3203	490445.9	273936		
	8816.4	1100	6812529	1095	1017	838	6100.6	67.3203	490476.7	273967		
	8772.6	1096	6623212	1095	1016	837	6144.4	67.3203	490445.9	273997		
	8741.6	1098	6615524	1095	1015	837	6175.4	67.3203	490445.9	274028		
	8710.6	1100	6614563	1095	1014	837	6206.4	93.105	490445.9	274059		
	8679.6	1095	6505009	1098.667	1013	837	6237.4	93.105	490445.9	274090		
	8648.6	1106	6504048	1104.667	1012	837	6268.4	93.105	490445.9	274121		
	8617.6	1113	6503087	1112	1011	837	6299.4	93.105	490445.9	274151		
	8586.6	1117	6502126	1116	1010	837	6330.4	93.105	490445.9	274182		
	8555.6	1121	6501165	1117.667	1009	837	6361.4	93.105	490445.9	274213		
	8511.8	1121	6499243	1118	1008	836	6405.2	93.105	490415.1	274244		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	8480.8	1126	6487711	1118	1007	836	6436.2	93.105	490415.1	274275		
	8449.8	1128	6486750	1118	1006	836	6467.2	93.105	490415.1	274305		
	8406	1129	6481945	1118	1005	837	6511	93.105	490445.9	274336		
	8375	1129	6427168	1118	1004	837	6542	93.105	490445.9	274367		
	8331.2	1129	6421402	1118	1003	838	6585.8	93.105	490476.7	274398		
	8300.2	1127	6414675	1118	1002	838	6616.8	93.105	490476.7	274429		
	8256.4	1119	6403143	1118	1001	839	6660.6	93.105	490507.5	274459		
	8212.6	1119	6381040	1118	1000	840	6704.4	0	490538.3	274490		
	8181.6	1120	6377196	1118	999	840	6735.4	0	490538.3	274521		
	8150.6	1118	6326263	1118	998	840	6766.4	0	490538.3	274552		
	8119.6	1124	6319536	1118	997	840	6797.4	0	490538.3	274583		
	8075.8	1126	6235929	1118	996	841	6841.2	0	490569.1	274613		
	8044.8	1120	6198450	1118	995	841	6872.2	0	490569.1	274644		
	8013.8	1124	6197489	1118	994	841	6903.2	19.364	490569.1	274675		
	7982.8	1129	6195567	1118	993	841	6934.2	19.364	490569.1	274706		
	7951.8	1129	6193645	1118	992	841	6965.2	19.364	490569.1	274737		
	7908	1129	6184035	1118	991	842	7009	19.364	490599.9	274767		
	7877	1130	6178269	1118	990	842	7040	19.364	490599.9	274798		
	7833.2	1129	6177308	1118	989	843	7083.8	19.364	490630.7	274829		
	7789.4	1124	5994718	1118	988	844	7127.6	19.364	490661.5	274860		
	7745.6	1118	5980303	1119	987	845	7171.4	19.364	490692.3	274891		
	7701.8	1122	5961083	1120	986	846	7215.2	19.364	490723.1	274921		
	7670.8	1123	5959161	1121	985	846	7246.2	19.364	490723.1	274952		
	7627	1129	5773688	1121	984	847	7290	19.364	490753.9	274983		
	7596	1127	5718911	1121	983	847	7321	19.364	490753.9	275014		
	7565	1126	5660290	1121	982	847	7352	19.364	490753.9	275044		
	7534	1124	5659329	1121	981	847	7383	19.364	490753.9	275075		
	7503	1129	5656446	1121	980	847	7414	19.364	490753.9	275106		
	7472	1121	5632421	1121.333	979	847	7445	39.1515	490753.9	275137		
	7441	1123	5631460	1121.667	978	847	7476	39.1515	490753.9	275168		
	7410	1122	5630499	1125.333	977	847	7507	39.1515	490753.9	275198		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	7379	1132	5594942	1129	976	847	7538	39.1515	490753.9	275229		
	7348	1133	5593020	1132.667	975	847	7569	39.1515	490753.9	275260		
	7304.2	1137	5519984	1133	974	846	7612.8	39.1515	490723.1	275291		
	7273.2	1141	5517101	1133	973	846	7643.8	39.1515	490723.1	275322		
	7229.4	1144	5515179	1133	972	845	7687.6	39.1515	490692.3	275352		
	7198.4	1140	5420040	1133	971	845	7718.6	98.844	490692.3	275383		
	7167.4	1136	5415235	1133	970	845	7749.6	98.844	490692.3	275414		
	7136.4	1133	5409469	1135.667	969	845	7780.6	98.844	490692.3	275445		
	7105.4	1141	5396976	1139.333	968	845	7811.6	98.844	490692.3	275476		
	7074.4	1144	5396015	1143.667	967	845	7842.6	98.844	490692.3	275506		
	7043.4	1146	5338355	1147	966	845	7873.6	98.844	490692.3	275537		
	7012.4	1151	5332589	1150.667	965	845	7904.6	98.844	490692.3	275568		
	6981.4	1155	5322018	1155	964	845	7935.6	85.2411	490692.3	275599		
	6937.6	1159	5314330	1158	963	844	7979.4	85.2411	490661.5	275630		
	6906.6	1166	5301837	1159.667	962	844	8010.4	85.2411	490661.5	275660		
	6875.6	1172	5299915	1160	961	844	8041.4	85.2411	490661.5	275691		
	6844.6	1175	5190361	1160	960	844	8072.4	85.2411	490661.5	275722		
	6813.6	1172	5096183	1160	959	844	8103.4	85.2411	490661.5	275753		
	6782.6	1162	5095222	1160	958	844	8134.4	85.2411	490661.5	275784		
	6751.6	1160	5094261	1160	957	844	8165.4	85.2411	490661.5	275814		
	6720.6	1160	5093300	1161	956	844	8196.4	50.1952	490661.5	275845		
	6689.6	1163	5092339	1162	955	844	8227.4	50.1952	490661.5	275876		
	6658.6	1163	5090417	1166	954	844	8258.4	50.1952	490661.5	275907		
	6627.6	1173	5088495	1169	953	844	8289.4	50.1952	490661.5	275938		
	6596.6	1172	5086573	1172.667	952	844	8320.4	50.1952	490661.5	275968		
	6565.6	1178	5073119	1173.333	951	844	8351.4	50.1952	490661.5	275999		
	6534.6	1177	5072158	1174	950	844	8382.4	50.1952	490661.5	276030		
	6503.6	1174	5050055	1175	949	844	8413.4	50.1952	490661.5	276061		
	6459.8	1190	5015459	1176	948	843	8457.2	37.5013	490630.7	276092		
	6416	1192	5014498	1177	947	842	8501	37.5013	490599.9	276122		
	6385	1192	4836713	1177	946	842	8532	37.5013	490599.9	276153		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	6354	1182	4834791	1177	945	842	8563	37.5013	490599.9	276184		
	6323	1187	4829986	1177	944	842	8594	37.5013	490599.9	276215		
	6292	1188	4827103	1177	943	842	8625	37.5013	490599.9	276245		
	6248.2	1187	4807883	1177	942	843	8668.8	37.5013	490630.7	276276		
	6217.2	1185	4805961	1177	941	843	8699.8	146.089	490630.7	276307		
	6186.2	1187	4803078	1177	940	843	8730.8	146.089	490630.7	276338		
	6155.2	1184	4791546	1177	939	843	8761.8	146.089	490630.7	276369		
	6111.4	1192	4781936	1177	938	844	8805.6	146.089	490661.5	276399		
	6080.4	1186	4775209	1177	937	844	8836.6	146.089	490661.5	276430		
	6049.4	1185	4769443	1177	936	844	8867.6	146.089	490661.5	276461		
	6018.4	1177	4707939	1179.333	935	844	8898.6	146.089	490661.5	276492		
	5987.4	1184	4706978	1183.333	934	844	8929.6	146.089	490661.5	276523		
	5956.4	1189	4706017	1189.333	933	844	8960.6	78.247	490661.5	276553		
	5925.4	1195	4657006	1193	932	844	8991.6	78.247	490661.5	276584		
	5894.4	1206	4653162	1195	931	844	9022.6	78.247	490661.5	276615		
	5863.4	1210	4651240	1195	930	844	9053.6	78.247	490661.5	276646		
	5819.6	1212	4649318	1195	929	843	9097.4	78.247	490630.7	276677		
	5775.8	1212	4646435	1195	928	844	9141.2	78.247	490661.5	276707		
	5744.8	1209	4307202	1195	927	844	9172.2	78.247	490661.5	276738		
	5713.8	1204	4177467	1195	926	844	9203.2	56.5382	490661.5	276769		
	5682.8	1198	4176506	1195	925	844	9234.2	56.5382	490661.5	276800		
	5651.8	1195	4175545	1195.667	924	844	9265.2	56.5382	490661.5	276831		
	5620.8	1197	4174584	1197.667	923	844	9296.2	56.5382	490661.5	276861		
	5589.8	1201	4173623	1199.667	922	844	9327.2	56.5382	490661.5	276892		
	5558.8	1202	4172662	1201	921	844	9358.2	56.5382	490661.5	276923		
	5527.8	1206	4171701	1201	920	844	9389.2	56.5382	490661.5	276954		
	5496.8	1201	4170740	1202.333	919	844	9420.2	56.5382	490661.5	276985		
	5465.8	1205	4169779	1204.667	918	844	9451.2	34.2585	490661.5	277015		
	5434.8	1208	4168818	1207.667	917	844	9482.2	34.2585	490661.5	277046		
	5403.8	1210	4155364	1210	916	844	9513.2	34.2585	490661.5	277077		
	5360	1217	4142871	1211.333	915	845	9557	34.2585	490692.3	277108		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	5329	1220	4138066	1212	914	845	9588	34.2585	490692.3	277139		
	5285.2	1222	4128456	1212	913	844	9631.8	34.2585	490661.5	277169		
	5241.4	1221	4115963	1212	912	845	9675.6	34.2585	490692.3	277200		
	5210.4	1223	4108275	1212	911	845	9706.6	46.0741	490692.3	277231		
	5179.4	1221	4107314	1212	910	845	9737.6	46.0741	490692.3	277262		
	5135.6	1217	4103470	1212	909	844	9781.4	46.0741	490661.5	277293		
	5091.8	1217	4036200	1212	908	845	9825.2	46.0741	490692.3	277323		
	5048	1212	4016019	1212.333	907	846	9869	46.0741	490723.1	277354		
	5017	1213	3987189	1215.333	906	846	9900	46.0741	490723.1	277385		
	4986	1221	3986228	1218.667	905	846	9931	46.0741	490723.1	277416		
	4955	1226	3979501	1221.667	904	846	9962	37.7794	490723.1	277446		
	4924	1223	3978540	1222	903	846	9993	37.7794	490723.1	277477		
	4880.2	1225	3893011	1222	902	845	10036.8	37.7794	490692.3	277508		
	4849.2	1222	3788262	1222	901	845	10067.8	37.7794	490692.3	277539		
	4818.2	1225	3786340	1222	900	845	10098.8	37.7794	490692.3	277570		
	4787.2	1230	3783457	1222	899	845	10129.8	37.7794	490692.3	277600		
	4756.2	1230	3771925	1222	898	845	10160.8	37.7794	490692.3	277631		
	4725.2	1230	3770964	1222	897	845	10191.8	49.6507	490692.3	277662		
	4694.2	1224	3762315	1222	896	845	10222.8	49.6507	490692.3	277693		
	4663.2	1222	3538402	1224	895	845	10253.8	49.6507	490692.3	277724		
	4632.2	1228	3537441	1228	894	845	10284.8	49.6507	490692.3	277754		
	4588.4	1234	3511494	1232.667	893	846	10328.6	49.6507	490723.1	277785		
	4544.6	1237	3505728	1235.333	892	847	10372.4	49.6507	490753.9	277816		
	4500.8	1236	3501884	1237.333	891	848	10416.2	49.6507	490784.7	277847		
	4457	1240	3474976	1241.333	890	849	10460	61.9394	490815.5	277878		
	4426	1251	2575480	1245.333	890	850	10491	61.9394	490846.3	277878		
	4382.2	1248	2573558	1248	889	851	10534.8	61.9394	490877.1	277908		
	4338.4	1250	2548572	1248	888	852	10578.6	61.9394	490907.9	277939		
	4294.6	1250	2542806	1248	887	853	10622.4	61.9394	490938.7	277970		
	4263.6	1248	2522625	1249	886	853	10653.4	61.9394	490938.7	278001		
	4219.8	1251	2513976	1252	885	854	10697.2	35.4889	490969.4	278032		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	4188.8	1257	2496678	1255	884	854	10728.2	35.4889	490969.4	278062		
	4145	1261	2464965	1257	883	855	10772	35.4889	491000.2	278093		
	4114	1265	2464004	1257	883	856	10803	35.4889	491031	278093		
	4070.2	1265	2463043	1257	882	857	10846.8	35.4889	491061.8	278124		
	4026.4	1262	2457277	1257	881	858	10890.6	35.4889	491092.6	278155		
	3982.6	1257	2402500	1257	880	859	10934.4	35.4889	491123.4	278186		
	3938.8	1257	2299673	1257.333	879	860	10978.2	30.749	491154.2	278216		
	3895	1258	2290063	1258	878	861	11022	30.749	491185	278247		
	3864	1259	2239130	1259.667	877	861	11053	30.749	491185	278278		
	3833	1263	2238169	1261	876	861	11084	30.749	491185	278309		
	3802	1262	2237208	1263.333	875	861	11115	30.749	491185	278340		
	3771	1268	2236247	1264.667	874	861	11146	30.749	491185	278370		
	3727.2	1266	2235286	1268.667	873	860	11189.8	43.2367	491154.2	278401		
	3696.2	1274	2160328	1273	872	860	11220.8	43.2367	491154.2	278432		
	3665.2	1282	2158406	1277.333	871	860	11251.8	43.2367	491154.2	278463		
	3621.4	1281	2157445	1279	870	861	11295.6	43.2367	491185	278494		
	3577.6	1283	2154562	1279	869	862	11339.4	43.2367	491215.8	278524		
	3533.8	1279	2140147	1280	868	863	11383.2	43.2367	491246.6	278555		
	3490	1282	1863379	1281.333	867	864	11427	43.2367	491277.4	278586		
	3446.2	1284	1859535	1282.667	866	865	11470.8	25.0525	491308.2	278617		
	3402.4	1283	1854730	1284	865	866	11514.6	25.0525	491339	278647		
	3358.6	1286	1851847	1285.333	866	867	11558.4	25.0525	491369.8	278617		
	3327.6	1292	1846081	1286.667	866	868	11589.4	25.0525	491400.6	278617		
	3283.8	1297	1844159	1287	865	869	11633.2	25.0525	491431.4	278647		
	3240	1292	1840315	1287	864	870	11677	25.0525	491462.2	278678		
	3209	1288	1782655	1287	863	870	11708	2.64591	491462.2	278709		
	3178	1289	1779772	1287	862	870	11739	2.64591	491462.2	278740		
	3147	1290	1776889	1287	861	870	11770	2.64591	491462.2	278771		
	3116	1291	1773045	1287	860	870	11801	2.64591	491462.2	278801		
	3072.2	1296	1756708	1287	859	871	11844.8	2.64591	491493	278832		
	3028.4	1296	1751903	1287	858	872	11888.6	2.64591	491523.8	278863		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	2997.4	1291	1745176	1287	857	872	11919.6	2.64591	491523.8	278894		
	2953.6	1297	1733644	1287	856	873	11963.4	0	491554.5	278925		
	2922.6	1291	1729800	1287	855	873	11994.4	0	491554.5	278955		
	2878.8	1293	1723073	1287	854	874	12038.2	0	491585.3	278986		
	2835	1293	1686555	1287	853	875	12082	0	491616.1	279017		
	2804	1293	1681750	1287	853	876	12113	0	491646.9	279017		
	2773	1292	1678867	1287	853	877	12144	0	491677.7	279017		
	2729.2	1300	1663491	1287	852	878	12187.8	0	491708.5	279048		
	2698.2	1304	1661569	1287	851	878	12218.8	0	491708.5	279079		
	2654.4	1301	1660608	1287	850	879	12262.6	0	491739.3	279109		
	2610.6	1296	1643310	1287	849	880	12306.4	0	491770.1	279140		
	2566.8	1292	1629856	1287	848	881	12350.2	0	491800.9	279171		
	2535.8	1287	1481862	1287.667	847	881	12381.2	0	491800.9	279202		
	2504.8	1290	1480901	1288.333	846	881	12412.2	11.7318	491800.9	279233		
	2473.8	1295	1479940	1289	845	881	12443.2	11.7318	491800.9	279263		
	2442.8	1298	1478979	1289	844	881	12474.2	11.7318	491800.9	279294		
	2411.8	1302	1478018	1289	843	881	12505.2	11.7318	491800.9	279325		
	2368	1295	1472252	1289	842	880	12549	11.7318	491770.1	279356		
	2324.2	1299	908145	1289	841	879	12592.8	11.7318	491739.3	279387		
	2293.2	1299	828382	1289	841	878	12623.8	11.7318	491708.5	279387		
	2262.2	1301	827421	1289	841	877	12654.8	11.7318	491677.7	279387		
	2231.2	1299	818772	1289	841	876	12685.8	11.7318	491646.9	279387		
	2200.2	1299	817811	1289	841	875	12716.8	11.7318	491616.1	279387		
	2169.2	1293	816850	1289	841	874	12747.8	11.7318	491585.3	279387		
	2138.2	1293	815889	1289	841	873	12778.8	11.7318	491554.5	279387		
	2107.2	1289	814928	1290.667	841	872	12809.8	11.7318	491523.8	279387		
	2076.2	1297	813967	1292.333	841	871	12840.8	11.7318	491493	279387		
	2045.2	1302	813006	1294	841	870	12871.8	11.7318	491462.2	279387		
	2001.4	1305	810123	1294	840	869	12915.6	11.7318	491431.4	279417		
	1957.6	1300	809162	1294	839	868	12959.4	15.4454	491400.6	279448		
	1913.8	1294	787059	1295.333	838	867	13003.2	15.4454	491369.8	279479		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	1882.8	1298	578522	1297.667	837	867	13034.2	15.4454	491369.8	279510		
	1851.8	1302	577561	1300	836	867	13065.2	15.4454	491369.8	279541		
	1820.8	1303	576600	1301	835	867	13096.2	15.4454	491369.8	279571		
	1789.8	1301	575639	1301	834	867	13127.2	15.4454	491369.8	279602		
	1758.8	1301	574678	1301.333	833	867	13158.2	15.4454	491369.8	279633		
	1727.8	1303	572756	1301.667	832	867	13189.2	35.1096	491369.8	279664		
	1684	1302	566990	1303.667	831	866	13233	35.1096	491339	279694		
	1640.2	1307	554497	1306	832	865	13276.8	35.1096	491308.2	279664		
	1609.2	1309	543926	1312.667	832	864	13307.8	35.1096	491277.4	279664		
	1565.4	1322	518940	1319.333	831	863	13351.6	35.1096	491246.6	279694		
	1521.6	1329	517018	1325.333	830	862	13395.4	35.1096	491215.8	279725		
	1477.8	1327	516057	1327	829	861	13439.2	42.2143	491185	279756		
	1446.8	1327	498759	1329	828	861	13470.2	42.2143	491185	279787		
	1403	1333	494915	1332	827	860	13514	42.2143	491154.2	279818		
	1359.2	1336	481461	1337.667	826	859	13557.8	42.2143	491123.4	279848		
	1328.2	1345	478578	1341.333	825	859	13588.8	42.2143	491123.4	279879		
	1284.4	1344	477617	1346	824	858	13632.6	42.2143	491092.6	279910		
	1240.6	1350	397854	1349.667	825	857	13676.4	42.2143	491061.8	279879		
	1209.6	1355	394971	1356.333	825	856	13707.4	33.5403	491031	279879		
	1178.6	1368	392088	1361	825	855	13738.4	33.5403	491000.2	279879		
	1134.8	1370	389205	1364	824	854	13782.2	33.5403	490969.4	279910		
	1091	1370	385361	1364	823	853	13826	33.5403	490938.7	279941		
	1047.2	1368	382478	1364	822	852	13869.8	33.5403	490907.9	279972		
	1003.4	1370	350765	1364	823	851	13913.6	33.5403	490877.1	279941		
	959.6	1366	334428	1364	824	850	13957.4	19.4065	490846.3	279910		
	915.8	1364	317130	1365	825	849	14001.2	19.4065	490815.5	279879		
	884.8	1370	297910	1366	825	848	14032.2	19.4065	490784.7	279879		
	853.8	1369	296949	1367	825	847	14063.2	19.4065	490753.9	279879		
	822.8	1367	295988	1367.333	825	846	14094.2	19.4065	490723.1	279879		
	791.8	1369	295027	1367.667	825	845	14125.2	19.4065	490692.3	279879		
	748	1371	202771	1368	824	844	14169	19.4065	490661.5	279910		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 9												
	717	1368	200849	1368.333	824	843	14200	7.27273	490630.7	279910		
	673.2	1369	189317	1369.667	823	842	14243.8	7.27273	490599.9	279941		
	629.4	1372	177785	1372.667	822	841	14287.6	7.27273	490569.1	279972		
	598.4	1379	171058	1375.333	821	841	14318.6	7.27273	490569.1	280002		
	554.6	1385	168175	1377	820	842	14362.4	7.27273	490599.9	280033		
	523.6	1382	157604	1377	819	842	14393.4	7.27273	490599.9	280064		
	492.6	1384	156643	1377	818	842	14424.4	7.27273	490599.9	280095		
	461.6	1384	155682	1377	817	842	14455.4	6.79844	490599.9	280126		
	417.8	1384	149916	1377	816	843	14499.2	6.79844	490630.7	280156		
	374	1377	135501	1377	815	844	14543	6.79844	490661.5	280187		
	330.2	1382	128774	1377	814	845	14586.8	6.79844	490692.3	280218		
	299.2	1377	123969	1379	814	846	14617.8	6.79844	490723.1	280218		
	268.2	1384	87451	1381	814	847	14648.8	6.79844	490753.9	280218		
	224.4	1383	82646	1383.333	813	848	14692.6	5.77739	490784.7	280249		
	193.4	1388	60543	1383.667	813	849	14723.6	5.77739	490815.5	280249		
	149.6	1388	53816	1384	812	850	14767.4	5.77739	490846.3	280280		
	105.8	1384	22103	1384.333	811	851	14811.2	5.77739	490877.1	280310		
	74.8	1385	16337	1387.333	810	851	14842.2	5.77739	490877.1	280341		
	31	1395	12493	1390.333	809	852	14886	5.77739	490907.9	280372		
	0	1393	5766	1393	809	853	14917	5.77739	490938.7	280372		
South 11a												
	11493.6	900	961	889	1140	944	0	0	493741	270179	281838.3	0.10211
	11449.8	894	1.4E+07	889	1141	945	43.8	0	493771.8	270148	354813.4	0.11875
	11418.8	899	1.4E+07	889	1140	945	74.8	0	493771.8	270179	707945.8	0.05429
	11375	898	1.4E+07	889	1139	944	118.6	0	493741	270210	891250.9	0.06361
	11331.2	900	1.4E+07	889	1138	943	162.4	0	493710.2	270240	1122018	0.09012
	11287.4	894	1.4E+07	889	1137	942	206.2	0	493679.4	270271	1412538	0.16488
	11243.6	897	1.4E+07	889	1136	941	250	0	493648.6	270302	1778279	0.07346
	11199.8	896	1.4E+07	889	1135	940	293.8	0	493617.8	270333	2238721	0.07106
	11168.8	898	1.4E+07	889	1134	940	324.8	0	493617.8	270364	2818383	0.07459

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	11137.8	900	1.4E+07	889	1133	940	355.8	0	493617.8	270394	4466836	0.05048
	11094	907	1.4E+07	889	1132	939	399.6	0	493587	270425	5623413	0.06878
	11050.2	907	1.4E+07	889	1131	938	443.4	0	493556.2	270456	7079458	0.06515
	11006.4	907	1.4E+07	889	1130	939	487.2	0	493587	270487	11220185	0.0528
	10975.4	906	1.4E+07	889	1129	939	518.2	0	493587	270518	14125375	0.11214
	10931.6	904	1.4E+07	889	1128	940	562	0	493617.8	270548		
	10900.6	906	1.4E+07	889	1127	940	593	0	493617.8	270579		
	10869.6	909	1.4E+07	889	1126	940	624	0	493617.8	270610		
	10825.8	905	1.4E+07	889	1125	939	667.8	0	493587	270641		
	10782	901	1.4E+07	889	1124	938	711.6	0	493556.2	270672		
	10738.2	907	1.3E+07	889	1123	937	755.4	0	493525.4	270702		
	10694.4	908	1.3E+07	889	1122	936	799.2	0	493494.6	270733		
	10650.6	901	1.3E+07	889	1121	935	843	0	493463.8	270764		
	10606.8	908	1.3E+07	889	1120	934	886.8	0	493433	270795		
	10575.8	909	1.3E+07	889	1119	934	917.8	0	493433	270826		
	10532	909	1.3E+07	889	1118	933	961.6	0	493402.2	270856		
	10501	910	1.3E+07	889	1117	933	992.6	255.595	493402.2	270887		
	10457.2	910	1.3E+07	889	1116	934	1036.4	255.595	493433	270918		
	10413.4	910	1.3E+07	889	1115	933	1080.2	255.595	493402.2	270949		
	10369.6	910	1.3E+07	889	1114	932	1124	255.595	493371.4	270980		
	10325.8	910	1.3E+07	889	1113	933	1167.8	255.595	493402.2	271010		
	10282	911	1.3E+07	889	1112	932	1211.6	255.595	493371.4	271041		
	10238.2	894	1.3E+07	889	1111	931	1255.4	255.595	493340.6	271072		
	10194.4	889	1.3E+07	889.3333	1110	930	1299.2	255.595	493309.9	271103		
	10150.6	890	1.3E+07	893	1109	929	1343	255.595	493279.1	271134		
	10106.8	900	1.3E+07	899.6667	1108	928	1386.8	255.595	493248.3	271164		
	10063	909	1.3E+07	907.3333	1107	927	1430.6	255.595	493217.5	271195		
	10032	913	1.3E+07	915	1106	927	1461.6	255.595	493217.5	271226		
	9988.2	923	1.3E+07	920.6667	1105	926	1505.4	255.595	493186.7	271257		
	9944.4	926	1.3E+07	927.3333	1104	925	1549.2	304.668	493155.9	271288		
	9913.4	933	1.3E+07	932.3333	1103	925	1580.2	304.668	493155.9	271318		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	9869.6	938	1.3E+07	937.3333	1102	924	1624	304.668	493125.1	271349		
	9838.6	941	1.3E+07	943.3333	1101	924	1655	304.668	493125.1	271380		
	9807.6	951	1.3E+07	953	1100	924	1686	304.668	493125.1	271411		
	9776.6	967	1.3E+07	964	1099	924	1717	304.668	493125.1	271441		
	9745.6	974	1.3E+07	972.3333	1098	924	1748	304.668	493125.1	271472		
	9701.8	981	1.3E+07	975.3333	1097	923	1791.8	249.093	493094.3	271503		
	9670.8	984	1.3E+07	976	1096	923	1822.8	249.093	493094.3	271534		
	9639.8	989	1.3E+07	976	1095	923	1853.8	249.093	493094.3	271565		
	9596	988	1.3E+07	976	1094	922	1897.6	249.093	493063.5	271595		
	9552.2	982	1.3E+07	976	1093	921	1941.4	249.093	493032.7	271626		
	9508.4	981	1.3E+07	976	1092	920	1985.2	249.093	493001.9	271657		
	9477.4	977	1.3E+07	976	1091	920	2016.2	9.72287	493001.9	271688		
	9446.4	977	1.3E+07	976	1090	920	2047.2	9.72287	493001.9	271719		
	9415.4	976	1.3E+07	976.3333	1089	920	2078.2	9.72287	493001.9	271749		
	9384.4	981	1.3E+07	976.6667	1088	920	2109.2	9.72287	493001.9	271780		
	9353.4	987	1.3E+07	977	1087	920	2140.2	9.72287	493001.9	271811		
	9322.4	989	1.3E+07	977	1086	920	2171.2	9.72287	493001.9	271842		
	9291.4	992	1.3E+07	977	1085	920	2202.2	9.72287	493001.9	271873		
	9247.6	992	1.3E+07	977	1084	921	2246	9.72287	493032.7	271903		
	9216.6	987	1.3E+07	977	1083	921	2277	142.049	493032.7	271934		
	9185.6	987	1.3E+07	977	1082	921	2308	142.049	493032.7	271965		
	9154.6	991	1.3E+07	977	1081	921	2339	142.049	493032.7	271996		
	9123.6	990	1.3E+07	977	1080	921	2370	142.049	493032.7	272027		
	9079.8	987	1.3E+07	977	1079	922	2413.8	142.049	493063.5	272057		
	9048.8	985	1.3E+07	977	1078	922	2444.8	142.049	493063.5	272088		
	9017.8	987	1.3E+07	977	1077	922	2475.8	142.049	493063.5	272119		
	8974	989	1.3E+07	977	1076	923	2519.6	142.049	493094.3	272150		
	8943	978	1.3E+07	977	1075	923	2550.6	142.049	493094.3	272181		
	8912	977	1.3E+07	977	1074	923	2581.6	142.049	493094.3	272211		
	8881	977	1.3E+07	981.3333	1073	923	2612.6	142.049	493094.3	272242		
	8850	990	1.3E+07	986	1072	923	2643.6	142.049	493094.3	272273		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	8819	992	1.3E+07	990.6667	1071	923	2674.6	142.049	493094.3	272304		
	8788	991	1.3E+07	991.3333	1070	923	2705.6	142.049	493094.3	272335		
	8757	996	1.3E+07	991.6667	1069	923	2736.6	142.049	493094.3	272365		
	8713.2	992	1.3E+07	993.3333	1068	922	2780.4	69.5919	493063.5	272396		
	8682.2	1004	1.2E+07	994.6667	1067	922	2811.4	69.5919	493063.5	272427		
	8651.2	1008	1.2E+07	996	1066	922	2842.4	69.5919	493063.5	272458		
	8620.2	1007	1.2E+07	996	1065	922	2873.4	69.5919	493063.5	272489		
	8576.4	1007	1.2E+07	996	1064	921	2917.2	69.5919	493032.7	272519		
	8545.4	1004	1.2E+07	996	1063	921	2948.2	69.5919	493032.7	272550		
	8514.4	1007	1.2E+07	996	1062	921	2979.2	69.5919	493032.7	272581		
	8483.4	1007	1.2E+07	996	1061	921	3010.2	8.18317	493032.7	272612		
	8452.4	996	1.2E+07	996	1060	921	3041.2	8.18317	493032.7	272642		
	8408.6	996	1.2E+07	996.3333	1059	920	3085	8.18317	493001.9	272673		
	8364.8	1006	1.2E+07	996.6667	1058	919	3128.8	8.18317	492971.1	272704		
	8333.8	1002	1.2E+07	997	1057	919	3159.8	8.18317	492971.1	272735		
	8302.8	1004	1.2E+07	997	1056	919	3190.8	8.18317	492971.1	272766		
	8259	1007	1.2E+07	997	1055	918	3234.6	8.18317	492940.3	272796		
	8215.2	1006	1.2E+07	997	1054	917	3278.4	0	492909.5	272827		
	8184.2	1007	1.2E+07	997	1053	917	3309.4	0	492909.5	272858		
	8140.4	1002	1.2E+07	997	1052	916	3353.2	0	492878.7	272889		
	8096.6	997	1.2E+07	997.3333	1051	915	3397	0	492847.9	272920		
	8052.8	998	1.2E+07	998	1050	914	3440.8	0	492817.1	272950		
	8009	999	1.2E+07	998.6667	1049	913	3484.6	45.4065	492786.3	272981		
	7978	1017	1.2E+07	999	1049	912	3515.6	45.4065	492755.5	272981		
	7934.2	1016	1.2E+07	999	1048	911	3559.4	45.4065	492724.7	273012		
	7890.4	1017	1.2E+07	999	1047	910	3603.2	45.4065	492694	273043		
	7846.6	1003	1.2E+07	999	1046	909	3647	45.4065	492663.2	273074		
	7802.8	1003	1.2E+07	999	1045	908	3690.8	45.4065	492632.4	273104		
	7759	1000	1.2E+07	999	1044	907	3734.6	45.4065	492601.6	273135		
	7715.2	999	1.2E+07	1000.333	1043	906	3778.4	45.4065	492570.8	273166		
	7671.4	1008	1.2E+07	1001.667	1042	905	3822.2	45.4065	492540	273197		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	7627.6	1003	1.2E+07	1005	1041	904	3866	45.4065	492509.2	273228		
	7583.8	1009	1.2E+07	1007	1040	903	3909.8	45.4065	492478.4	273258		
	7552.8	1014	1.2E+07	1009	1039	903	3940.8	45.4065	492478.4	273289		
	7521.8	1014	1.2E+07	1009	1038	903	3971.8	45.4065	492478.4	273320		
	7490.8	1011	1.2E+07	1009	1037	903	4002.8	45.4065	492478.4	273351		
	7459.8	1017	1.2E+07	1009	1036	903	4033.8	86.2309	492478.4	273382		
	7428.8	1013	1.2E+07	1009	1035	903	4064.8	86.2309	492478.4	273412		
	7385	1012	1.2E+07	1009	1034	902	4108.6	86.2309	492447.6	273443		
	7354	1012	1.2E+07	1009	1033	902	4139.6	86.2309	492447.6	273474		
	7323	1009	1.2E+07	1011.333	1032	902	4170.6	86.2309	492447.6	273505		
	7292	1016	1.2E+07	1015.667	1031	902	4201.6	86.2309	492447.6	273536		
	7248.2	1023	1.2E+07	1020	1030	901	4245.4	86.2309	492416.8	273566		
	7204.4	1026	1.1E+07	1022	1029	900	4289.2	71.2609	492386	273597		
	7160.6	1033	1.1E+07	1022	1028	899	4333	71.2609	492355.2	273628		
	7129.6	1036	1.1E+07	1022	1028	898	4364	71.2609	492324.4	273628		
	7085.8	1025	1.1E+07	1022	1027	897	4407.8	71.2609	492293.6	273659		
	7042	1031	1.1E+07	1022	1026	896	4451.6	71.2609	492262.8	273690		
	7011	1031	1.1E+07	1022	1026	895	4482.6	71.2609	492232	273690		
	6980	1028	1.1E+07	1022	1026	894	4513.6	99.491	492201.2	273690		
	6936.2	1036	1.1E+07	1022	1025	893	4557.4	99.491	492170.4	273720		
	6905.2	1034	1.1E+07	1022	1025	892	4588.4	99.491	492139.6	273720		
	6861.4	1034	1.1E+07	1022	1024	891	4632.2	99.491	492108.9	273751		
	6830.4	1031	1.1E+07	1022	1024	890	4663.2	99.491	492078.1	273751		
	6786.6	1032	1.1E+07	1022	1023	889	4707	99.491	492047.3	273782		
	6742.8	1024	7071999	1022	1022	888	4750.8	99.491	492016.5	273813		
	6711.8	1022	7027793	1022.667	1021	888	4781.8	99.491	492016.5	273843		
	6680.8	1024	7026832	1025.667	1020	888	4812.8	99.491	492016.5	273874		
	6649.8	1031	7025871	1030.333	1019	888	4843.8	99.491	492016.5	273905		
	6618.8	1036	7024910	1035	1018	888	4874.8	99.491	492016.5	273936		
	6575	1038	7022988	1038.333	1017	887	4918.6	99.491	491985.7	273967		
	6531.2	1041	7019144	1040	1016	886	4962.4	99.491	491954.9	273997		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	6487.4	1041	7016261	1041.333	1015	885	5006.2	99.491	491924.1	274028		
	6456.4	1042	6917278	1043	1014	885	5037.2	71.6691	491924.1	274059		
	6412.6	1054	6913434	1044.667	1013	884	5081	71.6691	491893.3	274090		
	6368.8	1054	6912473	1046	1012	883	5124.8	71.6691	491862.5	274121		
	6325	1055	6899980	1046	1011	882	5168.6	71.6691	491831.7	274151		
	6281.2	1053	6889409	1046	1010	881	5212.4	71.6691	491800.9	274182		
	6237.4	1049	6874033	1046	1009	880	5256.2	71.6691	491770.1	274213		
	6193.6	1048	6867306	1046	1008	879	5300	86.3827	491739.3	274244		
	6149.8	1046	6818295	1046	1007	878	5343.8	86.3827	491708.5	274275		
	6106	1046	6790426	1048	1006	877	5387.6	86.3827	491677.7	274305		
	6075	1052	6780816	1052.333	1005	877	5418.6	86.3827	491677.7	274336		
	6044	1059	6724117	1057	1004	877	5449.6	86.3827	491677.7	274367		
	6000.2	1060	6721234	1061.333	1003	876	5493.4	86.3827	491646.9	274398		
	5956.4	1065	6197489	1066	1002	877	5537.2	104.379	491677.7	274429		
	5925.4	1073	6194606	1070.333	1001	877	5568.2	104.379	491677.7	274459		
	5894.4	1076	6191723	1073	1000	877	5599.2	104.379	491677.7	274490		
	5863.4	1075	6189801	1073	999	877	5630.2	104.379	491677.7	274521		
	5832.4	1073	6187879	1074.333	998	877	5661.2	104.379	491677.7	274552		
	5788.6	1077	6185957	1077.333	997	878	5705	104.379	491708.5	274583		
	5744.8	1082	6160971	1081.333	996	879	5748.8	104.379	491739.3	274613		
	5701	1092	6159049	1084	995	880	5792.6	55.9306	491770.1	274644		
	5670	1096	6153283	1085	994	880	5823.6	55.9306	491770.1	274675		
	5626.2	1096	6135985	1085	993	879	5867.4	55.9306	491739.3	274706		
	5595.2	1091	6111960	1085	992	879	5898.4	55.9306	491739.3	274737		
	5564.2	1096	6110999	1085	991	879	5929.4	55.9306	491739.3	274767		
	5533.2	1096	6109077	1085	990	879	5960.4	55.9306	491739.3	274798		
	5489.4	1090	6105233	1085	989	880	6004.2	55.9306	491770.1	274829		
	5458.4	1091	6095623	1085	988	880	6035.2	11.699	491770.1	274860		
	5427.4	1095	6093701	1085	987	880	6066.2	11.699	491770.1	274891		
	5383.6	1093	5967810	1085	986	881	6110	11.699	491800.9	274921		
	5339.8	1090	5946668	1085	985	882	6153.8	11.699	491831.7	274952		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	5308.8	1093	5915916	1085	984	882	6184.8	11.699	491831.7	274983		
	5277.8	1089	5914955	1085	983	882	6215.8	11.699	491831.7	275014		
	5246.8	1085	5913033	1085	982	882	6246.8	11.699	491831.7	275044		
	5215.8	1085	5911111	1087.333	981	882	6277.8	29.8278	491831.7	275075		
	5184.8	1092	5904384	1090	980	882	6308.8	29.8278	491831.7	275106		
	5153.8	1104	5898618	1092.667	979	882	6339.8	29.8278	491831.7	275137		
	5110	1098	5879398	1093	978	883	6383.6	29.8278	491862.5	275168		
	5066.2	1095	5870749	1093	977	884	6427.4	29.8278	491893.3	275198		
	5035.2	1094	5792908	1093	976	884	6458.4	29.8278	491893.3	275229		
	5004.2	1093	5791947	1094.667	975	884	6489.4	29.8278	491893.3	275260		
	4973.2	1101	5790986	1096.333	974	884	6520.4	26.4	491893.3	275291		
	4942.2	1102	5786181	1098	973	884	6551.4	26.4	491893.3	275322		
	4911.2	1106	5783298	1098	972	884	6582.4	26.4	491893.3	275352		
	4867.4	1100	5781376	1098	971	883	6626.2	26.4	491862.5	275383		
	4823.6	1099	5729482	1098	970	882	6670	26.4	491831.7	275414		
	4792.6	1102	4878997	1098	969	882	6701	26.4	491831.7	275445		
	4761.6	1098	4878036	1100	968	882	6732	26.4	491831.7	275476		
	4730.6	1106	4877075	1102	967	882	6763	18.2553	491831.7	275506		
	4686.8	1110	4870348	1104	966	883	6806.8	18.2553	491862.5	275537		
	4655.8	1115	4862660	1104	966	884	6837.8	18.2553	491893.3	275537		
	4612	1110	4860738	1104	965	885	6881.6	18.2553	491924.1	275568		
	4568.2	1109	4828064	1104	964	886	6925.4	18.2553	491954.9	275599		
	4524.4	1108	4779053	1104	963	887	6969.2	18.2553	491985.7	275630		
	4493.4	1114	4777131	1104	962	887	7000.2	18.2553	491985.7	275660		
	4449.6	1112	4765599	1104	961	888	7044	41.5331	492016.5	275691		
	4418.6	1104	2754226	1104	960	888	7075	41.5331	492016.5	275722		
	4387.6	1104	2753265	1106	959	888	7106	41.5331	492016.5	275753		
	4356.6	1110	2752304	1110.333	958	888	7137	41.5331	492016.5	275784		
	4325.6	1124	2751343	1114.667	957	888	7168	41.5331	492016.5	275814		
	4294.6	1130	2749421	1117	956	888	7199	41.5331	492016.5	275845		
	4250.8	1127	2717708	1117	955	887	7242.8	41.5331	491985.7	275876		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	4219.8	1130	2702332	1117	954	887	7273.8	41.5331	491985.7	275907		
	4176	1125	2682151	1117	953	886	7317.6	41.5331	491954.9	275938		
	4132.2	1123	2661970	1117	952	885	7361.4	41.5331	491924.1	275968		
	4088.4	1129	2643711	1117	951	884	7405.2	41.5331	491893.3	275999		
	4057.4	1122	2577402	1117	950	884	7436.2	41.5331	491893.3	276030		
	4026.4	1120	2576441	1117	949	884	7467.2	41.5331	491893.3	276061		
	3995.4	1122	2575480	1117	948	884	7498.2	41.5331	491893.3	276092		
	3964.4	1123	2574519	1117	947	884	7529.2	100.346	491893.3	276122		
	3933.4	1126	2570675	1117	946	884	7560.2	100.346	491893.3	276153		
	3902.4	1126	2528391	1117	945	884	7591.2	100.346	491893.3	276184		
	3871.4	1125	2527430	1117	944	884	7622.2	100.346	491893.3	276215		
	3840.4	1117	2526469	1117	943	884	7653.2	100.346	491893.3	276245		
	3809.4	1117	2525508	1119.333	942	884	7684.2	100.346	491893.3	276276		
	3778.4	1124	2524547	1123.667	941	884	7715.2	100.346	491893.3	276307		
	3747.4	1131	2493795	1128	940	884	7746.2	100.346	491893.3	276338		
	3716.4	1130	2482263	1131.333	939	884	7777.2	58.9265	491893.3	276369		
	3685.4	1134	2478419	1134	938	884	7808.2	58.9265	491893.3	276399		
	3641.6	1141	2464965	1136.667	937	883	7852	58.9265	491862.5	276430		
	3610.6	1148	2373670	1138	936	883	7883	58.9265	491862.5	276461		
	3566.8	1144	2370787	1138	935	882	7926.8	58.9265	491831.7	276492		
	3523	1139	2329464	1138	934	881	7970.6	58.9265	491800.9	276523		
	3479.2	1138	2233364	1139.667	933	880	8014.4	58.9265	491770.1	276553		
	3435.4	1143	2227598	1141.333	932	879	8058.2	25.366	491739.3	276584		
	3404.4	1147	2214144	1143	931	879	8089.2	25.366	491739.3	276615		
	3360.6	1146	2202612	1143	930	878	8133	25.366	491708.5	276646		
	3329.6	1144	2056540	1143	929	878	8164	25.366	491708.5	276677		
	3298.6	1143	2055579	1143.333	928	878	8195	25.366	491708.5	276707		
	3254.8	1144	2041164	1143.667	927	877	8238.8	25.366	491677.7	276738		
	3211	1144	1957557	1144.667	926	876	8282.6	23.4655	491646.9	276769		
	3180	1146	1954674	1147	925	876	8313.6	23.4655	491646.9	276800		
	3149	1151	1944103	1149.667	924	876	8344.6	23.4655	491646.9	276831		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	3118	1156	1884521	1151.667	923	876	8375.6	23.4655	491646.9	276861		
	3087	1159	1883560	1152	922	876	8406.6	23.4655	491646.9	276892		
	3043.2	1157	1882599	1152	921	875	8450.4	23.4655	491616.1	276923		
	2999.4	1152	1850886	1152.333	920	874	8494.2	23.4655	491585.3	276954		
	2955.6	1153	1842237	1154.667	919	873	8538	58.8338	491554.5	276985		
	2911.8	1159	1827822	1158.333	918	872	8581.8	58.8338	491523.8	277015		
	2880.8	1163	1692321	1163.333	917	872	8612.8	58.8338	491523.8	277046		
	2837	1168	1365581	1166.333	916	873	8656.6	58.8338	491554.5	277077		
	2793.2	1168	1360776	1170	915	874	8700.4	58.8338	491585.3	277108		
	2749.4	1174	1349244	1177	914	873	8744.2	58.8338	491554.5	277139		
	2718.4	1189	1345400	1185.667	913	873	8775.2	70.5691	491554.5	277169		
	2687.4	1194	1338673	1192.667	912	873	8806.2	70.5691	491554.5	277200		
	2643.6	1199	1330024	1194.667	911	874	8850	70.5691	491585.3	277231		
	2612.6	1195	1329063	1195.333	910	874	8881	70.5691	491585.3	277262		
	2568.8	1196	1322336	1196.667	909	875	8924.8	70.5691	491616.1	277293		
	2537.8	1199	1319453	1198	908	875	8955.8	70.5691	491616.1	277323		
	2506.8	1200	1224314	1199	907	875	8986.8	70.5691	491616.1	277354		
	2475.8	1199	1220470	1200.333	906	875	9017.8	61.0113	491616.1	277385		
	2432	1206	1165693	1201.667	905	876	9061.6	61.0113	491646.9	277416		
	2388.2	1203	1148395	1205.667	904	877	9105.4	61.0113	491677.7	277446		
	2344.4	1211	1126292	1209.667	903	878	9149.2	61.0113	491708.5	277477		
	2300.6	1215	1125331	1215.333	902	879	9193	61.0113	491739.3	277508		
	2269.6	1220	992713	1221	901	879	9224	61.0113	491739.3	277539		
	2238.6	1228	989830	1226.333	900	879	9255	61.0113	491739.3	277570		
	2194.8	1231	987908	1230	899	878	9298.8	47.0873	491708.5	277600		
	2151	1231	985025	1231	898	879	9342.6	47.0873	491739.3	277631		
	2107.2	1234	973493	1231	897	878	9386.4	47.0873	491708.5	277662		
	2063.4	1231	955234	1231	896	877	9430.2	47.0873	491677.7	277693		
	2032.4	1231	900457	1232.667	895	877	9461.2	47.0873	491677.7	277724		
	2001.4	1236	899496	1234.333	894	877	9492.2	47.0873	491677.7	277754		
	1970.4	1237	896613	1236	893	877	9523.2	19.3749	491677.7	277785		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	1926.6	1236	894691	1236	892	878	9567	19.3749	491708.5	277816		
	1895.6	1239	876432	1236	891	878	9598	19.3749	491708.5	277847		
	1864.6	1241	834148	1236	890	878	9629	19.3749	491708.5	277878		
	1820.8	1239	814928	1236	889	879	9672.8	19.3749	491739.3	277908		
	1789.8	1236	800513	1238.333	888	879	9703.8	19.3749	491739.3	277939		
	1758.8	1243	796669	1242.667	887	879	9734.8	19.3749	491739.3	277970		
	1715	1249	790903	1247	886	878	9778.6	16.4919	491708.5	278001		
	1671.2	1249	786098	1249.667	885	879	9822.4	16.4919	491739.3	278032		
	1640.2	1252	777449	1250.333	884	879	9853.4	16.4919	491739.3	278062		
	1596.4	1254	772644	1251	883	880	9897.2	16.4919	491770.1	278093		
	1552.6	1263	632338	1251	882	879	9941	16.4919	491739.3	278124		
	1508.8	1259	631377	1251	881	878	9984.8	16.4919	491708.5	278155		
	1465	1256	517018	1251	880	879	10028.6	11.0983	491739.3	278186		
	1421.2	1258	492032	1251	879	880	10072.4	11.0983	491770.1	278216		
	1390.2	1260	490110	1251	878	880	10103.4	11.0983	491770.1	278247		
	1346.4	1263	481461	1251	877	881	10147.2	11.0983	491800.9	278278		
	1315.4	1258	478578	1251	876	881	10178.2	11.0983	491800.9	278309		
	1271.6	1257	442060	1251	875	882	10222	11.0983	491831.7	278340		
	1240.6	1252	440138	1251	874	882	10253	11.0983	491831.7	278370		
	1209.6	1252	431489	1251	873	882	10284	40.4968	491831.7	278401		
	1178.6	1251	391127	1251	872	882	10315	40.4968	491831.7	278432		
	1147.6	1251	390166	1253.333	871	882	10346	40.4968	491831.7	278463		
	1116.6	1258	389205	1259	870	882	10377	40.4968	491831.7	278494		
	1085.6	1268	388244	1265.667	869	882	10408	40.4968	491831.7	278524		
	1041.8	1274	386322	1270	868	883	10451.8	40.4968	491862.5	278555		
	998	1271	385361	1271.333	867	884	10495.6	40.4968	491893.3	278586		
	954.2	1272	375751	1274.333	866	883	10539.4	30.3716	491862.5	278617		
	923.2	1280	321935	1278.667	865	883	10570.4	30.3716	491862.5	278647		
	892.2	1286	320013	1282.667	864	883	10601.4	30.3716	491862.5	278678		
	848.4	1290	316169	1284	863	884	10645.2	30.3716	491893.3	278709		
	817.4	1289	310403	1284	862	884	10676.2	30.3716	491893.3	278740		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11a												
	786.4	1289	308481	1284	861	884	10707.2	30.3716	491893.3	278771		
	742.6	1287	283495	1284	860	885	10751	30.3716	491924.1	278801		
	698.8	1284	263314	1284.667	859	886	10794.8	12.7816	491954.9	278832		
	655	1286	243133	1286	858	887	10838.6	12.7816	491985.7	278863		
	624	1288	234484	1288	857	887	10869.6	12.7816	491985.7	278894		
	593	1296	233523	1289.333	856	887	10900.6	12.7816	491985.7	278925		
	549.2	1296	228718	1290	855	888	10944.4	12.7816	492016.5	278955		
	505.4	1290	186434	1291.333	854	889	10988.2	12.7816	492047.3	278986		
	461.6	1294	173941	1293	853	890	11032	9.56332	492078.1	279017		
	417.8	1295	124930	1294.667	852	891	11075.8	9.56332	492108.9	279048		
	374	1296	106671	1295	851	892	11119.6	9.56332	492139.6	279079		
	330.2	1295	98983	1295	850	893	11163.4	9.56332	492170.4	279109		
	286.4	1299	97061	1295	849	894	11207.2	9.56332	492201.2	279140		
	255.4	1305	95139	1295	848	894	11238.2	9.56332	492201.2	279171		
	224.4	1300	94178	1295	847	894	11269.2	0	492201.2	279202		
	193.4	1303	80724	1295	846	894	11300.2	0	492201.2	279233		
	149.6	1304	52855	1295	845	895	11344	0	492232	279263		
	105.8	1300	41323	1295	844	896	11387.8	0	492262.8	279294		
	62	1303	22103	1295	843	897	11431.6	0	492293.6	279325		
	31	1295	19220	1295.333	842	897	11462.6	0	492293.6	279356		
	0	1296	8649	1296	841	897	11493.6	0	492293.6	279387		
South 11b												
	11440.4	900	961	889	1140	944	0	0	493741	270179	17782.79	0.15982
	11396.6	894	1.4E+07	889	1141	945	43.8	0	493771.8	270148	35481.34	0.15982
	11365.6	899	1.4E+07	889	1140	945	74.8	0	493771.8	270179	56234.13	0.07295
	11321.8	898	1.4E+07	889	1139	944	118.6	0	493741	270210	70794.58	0.10506
	11278	900	1.4E+07	889	1138	943	162.4	0	493710.2	270240	354813.4	0.07381
	11234.2	894	1.4E+07	889	1137	942	206.2	0	493679.4	270271	707945.8	0.06858
	11190.4	897	1.4E+07	889	1136	941	250	0	493648.6	270302	891250.9	0.12068
	11146.6	896	1.4E+07	889	1135	940	293.8	0	493617.8	270333	1122018	0.11746

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	11115.6	898	1.4E+07	889	1134	940	324.8	0	493617.8	270364	1412538	0.12223
	11084.6	900	1.4E+07	889	1133	940	355.8	0	493617.8	270394	1778279	0.06498
	11040.8	907	1.4E+07	889	1132	939	399.6	0	493587	270425	4466836	0.03061
	10997	907	1.4E+07	889	1131	938	443.4	0	493556.2	270456	5623413	0.06878
	10953.2	907	1.4E+07	889	1130	939	487.2	0	493587	270487	7079458	0.06515
	10922.2	906	1.4E+07	889	1129	939	518.2	0	493587	270518	11220185	0.0528
	10878.4	904	1.4E+07	889	1128	940	562	0	493617.8	270548	14125375	0.11214
	10847.4	906	1.4E+07	889	1127	940	593	0	493617.8	270579		
	10816.4	909	1.4E+07	889	1126	940	624	0	493617.8	270610		
	10772.6	905	1.4E+07	889	1125	939	667.8	0	493587	270641		
	10728.8	901	1.4E+07	889	1124	938	711.6	0	493556.2	270672		
	10685	907	1.3E+07	889	1123	937	755.4	0	493525.4	270702		
	10641.2	908	1.3E+07	889	1122	936	799.2	0	493494.6	270733		
	10597.4	901	1.3E+07	889	1121	935	843	0	493463.8	270764		
	10553.6	908	1.3E+07	889	1120	934	886.8	0	493433	270795		
	10522.6	909	1.3E+07	889	1119	934	917.8	0	493433	270826		
	10478.8	909	1.3E+07	889	1118	933	961.6	246.728	493402.2	270856		
	10447.8	910	1.3E+07	889	1117	933	992.6	246.728	493402.2	270887		
	10404	910	1.3E+07	889	1116	934	1036.4	246.728	493433	270918		
	10360.2	910	1.3E+07	889	1115	933	1080.2	246.728	493402.2	270949		
	10316.4	910	1.3E+07	889	1114	932	1124	246.728	493371.4	270980		
	10272.6	910	1.3E+07	889	1113	933	1167.8	246.728	493402.2	271010		
	10228.8	911	1.3E+07	889	1112	932	1211.6	246.728	493371.4	271041		
	10185	894	1.3E+07	889	1111	931	1255.4	246.728	493340.6	271072		
	10141.2	889	1.3E+07	889.3333	1110	930	1299.2	246.728	493309.9	271103		
	10097.4	890	1.3E+07	893	1109	929	1343	246.728	493279.1	271134		
	10053.6	900	1.3E+07	899.6667	1108	928	1386.8	246.728	493248.3	271164		
	10009.8	909	1.3E+07	907.3333	1107	927	1430.6	246.728	493217.5	271195		
	9978.8	913	1.3E+07	915	1106	927	1461.6	284.23	493217.5	271226		
	9935	923	1.3E+07	920.6667	1105	926	1505.4	284.23	493186.7	271257		
	9891.2	926	1.3E+07	927.3333	1104	925	1549.2	284.23	493155.9	271288		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	9860.2	933	1.3E+07	932.3333	1103	925	1580.2	284.23	493155.9	271318		
	9816.4	938	1.3E+07	937.3333	1102	924	1624	284.23	493125.1	271349		
	9785.4	941	1.3E+07	943.3333	1101	924	1655	284.23	493125.1	271380		
	9754.4	951	1.3E+07	953	1100	924	1686	284.23	493125.1	271411		
	9723.4	967	1.3E+07	964	1099	924	1717	253.012	493125.1	271441		
	9692.4	974	1.3E+07	972.3333	1098	924	1748	253.012	493125.1	271472		
	9648.6	981	1.3E+07	975.3333	1097	923	1791.8	253.012	493094.3	271503		
	9617.6	984	1.3E+07	976	1096	923	1822.8	253.012	493094.3	271534		
	9586.6	989	1.3E+07	976	1095	923	1853.8	253.012	493094.3	271565		
	9542.8	988	1.3E+07	976	1094	922	1897.6	253.012	493063.5	271595		
	9499	982	1.3E+07	976	1093	921	1941.4	253.012	493032.7	271626		
	9455.2	981	1.3E+07	976	1092	920	1985.2	183.243	493001.9	271657		
	9424.2	977	1.3E+07	976	1091	920	2016.2	183.243	493001.9	271688		
	9393.2	977	1.3E+07	976	1090	920	2047.2	183.243	493001.9	271719		
	9362.2	976	1.3E+07	976.3333	1089	920	2078.2	183.243	493001.9	271749		
	9331.2	981	1.3E+07	976.6667	1088	920	2109.2	183.243	493001.9	271780		
	9300.2	987	1.3E+07	977	1087	920	2140.2	183.243	493001.9	271811		
	9269.2	989	1.3E+07	977	1086	920	2171.2	183.243	493001.9	271842		
	9238.2	992	1.3E+07	977	1085	920	2202.2	183.243	493001.9	271873		
	9194.4	992	1.3E+07	977	1084	921	2246	142.049	493032.7	271903		
	9163.4	987	1.3E+07	977	1083	921	2277	142.049	493032.7	271934		
	9132.4	987	1.3E+07	977	1082	921	2308	142.049	493032.7	271965		
	9101.4	991	1.3E+07	977	1081	921	2339	142.049	493032.7	271996		
	9070.4	990	1.3E+07	977	1080	921	2370	142.049	493032.7	272027		
	9026.6	987	1.3E+07	977	1079	922	2413.8	142.049	493063.5	272057		
	8995.6	985	1.3E+07	977	1078	922	2444.8	142.049	493063.5	272088		
	8964.6	987	1.3E+07	977	1077	922	2475.8	142.049	493063.5	272119		
	8920.8	989	1.3E+07	977	1076	923	2519.6	142.049	493094.3	272150		
	8889.8	978	1.3E+07	977	1075	923	2550.6	142.049	493094.3	272181		
	8858.8	977	1.3E+07	977	1074	923	2581.6	142.049	493094.3	272211		
	8827.8	977	1.3E+07	981.3333	1073	923	2612.6	142.049	493094.3	272242		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	8796.8	990	1.3E+07	986	1072	923	2643.6	142.049	493094.3	272273		
	8765.8	992	1.3E+07	990.6667	1071	923	2674.6	142.049	493094.3	272304		
	8734.8	991	1.3E+07	991.3333	1070	923	2705.6	142.049	493094.3	272335		
	8703.8	996	1.3E+07	991.6667	1069	923	2736.6	69.5919	493094.3	272365		
	8660	992	1.3E+07	993.3333	1068	922	2780.4	69.5919	493063.5	272396		
	8629	1004	1.2E+07	994.6667	1067	922	2811.4	69.5919	493063.5	272427		
	8598	1008	1.2E+07	996	1066	922	2842.4	69.5919	493063.5	272458		
	8567	1007	1.2E+07	996	1065	922	2873.4	69.5919	493063.5	272489		
	8523.2	1007	1.2E+07	996	1064	921	2917.2	69.5919	493032.7	272519		
	8492.2	1004	1.2E+07	996	1063	921	2948.2	69.5919	493032.7	272550		
	8461.2	1007	1.2E+07	996	1062	921	2979.2	8.18317	493032.7	272581		
	8430.2	1007	1.2E+07	996	1061	921	3010.2	8.18317	493032.7	272612		
	8399.2	996	1.2E+07	996	1060	921	3041.2	8.18317	493032.7	272642		
	8355.4	996	1.2E+07	996.3333	1059	920	3085	8.18317	493001.9	272673		
	8311.6	1006	1.2E+07	996.6667	1058	919	3128.8	8.18317	492971.1	272704		
	8280.6	1002	1.2E+07	997	1057	919	3159.8	8.18317	492971.1	272735		
	8249.6	1004	1.2E+07	997	1056	919	3190.8	8.18317	492971.1	272766		
	8205.8	1007	1.2E+07	997	1055	918	3234.6	0	492940.3	272796		
	8162	1006	1.2E+07	997	1054	917	3278.4	0	492909.5	272827		
	8131	1007	1.2E+07	997	1053	917	3309.4	0	492909.5	272858		
	8087.2	1002	1.2E+07	997	1052	916	3353.2	0	492878.7	272889		
	8043.4	997	1.2E+07	997.3333	1051	915	3397	0	492847.9	272920		
	7999.6	998	1.2E+07	998	1050	914	3440.8	45.4065	492817.1	272950		
	7955.8	999	1.2E+07	998.6667	1049	913	3484.6	45.4065	492786.3	272981		
	7924.8	1017	1.2E+07	999	1049	912	3515.6	45.4065	492755.5	272981		
	7881	1016	1.2E+07	999	1048	911	3559.4	45.4065	492724.7	273012		
	7837.2	1017	1.2E+07	999	1047	910	3603.2	45.4065	492694	273043		
	7793.4	1003	1.2E+07	999	1046	909	3647	45.4065	492663.2	273074		
	7749.6	1003	1.2E+07	999	1045	908	3690.8	45.4065	492632.4	273104		
	7705.8	1000	1.2E+07	999	1044	907	3734.6	45.4065	492601.6	273135		
	7662	999	1.2E+07	1000.333	1043	906	3778.4	45.4065	492570.8	273166		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	7618.2	1008	1.2E+07	1001.667	1042	905	3822.2	45.4065	492540	273197		
	7574.4	1003	1.2E+07	1005	1041	904	3866	45.4065	492509.2	273228		
	7530.6	1009	1.2E+07	1007	1040	903	3909.8	45.4065	492478.4	273258		
	7499.6	1014	1.2E+07	1009	1039	903	3940.8	45.4065	492478.4	273289		
	7468.6	1014	1.2E+07	1009	1038	903	3971.8	86.2309	492478.4	273320		
	7437.6	1011	1.2E+07	1009	1037	903	4002.8	86.2309	492478.4	273351		
	7406.6	1017	1.2E+07	1009	1036	903	4033.8	86.2309	492478.4	273382		
	7375.6	1013	1.2E+07	1009	1035	903	4064.8	86.2309	492478.4	273412		
	7331.8	1012	1.2E+07	1009	1034	902	4108.6	86.2309	492447.6	273443		
	7300.8	1012	1.2E+07	1009	1033	902	4139.6	86.2309	492447.6	273474		
	7269.8	1009	1.2E+07	1011.333	1032	902	4170.6	86.2309	492447.6	273505		
	7238.8	1016	1.2E+07	1015.667	1031	902	4201.6	86.2309	492447.6	273536		
	7195	1023	1.2E+07	1020	1030	901	4245.4	71.2609	492416.8	273566		
	7151.2	1026	1.1E+07	1022	1029	900	4289.2	71.2609	492386	273597		
	7107.4	1033	1.1E+07	1022	1028	899	4333	71.2609	492355.2	273628		
	7076.4	1036	1.1E+07	1022	1028	898	4364	71.2609	492324.4	273628		
	7032.6	1025	1.1E+07	1022	1027	897	4407.8	71.2609	492293.6	273659		
	6988.8	1031	1.1E+07	1022	1026	896	4451.6	71.2609	492262.8	273690		
	6957.8	1031	1.1E+07	1022	1026	895	4482.6	13.494	492232	273690		
	6926.8	1028	1.1E+07	1022	1026	894	4513.6	13.494	492201.2	273690		
	6883	1036	1.1E+07	1022	1025	893	4557.4	13.494	492170.4	273720		
	6852	1034	1.1E+07	1022	1025	892	4588.4	13.494	492139.6	273720		
	6808.2	1034	1.1E+07	1022	1024	891	4632.2	13.494	492108.9	273751		
	6777.2	1031	1.1E+07	1022	1024	890	4663.2	13.494	492078.1	273751		
	6733.4	1032	1.1E+07	1022	1023	889	4707	13.494	492047.3	273782		
	6689.6	1024	7071999	1022	1022	888	4750.8	128.211	492016.5	273813		
	6658.6	1022	7027793	1022.667	1021	888	4781.8	128.211	492016.5	273843		
	6627.6	1024	7026832	1025.667	1020	888	4812.8	128.211	492016.5	273874		
	6596.6	1031	7025871	1030.333	1019	888	4843.8	128.211	492016.5	273905		
	6565.6	1036	7024910	1035	1018	888	4874.8	128.211	492016.5	273936		
	6521.8	1038	7022988	1038.333	1017	887	4918.6	128.211	491985.7	273967		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	6478	1041	7019144	1040	1016	886	4962.4	71.6691	491954.9	273997		
	6434.2	1041	7016261	1041.333	1015	885	5006.2	71.6691	491924.1	274028		
	6403.2	1042	6917278	1043	1014	885	5037.2	71.6691	491924.1	274059		
	6359.4	1054	6913434	1044.667	1013	884	5081	71.6691	491893.3	274090		
	6315.6	1054	6912473	1046	1012	883	5124.8	71.6691	491862.5	274121		
	6271.8	1055	6899980	1046	1011	882	5168.6	71.6691	491831.7	274151		
	6228	1053	6889409	1046	1010	881	5212.4	67.6852	491800.9	274182		
	6184.2	1049	6874033	1046	1009	880	5256.2	67.6852	491770.1	274213		
	6140.4	1048	6867306	1046	1008	879	5300	67.6852	491739.3	274244		
	6096.6	1046	6818295	1046	1007	878	5343.8	67.6852	491708.5	274275		
	6052.8	1046	6790426	1048	1006	877	5387.6	67.6852	491677.7	274305		
	6021.8	1052	6780816	1052.333	1005	877	5418.6	67.6852	491677.7	274336		
	5990.8	1059	6724117	1057	1004	877	5449.6	67.6852	491677.7	274367		
	5947	1060	6721234	1061.333	1003	876	5493.4	113.372	491646.9	274398		
	5903.2	1065	6197489	1066	1002	877	5537.2	113.372	491677.7	274429		
	5872.2	1073	6194606	1070.333	1001	877	5568.2	113.372	491677.7	274459		
	5841.2	1076	6191723	1073	1000	877	5599.2	113.372	491677.7	274490		
	5810.2	1075	6189801	1073	999	877	5630.2	113.372	491677.7	274521		
	5779.2	1073	6187879	1074.333	998	877	5661.2	113.372	491677.7	274552		
	5735.4	1077	6185957	1077.333	997	878	5705	113.372	491708.5	274583		
	5691.6	1082	6160971	1081.333	996	879	5748.8	63.8101	491739.3	274613		
	5647.8	1092	6159049	1084	995	880	5792.6	63.8101	491770.1	274644		
	5616.8	1096	6153283	1085	994	880	5823.6	63.8101	491770.1	274675		
	5573	1096	6135985	1085	993	879	5867.4	63.8101	491739.3	274706		
	5542	1091	6111960	1085	992	879	5898.4	63.8101	491739.3	274737		
	5511	1096	6110999	1085	991	879	5929.4	63.8101	491739.3	274767		
	5480	1096	6109077	1085	990	879	5960.4	27.2705	491739.3	274798		
	5436.2	1090	6105233	1085	989	880	6004.2	27.2705	491770.1	274829		
	5405.2	1091	6095623	1085	988	880	6035.2	27.2705	491770.1	274860		
	5374.2	1095	6093701	1085	987	880	6066.2	27.2705	491770.1	274891		
	5330.4	1093	5967810	1085	986	881	6110	27.2705	491800.9	274921		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	5286.6	1090	5946668	1085	985	882	6153.8	27.2705	491831.7	274952		
	5255.6	1093	5915916	1085	984	882	6184.8	27.2705	491831.7	274983		
	5224.6	1089	5914955	1085	983	882	6215.8	29.8278	491831.7	275014		
	5193.6	1085	5913033	1085	982	882	6246.8	29.8278	491831.7	275044		
	5162.6	1085	5911111	1087.333	981	882	6277.8	29.8278	491831.7	275075		
	5131.6	1092	5904384	1090	980	882	6308.8	29.8278	491831.7	275106		
	5100.6	1104	5898618	1092.667	979	882	6339.8	29.8278	491831.7	275137		
	5056.8	1098	5879398	1093	978	883	6383.6	29.8278	491862.5	275168		
	5013	1095	5870749	1093	977	884	6427.4	29.8278	491893.3	275198		
	4982	1094	5792908	1093	976	884	6458.4	24.8226	491893.3	275229		
	4951	1093	5791947	1094.667	975	884	6489.4	24.8226	491893.3	275260		
	4920	1101	5790986	1096.333	974	884	6520.4	24.8226	491893.3	275291		
	4889	1102	5786181	1098	973	884	6551.4	24.8226	491893.3	275322		
	4858	1106	5783298	1098	972	884	6582.4	24.8226	491893.3	275352		
	4814.2	1100	5781376	1098	971	883	6626.2	24.8226	491862.5	275383		
	4770.4	1099	5729482	1098	970	882	6670	24.8226	491831.7	275414		
	4739.4	1102	4878997	1098	969	882	6701	24.8226	491831.7	275445		
	4708.4	1098	4878036	1099	968	882	6732	11.0438	491831.7	275476		
	4677.4	1106	4877075	1100	967	882	6763	11.0438	491831.7	275506		
	4633.6	1110	4870348	1101	966	883	6806.8	11.0438	491862.5	275537		
	4602.6	1115	4862660	1101	966	884	6837.8	11.0438	491893.3	275537		
	4558.8	1110	4860738	1101	965	885	6881.6	11.0438	491924.1	275568		
	4515	1109	4828064	1101	964	886	6925.4	11.0438	491954.9	275599		
	4471.2	1108	4779053	1101	963	887	6969.2	5.90424	491985.7	275630		
	4440.2	1114	4777131	1101	962	887	7000.2	5.90424	491985.7	275660		
	4396.4	1112	4765599	1101	961	888	7044	5.90424	492016.5	275691		
	4352.6	1101	1999841	1101.333	960	889	7087.8	5.90424	492047.3	275722		
	4308.8	1104	1953713	1101.667	959	890	7131.6	5.90424	492078.1	275753		
	4277.8	1108	1946986	1102	959	891	7162.6	5.90424	492108.9	275753		
	4246.8	1108	1946025	1102	959	892	7193.6	5.90424	492139.6	275753		
	4203	1109	1925844	1102	958	893	7237.4	113.094	492170.4	275784		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	4172	1111	1922000	1102	958	894	7268.4	113.094	492201.2	275784		
	4128.2	1113	1917195	1102	957	895	7312.2	113.094	492232	275814		
	4097.2	1116	1886443	1102	956	895	7343.2	113.094	492232	275845		
	4066.2	1111	1885482	1102	955	895	7374.2	113.094	492232	275876		
	4022.4	1115	1875872	1102	954	894	7418	113.094	492201.2	275907		
	3991.4	1118	1869145	1102	953	894	7449	113.094	492201.2	275938		
	3947.6	1112	1862418	1102	952	895	7492.8	113.094	492232	275968		
	3903.8	1113	1857613	1102	951	896	7536.6	113.094	492262.8	275999		
	3872.8	1118	1855691	1102	950	896	7567.6	113.094	492262.8	276030		
	3829	1102	1832627	1103	949	897	7611.4	113.094	492293.6	276061		
	3785.2	1105	1806680	1108	948	898	7655.2	113.094	492324.4	276092		
	3754.2	1117	1769201	1114.667	947	898	7686.2	113.094	492324.4	276122		
	3723.2	1123	1762474	1120.333	946	898	7717.2	67.1817	492324.4	276153		
	3692.2	1129	1760552	1122	945	898	7748.2	67.1817	492324.4	276184		
	3648.4	1124	1759591	1122	944	897	7792	67.1817	492293.6	276215		
	3617.4	1129	1750942	1122	943	897	7823	67.1817	492293.6	276245		
	3586.4	1129	1707697	1122	942	897	7854	67.1817	492293.6	276276		
	3555.4	1128	1692321	1122	941	897	7885	67.1817	492293.6	276307		
	3524.4	1122	1691360	1123.667	940	897	7916	67.1817	492293.6	276338		
	3493.4	1127	1690399	1126	939	897	7947	67.1817	492293.6	276369		
	3462.4	1129	1687516	1129.333	938	897	7978	45.2653	492293.6	276399		
	3431.4	1132	1624090	1132	937	897	8009	45.2653	492293.6	276430		
	3400.4	1136	1601026	1134	936	897	8040	45.2653	492293.6	276461		
	3369.4	1135	1600065	1135.667	935	897	8071	45.2653	492293.6	276492		
	3325.6	1137	1579884	1137.667	934	896	8114.8	45.2653	492262.8	276523		
	3294.6	1141	1561625	1141.333	933	896	8145.8	45.2653	492262.8	276553		
	3250.8	1147	1548171	1144.333	932	897	8189.6	45.2653	492293.6	276584		
	3219.8	1150	1547210	1146	931	897	8220.6	47.2661	492293.6	276615		
	3188.8	1148	1544327	1146	930	897	8251.6	47.2661	492293.6	276646		
	3145	1146	1486667	1146	929	898	8295.4	47.2661	492324.4	276677		
	3114	1147	1481862	1146	928	898	8326.4	47.2661	492324.4	276707		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	3083	1146	1478018	1146.667	927	898	8357.4	47.2661	492324.4	276738		
	3052	1150	1474174	1147.333	926	898	8388.4	47.2661	492324.4	276769		
	3021	1148	1447266	1150.667	925	898	8419.4	47.2661	492324.4	276800		
	2990	1156	1441500	1156	924	898	8450.4	47.2661	492324.4	276831		
	2959	1165	1439578	1161.333	923	898	8481.4	55.676	492324.4	276861		
	2928	1165	1438617	1164	922	898	8512.4	55.676	492324.4	276892		
	2884.2	1165	1415553	1164	921	897	8556.2	55.676	492293.6	276923		
	2840.4	1164	1389606	1165.667	920	898	8600	55.676	492324.4	276954		
	2796.6	1169	1375191	1170.667	919	899	8643.8	55.676	492355.2	276985		
	2752.8	1179	1329063	1177.333	918	900	8687.6	55.676	492386	277015		
	2709	1184	1324258	1186	917	899	8731.4	55.1166	492355.2	277046		
	2678	1195	1279091	1192	916	899	8762.4	55.1166	492355.2	277077		
	2647	1202	1277169	1196.333	915	899	8793.4	55.1166	492355.2	277108		
	2616	1200	1276208	1197	914	899	8824.4	55.1166	492355.2	277139		
	2572.2	1201	1270442	1197	913	900	8868.2	55.1166	492386	277169		
	2528.4	1201	1262754	1197	912	901	8912	55.1166	492416.8	277200		
	2484.6	1200	1256027	1197	911	900	8955.8	55.1166	492386	277231		
	2453.6	1198	1161849	1197	910	900	8986.8	51.6615	492386	277262		
	2422.6	1200	1158966	1197	909	900	9017.8	51.6615	492386	277293		
	2391.6	1202	1156083	1197	908	900	9048.8	51.6615	492386	277323		
	2347.8	1204	1079203	1197	907	901	9092.6	51.6615	492416.8	277354		
	2304	1202	1066710	1197	906	902	9136.4	51.6615	492447.6	277385		
	2273	1200	1057100	1197	905	902	9167.4	51.6615	492447.6	277416		
	2242	1197	1039802	1198	904	902	9198.4	51.6615	492447.6	277446		
	2211	1200	1038841	1201.333	903	902	9229.4	60.1053	492447.6	277477		
	2180	1207	975415	1206.667	902	902	9260.4	60.1053	492447.6	277508		
	2136.2	1213	965805	1214.667	901	901	9304.2	60.1053	492416.8	277539		
	2105.2	1224	936975	1222	900	901	9335.2	60.1053	492416.8	277570		
	2074.2	1229	936014	1228.333	899	901	9366.2	60.1053	492416.8	277600		
	2043.2	1232	935053	1231	898	901	9397.2	60.1053	492416.8	277631		
	2012.2	1234	925443	1232	897	901	9428.2	60.1053	492416.8	277662		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	1968.4	1240	923521	1232	896	902	9472	60.1053	492447.6	277693		
	1924.6	1239	904301	1232	895	901	9515.8	60.1053	492416.8	277724		
	1880.8	1237	899496	1232	894	902	9559.6	60.1053	492447.6	277754		
	1837	1241	889886	1232	893	901	9603.4	60.1053	492416.8	277785		
	1793.2	1238	888925	1232	892	900	9647.2	60.1053	492386	277816		
	1749.4	1241	869705	1232	891	901	9691	60.1053	492416.8	277847		
	1705.6	1234	808201	1232	890	902	9734.8	10.2922	492447.6	277878		
	1674.6	1235	772644	1232	889	902	9765.8	10.2922	492447.6	277908		
	1643.6	1232	771683	1233.333	888	902	9796.8	10.2922	492447.6	277939		
	1612.6	1237	770722	1234.667	887	902	9827.8	10.2922	492447.6	277970		
	1581.6	1236	769761	1236.667	886	902	9858.8	10.2922	492447.6	278001		
	1537.8	1249	645792	1237.333	885	903	9902.6	10.2922	492478.4	278032		
	1494	1256	643870	1238	884	904	9946.4	10.2922	492509.2	278062		
	1450.2	1252	630416	1238	883	905	9990.2	11.107	492540	278093		
	1406.4	1238	620806	1239.333	882	906	10034	11.107	492570.8	278124		
	1375.4	1244	523745	1240.667	881	906	10065	11.107	492570.8	278155		
	1344.4	1249	522784	1242	880	906	10096	11.107	492570.8	278186		
	1300.6	1253	515096	1242	879	905	10139.8	11.107	492540	278216		
	1269.6	1248	512213	1242	878	905	10170.8	11.107	492540	278247		
	1238.6	1242	505486	1243.667	877	905	10201.8	11.107	492540	278278		
	1207.6	1247	504525	1247.667	876	905	10232.8	23.8722	492540	278309		
	1176.6	1254	503564	1252	875	905	10263.8	23.8722	492540	278340		
	1145.6	1257	369985	1254.667	874	905	10294.8	23.8722	492540	278370		
	1114.6	1255	369024	1255	873	905	10325.8	23.8722	492540	278401		
	1083.6	1255	357492	1257	872	905	10356.8	23.8722	492540	278432		
	1052.6	1261	346921	1260.333	871	905	10387.8	23.8722	492540	278463		
	1008.8	1269	328662	1263.667	870	906	10431.6	23.8722	492570.8	278494		
	977.8	1274	325779	1265	869	906	10462.6	17.9402	492570.8	278524		
	946.8	1276	323857	1265	868	906	10493.6	17.9402	492570.8	278555		
	903	1276	321935	1265	867	907	10537.4	17.9402	492601.6	278586		
	872	1274	319052	1265	866	907	10568.4	17.9402	492601.6	278617		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 11b												
	828.2	1273	213342	1265	865	906	10612.2	17.9402	492570.8	278647		
	784.4	1266	191239	1265	864	905	10656	17.9402	492540	278678		
	753.4	1265	115320	1265.333	863	905	10687	17.9402	492540	278709		
	722.4	1266	114359	1265.667	862	905	10718	2.87316	492540	278740		
	691.4	1266	113398	1266	861	905	10749	2.87316	492540	278771		
	660.4	1270	112437	1266	860	905	10780	2.87316	492540	278801		
	629.4	1270	111476	1266	859	905	10811	2.87316	492540	278832		
	598.4	1269	110515	1266	858	905	10842	2.87316	492540	278863		
	567.4	1266	109554	1266	857	905	10873	2.87316	492540	278894		
	536.4	1273	108593	1266	856	905	10904	2.87316	492540	278925		
	492.6	1271	91295	1266	855	906	10947.8	2.87316	492570.8	278955		
	461.6	1266	88412	1269	854	906	10978.8	14.6272	492570.8	278986		
	430.6	1275	87451	1272	853	906	11009.8	14.6272	492570.8	279017		
	386.8	1275	76880	1276	852	907	11053.6	14.6272	492601.6	279048		
	355.8	1278	75919	1278	851	907	11084.6	14.6272	492601.6	279079		
	324.8	1281	69192	1281	850	907	11115.6	14.6272	492601.6	279109		
	293.8	1284	63426	1285.333	849	907	11146.6	14.6272	492601.6	279140		
	250	1291	60543	1289	848	908	11190.4	14.6272	492632.4	279171		
	206.2	1293	57660	1291.667	847	907	11234.2	11.8981	492601.6	279202		
	162.4	1292	56699	1292	846	906	11278	11.8981	492570.8	279233		
	118.6	1292	46128	1294.667	845	905	11321.8	11.8981	492540	279263		
	74.8	1300	17298	1299.333	844	904	11365.6	11.8981	492509.2	279294		
	43.8	1306	10571	1305	844	903	11396.6	11.8981	492478.4	279294		
	0	1309	8649	1309	843	902	11440.4	11.8981	492447.6	279325		
South 13												
	10095.4	898	29791	895	1135	991	0	0	495188.3	270333	7079.458	0.16129
	10064.4	895	8320338	897	1135	990	31	0	495157.5	270333	14125.38	0.16129
	10020.6	902	8286703	899	1134	991	74.8	6.37472	495188.3	270364	17782.79	0.21946
	9976.8	901	8285742	901	1133	990	118.6	6.37472	495157.5	270394	35481.34	0.15567
	9945.8	903	8282859	901	1132	990	149.6	6.37472	495157.5	270425	44668.36	0.16871

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	9914.8	903	8281898	901	1131	990	180.6	6.37472	495157.5	270456	141253.8	0.0274
	9871	903	8274210	901	1130	991	224.4	6.37472	495188.3	270487	177827.9	0.06983
	9827.2	905	8268444	901	1129	992	268.2	6.37472	495219.1	270518	223872.1	0.09736
	9796.2	910	8264600	901	1128	992	299.2	6.37472	495219.1	270548	281838.3	0.04969
	9752.4	905	8262678	901	1127	993	343	6.37472	495249.9	270579	446683.6	0.06749
	9721.4	901	8243458	901	1126	993	374	6.37472	495249.9	270610	1122018	0.14756
	9677.6	908	8179071	901	1125	992	417.8	6.37472	495219.1	270641	1412538	0.03979
	9633.8	903	8137748	901	1124	991	461.6	6.37472	495188.3	270672	1778279	0.05537
	9602.8	901	8134865	901.3333	1123	991	492.6	6.37472	495188.3	270702	2818383	0.0426
	9559	909	8126216	901.6667	1122	990	536.4	6.37472	495157.5	270733	3548134	0.1029
	9528	904	8124294	902	1121	990	567.4	6.37472	495157.5	270764	4466836	0.05717
	9497	906	8122372	902	1120	990	598.4	6.37472	495157.5	270795	7079458	0.07997
	9466	906	8120450	902	1119	990	629.4	0	495157.5	270826	8912509	0.02598
	9422.2	910	8118528	902	1118	989	673.2	0	495126.7	270856		
	9378.4	909	8099308	902	1117	988	717	0	495095.9	270887		
	9347.4	911	8091620	902	1116	988	748	0	495095.9	270918		
	9316.4	913	8089698	902	1115	988	779	0	495095.9	270949		
	9272.6	909	8059907	902	1114	987	822.8	0	495065.2	270980		
	9228.8	908	7963807	902	1113	986	866.6	36.7784	495034.4	271010		
	9185	907	7925367	902	1112	985	910.4	36.7784	495003.6	271041		
	9154	910	7921523	902	1112	984	941.4	36.7784	494972.8	271041		
	9123	910	7919601	902	1112	983	972.4	36.7784	494942	271041		
	9079.2	912	7916718	902	1111	982	1016.2	36.7784	494911.2	271072		
	9035.4	906	7864824	902	1110	981	1060	36.7784	494880.4	271103		
	8991.6	902	7857136	904.3333	1109	980	1103.8	36.7784	494849.6	271134		
	8947.8	909	7834072	907	1108	979	1147.6	36.7784	494818.8	271164		
	8904	910	7804281	909.6667	1107	978	1191.4	36.7784	494788	271195		
	8873	910	7757192	910.3333	1106	978	1222.4	36.7784	494788	271226		
	8842	911	7756231	910.6667	1105	978	1253.4	36.7784	494788	271257		
	8811	911	7751426	911	1104	978	1284.4	36.7784	494788	271288		
	8780	911	7736050	911.6667	1103	978	1315.4	36.7784	494788	271318		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	8749	913	7735089	912.3333	1102	978	1346.4	36.7784	494788	271349		
	8718	916	7725479	913	1101	978	1377.4	51.9982	494788	271380		
	8687	917	7680312	913	1100	978	1408.4	51.9982	494788	271411		
	8643.2	915	7675507	913	1099	979	1452.2	51.9982	494818.8	271441		
	8612.2	913	7671663	913.3333	1098	979	1483.2	51.9982	494818.8	271472		
	8581.2	914	7491956	914	1097	979	1514.2	51.9982	494818.8	271503		
	8550.2	915	7488112	916.3333	1096	979	1545.2	51.9982	494818.8	271534		
	8519.2	920	7457360	919.3333	1095	979	1576.2	51.9982	494818.8	271565		
	8475.4	932	7450633	922	1094	978	1620	38.5455	494788	271595		
	8444.4	932	7449672	923	1093	978	1651	38.5455	494788	271626		
	8413.4	937	7442945	923	1092	978	1682	38.5455	494788	271657		
	8382.4	940	7439101	923	1091	978	1713	38.5455	494788	271688		
	8338.6	938	7438140	923	1090	979	1756.8	38.5455	494818.8	271719		
	8294.8	938	7394895	923	1089	978	1800.6	38.5455	494788	271749		
	8251	936	7390090	923	1088	977	1844.4	38.5455	494757.2	271780		
	8207.2	935	7354533	923	1087	976	1888.2	113.893	494726.4	271811		
	8163.4	932	7345884	923	1086	975	1932	113.893	494695.6	271842		
	8119.6	927	7318015	923	1085	974	1975.8	113.893	494664.8	271873		
	8088.6	925	7020105	923	1084	974	2006.8	113.893	494664.8	271903		
	8057.6	923	7019144	927.6667	1083	974	2037.8	113.893	494664.8	271934		
	8026.6	937	7018183	933.6667	1082	974	2068.8	113.893	494664.8	271965		
	7995.6	941	7012417	940	1081	974	2099.8	113.893	494664.8	271996		
	7951.8	943	7008573	941.6667	1080	975	2143.6	140.964	494695.6	272027		
	7908	943	7004729	942	1079	976	2187.4	140.964	494726.4	272057		
	7864.2	944	6989353	942	1078	975	2231.2	140.964	494695.6	272088		
	7833.2	942	6986470	944.3333	1077	975	2262.2	140.964	494695.6	272119		
	7789.4	949	4820376	949.3333	1076	974	2306	140.964	494664.8	272150		
	7758.4	957	4815571	955.3333	1075	974	2337	140.964	494664.8	272181		
	7714.6	960	4814610	959.6667	1074	973	2380.8	77.6059	494634	272211		
	7670.8	963	4811727	961.3333	1073	972	2424.6	77.6059	494603.2	272242		
	7639.8	962	4780014	962.6667	1072	972	2455.6	77.6059	494603.2	272273		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	7596	972	4770404	963.3333	1071	971	2499.4	77.6059	494572.4	272304		
	7565	969	4769443	964	1070	971	2530.4	77.6059	494572.4	272335		
	7534	975	4745418	964	1069	971	2561.4	77.6059	494572.4	272365		
	7490.2	980	4737730	964	1068	970	2605.2	77.6059	494541.6	272396		
	7446.4	981	4731964	964	1067	969	2649	33.7304	494510.8	272427		
	7415.4	980	4641630	964	1066	969	2680	33.7304	494510.8	272458		
	7384.4	971	4638747	964	1065	969	2711	33.7304	494510.8	272489		
	7353.4	964	4606073	964.6667	1064	969	2742	33.7304	494510.8	272519		
	7322.4	971	4605112	965.3333	1063	969	2773	33.7304	494510.8	272550		
	7291.4	966	4604151	968.3333	1062	969	2804	33.7304	494510.8	272581		
	7260.4	974	4603190	970.6667	1061	969	2835	33.7304	494510.8	272612		
	7229.4	979	4602229	973	1060	969	2866	29.0552	494510.8	272642		
	7185.6	979	4571477	973	1059	968	2909.8	29.0552	494480.1	272673		
	7154.6	973	4570516	974.3333	1058	968	2940.8	29.0552	494480.1	272704		
	7123.6	979	4569555	975.6667	1057	968	2971.8	29.0552	494480.1	272735		
	7092.6	977	4538803	977.3333	1056	968	3002.8	29.0552	494480.1	272766		
	7061.6	980	4537842	977.6667	1055	968	3033.8	29.0552	494480.1	272796		
	7030.6	981	4516700	978	1054	968	3064.8	29.0552	494480.1	272827		
	6999.6	985	4514778	978	1053	968	3095.8	29.0552	494480.1	272858		
	6955.8	986	4513817	978	1052	967	3139.6	8.82932	494449.3	272889		
	6912	980	4500363	978	1051	968	3183.4	8.82932	494480.1	272920		
	6868.2	982	4453274	978	1050	967	3227.2	8.82932	494449.3	272950		
	6824.4	978	4427327	978	1049	966	3271	8.82932	494418.5	272981		
	6780.6	980	4389848	978	1048	965	3314.8	8.82932	494387.7	273012		
	6749.6	982	4387926	978	1047	965	3345.8	8.82932	494387.7	273043		
	6718.6	985	4377355	978	1046	965	3376.8	69.2384	494387.7	273074		
	6687.6	981	4374472	978	1045	965	3407.8	69.2384	494387.7	273104		
	6643.8	979	4361979	978	1044	964	3451.6	69.2384	494356.9	273135		
	6600	978	4352369	978	1043	963	3495.4	69.2384	494326.1	273166		
	6569	978	4344681	980.6667	1042	963	3526.4	69.2384	494326.1	273197		
	6538	986	4285099	985	1041	963	3557.4	69.2384	494326.1	273228		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	6507	991	4274528	990.3333	1040	963	3588.4	69.2384	494326.1	273258		
	6476	995	4242815	993	1039	963	3619.4	69.2384	494326.1	273289		
	6445	999	4240893	994	1038	963	3650.4	69.2384	494326.1	273320		
	6401.2	997	4237049	994	1037	962	3694.2	69.2384	494295.3	273351		
	6370.2	1002	4228400	994	1036	962	3725.2	69.2384	494295.3	273382		
	6339.2	1002	4209180	994	1035	962	3756.2	69.2384	494295.3	273412		
	6308.2	999	4202453	994	1034	962	3787.2	69.2384	494295.3	273443		
	6277.2	1002	4200531	994	1033	962	3818.2	69.2384	494295.3	273474		
	6233.4	1000	4193804	994	1032	961	3862	69.2384	494264.5	273505		
	6189.6	994	4165935	995.6667	1031	960	3905.8	22.6071	494233.7	273536		
	6158.6	1000	4150559	997.3333	1030	960	3936.8	22.6071	494233.7	273566		
	6127.6	1001	4149598	999	1029	960	3967.8	22.6071	494233.7	273597		
	6083.8	1001	4133261	999	1028	961	4011.6	22.6071	494264.5	273628		
	6040	999	4086172	999.3333	1027	962	4055.4	22.6071	494295.3	273659		
	5996.2	1000	4066952	1000	1026	963	4099.2	22.6071	494326.1	273690		
	5965.2	1001	3914153	1002	1025	963	4130.2	42.9154	494326.1	273720		
	5921.4	1005	3904543	1005	1024	962	4174	42.9154	494295.3	273751		
	5877.6	1009	3899738	1010.333	1025	961	4217.8	42.9154	494264.5	273720		
	5833.8	1023	3896855	1014.333	1024	960	4261.6	42.9154	494233.7	273751		
	5790	1022	3895894	1017	1023	959	4305.4	42.9154	494202.9	273782		
	5759	1019	3892050	1017	1022	959	4336.4	42.9154	494202.9	273813		
	5728	1017	3889167	1017	1021	959	4367.4	46.7585	494202.9	273843		
	5684.2	1022	3867064	1017	1020	958	4411.2	46.7585	494172.1	273874		
	5653.2	1025	3859376	1017	1019	958	4442.2	46.7585	494172.1	273905		
	5609.4	1022	3837273	1017	1018	957	4486	46.7585	494141.3	273936		
	5565.6	1020	3833429	1017	1017	956	4529.8	46.7585	494110.5	273967		
	5534.6	1022	3771925	1017	1016	956	4560.8	46.7585	494110.5	273997		
	5503.6	1025	3770964	1017	1015	956	4591.8	46.7585	494110.5	274028		
	5459.8	1023	3706577	1017	1014	957	4635.6	19.8506	494141.3	274059		
	5428.8	1017	3703694	1019	1013	957	4666.6	19.8506	494141.3	274090		
	5397.8	1023	3699850	1021	1012	957	4697.6	19.8506	494141.3	274121		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	5366.8	1027	3687357	1023	1011	957	4728.6	19.8506	494141.3	274151		
	5323	1027	3685435	1023	1010	956	4772.4	19.8506	494110.5	274182		
	5279.2	1025	3650839	1023	1009	957	4816.2	19.8506	494141.3	274213		
	5248.2	1027	3645073	1023	1008	957	4847.2	19.8506	494141.3	274244		
	5204.4	1023	3607594	1024	1007	958	4891	15.6042	494172.1	274275		
	5173.4	1026	3583569	1025.667	1006	958	4922	15.6042	494172.1	274305		
	5142.4	1036	3555700	1027.333	1005	958	4953	15.6042	494172.1	274336		
	5111.4	1041	3550895	1028	1004	958	4984	15.6042	494172.1	274367		
	5067.6	1037	3513416	1028	1003	959	5027.8	15.6042	494202.9	274398		
	5023.8	1030	3421160	1028	1002	960	5071.6	15.6042	494233.7	274429		
	4980	1031	3407706	1028	1001	961	5115.4	15.6042	494264.5	274459		
	4936.2	1038	3358695	1028	1000	962	5159.2	57.6566	494295.3	274490		
	4905.2	1033	3354851	1028	999	962	5190.2	57.6566	494295.3	274521		
	4874.2	1028	3284698	1028	998	962	5221.2	57.6566	494295.3	274552		
	4843.2	1028	3283737	1028.667	997	962	5252.2	57.6566	494295.3	274583		
	4812.2	1030	3282776	1030.667	996	962	5283.2	57.6566	494295.3	274613		
	4781.2	1034	3281815	1033.667	995	962	5314.2	57.6566	494295.3	274644		
	4750.2	1037	3280854	1040	994	962	5345.2	57.6566	494295.3	274675		
	4719.2	1055	3264517	1045	993	962	5376.2	78.4756	494295.3	274706		
	4675.4	1063	3262595	1049	992	961	5420	78.4756	494264.5	274737		
	4644.4	1063	3261634	1049	991	961	5451	78.4756	494264.5	274767		
	4600.6	1058	3227038	1049	990	962	5494.8	78.4756	494295.3	274798		
	4569.6	1051	3207818	1049	989	962	5525.8	78.4756	494295.3	274829		
	4538.6	1049	3206857	1049.333	988	962	5556.8	78.4756	494295.3	274860		
	4507.6	1054	3205896	1049.667	987	962	5587.8	78.4756	494295.3	274891		
	4476.6	1057	3203974	1050	986	962	5618.8	8.79887	494295.3	274921		
	4445.6	1062	3171300	1050	985	962	5649.8	8.79887	494295.3	274952		
	4401.8	1068	3096342	1050	984	961	5693.6	8.79887	494264.5	274983		
	4358	1066	3095381	1050	983	960	5737.4	8.79887	494233.7	275014		
	4314.2	1064	2984866	1050	982	961	5781.2	8.79887	494264.5	275044		
	4283.2	1065	2964685	1050	981	961	5812.2	8.79887	494264.5	275075		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	4252.2	1059	2963724	1050	980	961	5843.2	8.79887	494264.5	275106		
	4221.2	1061	2961802	1050	979	961	5874.2	4.40104	494264.5	275137		
	4190.2	1065	2958919	1050	978	961	5905.2	4.40104	494264.5	275168		
	4146.4	1061	2940660	1050	977	962	5949	4.40104	494295.3	275198		
	4115.4	1060	2929128	1050	976	962	5980	4.40104	494295.3	275229		
	4071.6	1065	2913752	1050	975	963	6023.8	4.40104	494326.1	275260		
	4040.6	1061	2911830	1050	974	963	6054.8	4.40104	494326.1	275291		
	3996.8	1062	2811886	1050	973	964	6098.6	4.40104	494356.9	275322		
	3965.8	1058	2802276	1050	972	964	6129.6	143.575	494356.9	275352		
	3934.8	1063	2797471	1050	971	964	6160.6	143.575	494356.9	275383		
	3903.8	1063	2791705	1050	970	964	6191.6	143.575	494356.9	275414		
	3872.8	1065	2789783	1050	969	964	6222.6	143.575	494356.9	275445		
	3841.8	1068	2690800	1050	968	964	6253.6	143.575	494356.9	275476		
	3810.8	1066	2685034	1050	967	964	6284.6	143.575	494356.9	275506		
	3767	1074	2682151	1050	966	965	6328.4	143.575	494387.7	275537		
	3736	1073	2677346	1050	965	965	6359.4	143.575	494387.7	275568		
	3692.2	1080	2671580	1050	964	966	6403.2	143.575	494418.5	275599		
	3648.4	1088	2627374	1050	963	967	6447	143.575	494449.3	275630		
	3617.4	1085	2623530	1050	962	967	6478	143.575	494449.3	275660		
	3573.6	1058	2574519	1050	961	968	6521.8	143.575	494480.1	275691		
	3542.6	1050	2485146	1052.333	960	968	6552.8	143.575	494480.1	275722		
	3511.6	1057	2484185	1055.333	959	968	6583.8	143.575	494480.1	275753		
	3480.6	1059	2483224	1061.667	958	968	6614.8	96.4953	494480.1	275784		
	3449.6	1069	2482263	1066.667	957	968	6645.8	96.4953	494480.1	275814		
	3418.6	1072	2481302	1074	956	968	6676.8	96.4953	494480.1	275845		
	3387.6	1085	2480341	1078	955	968	6707.8	96.4953	494480.1	275876		
	3356.6	1087	2476497	1081	954	968	6738.8	96.4953	494480.1	275907		
	3325.6	1086	2466887	1081	953	968	6769.8	96.4953	494480.1	275938		
	3294.6	1089	2444784	1081	952	968	6800.8	96.4953	494480.1	275968		
	3263.6	1085	1682711	1081	951	968	6831.8	96.4953	494480.1	275999		
	3219.8	1081	1677906	1083	950	967	6875.6	60.8599	494449.3	276030		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	3188.8	1088	1642349	1085	949	967	6906.6	60.8599	494449.3	276061		
	3157.8	1087	1641388	1088.333	948	967	6937.6	60.8599	494449.3	276092		
	3126.8	1091	1640427	1089.667	947	967	6968.6	60.8599	494449.3	276122		
	3083	1092	1638505	1091	946	966	7012.4	60.8599	494418.5	276153		
	3052	1095	1527990	1091	945	966	7043.4	60.8599	494418.5	276184		
	3021	1095	1527029	1091	944	966	7074.4	60.8599	494418.5	276215		
	2977.2	1098	1522224	1091	943	967	7118.2	14.5179	494449.3	276245		
	2933.4	1098	1514536	1091	942	966	7162	14.5179	494418.5	276276		
	2902.4	1091	1512614	1093	941	966	7193	14.5179	494418.5	276307		
	2871.4	1098	1509731	1095	940	966	7224	14.5179	494418.5	276338		
	2840.4	1097	1507809	1097	939	966	7255	14.5179	494418.5	276369		
	2809.4	1100	1487628	1097	938	966	7286	14.5179	494418.5	276399		
	2778.4	1097	1472252	1097.667	937	966	7317	14.5179	494418.5	276430		
	2747.4	1104	1469369	1098.333	936	966	7348	14.5179	494418.5	276461		
	2703.6	1111	1453993	1099	935	967	7391.8	5.56359	494449.3	276492		
	2659.8	1112	1448227	1099	934	966	7435.6	5.56359	494418.5	276523		
	2628.8	1108	1367503	1099	933	966	7466.6	5.56359	494418.5	276553		
	2585	1109	1343478	1099	932	965	7510.4	5.56359	494387.7	276584		
	2554	1111	1175303	1099	931	965	7541.4	5.56359	494387.7	276615		
	2523	1108	1174342	1099	930	965	7572.4	5.56359	494387.7	276646		
	2492	1104	1173381	1099	929	965	7603.4	5.56359	494387.7	276677		
	2461	1103	1172420	1099	928	965	7634.4	81.0534	494387.7	276707		
	2430	1102	1171459	1099	927	965	7665.4	81.0534	494387.7	276738		
	2399	1102	1170498	1099	926	965	7696.4	81.0534	494387.7	276769		
	2368	1104	1169537	1099	925	965	7727.4	81.0534	494387.7	276800		
	2337	1099	1168576	1099.333	924	965	7758.4	81.0534	494387.7	276831		
	2306	1100	1167615	1102	923	965	7789.4	81.0534	494387.7	276861		
	2275	1107	1166654	1106.333	922	965	7820.4	81.0534	494387.7	276892		
	2244	1112	1165693	1112.333	921	965	7851.4	81.0534	494387.7	276923		
	2213	1118	1133980	1117.333	920	965	7882.4	80.9572	494387.7	276954		
	2182	1122	1133019	1122.667	919	965	7913.4	80.9572	494387.7	276985		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	2138.2	1128	1129175	1126	918	964	7957.2	80.9572	494356.9	277015		
	2094.4	1128	1084969	1131	917	965	8001	80.9572	494387.7	277046		
	2050.6	1137	1042685	1139	916	966	8044.8	80.9572	494418.5	277077		
	2006.8	1152	1037880	1148	915	967	8088.6	80.9572	494449.3	277108		
	1963	1155	1036919	1155	914	968	8132.4	55.3121	494480.1	277139		
	1932	1158	1028270	1157.667	914	969	8163.4	55.3121	494510.8	277139		
	1888.2	1172	1025387	1159.333	913	970	8207.2	55.3121	494541.6	277169		
	1857.2	1175	1022504	1160	912	970	8238.2	55.3121	494541.6	277200		
	1813.4	1174	1021543	1160	911	971	8282	55.3121	494572.4	277231		
	1769.6	1176	783215	1160	910	970	8325.8	55.3121	494541.6	277262		
	1725.8	1175	782254	1160	909	969	8369.6	22.7678	494510.8	277293		
	1694.8	1174	764956	1160	908	969	8400.6	22.7678	494510.8	277323		
	1651	1167	763034	1160	907	968	8444.4	22.7678	494480.1	277354		
	1607.2	1173	724594	1160	906	967	8488.2	22.7678	494449.3	277385		
	1576.2	1160	476656	1160	905	967	8519.2	22.7678	494449.3	277416		
	1545.2	1162	475695	1160	904	967	8550.2	22.7678	494449.3	277446		
	1514.2	1160	474734	1160	903	967	8581.2	22.7678	494449.3	277477		
	1483.2	1160	473773	1162	902	967	8612.2	5.70353	494449.3	277508		
	1452.2	1167	472812	1164	901	967	8643.2	5.70353	494449.3	277539		
	1421.2	1168	471851	1166	900	967	8674.2	5.70353	494449.3	277570		
	1390.2	1169	470890	1166	899	967	8705.2	5.70353	494449.3	277600		
	1359.2	1177	469929	1166	898	967	8736.2	5.70353	494449.3	277631		
	1315.4	1178	465124	1166	897	966	8780	5.70353	494418.5	277662		
	1284.4	1187	426684	1166	896	966	8811	5.70353	494418.5	277693		
	1253.4	1187	425723	1166	895	966	8842	5.70353	494418.5	277724		
	1222.4	1186	357492	1166	894	966	8873	22.3521	494418.5	277754		
	1191.4	1177	353648	1166	893	966	8904	22.3521	494418.5	277785		
	1160.4	1177	322896	1166	892	966	8935	22.3521	494418.5	277816		
	1129.4	1166	321935	1169.333	891	966	8966	22.3521	494418.5	277847		
	1098.4	1176	320974	1172.667	890	966	8997	22.3521	494418.5	277878		
	1067.4	1176	320013	1176	889	966	9028	22.3521	494418.5	277908		

	Distance from divide (m)	Elevation (m)	Drainage area (m^2)	Smoothed Elevation (m)	Project. x coord.	Project. y coord.	Distance from mouth	Auto extract. steep.	Easting	Northing	Log bin area (m^2)	Log bin slope
South 13												
	1036.4	1176	319052	1178.333	888	966	9059	22.3521	494418.5	277939		
	1005.4	1183	318091	1183.333	887	966	9090	22.3521	494418.5	277970		
	961.6	1191	258509	1189.333	886	965	9133.8	26.0587	494387.7	278001		
	917.8	1194	256587	1193	885	964	9177.6	26.0587	494356.9	278032		
	874	1197	252743	1194	886	963	9221.4	26.0587	494326.1	278001		
	830.2	1194	246016	1195.333	885	962	9265.2	26.0587	494295.3	278032		
	786.4	1198	243133	1197.667	884	961	9309	26.0587	494264.5	278062		
	742.6	1201	225835	1201.667	885	960	9352.8	26.0587	494233.7	278032		
	698.8	1206	222952	1206	886	959	9396.6	19.8997	494202.9	278001		
	655	1212	215264	1209.333	885	958	9440.4	19.8997	494172.1	278032		
	624	1211	214303	1213	885	957	9471.4	19.8997	494141.3	278032		
	580.2	1217	185473	1216	884	956	9515.2	19.8997	494110.5	278062		
	549.2	1222	172019	1219	884	955	9546.2	19.8997	494079.7	278062		
	505.4	1222	171058	1220	883	954	9590	19.8997	494048.9	278093		
	474.4	1220	165292	1221.333	882	954	9621	14.3056	494048.9	278124		
	430.6	1224	157604	1222.667	881	953	9664.8	14.3056	494018.1	278155		
	386.8	1228	107632	1224	880	952	9708.6	14.3056	493987.3	278186		
	355.8	1227	106671	1224	879	952	9739.6	14.3056	493987.3	278216		
	312	1224	75919	1225.333	878	953	9783.4	14.3056	494018.1	278247		
	268.2	1228	52855	1227.333	877	954	9827.2	14.3056	494048.9	278278		
	237.2	1230	44206	1231.333	876	954	9858.2	14.3056	494048.9	278309		
	206.2	1236	42284	1236.333	875	954	9889.2	15.5562	494048.9	278340		
	162.4	1243	40362	1242.667	874	953	9933	15.5562	494018.1	278370		
	118.6	1249	20181	1252	873	952	9976.8	15.5562	493987.3	278401		
	74.8	1264	16337	1259.333	872	951	10020.6	15.5562	493956.5	278432		
	31	1265	15376	1266.333	871	950	10064.4	15.5562	493925.7	278463		
	0	1270	7688	1270	870	950	10095.4	15.5562	493925.7	278494		

Appendix Table 6.1: Acquisition parameters for matrix glass

Column Conditions								
HV (kV)	15							
I (nA)	10							
Beam Size (µm	10							
Acquisition Information								
Element	**Line**	**Spectrometer**	**Xstal**	**Peak**	**Peak Time (s)**	**Bg Off1**	**Bg Off2**	**Calibration**
Si	Ka	1	TAP	27748	10	-600	600	RHYO
Al	Ka	1	TAP	32481	10	-600	600	RHYO
Ti	Ka	3	LPET	31418	20	-500	500	BASL
K	Ka	5	PET	42759	20	-700	700	KSPR
Ca	Ka	5	PET	38395	20	-500	500	BASL
Mn	Ka	4	LIF	52204	60	-500	500	PYMN
Fe	Ka	4	LIF	48089	60	-500	500	FO83
Na	Ka	2	LTAP	46386	10	-1300	1300	RHYO
Mg	Ka	2	LTAP	38533	20	-1300	1300	BASL
Cl	Ka	3	LPET	54065	30	-600	600	TUGT
P	Ka	3	LPET	70398	20	-500	500	FLAP
P	Ka	5	PET	70368	20	-500	500	FLAP

Appendix Table 6.2: Standards run for matrix glass analyses

RHYO Standard													
Run 1	**Si**	**Al**	**Ti**	**K**	**Ca**	**Mn**	**Fe**	**Na**	**Mg**	**Cl**	**P**	**O**	**Total**
	36.17	6.47	0.06	4.38	0.27	0.01	0.81	2.77	0.02	0.13	0.01	49.25	100.36
	36.40	6.40	0.04	4.12	0.32	0.01	0.89	2.73	0.01	0.10	0.01	49.39	100.42
	36.13	6.43	0.05	4.20	0.33	0.04	0.73	3.00	0.02	0.10	0.01	49.19	100.23
	36.40	6.53	0.05	3.84	0.32	0.02	0.78	2.73	0.02	0.11	0.00	49.42	100.21
	36.30	6.39	0.05	4.21	0.29	0.01	0.83	2.89	0.02	0.11	0.00	49.32	100.43
	36.06	6.71	0.05	4.24	0.32	0.00	0.88	2.74	0.02	0.11	0.00	49.30	100.42
	36.01	6.63	0.05	4.24	0.34	0.03	0.80	2.85	0.02	0.11	0.00	49.21	100.28
	36.17	6.44	0.05	4.02	0.30	0.00	0.79	2.74	0.02	0.08	0.00	49.11	99.72
Average	36.21	6.50	0.05	4.16	0.31	0.02	0.81	2.81	0.02	0.11	0.00	49.27	100.26
1 SD	0.15	0.11	0.01	0.17	0.02	0.01	0.05	0.10	0.00	0.01	0.01	0.10	0.23
Run 2	**Si**	**Al**	**Ti**	**K**	**Ca**	**Mn**	**Fe**	**Na**	**Mg**	**Cl**	**P**	**O**	**Total**
	36.23	6.47	0.04	4.17	0.29	0.03	0.86	2.99	0.01	0.10	0.00	49.33	100.53
	36.47	6.63	0.05	4.14	0.35	0.03	0.84	2.82	0.03	0.10	0.00	49.71	101.17
	36.21	6.42	0.05	4.18	0.32	0.02	0.81	2.92	0.02	0.11	0.00	49.25	100.31
	36.44	6.77	0.05	3.90	0.32	0.01	0.88	3.03	0.01	0.10	0.00	49.81	101.31
	36.29	6.44	0.04	3.96	0.33	0.01	0.88	2.93	0.02	0.10	0.01	49.35	100.38
	36.42	6.58	0.04	3.85	0.30	0.02	0.88	3.05	0.02	0.10	0.00	49.62	100.88
	36.37	6.59	0.07	4.09	0.30	0.02	0.83	2.98	0.03	0.11	0.01	49.61	101.00
Average	36.35	6.56	0.05	4.04	0.32	0.02	0.85	2.96	0.02	0.10	0.00	49.53	100.80
1 SD	0.10	0.12	0.01	0.14	0.02	0.01	0.03	0.08	0.01	0.01	0.00	0.21	0.39
Run 3	**Si**	**Al**	**Ti**	**K**	**Ca**	**Mn**	**Fe**	**Na**	**Mg**	**Cl**	**P**	**O**	**Total**
	35.69	6.70	0.06	4.01	0.32	0.03	0.85	2.82	0.02	0.11	0.00	48.86	99.46
	35.86	6.31	0.04	4.17	0.31	0.06	0.87	2.65	0.02	0.09	0.01	48.70	99.10
	35.61	6.59	0.05	4.02	0.31	0.00	0.82	2.70	0.02	0.10	0.01	48.62	98.86
	35.60	6.77	0.04	4.16	0.32	0.02	0.81	2.63	0.01	0.11	0.03	48.79	99.31
	35.89	6.66	0.06	4.01	0.29	0.02	0.84	2.90	0.02	0.10	0.00	49.07	99.86
Average	35.73	6.61	0.05	4.08	0.31	0.02	0.84	2.74	0.02	0.10	0.01	48.81	99.32
1 SD	0.14	0.18	0.01	0.08	0.01	0.02	0.03	0.11	0.00	0.01	0.01	0.17	0.38

Appendix Table 6.3: Compiled data set for all Sumatran volcanoes

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[10396]	PRE-CALDERA
[10396]	INTRA-CALDERA, GENTENG AND PENDIAN
[10396]	EAST JAVA, GLAMAN, INTRA-CALDERA
[10396]	POST-CALDERA, CALDERA RIM, RINGGIH
[10396]	PRE-CALDERA
[10396]	INTRA-CALDERA, KUKUSAN
[10396]	PRE-CALDERA
[10396]	CALDERA
[10396]	POST-CALDERA, CALDERA RIM, RANTE
[10396]	POST-CALDERA, BLAU
[10396]	POST-CALDERA, BLAU
[10396]	EAST JAVA, GLAMAN, INTRA-CALDERA
[10396]	POST-CALDERA, CALDERA RIM, RINGGIH
[10396]	EAST JAVA, KAWAH IJEN, POST-CALDERA
[10396]	POST-CALDERA, CALDERA RIM, PAWENEN
[10396][18645]	EAST JAVA, DJAMPIT, POST-CALDERA, CALDERA RIM
[10396][18645]	EAST JAVA, ANYAR, INTRA-CALDERA
[10396][18645]	EAST JAVA, DJAMPIT, POST-CALDERA, CALDERA RIM
[10396][18645]	EAST JAVA, DJAMPIT, POST-CALDERA, CALDERA RIM
[10396][18645]	EAST JAVA, MERAPI, POST-CALDERA, CALDERA RIM
[10396][18645]	EAST JAVA, KAWAH IJEN, POST-CALDERA
[10396][18645]	EAST JAVA, KAWAH IJEN, POST-CALDERA
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[11042]	NORTHERN END OF PEGU YOMA HILL RANGE
[13319]	

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[10396]	Handley et al., 2007	63.14	0.53	16.85	
[10396]	Handley et al., 2007	52.79	1.02	18.28	
[10396]	Handley et al., 2007	53.29	0.99	18.16	
[10396]	Handley et al., 2007	50.35	1	19.14	
[10396]	Handley et al., 2007	50.57	1.28	15.7	
[10396]	Handley et al., 2007	55.21	0.95	17.89	
[10396]	Handley et al., 2007	55.93	0.74	20.4	
[10396]	Handley et al., 2007	57.29	1.05	15.8	
[10396]	Handley et al., 2007	49.71	0.99	18.43	
[10396]	Handley et al., 2007	57.88	0.77	16.97	
[10396]	Handley et al., 2007	49.76	1.04	20.2	
[10396]	Handley et al., 2007	62.32	0.66	16.45	
[10396]	Handley et al., 2007	51.7	0.92	19.7	
[10396]	Handley et al., 2007	50.47	0.92	20.77	
[10396]	Handley et al., 2007	49.15	1.23	18.5	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	48.89	1.17	17.62	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	53.8	0.97	18.06	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	59.64	0.6	17.68	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	53.03	1.01	18.75	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	51.49	0.98	18.94	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	57.21	0.8	17.16	
[10396][18645]	Handley et al., 2007; Handley et al., 2014	50.81	0.98	19.81	
[11042]	Stephenson and Marshall, 1984	53.26	0.72	16.1	2.86
[11042]	Stephenson and Marshall, 1984	50.14	0.87	17.08	4.03
[11042]	Stephenson and Marshall, 1984	50.14	0.81	18.3	2.99
[11042]	Stephenson and Marshall, 1984	50.93	0.85	16.59	4.69
[11042]	Stephenson and Marshall, 1984	52.86	0.75	17.09	5.27
[11042]	Stephenson and Marshall, 1984	50.23	0.93	17.04	6.09
[11042]	Stephenson and Marshall, 1984	58.84	0.54	16.56	3.24
[11042]	Stephenson and Marshall, 1984	58.35	0.56	17.38	3.08
[13319]	Chandrasekharam et al., 2009	49.8	0.74	15.7	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[10396]	0.13	1.78	5.21	3.61	2.21	0.24			635	4.3	24	17	6.78	3.8	11.4
[10396]	0.19	3.7	7.63	3.48	2.19	0.35			673	0.2	33	19	7	2.5	10.2
[10396]	0.18	3.58	7.51	3.55	2.3	0.35			449	3.4	64	18	7.01	14	9.3
[10396]	0.19	4.61	9.65	3.33	1.04	0.24			265	18.2	74	18	3.03	14.6	3.3
[10396]	0.22	3.85	9.2	3.28	1.37	0.24			492	0	233	20	4.73	8.3	6.3
[10396]	0.18	3.15	7.01	3.51	2.53	0.33			639	2.3	75	20	8.34	7.2	11.2
[10396]	0.15	1.96	7.79	3.47	1.93	0.31			568	0.4	42	20	8.38	2.6	8.3
[10396]	0.24	2.6	6.02	4.27	1.95	0.31			646	1.1	43	21	7.04	10.7	10.1
[10396]	0.19	5.33	9.51	2.71	1.04	0.25			365	18.5	147	21	3.76	28.4	6.7
[10396]	0.15	2.82	6.41	3.6	2.59	0.19			498	6.6	45	16	7.39	8	10.3
[10396]	0.16	3.64	9.39	3.11	1.29	0.28			382	3.7	105	19	4.23	11.9	5.7
[10396]	0.12	2.01	4.84	3.35	3.41	0.11			727	4.3	25	18	9.75	5.3	17.1
[10396]	0.24	2.7	9.59	3.41	1.26	0.27			407	0.3	123	18	3.86	4	6.3
[10396]	0.18	3.56	10.3	3.13	1.01	0.24			381	1	136	19	3.54	6.8	5
[10396]	0.25	4.09	8.6	3.2	1.27	0.29			466	1.3	52	19	4.11	4.3	5.6
[10396][18645]	0.19	5.77	10.2	2.62	1.44	0.2			422	59.4	175	19	4.15	37.8	6.1
[10396][18645]	0.18	3.47	7.39	3.52	2.31	0.32			621	1.1	74	19	7.59	6.3	9.8
[10396][18645]	0.13	1.75	5.87	3.36	2.07	0.23			601	1.4	24	19	9.17	2.7	10
[10396][18645]	0.2	3.48	8.38	2.83	1.4	0.29			446	1.1	34	20	9.43	7.1	6.3
[10396][18645]	0.18	4.4	8.91	3.21	1.36	0.26			365	12.2	68	19	4.25	22.2	6.7
[10396][18645]	0.15	2.93	6.7	4	2.6	0.22			614	5.8	21	18	8.13	6.9	9.8
[10396][18645]	0.18	3.95	9.91	3.09	1.13	0.23			339	4.9	107	22	3.9	12.5	5.5
[11042]	0.11	6.56	10	2.43	1.5	0.18			583	155	56		6	30	12
[11042]	0.14	6.22	10.9	2.56	1.36	0.22			522	56	129		4	21	9
[11042]	0.14	6.02	10.7	2.59	1.11	0.17			423	41	126		3	18	14
[11042]	0.13	6.09	10.8	2.52	1.66	0.21			680	69	114		6	19	22
[11042]	0.12	4.79	9.44	2.88	2.17	0.28			1069	46	73		5	17	8
[11042]	0.13	5.72	10.2	2.4	1.95	0.22			784	37	92		4	27	14
[11042]	0.08	3.6	5.55	2.99	2.95	0.22			650	66	51		7	16	23
[11042]	0.1	2.05	6.49	3.57	3.08	0.24			640	28	52		6	12	28
[13319]	0.17	11.4	10.7	2.3	0.24	0.06			47	557			0.58	218	0.86

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[10396]	61.9	547	95		20	62	131	25.7	45.2	23.8	4.49	1.26	0.58	1.9	0.32	6.19
[10396]	42.6	469	162		34	109	123	19.2	38.8	23.1	5.53	1.73	0.94	3.28	0.55	4.59
[10396]	59.9	473	201		29	76	144	19.9	41.2	23.9	5.35	1.4	0.83	2.7	0.44	6.18
[10396]	17.8	567	279		20	74	60	11.6	24.2	15.1	3.54	1.18	0.57	1.9	0.31	2.02
[10396]	27.4	517	462		30	111	85	14.7	28.6	18	4.44	1.47	0.81	2.66	0.44	3.38
[10396]	75.7	474	197		32	87	177	22.2	45.5	26.1	5.81	1.5	0.91	3.05	0.5	7.81
[10396]	45.1	575	95		28	73	146	20.3	40.7	22.7	4.94	1.54	0.76	2.61	0.43	4.87
[10396]	43.1	484	176		35	115	125	18.7	37.8	22.8	5.5	1.77	0.96	3.27	0.54	4.5
[10396]	25.4	543	314		22	93	78	13.6	28	16.9	3.94	1.27	0.63	2.02	0.34	2.9
[10396]	60.7	346	171		23	62	158	17.5	36.4	18.4	4	1.01	0.62	2.31	0.38	6.54
[10396]	22	562	287		23	81	74	15.4	33.1	19.7	4.41	1.37	0.68	2.02	0.33	2.73
[10396]	104	391	127		27	60	223	23.5	46.3	23	4.79	1.11	0.72	2.74	0.45	11.5
[10396]	25	626	217		21	73	69	13.7	28.3	16.4	3.81	1.26	0.61	1.98	0.33	2.83
[10396]	18.7	670	234		21	74	61	12.2	25.2	15.3	3.6	1.26	0.59	1.92	0.32	2.39
[10396]	19.4	612	241		28	98	81	17	34.3	22	5.2	1.66	0.8	2.46	0.4	3.41
[10396][18645]	38.5	491	418		25	85	93	13.6	28.4	17.4	4.29	1.3	0.71	2.17	0.35	3.68
[10396][18645]	66.7	499	204		31	86	159	21.3	43.8	25	5.73	1.51	0.88	2.92	0.48	7.02
[10396][18645]	60.3	485	89		39	89	166	25.2	45.9	29.5	6.37	1.73	0.98	3.53	0.61	6
[10396][18645]	28.4	501	199		30	106	135	19.6	40.3	23.5	5.28	1.63	0.85	2.84	0.47	4.25
[10396][18645]	25.9	513	264		21	79	92	14.4	30.5	17.8	3.95	1.21	0.62	1.96	0.33	3.08
[10396][18645]	67.4	440	197		28	72	170	20.6	41.8	22.7	4.97	1.29	0.76	2.73	0.47	7.44
[10396][18645]	26.9	549	306		22	86	81	12.6	26.4	16.4	3.86	1.25	0.63	2.08	0.34	3.01
[11042]	21	935			13	59	82	26	41							7
[11042]	18	1005			18	81	90	34	50							6
[11042]	12	795			16	58	76	19	36							9
[11042]	22	865			19	65	85	28	40							6
[11042]	37	1050			21	61	120	62	71							13
[11042]	37	711			24	64	103	48	49							11
[11042]	108	562			21	70	165	75	70							23
[11042]	116	508			24	66	180	54	67							21
[13319]	4	151	262		21		49	2.4	6.8	6.11	2.1	0.84	0.49	2.01	0.31	0.39

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[10396]	1.67	0.67	3.33	11	1.5	32	0.70419		0.5129				
[10396]	1.14	0.77	3.41	22	1.75	54	0.70422		0.5129				
[10396]	1.63	0.73	3.71	21	2.26	61	0.70423		0.5128				
[10396]	0.46	0.25	1.66	27	0.58	33	0.70423		0.5128				
[10396]	0.63	0.34	2.36	37	0.38	58	0.70425		0.5129				
[10396]	2.01	0.71	4.61	21	3.12	34	0.70426		0.5128				
[10396]	1.15	0.74	3.67	12	1.52	31	0.70426		0.5129				
[10396]	1.11	0.73	3.43	24	1.83	51	0.70428		0.5129				
[10396]	0.65	0.34	2.11	34	0.99	51	0.70429		0.5129				
[10396]	1.69	0.68	4.15	16	2.71	30	0.7043		0.5129				
[10396]	0.66	0.39	2.06	23	0.7	79	0.70431		0.5128				
[10396]	2.79	0.91	5.87	15	4.44	33	0.70432		0.5128				
[10396]	0.71	0.43	1.92	19	0.98	37	0.70435		0.5128				
[10396]	0.55	0.39	1.71	21	0.59	40	0.70438		0.5128				
[10396]	0.55	0.28	2.29	25	0.26	36	0.70452		0.5128				
[10396][18645]	1.07	0.43	2.49	38	1.23	55	0.70422		0.5129		18.526	15.617	38.768
[10396][18645]	1.83	0.69	4.12	22	2.7	41	0.70423		0.5129		18.563	15.623	38.789
[10396][18645]	1.45	0.67	4.24	10	1.35	24	0.70427		0.5129		18.54	15.611	38.747
[10396][18645]	1	0.74	3.43	18	0.76	35	0.70429		0.5128		18.551	15.611	38.753
[10396][18645]	0.73	0.37	2.43	27	0.65	48	0.70432		0.5128		18.578	15.626	38.802
[10396][18645]	1.79	0.65	4.44	21	2.84	33	0.70436		0.5128		18.598	15.628	38.836
[10396][18645]	0.71	0.38	2.18	28	0.56	49	0.70437		0.5128		18.602	15.635	38.861
[11042]	0					42	0.70431						
[11042]	0					50	0.70433						
[11042]	2					36	0.70435						
[11042]	0					49	0.70445						
[11042]	0					36	0.70445						
[11042]	0					50	0.70453						
[11042]	5					20	0.70478						
[11042]	6					18	0.70501						
[13319]	0.09	0.05	1.33	39	0.16		0.70381		0.513				

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[13319]	
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[13319]	
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[13319][13449]	
[13319][13449]	
[13319][13449]	
[13319][13449]	
[14434]	GOLDEN RIDGE, WEST NUSA TENGGARA PROVINCE, SW SUMBAWA
[14434]	SEKONGKANG, WEST NUSA TENGGARA PROVINCE, SW SUMBAWA
[14434]	TONGOLOKA, WEST NUSA TENGGARA PROVINCE, SW SUMBAWA
[14435][15430]	WEST JAVA
[14435][15430]	NEAR GEDE VOLCANO OBSERVATORY, WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	KAWAH WADON CRATER EDGE, WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430]	WEST JAVA
[14435][15430][18645]	WEST JAVA

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[13319]	Chandrasekharam et al., 2009	55.8	0.85	17.6	
[13319]	Chandrasekharam et al., 2009	50.7	0.81	21.2	
[13319]	Chandrasekharam et al., 2009	50.9	0.81	21.3	
[13319]	Chandrasekharam et al., 2009	50.7	0.8	21	
[13319]	Chandrasekharam et al., 2009	53.6	1.18	18	
[13319]	Chandrasekharam et al., 2009	54.7	1.18	17.6	
[13319]	Chandrasekharam et al., 2009	56.1	0.84	19.1	
[13319][13449]	Chandrasekharam et al., 2009; Chandrasekharam et al., 2004	50.5	0.7	18.6	
[13319][13449]	Chandrasekharam et al., 2009; Chandrasekharam et al., 2004	48.8	0.74	16.7	
[13319][13449]	Chandrasekharam et al., 2009; Chandrasekharam et al., 2004	53.5	0.68	17.6	
[13319][13449]	Chandrasekharam et al., 2009; Chandrasekharam et al., 2004	52.2	0.83	20.6	
[14434]	Fiorentini and Garwin, 2010	51.89	0.49	16.8	
[14434]	Fiorentini and Garwin, 2010	49.96	1.07	19.81	
[14434]	Fiorentini and Garwin, 2010	47.72	0.92	16.72	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	59.85	0.72	17.15	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	53.6	0.89	18.89	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	55.49	0.79	20.02	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	55.09	0.81	19.76	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	55.11	0.8	20.17	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	54.43	0.91	18.63	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	54.78	0.93	19.51	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	55.05	0.8	18.77	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	59.47	0.74	17.34	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	59.39	0.71	17.76	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	54.28	0.81	20.2	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	54.86	0.91	18.53	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	55.39	0.9	18.33	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	55.04	0.91	18.34	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	51.56	1.06	18.56	
[14435][15430]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011	51.48	1.08	19.41	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	58.81	0.76	17.29	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[13319]	0.17	4.9	8.4	3.8	0.52	0.13			110	103			0.84	43	1.55
[13319]	0.14	3.8	11.3	2.9	0.39	0.1			86	43			0.63	26	1.58
[13319]	0.14	3.9	11.3	2.9	0.38	0.09			77	41			0.53	24	1.48
[13319]	0.14	4	11.2	2.9	0.39	0.1			86	45			0.74	28	1.6
[13319]	0.18	4	9.2	3.5	0.51	0.13			99	36			0.74	21	2.81
[13319]	0.19	3.6	8.2	4.1	0.65	0.16			128	14			0.74	10	2.56
[13319]	0.02	5.3	9.8	4.6	0.27	0.1			70	171			0.63	50	1
[13319][13449]	0.15	7.7	11.3	2.4	0.26	0.07			61	241	73		0.43	100	2.21
[13319][13449]	0.15	10.9	10.7	2.3	0.27	0.08			71	496	70		0.74	218	1.3
[13319][13449]	0.15	6.7	9.8	3.2	0.46	0.11			98	216	59		0.84	76	1.76
[13319][13449]	0.14	4.7	10.3	3.3	0.51	0.14			107	81	58		2.08	42	2.44
[14434]	0.2	2.67	8.17	2.22	1.22	0.19		2	412	84	20		1	8	33
[14434]	0.22	5.28	6.8	2.37	0.12	0.13		2	73	63.8	78		1.1	25	5
[14434]	0.18	6.5	9.38	2.34	0.08	0.09		3	107	47	58		0.5	32	5
[14435][15430]	0.14	2.79	6.28	3.4	1.78	0.17	1169		308	13.1	43	18	5.29	7.3	8.8
[14435][15430]	0.2	3.88	8.83	3.09	0.93	0.23	1820		179	5.6	39	20	4.45	5.6	5.1
[14435][15430]	0.15	2.87	8.38	3.14	1.27	0.19	1208		237	14.6	49	19	4.73	8.9	10.4
[14435][15430]	0.16	3.09	8.35	3.08	1.2	0.19	1169		228	11	59	20	4.79	6.7	10.7
[14435][15430]	0.15	2.86	8.23	3.12	1.18	0.19	1216		238	8.8	48	19	4.78	7.6	6.6
[14435][15430]	0.2	3.49	8.69	3.11	1.01	0.29	1619		212	4.6	80	20	6.98	3.6	12.2
[14435][15430]	0.16	3.09	7.39	3.12	1.1	0.2	1239		266	1.9	49	20	4.97	2.8	12.3
[14435][15430]	0.16	3.61	8.72	3.07	1.02	0.16	1324		211	5.1	21	19	3.98	6.1	8.8
[14435][15430]	0.14	3.13	7.23	3.21	1.74	0.14	1162		318	8.4	23	18	5.09	4.9	12.6
[14435][15430]	0.14	3.03	7.27	3.22	1.73	0.14	1076		313	6.2	21	18	4.92	5.2	9.5
[14435][15430]	0.15	3.29	8.95	3.04	1.23	0.16	1076		235	3.3	49	21	4.61	3	11
[14435][15430]	0.15	4.06	8.92	2.96	1.32	0.14	1185		247	18.2	15	19	4.18	13	10.3
[14435][15430]	0.15	3.97	8.75	2.96	1.38	0.13	1185		254	16.1	14	18	4.22	8.6	10.5
[14435][15430]	0.15	3.98	8.78	2.97	1.36	0.14	1185		250	17.4	12	18	4.22	15.6	10.5
[14435][15430]	0.18	4.98	9.67	2.7	1.19	0.18	1518		212	10.9	104	20	4.96	9.6	14.4
[14435][15430]	0.2	4.21	9.26	2.77	1.18	0.18	1603		242	6.2	72	21	5.25	6.1	11.7
[14435][15430][18645]	0.13	3.02	6.79	3.2	1.59	0.15	1131		334	13.3	35	18	5.07	7.8	8.4

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[13319]	10	188	249		28		88	5	13.1	9.9	2.94	1.08	0.66	2.62	0.41	1.08
[13319]	10	219	277		24		62	4.64	11.8	8.87	2.57	0.97	0.57	2.25	0.33	1.3
[13319]	10	217	290		23		62	4.55	11.7	8.54	2.55	0.99	0.56	2.25	0.33	1.28
[13319]	10	216	286		23		62	4.76	12	8.76	2.68	0.89	0.54	2.2	0.33	1.28
[13319]	12	190	429		32		84	5.8	15.2	11.7	3.59	1.32	0.72	3.1	0.44	1.32
[13319]	18	195	349		36		101	7.9	20.1	14.2	4.06	1.39	0.84	3.43	0.5	2.42
[13319]	3	215	256		25		59	3.06	8.2	7.1	2.52	0.84	0.54	2.43	0.34	0.56
[13319][13449]	6	177	253		21	68	49	2.83	7.5	6.1	2.01	1.02	0.47	1.78	0.26	0.58
[13319][13449]	6	203	257		20	69	51	4.4	11	8.2	2.33	0.81	0.48	1.91	0.28	0.89
[13319][13449]	9	199	216		24	71	72	5	12.7	9.1	2.58	0.92	0.57	2.33	0.35	1.1
[13319][13449]	11	250	220		24	63	77	6.7	16	10.7	3.1	1.28	0.55	2.23	0.33	1.58
[14434]	31	366	104	0.2	13	171	49	7.6	17	9.71	2.16	0.79	0.32	1.12	0.19	1.3
[14434]	2.6	301	338	0.8	15	137	45	4.64	10.8	8.12	2.47	0.92	0.51	1.68	0.25	0.57
[14434]	2	321	301	0.4	11	82	29	2.05	5.4	4.15	1.34	0.61	0.29	1.08	0.17	0.27
[14435][15430]	56.1	342	151		26	70	132	20.4	38.8	23.3	4.94	1.29	0.75	2.52	0.41	7.43
[14435][15430]	31.9	406	192		26	79	98	12.9	28.8	18.5	4.3	1.34	0.68	2.39	0.4	3.73
[14435][15430]	50.7	337	130		25	70	124	12.6	28.1	17.1	4.09	1.24	0.69	2.35	0.39	5.3
[14435][15430]	50.1	376	151		27	67	131	13.8	30.8	18.6	4.4	1.24	0.73	2.48	0.42	5.29
[14435][15430]	46.7	357	132		26	67	128	13.8	30.8	18.7	4.37	1.25	0.74	2.44	0.41	5.4
[14435][15430]	39.1	422	152		30	88	125	17.1	38.6	24.2	5.47	1.54	0.84	2.77	0.46	4.14
[14435][15430]	40	320	191		28	79	118	16.5	33.5	20.8	4.71	1.34	0.78	2.5	0.41	4.99
[14435][15430]	37	362	201		21	82	100	12	26	15.2	3.5	1.08	0.59	2.01	0.33	4.1
[14435][15430]	66.2	307	173		24	75	138	16.4	34.3	18.6	4.05	1.05	0.65	2.2	0.37	7.15
[14435][15430]	62.1	302	158		23	69	117	15.7	32.4	17.5	3.92	1.04	0.64	2.07	0.34	6.61
[14435][15430]	48.3	347	198		25	72	113	13.4	29.1	17.5	4.13	1.15	0.69	2.33	0.39	4.78
[14435][15430]	49	319	246		22	76	107	13.4	28.5	16.4	3.8	1.07	0.63	2.05	0.34	5.47
[14435][15430]	51.5	297	252		23	74	109	13.8	29.2	16.6	3.84	1.08	0.63	2.05	0.34	5.6
[14435][15430]	49.6	323	238		22	76	108	13.6	28.6	16.1	3.76	1.06	0.63	2.02	0.33	5.48
[14435][15430]	45.8	302	259		30	96	110	13.5	29.9	18.8	4.72	1.25	0.83	2.66	0.43	5.16
[14435][15430]	34.1	301	245		32	95	116	14.4	31.5	20	4.96	1.33	0.88	2.92	0.48	5.5
[14435][15430][18645]	52.8	306	184		27	85	115	19.2	38.6	20.8	4.52	1.2	0.73	2.47	0.42	9.34

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[13319]	0.24	0.07	2.3	29	0.14		0.70388		0.513				
[13319]	0.21	0.05	1.66	29	0.37		0.704		0.5129				
[13319]	0.2	0.05	1.69	30	0.39		0.704		0.5129				
[13319]	0.22	0.06	1.62	29	0.41		0.704		0.5129				
[13319]	0.24	0.07	2.08	40	0.54		0.70401		0.5129				
[13319]	0.4	0.08	2.6	35	0.66		0.70403		0.5129				
[13319]	0.12	0.08	1.62	31	0.15		0.70413		0.513				
[13319][13449]	0.11	0.05	1.4	36	0.24		0.70389		0.513				
[13319][13449]	0.15	0.05	1.36	34	0.36		0.7039		0.5129				
[13319][13449]	0.23	0.07	1.93	33	0.2		0.70398		0.5129				
[13319][13449]	0.25	0.12	1.86	28	0.39		0.704		0.5129				
[14434]	0.36	0.11	1.6	11.1	5.9	13.7	0.70395		0.513		18.635	15.593	38.768
[14434]	0.16	0.08	1.4	34.5	0.2	26	0.70396		0.513		18.648	15.61	38.841
[14434]	0.08	0.09	0.9	33.3	0.3	35.8	0.70398		0.513		18.67	15.629	38.925
[14435][15430]	1.54	0.39	3.61	17	1.54	18	0.70474		0.5127				
[14435][15430]	0.86	0.29	2.65	20	0.91	25	0.70488		0.5127				
[14435][15430]	1.23	0.35	3.38	16	2.59	18	0.70498		0.5127				
[14435][15430]	1.25	0.35	3.46	18	3.45	22	0.705		0.5127				
[14435][15430]	1.22	0.35	3.43	17	3.44	19	0.705		0.5127				
[14435][15430]	1.01	0.43	3.28	19	1.11	21	0.70506		0.5127				
[14435][15430]	1.15	0.36	3.22	17	3.35	21	0.70506		0.5127				
[14435][15430]	0.92	0.3	2.66	22	2.39	22	0.70512		0.5127				
[14435][15430]	1.63	0.41	3.64	20	4.41	19	0.70514		0.5127				
[14435][15430]	1.5	0.4	3.21	19	2.11	19	0.70514		0.5127				
[14435][15430]	1.13	0.34	3.02	21	3.48	23	0.70521		0.5127				
[14435][15430]	1.2	0.33	2.92	30	3.31	25	0.70529		0.5127				
[14435][15430]	1.27	0.33	2.94	29	3.34	25	0.70529		0.5127				
[14435][15430]	1.22	0.35	2.9	30	3.33	24	0.70533		0.5126				
[14435][15430]	1.17	0.37	3.04	32	1.01	32	0.70539		0.5126				
[14435][15430]	1.16	0.4	3.22	29	2.55	29	0.70554		0.5126				
[14435][15430][18645]	1.83	0.39	3.25	20	3.18	20	0.70451		0.5127		18.774	15.687	39.117

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[14435][15430][18645]	WEST JAVA
[14435][15430][18645]	WEST JAVA, GEGERBENTANG
[14435][15430][18645]	WEST JAVA, KAWA RATU
[14435][15430][18645]	WEST JAVA
[14435][15430][18645]	WEST JAVA, KAWA RATU
[14435][15430][18645]	WEST JAVA
[14435][15430][18645]	WEST JAVA, KAWA RATU
[14435][15430][18645]	WEST JAVA, PANGRANGO
[14435][15430][18645]	WEST JAVA, PANGRANGO
[14827]	ASH DEPOSITS
[14827]	SE OF BARREN ISLAND
[14827]	ASH DEPOSITS
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[14827]	SE OF BARREN ISLAND
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[14827]	SE OF BARREN ISLAND
[14827]	NNE OF BARREN ISLAND
[14827]	NNE OF BARREN ISLAND
[15296]	
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Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	61.11	0.62	17.72	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	53.23	0.92	19.35	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	57.45	0.77	18.46	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	53.98	0.94	17.05	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	59.29	0.72	17.55	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	54.96	0.83	19.97	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	52.52	0.9	19.19	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	54.71	0.91	18.52	
[14435][15430][18645]	Handley, MacPherson, and Davidson, 2010; Handley et al., 2011; Handley et al	50.56	1.15	19.29	
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[14827]	Awasthi et al., 2010				
[15296]	Sendjaja, Kimura, and Sunardi, 2009	53.8	0.75	19.53	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	50.01	1.09	18.31	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	50.95	1.03	19.39	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	51.9	1.09	21.34	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[14435][15430][18645]	0.14	2.54	6.15	3.34	1.53	0.17	1162		315	3.7	17	18	5.9	4.2	11.3
[14435][15430][18645]	0.19	3.7	8.76	3.05	0.87	0.26	1541		188	10.4	42	20	4.99	7.3	8.9
[14435][15430][18645]	0.17	3.01	7.66	3.18	1.26	0.19	1216		245	2.5	28	18	4.83	1.9	8.6
[14435][15430][18645]	0.19	5.22	7.5	2.61	1.29	0.16	1557		229	26.5	50	18	4.47	17	7.5
[14435][15430][18645]	0.14	2.97	7.16	3.21	1.76	0.14	1146		330	6.6	25	19	5.22	4.1	12.9
[14435][15430][18645]	0.15	3.13	8.85	3.07	1.06	0.17	1247		217	3.1	45	20	3.95	4.4	9.7
[14435][15430][18645]	0.17	4.51	9.86	2.75	0.91	0.13	1371		183	8.3	48	19	3.46	8	8.3
[14435][15430][18645]	0.14	4.01	8.95	2.89	1.3	0.13	1200		245	17.3	14	19	4.15	7.9	10.4
[14435][15430][18645]	0.18	4.89	9.78	2.94	0.92	0.15	1688		160	15.6	73	21	3.72	8.6	5.1
[14827]															
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[15296]	0.18	3.51	8.04	3.31	0.76	0.37			212	7		17.3	10.4	8	4.59
[15296]	0.18	6.04	10.1	3.09	0.43	0.17			93	52		17.4	3.25	19	1.7
[15296]	0.17	4.82	9.71	3.23	0.57	0.17			132	35		18	2.33	10	2.82
[15296]	0.2	4.92	6.56	2.59	0.2	0.16			152	19		20.2		9	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[14435][15430][18645]	58.5	317	115		22	68	142	16.5	34.5	18.9	4.08	1.15	0.62	2.15	0.36	6.24
[14435][15430][18645]	30.4	423	184		24	88	91	14.5	31.7	20.7	4.7	1.42	0.73	2.15	0.35	3.41
[14435][15430][18645]	48.6	370	147		26	65	126	15	32	19.5	4.47	1.24	0.73	2.41	0.41	5.08
[14435][15430][18645]	57.3	280	228		24	88	120	10.9	27.2	15.3	3.82	1.13	0.68	2.41	0.4	5.23
[14435][15430][18645]	68.8	316	167		24	74	143	17.2	35.9	19.1	4.22	1.08	0.68	2.25	0.36	7.43
[14435][15430][18645]	38.7	347	193		24	77	96	12.7	26.8	16.4	3.83	1.16	0.65	2.18	0.36	3.96
[14435][15430][18645]	32.4	354	257		21	81	80	10.4	22.6	13.8	3.34	1.04	0.58	1.92	0.31	3.45
[14435][15430][18645]	48.8	324	252		22	77	108	13.3	28.2	16.2	3.8	1.06	0.64	2.05	0.33	5.34
[14435][15430][18645]	30	326	316		27	84	82	9.8	22.2	15	3.89	1.21	0.73	2.49	0.41	3.21
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[15296]	13.9	513	130		17.2		96.9	14.1	28.7	15	3.24	1.15	0.52	1.83	0.28	3.69
[15296]	5.23	225	271		24.4		94.6	5.07	13.8	10.3	3.11	1.11	0.69	2.77	0.42	0.58
[15296]	9.68	307	280		20.3		68.9	5.94	14.7	10.2	2.68	1.01	0.55	2.2	0.33	0.93
[15296]		238	258				74.2									

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[14435][15430][18645]	1.39	0.44	3.71	13	1.99	15	0.70499		0.5127		18.837	15.699	39.194
[14435][15430][18645]	0.82	0.31	2.49	19	1.27	24	0.705		0.5127		18.914	15.725	39.352
[14435][15430][18645]	1.19	0.36	3.35	17	2.08	18	0.70507		0.5127		18.87	15.71	39.262
[14435][15430][18645]	1.25	0.34	3.27	27	4.19	31	0.70509		0.5127		18.867	15.707	39.27
[14435][15430][18645]	1.7	0.43	3.77	19	4.55	19	0.70512		0.5127		18.83	15.688	39.155
[14435][15430][18645]	0.93	0.29	2.64	21	2.23	21	0.7052		0.5127		18.873	15.708	39.262
[14435][15430][18645]	0.78	0.26	2.2	30	2.28	29	0.70527		0.5127		18.879	15.715	39.281
[14435][15430][18645]	1.18	0.33	2.91	30	3.27	26	0.70532		0.5127		18.863	15.706	39.236
[14435][15430][18645]	0.73	0.26	2.33	36	0.84	33	0.70536		0.5126		18.938	15.733	39.4
[14827]							0.70393		0.513				
[14827]							0.70395		0.5129				
[14827]							0.70396		0.513				
[14827]							0.70397		0.5129				
[14827]							0.704		0.513				
[14827]							0.704		0.513				
[14827]							0.70401		0.513				
[14827]							0.70401		0.5129				
[14827]							0.70404		0.5129				
[14827]							0.70404		0.5129				
[14827]							0.70404		0.5129				
[14827]							0.70409		0.5129				
[14827]							0.70409		0.5129				
[14827]							0.7041		0.5129				
[14827]							0.70411		0.5129				
[14827]							0.70413		0.5129				
[14827]							0.70414		0.5129				
[14827]							0.70444		0.5128				
[14827]							0.70503		0.5127				
[15296]	0.77	0.7	2.22		0.77		0.70379		0.5128				
[15296]	0.17	0.22	2.19		0.09		0.70388		0.513				
[15296]	1.08	0.15	1.84		0.39		0.70396		0.5128				
[15296]							0.70409		0.5129				

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[15296]	
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[15296]	
[15430]	CENTRAL JAVA
[15430]	CENTRAL JAVA
[15430]	CENTRAL JAVA
[15430][18645]	CENTRAL JAVA, E OF KOPENG
[15430][18645]	CENTRAL JAVA, NE OF GETASAN
[15430][18645]	CENTRAL JAVA, JRAKAH-SELO
[15430][18645]	CENTRAL JAVA, N OF PENGGUNG
[15430][18645]	CENTRAL JAVA,SE OF CANDIMULYO
[15430][18645]	CENTRAL JAVA, PATRAN
[15465]	BANDA
[15465]	BANDA
[15465]	BANDA
[2479]	BANDA

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[15296]	Sendjaja, Kimura, and Sunardi, 2009	49.79	0.96	20.27	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	58.83	0.68	17.32	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	54.4	0.98	18.3	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	58.09	0.78	17.13	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	52.99	0.88	18.83	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	50.79	0.99	19.01	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	75.54	0.19	15.17	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	60.42	0.74	19.01	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	48.14	0.82	15.63	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	53.77	0.98	17.28	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	53.73	0.89	16.95	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	53.24	1.01	17.52	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	63.29	0.6	16.43	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	58.46	0.77	19.46	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	53.25	0.82	17.36	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	53.78	0.91	20.31	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	52.6	0.85	20.86	
[15296]	Sendjaja, Kimura, and Sunardi, 2009	62.27	0.88	16.67	
[15430]	Handley et al., 2011	56.49	0.72	18.71	
[15430]	Handley et al., 2011	50.37	1.09	18.68	
[15430]	Handley et al., 2011	50.2	1.03	19.78	
[15430][18645]	Handley et al., 2011; Handley et al., 2014	59.07	0.7	18.87	
[15430][18645]	Handley et al., 2011; Handley et al., 2014	58.28	0.73	18.76	
[15430][18645]	Handley et al., 2011; Handley et al., 2014	49.7	0.83	17.23	
[15430][18645]	Handley et al., 2011; Handley et al., 2014	51.41	1.03	17.64	
[15430][18645]	Handley et al., 2011; Handley et al., 2014	50.81	0.81	19.73	
[15430][18645]	Handley et al., 2011; Handley et al., 2014	49.55	0.86	21.22	
[15465]	Ely et al., 2011	66.29	0.46	14.07	3.22
[15465]	Ely et al., 2011	71.37	0.49	14.38	0.69
[15465]	Ely et al., 2011	65.25	0.63	14.73	4.08
[2479]	Gill and Williams, 1990	64.44	0.98	14.56	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[15296]	0.17	4.8	10.5	2.57	0.59	0.15			126	17		18	1.3	12	2.3
[15296]	0.15	3.34	7.19	3.27	0.86	0.12			165	34		16.2		13	
[15296]	0.18	4.15	7.63	3.17	0.74	0.16			163	13		17.4		9	
[15296]	0.13	3.91	6.94	3.55	1.28	0.14			221	118		18		33	
[15296]	0.19	4.39	8.68	3.24	1.15	0.2			231	26		18.4	2.82	14	4.14
[15296]	0.17	5.16	10.1	3.11	0.62	0.17			156	28		19.3		15	
[15296]	0.08	0.62	2.6	4.78	1.45	0.09			174	0		12.9		2	
[15296]	0.14	1.71	6.02	4.02	1.11	0.22			198	4		17.8		2	
[15296]	0.16	11.45	11.5	2.2	0.37	0.09			92	642		10.3	1.52	189	3.22
[15296]	0.15	5.81	8.07	3.13	1.81	0.23			291	171		17.9	5.87	79	7.09
[15296]	0.71	4.83	8.82	3.18	1.85	0.22			271	171		17.4		82	
[15296]	0.25	4.71	8.41	3.37	1.5	0.23			261	101		18.5		35	
[15296]	0.11	2.23	5.49	3.41	2.23	0.11			308	11		16.1		6	
[15296]	0.14	2.88	6.24	3.34	1.09	0.15			322	7		19.9		6	
[15296]	0.18	4.9	9.36	3.04	1.6	0.25			303	121		17.6	3.85	30	6.31
[15296]	0.14	2.93	9.4	3.15	0.84	0.14			191	9		19.3		9	
[15296]	0.14	3.01	10.1	3	0.83	0.13			155	13		19.1	2.29	9	5.89
[15296]	0.12	1.83	5.09	3.8	2.31	0.2			382	3		19.5		3	
[15430]	0.17	2.58	8.09	3.59	1.59	0.29			428	10.4			4.49	0	25.4
[15430]	0.14	4.28	9.26	3.18	1.83	0.28			584	34.3			2.42	16.4	18.3
[15430]	0.13	3.19	9.72	3.19	1.97	0.28			474	124			2.02	43.1	16.6
[15430][18645]	0.17	1.95	6.08	3.52	1.91	0.31			487	5.7	19	20	6.65	0	21.2
[15430][18645]	0.18	2.27	6.72	3.51	1.74	0.3			431	7.3	16	21	5.73	0	18.6
[15430][18645]	0.21	5.75	10.8	2.76	1.47	0.18			462	69	143	17	1.5	19.8	16.3
[15430][18645]	0.17	4.54	9.26	3.09	2.1	0.31			545	59.9	151	21	3.11	15.3	22.8
[15430][18645]	0.18	3.78	8.57	2.78	2.24	0.32			677	14.8	216	19	2.18	8.9	25.3
[15430][18645]	0.17	3.18	10.2	2.84	1.76	0.26			546	26	148	21	1.94	8.9	21.6
[15465]	0.08	0.92	2.84	4.48	3.08	0.08			296	53.1	33.4		6.1	24.2	
[15465]	0.01	0.27	1.77	4.67	2.52	0.02			315	5.8	142		2.3	7.6	
[15465]	0.09	1.06	3.26	4.21	3.11	0.14			416	5	52.8		4.9	4	
[2479]	0.24	1.76	4.91	4.7	0.89	0.25									

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[15296]	15.3	354	264		15.1		43.5	5.74	12.8	8.45	2.19	0.86	0.44	1.64	0.24	1.5
[15296]		238	167				85.8									
[15296]		285	235				71.6									
[15296]		205	167				149									
[15296]	28.4	333	215		19.6		94.1	13	27.7	14.7	3.4	1.03	0.56	2.02	0.31	4.98
[15296]		286	279				75.3									
[15296]		224	16				91.9									
[15296]		308	95				92.8									
[15296]	6.49	199	271		13.6		48.2	3.49	8.47	5.95	1.82	0.7	0.39	1.44	0.21	0.67
[15296]	37.6	345	212		22.7		127	15.8	31.1	15.6	3.56	1.16	0.6	2.05	0.31	5.28
[15296]		354	212				102									
[15296]		342	236				115									
[15296]		224	119				159									
[15296]		243	147				192									
[15296]	66.1	428	208		17.9		90.8	21.3	44.6	21.4	4.17	1.2	0.57	1.93	0.3	6.73
[15296]		320	235				81.4									
[15296]	21.6	320	203		18.2		76.4	7.66	17.6	10.8	2.79	0.91	0.51	1.98	0.3	1.88
[15296]		268	123				182									
[15430]	37.8	529	151		22.4		114	18.9	38.2	20	4.22	1.43	0.6	2.11	0.37	5.68
[15430]	36.2	467	298		21.1		68	14.3	28.7	15.5	3.82	1.33	0.56	1.98	0.33	5.46
[15430]	23.9	568	331		18		64	11.6	23.3	12.1	3.1	1.1	0.47	1.61	0.25	4.91
[15430][18645]	45	437	92		25.5	95	156	24.1	48.6	23.2	5.06	1.55	0.76	2.8	0.47	9.27
[15430][18645]	38.5	431	113		23.3	91	139	21.2	42.6	20.4	4.52	1.43	0.66	2.47	0.43	7.98
[15430][18645]	29.4	460	333		17.2	89	49	11	21.5	11.7	3.18	1.06	0.45	1.78	0.29	4.37
[15430][18645]	44.2	421	295		23.3	101	85	17.5	35	18	4.17	1.33	0.63	2.23	0.38	7.75
[15430][18645]	53.6	565	256		19.4	89	65	19.4	36.5	18.3	4.12	1.38	0.61	2	0.33	8.74
[15430][18645]	24.8	592	249		18.2	84	62	14.6	29.3	14.9	3.91	1.23	0.53	1.72	0.28	6.43
[15465]	41.6	338	195		25.8	57.5	125									
[15465]	36.3	363	254		33.9	81.4	123									
[15465]	57.4	384	113		41.8	76.5	169									
[2479]	25	184														

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[15296]	0.31	0.09	1.11		0.86		0.70409		0.5128				
[15296]							0.70414		0.5129				
[15296]							0.70415		0.5129				
[15296]							0.70419		0.5129				
[15296]	0.98	0.2	2.28		0.77		0.70423		0.5128				
[15296]							0.70428		0.5128				
[15296]							0.70434		0.5129				
[15296]							0.70437		0.5128				
[15296]	0.16	0.1	1.12		0.5		0.70444		0.5129				
[15296]	1.08	0.44	2.49		0.89		0.70449		0.5127				
[15296]							0.70451		0.5125				
[15296]							0.70457		0.5128				
[15296]							0.70463		0.5128				
[15296]							0.70477		0.5128				
[15296]	1.42	0.27	2.19		2.86		0.70486		0.5127				
[15296]							0.70521		0.5125				
[15296]	1.08	0.18	1.98		2.55		0.70525		0.5126				
[15296]							0.70567		0.5125				
[15430]	1.35	0.38	2.77			14.6	0.70511		0.5128				
[15430]	1.08	0.2	1.93			28.1	0.70554		0.5127				
[15430]	0.84	0.15	1.67			31	0.70579		0.5127				
[15430][18645]	1.95	0.56	3.92		4.87	7.5	0.70567		0.5127		18.756	15.665	39.04
[15430][18645]	1.76	0.5	3.82		3.25	9.2	0.70569		0.5127		18.755	15.669	39.045
[15430][18645]	0.99	0.13	1.59		2.43	33.8	0.70577		0.5127		18.802	15.69	39.173
[15430][18645]	1.71	0.25	2.47		3.72	30	0.70581		0.5127		18.807	15.696	39.188
[15430][18645]	1.79	0.19	1.95		3.34	25.2	0.70583		0.5127		18.805	15.691	39.182
[15430][18645]	0.82	0.16	1.79		0.78	23	0.70589		0.5127		18.828	15.71	39.245
[15465]					2.77		0.7041				18.588	15.597	38.612
[15465]					2.5		0.70419						
[15465]					3.94		0.70424				18.61	15.62	38.68
[2479]							0.70483						

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[2608]	
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[2608]	LAMONGAN, SUMMIT CRATER
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[2608]	LAMONGAN, SUMMIT CRATER
[2608]	
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[2608]	
[2608]	GUNUNG BROMO, TENGGER CALDERA
[2608]	GUNUNG BROMO, TENGGER CALDERA
[2608]	
[2608]	LAMONGAN, SUMMIT CRATER
[2608]	
[2608]	

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[2608]	Whitford, 1975	52.8			
[2608]	Whitford, 1975	50.4			
[2608]	Whitford, 1975	55.2			
[2608]	Whitford, 1975	53			
[2608]	Whitford, 1975	60			
[2608]	Whitford, 1975	58.8			
[2608]	Whitford, 1975	65.9			
[2608]	Whitford, 1975	58.6			
[2608]	Whitford, 1975	57.8			
[2608]	Whitford, 1975	49.4			
[2608]	Whitford, 1975	56.7			
[2608]	Whitford, 1975	49.4			
[2608]	Whitford, 1975	55.3			
[2608]	Whitford, 1975	54.3			
[2608]	Whitford, 1975	59.7			
[2608]	Whitford, 1975	51.4			
[2608]	Whitford, 1975	67.8			
[2608]	Whitford, 1975	51.3			
[2608]	Whitford, 1975	48.5			
[2608]	Whitford, 1975	50.6			
[2608]	Whitford, 1975	48.4			
[2608]	Whitford, 1975	54.1			
[2608]	Whitford, 1975	55.4			
[2608]	Whitford, 1975	57.7			
[2608]	Whitford, 1975	56			
[2608]	Whitford, 1975	59.9			
[2608]	Whitford, 1975	53.9			
[2608]	Whitford, 1975	48.8			
[2608]	Whitford, 1975	48.6			
[2608]	Whitford, 1975	52.1			

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[2608]					1.42										
[2608]					0.98										
[2608]					1.56										
[2608]					1.06										
[2608]					1.81										
[2608]					1.86										
[2608]					2.7										
[2608]					2.84										
[2608]					0.81										
[2608]					1.66										
[2608]					0.73										
[2608]					0.81										
[2608]					1.23										
[2608]					1.64										
[2608]					3.18										
[2608]					0.54										
[2608]					2.33										
[2608]					0.7										
[2608]					0.81										
[2608]					0.48										
[2608]					0.18										
[2608]					1.54										
[2608]					0.75										
[2608]					2.93										
[2608]					2.8										
[2608]					2.99										
[2608]					0.65										
[2608]					0.81										
[2608]					5.73										
[2608]					0.87										

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[2608]	30	497														
[2608]	17	483														
[2608]	33	462														
[2608]	20	453														
[2608]	45	414														
[2608]	55	537														
[2608]	65	300														
[2608]	90	353														
[2608]	24	291														
[2608]	33	470														
[2608]	20	286														
[2608]	10	390														
[2608]	20	408														
[2608]	43	585														
[2608]	103	347														
[2608]	9.6	296														
[2608]	63	203														
[2608]	19	342														
[2608]	13	378														
[2608]	8.5	290														
[2608]	4	332														
[2608]	37	496														
[2608]	12	587														
[2608]	100	449														
[2608]	97	390														
[2608]	94	300														
[2608]	14	271														
[2608]	13	383														
[2608]	185	2100														
[2608]	27	344														

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[2608]							0.70384						
[2608]							0.70395						
[2608]							0.70398						
[2608]							0.70399						
[2608]							0.70402						
[2608]							0.70406						
[2608]							0.70407						
[2608]							0.70407						
[2608]							0.70407						
[2608]							0.70409						
[2608]							0.70415						
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[2608]							0.70437						
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[2608]							0.70439						
[2608]							0.70441						
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[2608]							0.70444						
[2608]							0.70445						
[2608]							0.70447						
[2608]							0.70448						

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
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Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[2608]	Whitford, 1975	48.6			
[2608]	Whitford, 1975	53.1			
[2608]	Whitford, 1975	52.2			
[2608]	Whitford, 1975	54.4			
[2608]	Whitford, 1975	56.9			
[2608]	Whitford, 1975	56.2			
[2608]	Whitford, 1975	56.1			
[2608]	Whitford, 1975	58.9			
[2608]	Whitford, 1975	54.58			
[2608]	Whitford, 1975	58.6			
[2608]	Whitford, 1975	59.8			
[2608]	Whitford, 1975	56.6			
[2608]	Whitford, 1975	52.6			
[2608]	Whitford, 1975	56.9			
[2608]	Whitford, 1975	57.6			
[2608]	Whitford, 1975	51			
[2608]	Whitford, 1975	49.5			
[2608]	Whitford, 1975	56.4			
[2608]	Whitford, 1975	55.9			
[2608]	Whitford, 1975	57			
[2608]	Whitford, 1975	55			
[2608]	Whitford, 1975	48.96			
[2608]	Whitford, 1975	53.9			
[2608]	Whitford, 1975	49.46			
[2608]	Whitford, 1975	55			
[2608]	Whitford, 1975	55.3			
[2608]	Whitford, 1975	59.3			
[2608]	Whitford, 1975	62.3			
[2608]	Whitford, 1975	54.9			
[2608]	Whitford, 1975	57.9			

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[2608]					0.12										
[2608]					1.83										
[2608]					1.36										
[2608]					0.95										
[2608]					1.22										
[2608]					1.73										
[2608]					0.83										
[2608]					1.11										
[2608]					1.78										
[2608]					5.14										
[2608]					1.78										
[2608]					2.08										
[2608]					3.4										
[2608]					1.32										
[2608]					2.26										
[2608]					2.59										
[2608]					2.54										
[2608]					1.75										
[2608]					1.66										
[2608]					1.72										
[2608]					1.33										
[2608]					2.08										
[2608]					1.47										
[2608]					2.05										
[2608]					2.24										
[2608]					1.54										
[2608]					3.02										
[2608]					2.71										
[2608]					2										
[2608]					2.76										

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[2608]	3	334														
[2608]	60	390														
[2608]	40	584														
[2608]	24	373														
[2608]	27	414														
[2608]	61	295														
[2608]	17	507														
[2608]	27	339														
[2608]	53	344														
[2608]	139	966														
[2608]	70	217														
[2608]	73	383														
[2608]	112	919														
[2608]	29	403														
[2608]	80	358														
[2608]	81	580														
[2608]	73	530														
[2608]	43	471														
[2608]	42	500														
[2608]	41	399														
[2608]	44	327														
[2608]	53	496														
[2608]	47	363														
[2608]	43	629														
[2608]	67	784														
[2608]	35	295														
[2608]	144	287														
[2608]	80	269														
[2608]	48	578														
[2608]	100	334														

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[2608]							0.70451						
[2608]							0.70451						
[2608]							0.70452						
[2608]							0.70452						
[2608]							0.70462						
[2608]							0.70462						
[2608]							0.70464						
[2608]							0.70465						
[2608]							0.70467						
[2608]							0.7047						
[2608]							0.70472						
[2608]							0.70472						
[2608]							0.70474						
[2608]							0.70476						
[2608]							0.70477						
[2608]							0.70479						
[2608]							0.70482						
[2608]							0.70483						
[2608]							0.70486						
[2608]							0.70488						
[2608]							0.70491						
[2608]							0.70494						
[2608]							0.70496						
[2608]							0.70496						
[2608]							0.70496						
[2608]							0.70499						
[2608]							0.70504						
[2608]							0.70513						
[2608]							0.70519						
[2608]							0.70521						

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[2608]	
[2608]	
[2608]	
[2608]	
[2608]	
[2608][2545]	
[2608][2545]	
[2608][2545][2713]	
[2608][2713]	
[2608][2713]	
[2608][4590]	
[2608][4590]	
[2608][4927][3092]	
[2609]	
[2609]	
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[2609]	
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[2609]	
[2609]	
[2609]	
[2609]	
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[2608]	Whitford, 1975	51.8			
[2608]	Whitford, 1975	59.9			
[2608]	Whitford, 1975	51.5			
[2608]	Whitford, 1975	50.4			
[2608]	Whitford, 1975	52.4			
[2608][2545]	Whitford, 1975; White and Patchet, 1984	52.9			
[2608][2545]	Whitford, 1975; White and Patchet, 1984	58.79			
[2608][2545][2713]	Whitford, 1975; White and Patchet, 1984; Whitford, White, and Jezek, 1980	56.8			
[2608][2713]	Whitford, 1975; Whitford, White, and Jezek, 1980	50.7			
[2608][2713]	Whitford, 1975; Whitford, White, and Jezek, 1980	56.2			
[2608][4590]	Whitford, 1975; Woodhead et al., 2001	56.11			
[2608][4590]	Whitford, 1975; Woodhead et al., 2001	67.49			
[2608][4927][3092]	Whitford, 1975; Vukadinovic and Sutamidjaja, 1995; Vukadinovic and Nicholls, 1989	49.7		17.1	
[2609]	Whitford et al., 1977	56.4	0.93	17.5	
[2609]	Whitford et al., 1977	54.8	0.8	18.2	
[2609]	Whitford et al., 1977	66.1	0.82	14.6	
[2609]	Whitford et al., 1977	62.6	0.85	17	
[2609]	Whitford et al., 1977	65.7	0.88	14.1	
[2609]	Whitford et al., 1977	58.4	0.66	17.4	
[2609]	Whitford et al., 1977	48.6	0.68	19.5	
[2609]	Whitford et al., 1977	48.7	0.7	19.7	
[2609]	Whitford et al., 1977	49	0.82	19.2	
[2800]	Edwards et al., 1994	47.85	0.976	18.07	11.06
[2800]	Edwards et al., 1994	45.67	1.05	12.5	9.8
[2800]	Edwards et al., 1994	52.83	0.647	18.98	6.69
[2800]	Edwards et al., 1994	45.06	0.937	15.34	11.27
[2800]	Edwards et al., 1994	46.1	1.208	16.74	11.58
[2800]	Edwards et al., 1994	51.2	0.639	20.23	6.98
[2800]	Edwards et al., 1994	53.97	0.836	17.79	8.71
[2800]	Edwards et al., 1994	43.9	0.763	9.27	9.47

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[2608]					2.64										
[2608]					1.7										
[2608]					1.76										
[2608]					1.8										
[2608]					1.91										
[2608][2545]					1.63				1230						
[2608][2545]					1.32				215						
[2608][2545][2713]					2.64				505						
[2608][2713]					1.08										
[2608][2713]					2.24										
[2608][4590]					2.67				496	8	30		8.29	8	17.7
[2608][4590]					2.91				368				5.29		20.2
[2608][4927][3092]	0.21		10	3.23	1.34				201	100			12.5	24	
[2609]	0	2.99	8.3	2.6	1.77	0.14									
[2609]	0.12	4.69	9	2.76	0.73										
[2609]	0	1.37	3.76	3.65	3.16	0.19									
[2609]	0	2.3	5.18	3.95	2.61										
[2609]	0	1.33	3.67	3.57	3.15	0.22									
[2609]	0	3.92	8.02	2.97	0.98										
[2609]	0.18	6.07	11.8	1.67	0.4	0.07									
[2609]	0.14	6.05	12.2	1.74	0.43	0.06									
[2609]	0	6.6	11	2.54	1.68										
[2800]	0.187	6.26	10.8	2.42	1.17	0.27			497	109	248	19	5	38	6.6
[2800]	0.167	12.94	11.3	2.04	3.54	0.619			506	853	105	12	12.5	235	3.2
[2800]	0.178	2.22	7.46	3.83	6.15	0.467			743	13	53	21	30.5	11	10.9
[2800]	0.252	4.12	14.4	2.75	4.14	0.85			656	8	135	15	29.1	14	4.6
[2800]	0.207	6.23	11.9	2.06	2.8	0.599			482	115	93	18	8	41	4.4
[2800]	0.196	1.81	7.83	4.56	5.56	0.375			688	4	54	19	33.1	7	8
[2800]	0.204	3.05	8.65	3.3	2.92	0.498			678	23	54	19	11.1	15	7.2
[2800]	0.164	18.05	11.1	1.66	3.88	0.939			2363	1335	81	10	34.3	485	7.4

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[2608]	73	502														
[2608]	50	496														
[2608]	44	304														
[2608]	37	497														
[2608]	43	562														
[2608][2545]	35.8	567						18.7	38.9	21.2	5.24	1.82		3.06	0.46	
[2608][2545]	45.7	253						15.1	32.6	17.3	3.98	1.23		2.39	0.36	
[2608][2545][2713]	76.3	442						25.6	48.3	20.9	4.4	1.35		2.13	0.33	
[2608][2713]	26	443														
[2608][2713]	97	302														
[2608][4590]	84	498	160		25		136	30.7	56.9	25.3	5.4	1.51	0.76	2.55	0.4	13.7
[2608][4590]	129	165	92		30		181	31.6	51.1	28.8	5.97	1.06		2.82	0.44	14.6
[2608][4927][3092]	28	281	390		32			15.7	35.9	20.5	5.07	1.45	0.83	2.61		4.47
[2609]	68.5	397														
[2609]	17	350														
[2609]	116	280														
[2609]	75	578														
[2609]	134	276														
[2609]	28	355														
[2609]	9.4	365														
[2609]	12.4	385														
[2609]	41	836														
[2800]	40	495	341		19.7	83	61	14.6	30	16.5	3.2	1.15		1.82	0.29	3.4
[2800]	122	481	272		27.8	68	169	38	82	38						5.8
[2800]	200	1048	145		39.7	75	380	74	136	53						20.9
[2800]	144	2058	357		79.9	121	481	173	321	131	22.2	6.58		3.65	0.5	23.9
[2800]	186	600	353		28.5	75	109	29	61	31						5.6
[2800]	88	1762	173		56.9	87	474	105	191	72						21.3
[2800]	98	572	214		26.8	77	151	33	65	29						8.4
[2800]	177	793	224		17.9	65	119	68.6	123	50.4	7.3	2.22		1.16	0.12	12.8

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[2608]							0.70534						
[2608]							0.70552						
[2608]							0.70554						
[2608]							0.70576						
[2608]							0.70594						
[2608][2545]			2.6		1.43		0.705		0.5128				
[2608][2545]			3.31		2.24		0.70575		0.5125				
[2608][2545][2713]			2.8		6.09		0.70488		0.5127				
[2608][2713]							0.70476		0.5128				
[2608][2713]							0.70476		0.5128				
[2608][4590]	2.57	0.56	3.43	17	4.12	15	0.70513		0.5126		18.802	15.681	39.113
[2608][4590]	3.04	0.57	5.14	14	5.55		0.70587		0.5125		18.912	15.723	39.365
[2608][4927][3092]	0.88		3.39	57			0.70491						
[2609]							0.70548						
[2609]							0.70571						
[2609]							0.70572						
[2609]							0.70577						
[2609]							0.70577						
[2609]							0.70582						
[2609]							0.70587						
[2609]							0.70589						
[2609]							0.70646						
[2800]	1.03	0.2	1.5	37			0.70422		0.5128		18.667	15.631	38.974
[2800]				35			0.70434						
[2800]				10			0.70445		0.5127		18.611	15.62	39.007
[2800]				20			0.7045		0.5128		18.915	15.627	39.1
[2800]				32			0.70451						
[2800]				8			0.70459		0.5127		18.712	15.641	39.12
[2800]				22			0.70459		0.5128		18.754	15.672	39.146
[2800]		1.37	2.9	29			0.7046		0.5127		18.513	15.617	39.137

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
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[2800]	MADURA BASIN
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[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800]	MADURA BASIN
[2800][4938]	MADURA BASIN
[3058]	
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[3058]	
[3058]	
[3058]	
[3058]	
[3058]	
[3058]	
[3058]	
[3058]	
[3058]	
[3058][13600]	
[3058][13600][3085]	

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[2800]	Edwards et al., 1994	42.86	0.959	12.1	10.29
[2800]	Edwards et al., 1994	53.49	0.605	19.84	7.44
[2800]	Edwards et al., 1994	48.07	1.025	18.46	10.85
[2800]	Edwards et al., 1994	46.88	0.79	13.37	8.89
[2800]	Edwards et al., 1994	44.86	0.926	10.6	9.35
[2800]	Edwards et al., 1994	51.37	0.798	18.11	8.41
[2800]	Edwards et al., 1994	45.5	0.716	11.49	9.63
[2800]	Edwards et al., 1994	46.58	0.855	15.23	10.01
[2800]	Edwards et al., 1994	46.16	0.695	12.15	9.16
[2800]	Edwards et al., 1994	47.34	0.946	15.6	10.06
[2800]	Edwards et al., 1994	47.35	0.998	13.92	9.31
[2800]	Edwards et al., 1994	49.48	0.984	14.8	10.22
[2800][4938]	Edwards et al., 1994; Tomascak et al., 2002	46.88	0.983	18.01	11.88
[3058]	Hoogewerf et al., 1997	62	0.53	17.29	5.45
[3058]	Hoogewerf et al., 1997	53.03	0.73	19.53	9.67
[3058]	Hoogewerf et al., 1997	52.65	0.77	18.81	10.19
[3058]	Hoogewerf et al., 1997	56.25	0.75	18.83	7.08
[3058]	Hoogewerf et al., 1997	55.89	0.77	19.14	7.05
[3058]	Hoogewerf et al., 1997	60.06	0.64	17.34	7.86
[3058]	Hoogewerf et al., 1997	53.85	0.68	21.35	6.52
[3058]	Hoogewerf et al., 1997	53.77	0.78	19.46	7.87
[3058]	Hoogewerf et al., 1997	47.53	1.06	17.72	11.78
[3058]	Hoogewerf et al., 1997	47.67	1.04	18.02	11.68
[3058]	Hoogewerf et al., 1997	52.57	1.26	17.18	10.87
[3058]	Hoogewerf et al., 1997	59.38	1.11	16.66	7.82
[3058]	Hoogewerf et al., 1997	62.49	0.85	16.42	5.96
[3058]	Hoogewerf et al., 1997	56.93	0.71	18.9	6.68
[3058]	Hoogewerf et al., 1997	52.21	1.15	18.82	9.83
[3058]	Hoogewerf et al., 1997	49.41	0.9	18.41	10.26
[3058]	Hoogewerf et al., 1997	50.74	1.12	19.59	9.96
[3058][13600]	Hoogewerf et al., 1997; De Hoog, Taylor, and Van Bergen, 2009	49.8	0.8	18.32	12.38
[3058][13600][3085]	Hoogewerf et al., 1997; De Hoog, Taylor, and Van Bergen, 2009; Hilton et al., 19	48.95	0.88	18.12	10.43

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[2800]	0.165	14.42	10.8	2.02	4.72	0.813			2006	647	87	14	19.9	256	6.9
[2800]	0.221	1.63	8.01	3.95	4.19	0.369			636	3	17	20	19.9	5	10.1
[2800]	0.208	5.03	10.6	3.1	2.15	0.402			490	15	73	20	13.2	15	10.4
[2800]	0.16	7.7	12.3	2.76	5.97	0.812			2857	249	121	14	19.5	68	9
[2800]	0.162	10.01	14.3	2.22	5.76	1.289			4922	381	127	13	75.6	85	14.9
[2800]	0.191	3.66	9.57	4.53	2.38	0.634			507	38	66	18	17.3	19	7.9
[2800]	0.168	15.32	11.3	1.53	2.79	0.609			790	1115	100	11	9.6	436	6.5
[2800]	0.199	5.93	11.5	2.91	5.09	0.952			3116	85	99	15	24.6	37	8.5
[2800]	0.165	9.42	12.9	2.08	5.27	1.123			5424	378	84	14	42.2	86	8.4
[2800]	0.184	6.51	11.9	2.55	3.67	0.646			722	92	86	15	14.1	36	9.1
[2800]	0.251	6.62	12.7	1.43	5.92	1.1			475	166	114	15	12.2	50	4.5
[2800]	0.183	6.3	10.8	2.4	3.99	0.6			671	82	109	16	9.5	33	5.1
[2800][4938]	0.21	5.92	11.7	2.75	0.98	0.245			632	36	136	18	2.4	35	5.6
[3058]	0.16	1.8	4.88	3.64	3.94	0.31			1266		19		10.2		32.2
[3058]	0.2	3.88	10.1	2.43	0.37	0.1			268	11	41		0.8		
[3058]	0.17	4.8	9.69	2.47	0.37	0.11			100	14	44		0.7		5.2
[3058]	0.17	2.56	6.94	3.56	3.4	0.45			1377	3	45		11		29.2
[3058]	0.21	2.53	6.78	3.64	3.55	0.44			1391		58		9.4		30.2
[3058]	0.21	2.6	7.3	3.2	0.62	0.16			421	4	12				19.9
[3058]	0.13	2.36	8.63	3.22	2.92	0.35			1333	3	31		9		22.9
[3058]	0.2	3.29	8.14	3.23	3.01	0.25			1235	13	51		9.2		25.9
[3058]	0.2	6.08	11.3	2.5	1.68	0.19			761	31	34		5.2		21.2
[3058]	0.2	5.82	11.2	2.57	1.67	0.13			782	31	23		4.6		16.5
[3058]	0.2	4.08	8.72	3.14	1.63	0.34			820	6	45		7.9		30.1
[3058]	0.2	2.29	5.34	4.37	2.51	0.32			1255	5	23		9.9		40.3
[3058]	0.16	1.76	4.81	4.23	2.96	0.36			1318	6	11		11.4		44.5
[3058]	0.19	2.5	6.81	3.39	3.68	0.21			1239	5	53		9.9		35.2
[3058]	0.18	3.35	9.41	2.94	1.8	0.31			915	7	60		7		26.3
[3058]	0.19	5.52	10.7	2.46	1.91	0.27			747	26	61		5.9		20.7
[3058]	0.18	3.71	9.97	2.83	1.69	0.21			825	9	48		7.2		29.8
[3058][13600]	0.22	5.21	11.1	1.92	0.2	0.1			142	5	53		0.5		7.1
[3058][13600][3085]	0.19	5.68	11.2	2.36	1.84	0.33			762	26	51		5.2		17.1

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[2800]	179	576	280		19	80	101	44.4	89	42.8		2.1		1.36	0.22	5.4
[2800]	108	1352	132		47.4	93	302	104	186	71.3	11.8	3.51		3.53	0.52	17.9
[2800]	91	804	311		24.3	80	83	44.3	77	31.2	5.6	1.72		2.06	0.31	10.4
[2800]	267	1082	300		19.4	68	110	52	105	51						7
[2800]	232	1589	245		20.1	84	139	122	213	82		3.07		1.23		22.9
[2800]	84	949	191		37.1	71	264	66	125	51						13.8
[2800]	458	800	249		24.8	75	112	64.4	120	50.8		2.78		1.52	0.2	10.6
[2800]	176	1212	295		26.8	74	124	66	129	56						9.7
[2800]	375	974	282		17.2	71	89	75	137	59						12.1
[2800]	135	887	286		32.1	65	146	55	104	44						10.2
[2800]	1165	935	281		41.1	81	310	79.6	156	69.2	12.6	4.31		2.33	0.31	10.7
[2800]	268	716	306		29.3	74	160	51	101	45						9.7
[2800][4938]	19	666	424		19.9	81	43	12	30	15						2.6
[3058]	115	678			29	67	179			38.7	6.83					
[3058]	9.5	289			28	75	41	2.2	5.9	5.52	2.02	0.84	0.51	2.2	0.33	0.36
[3058]	13	243			17	68	43	2.8	6.9	4.7	1.6	0.66	0.37	1.58	0.26	0.53
[3058]	92	918			28	70	158	63	115	44.6	8.06	2.12	0.96	2.63	0.41	21.9
[3058]	94	956			28	62	165									19.2
[3058]	16.6	295			27	75	60	3.8	9.1	12.5	4.19	1.06	0.61	2.96	0.43	0.52
[3058]	80	1053			26	54	132	63	110	42	7.54	2.03	0.85	2.33	0.35	22.6
[3058]	79	931			25	64	133	65	121		8.3	2.2	0.91	2.66	0.43	24.2
[3058]	34	785			26	77	67	35	71		6.9	2.14	1.12	2.41	0.39	9.5
[3058]	35	820			26	75	69	33	65		6.7	1.99	0.83	2.07	0.32	9.2
[3058]	40	618			34	74	129	31	61	28.9	6.4	1.84	1	3.2	0.5	10.3
[3058]	61	548			43	80	190	47	90		9.2	2.4	1.14	4.28	0.62	16.9
[3058]	79	526			41	66	225	50	93	39.5	8.05	1.92	1.16	4	0.62	20.4
[3058]	99	775			29	74	160	55	99		7.1	1.87	0.79	2.46	0.41	26.3
[3058]	46	698			31	71	124	34	64		6.4	1.75	0.78	2.79	0.5	10.1
[3058]	46	814			25	76	91	42	79		7.3	2.16	1.02	2.32	0.39	11.5
[3058]	44	724			30	76	112	31	59		5.7	1.74	0.71	2.8	0.41	10.3
[3058][13600]	6.2	242			19	91	30	1.2	3.6	3.91	1.56	0.69	0.41	1.84	0.25	0.28
[3058][13600][3085]	45	821			25	69	87	38	72	31.5	6.48	1.88	0.88	2.19	0.35	11

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[2800]		1.04	2.9	37			0.70465		0.5127		18.57	15.628	39.153
[2800]				9			0.70465		0.5128		18.719	15.624	39.048
[2800]		0.53	2	28			0.70465		0.5127		18.596	15.624	39.02
[2800]				34			0.70467						
[2800]		3.37	3.8	37			0.70468				18.493	15.626	39.191
[2800]				19			0.70468						
[2800]		0.42	2.7	34			0.7047		0.5128		18.631	15.622	39.04
[2800]				29			0.70478		0.5127		18.498	15.633	39.182
[2800]	3.03			33			0.70478		0.5127		18.544	15.624	39.18
[2800]				39			0.70493						
[2800]	2.34	0.44	6	27			0.70496		0.5127		18.739	15.623	39.025
[2800]				33			0.70549						
[2800][4938]				38			0.70419		0.5128		18.72	15.647	39.03
[3058]							0.7054		0.5126		19.147	15.666	39.381
[3058]	0.11	0.04	1.04	35		24	0.70548		0.5129				
[3058]		0.04	0.98	30		28	0.70554						
[3058]	5.1	0.5	3.8	13		15	0.70567		0.5126		19.116	15.67	39.381
[3058]	4.89						0.70569		0.5126		19.114	15.668	39.387
[3058]			1.58	29		14	0.70569		0.5129		19.041	15.675	39.352
[3058]	4.7	0.38	3.27	15		15	0.70591		0.5126		19.153	15.671	39.399
[3058]	5.6		3.51	21		24	0.70595						
[3058]	2.9		1.92	45		73	0.70599						
[3058]	3	0.9	1.84	43		58	0.70601		0.5126		19.09	15.663	39.322
[3058]	2.7	0.38	3.1	30		25	0.70609		0.5127		19.021	15.692	39.425
[3058]	4.5	0.68	4.78	22		33	0.7061						
[3058]	5.1	0.67	5.3	14		8	0.70621		0.5127		19.019	15.691	39.417
[3058]	6.4	0.33	3.85	16		18	0.70621						
[3058]	3.2	0.47	3.11	28		35	0.7063		0.5127		18.99	15.671	39.327
[3058]	3.6		2.31	35		55	0.70661		0.5126				
[3058]	2.3	0.44	2.49	28		40	0.70672						
[3058][13600]		0.03	0.68	46		35	0.70564		0.5129				
[3058][13600][3085]	2.6	0.23	2.28	33		33	0.70669		0.5126		19.083	15.674	39.354

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[3058][3085]	
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Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[3058][3085]	Hoogewerf et al., 1997; Hilton et al., 1992	49.78	0.79	18.86	12.09
[3058][3085]	Hoogewerf et al., 1997; Hilton et al., 1992	53.67	0.69	18.88	9.91
[3058][3145]	Hoogewerf et al., 1997; Varekamp et al., 1989	53.25	0.9	19.04	8.5
[3058][3145]	Hoogewerf et al., 1997; Varekamp et al., 1989	50.47	1.15	19.18	10.48
[3059][3436][3113]	Stolz et al., 1990; Stolz et al., 1989; Stolz et al., 1988	47.68	0.9	13.58	3.67
[3059][3436][3146][3113]	Stolz et al., 1990; Stolz et al., 1989; Stolz et al., 1988; Wheller et al., 1987	47.76	0.9	13.48	4.42
[3092]	Vukadinovic and Nicholls, 1989	51.1	1.46		
[3092]	Vukadinovic and Nicholls, 1989	50.8	1.45		
[3092]	Vukadinovic and Nicholls, 1989	50.4	1.36		
[3092]	Vukadinovic and Nicholls, 1989	51.2	0.87		
[3092][4927]	Vukadinovic and Nicholls, 1989; Vukadinovic and Sutamidjaja, 1995	50.1	1.49	17.3	
[3092][4927]	Vukadinovic and Nicholls, 1989; Vukadinovic and Sutamidjaja, 1995	49.7	1.36	17.5	
[3092][4927]	Vukadinovic and Nicholls, 1989; Vukadinovic and Sutamidjaja, 1995	50.3	1.3	15.7	
[3092][4927]	Vukadinovic and Nicholls, 1989; Vukadinovic and Sutamidjaja, 1995	50.7	1.29	18.4	
[3092][4927]	Vukadinovic and Nicholls, 1989; Vukadinovic and Sutamidjaja, 1995	50.9	1.34	16.2	
[3092][4927]	Vukadinovic and Nicholls, 1989; Vukadinovic and Sutamidjaja, 1995	50.7	0.96	16.3	
[3113]	Stolz et al., 1990	55.22	0.94	17.74	
[3113]	Stolz et al., 1990	52.19	0.82	17.69	
[3113]	Stolz et al., 1990	55.14	0.82	17.54	
[3113]	Stolz et al., 1990	54.88	0.75	18.96	
[3113]	Stolz et al., 1990	50.24	0.69	18.56	
[3113]	Stolz et al., 1990	57.88	0.8	17.35	
[3113]	Stolz et al., 1990	58	0.79	17.73	
[3113]	Stolz et al., 1990	52.56	0.89	18.14	
[3113]	Stolz et al., 1990	54.6	1.02	17.27	
[3113]	Stolz et al., 1990	54.93	0.78	18.77	
[3113]	Stolz et al., 1990	53.93	0.83	18.86	
[3113]	Stolz et al., 1990	55.2	0.84	17.75	
[3113]	Stolz et al., 1990	57.22	0.79	16.63	
[3113]	Stolz et al., 1990	56.24	0.66	16.8	
[3113]	Stolz et al., 1990	63.47	0.47	18.21	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[3058][3085]	0.22	5.09	11	1.84	0.2	0.11			138	7	51		0.6		
[3058][3085]	0.22	4	9.7	2.41	0.42	0.11			263	8	36		0.9		13.2
[3058][3145]	0.22	3.36	8.29	3.36	2.75	0.33			1.27	7	28		8.5	4	22.6
[3058][3145]	0.18	4.02	10.1	2.65	1.61	0.18			789	9	64		6.2	4	31.6
[3059][3436][3113]	0.17	8.28	12.1	2.79	3.42	0.84			1119	272			19.6	79	11.3
[3059][3436][3146][3113]	0.17	8.38	12.2	1.48	4.69	0.87			1128	287			18.7	81	11.2
[3092]		5.6			1.27										
[3092]		5.95			1.25										
[3092]		6.56			1.15										
[3092]		8.28			0.98								2.3		
[3092][4927]		0.2	9.84	3.16	1.34				278	118			13.4	39	
[3092][4927]	0.19	7.07	10.3	2.93	0.86				266	108			9.3	53	
[3092][4927]	0.19	7.67	10.5	2.87	1.06				212	246			12.6	57	
[3092][4927]		0.17	9.61	3.46	1.36				320	89			10.4	46	
[3092][4927]	0.19	6.8	9.58	3.08	1.47				292	232			6.6	68	
[3092][4927]	0.18	8.16	10.6	2.36	1.02				141	252			2.8	73	
[3113]	0.16	3.93	8.42	3.14	1.06	0.22			244	9			2	7	9.45
[3113]	0.15	6.12	9.75	2.73	0.46	0.12			162	161			2	60	5.14
[3113]	0.18	4.08	7.94	3.25	2.36	0.27			1121	23			8	14	
[3113]	0.15	4.24	9.02	2.81	0.49	0.11			121	17			2	12	
[3113]	0.16	5.97	10.4	2.01	0.29	0.06			78	36			1	21	3.78
[3113]	0.13	4.2	7.65	2.92	1.06	0.14			591	26			2	12	
[3113]	0.12	3.86	7.36	2.97	1.06	0.13			422	62			2	26	
[3113]	0.17	4.15	8.82	2.84	2.71	0.42			1377	9			11	10	12.9
[3113]	0.16	4.14	8.2	3.17	0.88	0.13			222	19			2	16	
[3113]	0.17	2.86	7.2	3.69	3.04	0.42			1462	6			8	4	24.9
[3113]	0.15	4.46	8.8	2.81	0.65	0.1			139	18			3	19	8.11
[3113]	0.19	4.38	8.65	2.74	1.22	0.15			832	11			3	11	17.8
[3113]	0.17	4.46	8.19	2.85	1.22	0.15			719	59			3	18	18
[3113]	0.17	3.55	7.32	2.97	3.12	0.27			1261	60			8	19	
[3113]	0.1	2.49	5.72	3.23	1.23	0.1			273	12			2	9	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[3058][3085]		241			19	91	31	1.3	3.5	3.88	1.55	0.71	0.44	1.87	0.28	
[3058][3085]	12.2	291			20	82	43	2.7	7.3	5.57	1.92	0.8	0.47	2.11	0.33	0.48
[3058][3145]	70	1008			30	65	126	52	99		7.9	2.2	0.88	3.26	0.4	14.1
[3058][3145]	39	699			29	76	101	28	59		5.5	1.74	0.55	2.35	0.35	9.5
[3059][3436][3113]	184	818	302		33		195	47	95.1	47.6	10.3	2.79		2.29		13.2
[3059][3436][3146][3113]	196	819	276		35		195	45.7	91.9	45.8	10.5	3.05		2.4		11.2
[3092]		316					180									
[3092]		274					172									
[3092]		299					124									
[3092]		377					60	34.2	57.9	40.4	8.84	2.05	0.93	1.76		
[3092][4927]		326	264		32	96	177	20.2	45.5	23.7	5.57	1.46	0.87	2.77		5.73
[3092][4927]		361	277		27	84	117	16.4	37.6	18.8	4.77	1.44	0.87	2.41		4.06
[3092][4927]		273	260		24	85	133	16.7	37.9	19.3	4.54	1.29	0.72	2.33		4.08
[3092][4927]		346	268		24	85	117	16.4	35.5	20.3	4.41	1.34		2.22		4.68
[3092][4927]		288	306		24	89	112	15.3	35	18.5	4.5	1.27	0.66	2.26		5.13
[3092][4927]		297	283		21	84	66	10.5	25	14.2	3.57	1.02	0.57	2.02		3.71
[3113]	37	553	220		19		73	13.7	31.9	17.7	3.77	1.02		1.26		3.6
[3113]	12	314	250		17		44	7.05	15.2	9.29	3.03	0.89		1.66		0.99
[3113]	64	769	212		28		126	32.6	69.6	29.1	5.84	1.87		2.58		13.6
[3113]	15.4	301	171		18		46	5.01	11.5	8.21	2.18	0.77		1.63		0.81
[3113]	11	205	293		13		25	3.51	8.96	5.12	1.92	0.72		1.67		0.38
[3113]	49	331	133		18		93	11.6	27.8	11.3	3.41	1.12		2.07		5.6
[3113]	35	394	178		17		69		22	16						3.8
[3113]	83	918	285		30		135	49.8	112	43.6	7.5	2.29		2.11		18.2
[3113]	32	293	263		20		65	11.4	25.9	11.9	3.51	1.17		2.06		2.1
[3113]	87	934	173		31		160	67	126	43.9	8.26	2.57		2.88		20.8
[3113]	26	275	216		19		52	11.4	20.9	9.61	2.94	1.03		1.91		1.5
[3113]	33	545	214		26		79	16.6	37.2	17.7	3.81	1.28		2.52		6
[3113]	33	471	165		28		91	13.9	34.9	16.8	3.87	1.36		2.73		6
[3113]	103	705	174		30		156	58	111	38						29
[3113]	67	352	74		11		68	12.4	26.1	11.5	3.62	1.02		1.2		3.5

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[3058][3085]		0.02	0.7	45		34	0.70562		0.5129				
[3058][3085]	0.17	0.04	1.1	35		24	0.70569		0.5129				
[3058][3145]	3.9		3.1	22		20	0.70559		0.5127		19.114	15.666	39.363
[3058][3145]	2.3	0.39	2.35	30		40	0.70664		0.5127		19.01	15.688	39.387
[3059][3436][3113]	3.91	0.66	5.1	37	5.2		0.70571		0.5126		19.029	15.673	39.43
[3059][3436][3146][3113]	3.83	0.75	4.7	36	5.4		0.70571		0.5126		18.983	15.643	39.3
[3092]							0.70504						
[3092]							0.70542						
[3092]							0.7058						
[3092]	1.12		1.75				0.70629						
[3092][4927]	1.06		3.72	34			0.70495						
[3092][4927]	0.71		2.95	34			0.70512						
[3092][4927]	0.87		3.07	35			0.70541						
[3092][4927]	0.9		2.73	27			0.70569						
[3092][4927]	1.11		2.8	32			0.70589						
[3092][4927]	0.63		1.75	38			0.70623						
[3113]	2.25		2	22	3.5		0.70468		0.5127		18.786	15.643	38.97
[3113]	0.28		1.4	31	0		0.70492		0.5128		18.839	15.665	39.07
[3113]			2.7	25	2.2		0.70517		0.5127				
[3113]			1.2	23	1.9		0.70524		0.5129				
[3113]	0.12		0.83	39	0		0.7054		0.5129		18.909	15.76	39.32
[3113]	1.4		2.5	17	3.2		0.70543		0.5126				
[3113]			2	19	1.3		0.70545		0.5127				
[3113]	1.11		3	30	0.73		0.70553		0.5126		18.96	15.688	39.31
[3113]			1.4	31	0		0.70559		0.5127				
[3113]	4.43		3.7	18	3.9		0.70566		0.5127		19.143	15.71	39.51
[3113]	0.44		1.3	27	2		0.70573		0.5127		18.902	15.688	39.17
[3113]	1.41		2.1	28	2.3		0.70578		0.5127		19.011	15.7	39.44
[3113]	1.45		2.5	26	2.3		0.70579		0.5128		19.005	15.713	39.44
[3113]			3.5	17	4.9		0.70579		0.5126				
[3113]			1.5	12	6.7		0.70592		0.5126				

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
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[3147]	BANDA
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[3500]	400 M SOUTHWEST OF THE SUMMIT
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Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[3113]	Stolz et al., 1990	49.53	1.19	17.75	
[3113]	Stolz et al., 1990	61.52	0.54	17.32	
[3113]	Stolz et al., 1990	60.28	0.55	17.75	
[3113]	Stolz et al., 1990	49.72	1.26	16.57	
[3113]	Stolz et al., 1990	52.29	1.07	18.44	
[3113]	Stolz et al., 1990	64.17	0.44	17.97	
[3113]	Stolz et al., 1990	51.28	1.06	19.85	
[3113][3146]	Stolz et al., 1990; Wheller et al., 1987	56.95	0.85	16.89	
[3113][3146]	Stolz et al., 1990; Wheller et al., 1987	51.31	0.69	19.58	
[3113][3146]	Stolz et al., 1990; Wheller et al., 1987	55.63	0.61	17.84	
[3144]	Van Bergen et al., 1989	56.73	1.02	17.57	
[3144]	Van Bergen et al., 1990	57.49	0.76	17.5	
[3144]	Van Bergen et al., 1991	57.59	0.64	18.38	
[3144]	Van Bergen et al., 1992	55.1	1.31	16.35	
[3144]	Van Bergen et al., 1993	57.08	0.59	17.29	
[3145]	Varekamp et al., 1989	53.27	0.88	17.22	10.56
[3147]	Vroon, Van Bergen, and Forde, 1996	51.75	0.96	17.53	
[3147]	Vroon, Van Bergen, and Forde, 1996				
[3147]	Vroon, Van Bergen, and Forde, 1996				
[3436][3113]	Stolz et al., 1988; Stolz et al., 1990	48.05	0.94	15.98	2.35
[3436][3113]	Stolz et al., 1988; Stolz et al., 1990	48.71	0.87	14.5	3.4
[3500]	Varne and Foden, 1986	48.32	0.69	10.53	
[3500]	Varne and Foden, 1986	48.78	0.96	17.93	
[3500]	Varne and Foden, 1986	55.09	0.69	19.66	
[3500]	Varne and Foden, 1986	61.82	0.71	17.25	
[3500]	Varne and Foden, 1986	56.1	0.61	19.49	
[3500]	Varne and Foden, 1986	51.49	0.87	17.15	
[3500]	Varne and Foden, 1986	52.9	1.06	18.5	
[3500]	Varne and Foden, 1986	50.55	0.98	18.51	
[3500]	Varne and Foden, 1986	50.43	0.84	19	
[3500]	Varne and Foden, 1986	47.25	0.97	14.1	
[3500]	Varne and Foden, 1986	49.24	0.84	17.68	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[3113]	29	775	327		28		90	27.5	58.8	28.4	5.83	1.66		2.69		6.8
[3113]	110	597	47		29		128									31.7
[3113]	110	626	46		30		127	61.9	137	47.7	9.18	2.71		3.31		34.1
[3113]	34	733	369		29		94	28.2	63.9	27.9	5.54	1.91		2.45		9.1
[3113]	38	784	234		29		107	28.1	60.4	26.4	5.47	1.69		2.85		9.3
[3113]	94	329	77		9		68		18	10						4.1
[3113]	46	735	231		31		114	31.4	69.4	28.8	5.61	1.81		2.67		10.5
[3113][3146]	47	538	177		20		90	15.5	34.4	18.4	3.87	1.17		1.74		5
[3113][3146]	19.9	317	256		15		39	7.33	15.5	8.57	1.89	0.67		1.14		2
[3113][3146]	76	716	158		23		140	40.3	82.4	32.6	6.46	1.94		2.46		19.7
[3144]																
[3144]	27	177														
[3144]	27	197														
[3144]	22	167														
[3144]	26	171														
[3145]	48	404			25	87	89	16	26							
[3147]	9.1	217														
[3147]	18	184								14.6	4.48					
[3147]	26	180								19.2	5.79					
[3436][3113]	164	955	300		34		184	58.3	117	55	11.5	3.36		2.45		15.9
[3436][3113]	288	1040	282		42		312	81.9	173	82	16.6	4.18		2.68		30.7
[3500]	21	452			13		53	11								
[3500]	206	1141	335		23		82		55	27						
[3500]	136	1085	189		25		145		81	29						
[3500]	62	403			33		150									
[3500]	142	981	89		25		153	38.7	79.7	30.6	5.23	1.56		2.26		
[3500]	93	1031	255		25		104		64	26						
[3500]	30	510			28		107	12.1	26.6	14.4	3.28	1.05		2.31		2.54
[3500]	61	724			32		138									
[3500]	84	943			21		150									
[3500]	143	1190			21		96	63	121	48.4	8.82	2.39		1.49		
[3500]	144	2400			23		119									

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[3113]	0.64		2.2	33	2.6		0.70607		0.5127		18.879	15.672	39.13
[3113]			2.8	9	11.6		0.70615		0.5125				
[3113]	6.16		2.7	8	11.7		0.7062		0.5125		18.912	15.691	39.19
[3113]			2.1	34	1.2		0.70633		0.5127		18.985	15.701	39.43
[3113]	3.26		2.4	26	2.7		0.7064		0.5127		19.011	15.701	39.42
[3113]			1.7	12	9.5		0.70641		0.5125		18.982	15.708	39.45
[3113]	2.4		2.7	31	2.7		0.70667		0.5126		19.005	15.708	39.45
[3113][3146]	1.12		2.4	18	2.4		0.70476		0.5128		18.825	15.658	39.05
[3113][3146]	0.4		1.3	29	2.3		0.70556		0.5127		18.871	15.664	39.1
[3113][3146]	4.94		3.2	15	4.2		0.70573		0.5126		19.124	15.69	39.42
[3144]							0.7048						
[3144]							0.70482						
[3144]							0.70483						
[3144]							0.70484						
[3144]							0.70484						
[3145]				41			0.70575		0.5126				
[3147]					0.25		0.70423						
[3147]							0.7048		0.5129		18.68	15.627	38.854
[3147]							0.7048		0.5129				
[3436][3113]			3.9	34	6.5		0.70605		0.5126				
[3436][3113]			7.4	30	13.5		0.70706		0.5124		19.045	15.683	39.43
[3500]				50			0.70389		0.5128				
[3500]				26			0.70389		0.5128				
[3500]				10			0.70392		0.5128				
[3500]				11			0.70394		0.5129				
[3500]				6			0.70394		0.5128				
[3500]				26			0.704		0.5128				
[3500]	0.66		2.62	27	0.51		0.70408		0.5129				
[3500]				26			0.70415		0.5128				
[3500]				20			0.70474		0.5127				
[3500]				39			0.70485		0.5127				
[3500]				16			0.70527		0.5126				

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[3500]	
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[3741]	

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[3500]	Varne and Foden, 1986	45.17	1.13	13.55	
[3500]	Varne and Foden, 1986	44.63	1.12	11.3	
[3500][3732]	Varne and Foden, 1986; Foden, 1983	50.25	1.03	18.92	1.58
[3500][3732]	Varne and Foden, 1986; Foden, 1983	50.43	1	18.34	1.7
[3500][3734]	Varne and Foden, 1986; Foden and Varne, 1980	49.47	1.28	17.93	1.62
[3500][3734]	Varne and Foden, 1986; Foden and Varne, 1980	65.03	0.67	16.85	0.64
[3500][3734]	Varne and Foden, 1986; Foden and Varne, 1980	55.09	0.95	18.78	1.39
[3500][3734]	Varne and Foden, 1986; Foden and Varne, 1980	48.09	0.93	16.47	1.73
[3500][3734]	Varne and Foden, 1986; Foden and Varne, 1980	53.05	0.69	19.21	1.22
[3500][3740]	Varne and Foden, 1986; Gasparone, Hilton, and Varne, 1994	47.78	0.96	15.91	
[3732][3735]	Foden, 1983; Whitford, Foden, and Varne, 1978	52.03	1.09	18.26	1.57
[3735]	Whitford, Foden, and Varne, 1978	48.78			
[3735]	Whitford, Foden, and Varne, 1978	48.32			
[3735]	Whitford, Foden, and Varne, 1978	56.1			
[3735]	Whitford, Foden, and Varne, 1978	61.82			
[3735]	Whitford, Foden, and Varne, 1978	50.55			
[3735]	Whitford, Foden, and Varne, 1978	50.43			
[3735]	Whitford, Foden, and Varne, 1978	53.05			
[3735]	Whitford, Foden, and Varne, 1978	48.02			
[3735]	Whitford, Foden, and Varne, 1978	47.49			
[3735]	Whitford, Foden, and Varne, 1978	47.77			
[3735]	Whitford, Foden, and Varne, 1978	49.24			
[3735]	Whitford, Foden, and Varne, 1978	44.71			
[3737][3735]	Foden, 1986; Whitford, Foden, and Varne, 1978	55.09	0.69	19.66	2.51
[3737][3735]	Foden, 1986; Whitford, Foden, and Varne, 1978	51.49	0.87	17.15	3.78
[3741]	Edwards, Morris, and Thirwall, 1993	51.2			
[3741]	Edwards, Morris, and Thirwall, 1993	51.45			
[3741]	Edwards, Morris, and Thirwall, 1993	57.17			
[3741]	Edwards, Morris, and Thirwall, 1993	50.9			
[3741]	Edwards, Morris, and Thirwall, 1993	51.58			
[3741]	Edwards, Morris, and Thirwall, 1993	50.71			

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[3500]	0.2	7.28	14	1.57	4.52	0.66			1030	212			7	29	
[3500]	0.2	8.5	15.4	1.75	4.31	0.76			892	35			7	46	
[3500][3732]	0.19	5.38	10.1	3.12	0.98	0.19			338	23			3	25	
[3500][3732]	0.22	5.64	9.94	3.01	1	0.2			393	29			4	23	
[3500][3734]	0.2	6.6	10.4	2.99	1.26	0.26			441	259			5	76	
[3500][3734]	0.14	1.23	3.04	4.88	3.81	0.23			836	29			13	2	
[3500][3734]	0.18	3.23	7.43	3.69	1.59	0.27			374	27			5	2	
[3500][3734]	0.23	5.58	11.5	3.08	3.44	0.42			2680	61			12	15	
[3500][3734]	0.22	2.69	8.05	4.69	3.56	0.4			1981	38			4	5	
[3500][3740]	0.25	5.86	12.2	2.56	3.31	0.43			2640	87			12	22	
[3732][3735]	0.16	3.5	8.97	4.08	2	0.35				68			5	19	
[3735]					2.47										
[3735]					0.9										
[3735]					5.69										
[3735]					3										
[3735]					2.21										
[3735]					2.75										
[3735]					3.56										
[3735]					2.64										
[3735]					3.32										
[3735]					1.85										
[3735]					4										
[3735]					4.42										
[3737][3735]	0.18	2.71	5.47	4.56	5.03	0.54			1209	4			7.2	4	
[3737][3735]	0.18	4.65	9.04	4.16	2.89	0.4			791	7			4.3	15	
[3741]					0.52										
[3741]					0.55										
[3741]					1.28										
[3741]					2.32										
[3741]					1										
[3741]					1.07										

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[3500]	337	865	402		30		150	40.3	88.2	41.6	8.87	2.52		1.67		
[3500]	195	779	442		33		191	44.7	96	46.4	10.6	3.11		1.88		
[3500][3732]	19	552	302		20		56	7.4	17.6	10.3	2.61	0.88		1.49		
[3500][3732]	16	490			23		60									
[3500][3734]	22	497	313		21		73	12.6	30.2	17.3	4.5	1.3		2		6.83
[3500][3734]	96	331	39		41		276	26	56.5	25.1	4.98	1.26		3.23		10.9
[3500][3734]	37	495	186		29		122	12.8	27.5	16.9	4.09	1.24		2.69		3.17
[3500][3734]	107	1580	314		26		103		149	50						
[3500][3734]	112	1010	39		27		134	40.9	85	33.1	5.94	1.78		2.84		
[3500][3740]	112	1520	319		22		98	70	147	51						
[3732][3735]	51	527			30		173									
[3735]	189	1113														
[3735]	21	452														
[3735]	142	923														
[3735]	62	403														
[3735]	61	724														
[3735]	84	943														
[3735]	112	1010														
[3735]	92	1135														
[3735]	114	1511														
[3735]	73	850														
[3735]	144	2401														
[3735]	319	836														
[3737][3735]	136	1085	139		26		145		81	29						
[3737][3735]	93	1031	255		25		104		64	26						
[3741]																
[3741]																
[3741]																
[3741]																
[3741]																
[3741]																

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[3500]				51			0.70534		0.5126				
[3500]				54			0.7055		0.5126				
[3500][3732]				27			0.70396		0.5129				
[3500][3732]				35			0.70399		0.5129				
[3500][3734]	2.17		4	33	0.23		0.70395		0.5129				
[3500][3734]	2.96		5.85	10	2.97		0.70398		0.5129				
[3500][3734]	0.95		3.07	20	0.54		0.70401		0.5129				
[3500][3734]				29			0.7048		0.5127				
[3500][3734]			3.33	11			0.70485		0.5127				
[3500][3740]				35			0.70479		0.5127				
[3732][3735]				25			0.70398						
[3735]							0.70385						
[3735]							0.70388						
[3735]							0.70389						
[3735]							0.70394						
[3735]							0.70412						
[3735]							0.70469						
[3735]							0.70485						
[3735]							0.70486						
[3735]							0.70488						
[3735]							0.705						
[3735]							0.70527						
[3735]							0.70529						
[3737][3735]				10			0.70395						
[3737][3735]				21			0.70399						
[3741]							0.70408		0.5129		18.688	15.657	38.98
[3741]							0.7043		0.5129		18.69	15.654	38.98
[3741]							0.70447		0.5128				
[3741]							0.70455		0.5127		18.852	15.602	39.17
[3741]							0.70462		0.5127				
[3741]							0.70475		0.5127		18.726	15.666	39.02

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[3741]	
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[3741][4938]	

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[3741]	Edwards, Morris, and Thirwall, 1993	47.8			
[3741]	Edwards, Morris, and Thirwall, 1993	64.07			
[3741]	Edwards, Morris, and Thirwall, 1993	60.37			
[3741]	Edwards, Morris, and Thirwall, 1993	57.54			
[3741]	Edwards, Morris, and Thirwall, 1993	48.17			
[3741]	Edwards, Morris, and Thirwall, 1993	53.97			
[3741]	Edwards, Morris, and Thirwall, 1993	54.68			
[3741]	Edwards, Morris, and Thirwall, 1993	52.91			
[3741]	Edwards, Morris, and Thirwall, 1993	55.67			
[3741]	Edwards, Morris, and Thirwall, 1993	59.06			
[3741]	Edwards, Morris, and Thirwall, 1993	58.73			
[3741]	Edwards, Morris, and Thirwall, 1993	57.11			
[3741]	Edwards, Morris, and Thirwall, 1993	58.98			
[3741]	Edwards, Morris, and Thirwall, 1993	55.55			
[3741]	Edwards, Morris, and Thirwall, 1993	55.71			
[3741]	Edwards, Morris, and Thirwall, 1993	50.01			
[3741]	Edwards, Morris, and Thirwall, 1993	61.04			
[3741][13600][4938]	Edwards, Morris, and Thirwall, 1993; Tomascak et al., 2002; De Hoog, Taylor, V	51.63			
[3741][13600][4938]	Edwards, Morris, and Thirwall, 1993; Tomascak et al., 2002; De Hoog, Taylor, V	63.38			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	49.97			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	58.35			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	61.16			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	54.78			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	63.44			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	56.22			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	61.39			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	51.88			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	59.81			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	54.91			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	59.9			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	48.25			
[3741][4938]	Edwards, Morris, and Thirwall, 1993: Tomascak et al., 2002	56.1			

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[3741]					2.08										
[3741]					4.41										
[3741]					0.96										
[3741]					0.81										
[3741]					1.63										
[3741]					2.56										
[3741]					0.94										
[3741]					0.56										
[3741]					1.19										
[3741]					1.48										
[3741]					1.37										
[3741]					1.26										
[3741]					2.87										
[3741]					1.19										
[3741]					1.13										
[3741]					1.56										
[3741]					3.74										
[3741][13600][4938]					0.51										
[3741][13600][4938]					2.15										
[3741][4938]					0.33										
[3741][4938]					1.48										
[3741][4938]					1.85										
[3741][4938]					1.48										
[3741][4938]					1.56										
[3741][4938]					0.8										
[3741][4938]					1.75										
[3741][4938]					0.86										
[3741][4938]					1.7										
[3741][4938]					1.01										
[3741][4938]					1.42										
[3741][4938]					1.14										
[3741][4938]					2.5										

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[3741]																
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Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[3741]							0.70508		0.5127		18.838	15.618	39.18
[3741]							0.70515		0.5127		18.917	15.645	39.29
[3741]							0.70517		0.5128		18.96	15.67	39.29
[3741]							0.70524						
[3741]							0.70529		0.5127		18.957	15.651	39.35
[3741]							0.70539		0.5127		18.913	15.641	39.29
[3741]							0.70543						
[3741]							0.70548		0.5128		18.99	15.69	39.39
[3741]							0.70563		0.5128		19.009	15.674	39.38
[3741]							0.70566						
[3741]							0.7058		0.5128		19.012	15.681	39.42
[3741]							0.70599						
[3741]							0.70599		0.5127		18.989	15.7	39.42
[3741]							0.70605		0.5127		19.026	15.687	39.44
[3741]							0.70618		0.5127		19.01	15.69	39.42
[3741]							0.70638		0.5127		18.982	15.682	39.39
[3741]							0.70651		0.5127		18.97	15.676	39.38
[3741][13600][4938]							0.70404		0.5129		18.663	15.644	38.91
[3741][13600][4938]							0.70509		0.5127		18.853	15.704	39.27
[3741][4938]							0.70393		0.513		18.622	15.64	38.87
[3741][4938]							0.70441		0.5128		18.811	15.686	39.18
[3741][4938]							0.70472		0.5127		18.833	15.691	39.21
[3741][4938]							0.70476				18.725	15.673	39.03
[3741][4938]							0.70499		0.5128		18.869	15.662	39.15
[3741][4938]							0.70527		0.5128		18.97	15.67	39.34
[3741][4938]							0.70528				18.879	15.653	39.15
[3741][4938]							0.7053		0.5127		18.917	15.67	39.21
[3741][4938]							0.70537		0.5128		18.897	15.661	39.15
[3741][4938]							0.70548				18.914	15.689	39.26
[3741][4938]							0.70584		0.5128		19	15.68	39.41
[3741][4938]							0.70623		0.5126		18.97	15.682	39.39
[3741][4938]							0.70656		0.5127		18.95	15.664	39.34

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[3885]	
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[3885][3058]	
[3885][3058]	
[3885][3058]	
[3885][3145][3085][3058]	
[3885][3436][3113]	
[3910]	BANDA
[3910]	BANDA
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[4047]	1982-1983 ERUPTION

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[3885]	Van Bergen et al., 1992	45.62	1.17	16.63	
[3885]	Van Bergen et al., 1992	50.53	0.86	20.57	
[3885]	Van Bergen et al., 1992	48.19	1.08	19.35	
[3885][3058]	Van Bergen et al., 1992; Hoogewerf et al., 1997	47.87	0.99	15.34	
[3885][3058]	Van Bergen et al., 1992; Hoogewerf et al., 1997	48.37	0.98	17.31	
[3885][3058]	Van Bergen et al., 1992; Hoogewerf et al., 1997	50.4	0.93	18.99	
[3885][3145][3085][3058]	Van Bergen et al., 1992; Hoogewerf et al., 1997; Van Bergen et al., 1989; Hilton	47.8	0.92	13.37	9.17
[3885][3436][3113]	Van Bergen et al., 1992; Stolz et al., 1988; Stolz et al., 1990	48.97	0.85	12.3	2.73
[3910]	Morris et al., 1983	57.23	0.86	17.72	
[3910]	Morris et al., 1983	64.4			
[3968]	Edwards, Menzies, and Thirlwall, 1991	45.87	1.03	16.29	9.84
[3968]	Edwards, Menzies, and Thirlwall, 1991	45.48	1.079	15.07	10.29
[3968]	Edwards, Menzies, and Thirlwall, 1991	46.21	1.157	14.28	9.46
[3968]	Edwards, Menzies, and Thirlwall, 1991	47.52	0.937	17.72	8.53
[3968]	Edwards, Menzies, and Thirlwall, 1991	51.74	0.548	21.05	5.78
[3968]	Edwards, Menzies, and Thirlwall, 1991	51.74	0.548	21.05	5.78
[3968]	Edwards, Menzies, and Thirlwall, 1991	46.85	0.874	16.49	9.16
[3968]	Edwards, Menzies, and Thirlwall, 1991	55.54	0.283	22.67	2.65
[3968]	Edwards, Menzies, and Thirlwall, 1991	46.78	0.904	18.08	9.93
[3968]	Edwards, Menzies, and Thirlwall, 1991	51.1	0.746	18.08	8.26
[3968]	Edwards, Menzies, and Thirlwall, 1991	48.34	0.975	16.85	10.5
[3968]	Edwards, Menzies, and Thirlwall, 1991	49.12	0.929	17.02	9.26
[3968]	Edwards, Menzies, and Thirlwall, 1991	49.71	0.84	17.72	8.95
[3968]	Edwards, Menzies, and Thirlwall, 1991	54.8	0.737	18.06	7.86
[3968]	Edwards, Menzies, and Thirlwall, 1991	54.8	0.737	18.06	7.86
[3968]	Edwards, Menzies, and Thirlwall, 1991	51.1	0.819	16.64	8.91
[3968]	Edwards, Menzies, and Thirlwall, 1991	52.82	0.842	17.08	9.01
[3968]	Edwards, Menzies, and Thirlwall, 1991	51.1	0.819	16.64	8.91
[3968]	Edwards, Menzies, and Thirlwall, 1991	52.13	0.693	18.71	8.97
[3968]	Edwards, Menzies, and Thirlwall, 1991	53.07	0.64	17.06	8.63
[4047]	Gerbe et al., 1992	58.3	0.7	17.5	4.2

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[3885]	0.25	5.53	12	2.15	4.52	0.92			893	48			12.1	32	
[3885]	0.16	2.25	6.6	2.36	9.09	0.67			1285	7.6			14.4	18	18.6
[3885]	0.19	3.55	8.67	2.06	6.82	0.86			1319	16			14.5	26	16.5
[3885][3058]	0.21	6.82	11.5	1.84	5.41	0.71			1039	142			17.6	53	14.8
[3885][3058]	0.22	5.56	10.3	2.41	4.41	0.63			1146	66			9.6	32	14.2
[3885][3058]	0.2	3.51	7.65	2.94	6	0.72			1385	10			13.1	23	21.7
[3885][3145][3085][3058]	0.2	8.61	12.3	1.82	5.05	0.81			851	324	129		17.4	89	13.1
[3885][3436][3113]	0.16	9.5	11.8	1.55	5.24	0.93			711	461			12.1	110	13.1
[3910]		3.62	7.62	3.26	1.6	0.13									4.65
[3910]															
[3968]	0.189	5.11	10.7	3.26	5.887	1.02			2542	68.2	150	16.1	209	26	12.7
[3968]	0.208	6.58	12.9	2.77	4.089	1.008			1549	144	159	14.3	82.1	38.9	12.3
[3968]	0.185	8.01	13	2.6	3.585	0.814			747	272	114	16	46	61.7	6.98
[3968]	0.176	5.01	9.35	3.98	5.577	0.734			1153	119	109	17.8	78.3	34.7	10.5
[3968]	0.201	1.49	5.92	5.65	6.967	0.308			1106	5.9	54.1	21.3	120	6.8	17.2
[3968]	0.201	1.49	5.92	5.65	6.967	0.308			1106	5.9	54.1	21.3	120	6.8	17.2
[3968]	0.213	5.64	10.4	3.48	5.293	0.793			2407	141	99.8	17	67.7	46	8.5
[3968]	0.144	0.31	2.84	6.55	9.091	0.073			423	2.7	13.9	19.3	129	4.4	23.7
[3968]	0.244	3.24	10.4	3.97	5.155	0.701			1336	7.5	116	19.1	138	11.7	11.6
[3968]	0.194	3.14	8.08	3.91	5.511	0.641			1174	20.1	87.9	19.1	83.1	15.3	17.4
[3968]	0.2	5.68	11.3	2.38	2.927	0.546			1215	67.6	131	17.1	24.4	29.7	6.99
[3968]	0.19	5.16	10.8	2.64	4.322	0.54			784	80	116	16.5	37.4	23.3	12.5
[3968]	0.212	4.84	10.1	3.24	4.108	0.564			706	108	83.7	18.4	41.4	26.7	14.4
[3968]	0.175	2.9	6.71	3.91	4.257	0.564			1021	22.3	48	20.1	31.4	16.9	13.1
[3968]	0.175	2.9	6.71	3.91	4.257	0.564			1021	22.3	48	20.1	31.4	16.9	13.1
[3968]	0.186	3.38	8.38	4.18	5.365	0.796			1630	24.6	69.7	18	49.8	17.1	12.5
[3968]	0.193	3.78	8.06	3.44	4.009	0.696			797	23.9	54.3	18	35.4	16.8	12.8
[3968]	0.186	3.38	8.38	4.18	5.365	0.796			1630	24.6	69.7	18	49.8	17.1	12.5
[3968]	0.221	2.48	7.37	3.86	4.508	0.489			1398	17.1	39.1	18.5	24.1	11.4	6.27
[3968]	0.176	4.61	8.2	2.84	4.123	0.516			1183	109	64.5	16.7	27.5	43.4	9.63
[4047]	0.1	3.2	7.3	3.5	0.9				191	16				6	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[3885]	161	1206			36		172	50	108		11.7	3.21	1.39	2.89	0.39	14.8
[3885]	406	1076			30		185	53	110		8.1	2.43	0.88	2.03	0.32	16.9
[3885]	280	1155			32		169	58	116		10.3	2.99	1.02	1.86	0.29	16.7
[3885][3058]	195	938			31		199	51	103		9.7	2.6	1.29	2.29	0.31	14.5
[3885][3058]	177	1007			33		157	59	119		11.5	3.11	1.11	2.44	0.4	16.9
[3885][3058]	231	1115			34		196	69	148		11	3.15	1.23	2.23	0.36	24.8
[3885][3145][3085][3058]	201	820			32	73	210	50	107		10.7	2.99	1.29	2.14	0.42	12.8
[3885][3436][3113]	260	774	268		29		180	41.2	90.1	41.9	8.4	2.34		1.96		13.1
[3910]	11	209								11.2	3.65					1.04
[3910]	11	233														
[3968]	232	1498	311		26	80.4	213	188	283	88.7	14.2	3.81		1.74	0.23	45.1
[3968]	174	1476	336		35.9	83.2	239	167	300	115						29
[3968]	157	1126	295		30.9	75.2	203	96.3	183	77.5	13.4	3.63		1.96	0.28	18.9
[3968]	204	1543	243		31.6	86.1	250	138	241	86						32
[3968]	197	2146	148		37	86.7	322	174	290	93.4	16.5	4.45		2.5	0.19	49
[3968]	197	2146	148		37	86.7	322	174	290	93.4	16.5	4.45		2.5	0.19	49
[3968]	181	1754	268		36.3	87	250	157	283	110						28
[3968]	275	1297	37.5		27.8	71.3	321	156	235	62.6	10.1	2.73		2.17	0.29	57.4
[3968]	181	2264	289		46.8	98.3	314	237	402	139	22.9	5.9		2.97	0.44	53
[3968]	346	1737	215		35.9	81.3	302	163	280	100						42
[3968]	120	1052	283		23.6	77.5	107	56.3	114	51.6	8.9	2.62		1.78	0.25	10.7
[3968]	204	860	282		27.3	79.7	180	81	145	56						18.2
[3968]	118	1153	224		34.8	76.8	212	105	189	74.2		3.76		2.34	0.29	22
[3968]	130	1068	157		29.7	89.1	220	92.7	171	64	11.2	2.97		2.2	0.4	23.5
[3968]	130	1068	157		29.7	89.1	220	92.7	171	64	11.2	2.97		2.2	0.4	23.5
[3968]	149	1274	213		32.1	82.4	240	120	224	88						28
[3968]	153	1064	219		34.1	85	242	106	202	81						28
[3968]	149	1274	213		32.1	82.4	240	120	224	88						28
[3968]	145	1592	158		28.8	81.7	162	91	169	69						18.3
[3968]	150	1001	167		31.5	73.3	226	98.8	187	74.6	15.4	3.28		2.19	0.37	26.7
[4047]	19.5	250					93	8.2	16		2.5	0.98	0.41	1.8		2.01

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[3885]			5.1	35.6			0.7059						
[3885]			4.2	9.4			0.70611						
[3885]			3.8	18			0.70615						
[3885][3058]	4.25		4.7	415			0.70567						
[3885][3058]	3.11		3.9	36.7			0.70598						
[3885][3058]	5.43		4.6	17.6			0.70624						
[3885][3145][3085][3058]	3.98		5.4	48.7			0.70574		0.5124				
[3885][3436][3113]			4.4	36			0.70609		0.5126		18.95	15.661	39.31
[3910]	0.33						0.7045		0.5129		18.682	15.636	38.906
[3910]							0.70461						
[3968]	9.03	8.7	4.1	20.7			0.70426		0.5127		18.872	15.587	39.29
[3968]				25.9			0.7043						
[3968]	3.9	2.71	3.7	33.3			0.70432		0.5127		18.662	15.596	39.06
[3968]				14.5			0.70432						
[3968]		5.3	5.1	4.6			0.70439		0.5126				
[3968]		5.3	5.1	4.6			0.70439		0.5126				
[3968]				18.3			0.70442						
[3968]		4.94	4.9	1			0.70445						
[3968]	7.67			13			0.7045		0.5126		18.69	15.584	39.17
[3968]				13.6			0.70451						
[3968]		0.63	2.7	27.8			0.70453		0.5126				
[3968]				29.1			0.70463						
[3968]		1.78	4.3	21.4			0.70465						
[3968]		1.34	4.4	12.1			0.7047		0.5126				
[3968]		1.34	4.4	12.1			0.7047		0.5126				
[3968]	5.13			15.2			0.70476		0.5126		18.629	15.601	39.1
[3968]	4.5			17.3			0.70476				18.759	15.586	39.04
[3968]	5.13			15.2			0.70477		0.5126		18.629	15.601	39.1
[3968]				9.7			0.70479						
[3968]		1.18	4.6	15.3			0.70498		0.5125				
[4047]	0.5	0.28	2.3	15.1	1.6	17.9	0.7044		0.5129				

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[4047]	1982-1983 ERUPTION
[4047]	1982-1983 ERUPTION
[4047]	1982-1983 ERUPTION
[4047]	1982-1983 ERUPTION
[4047]	1982-1983 ERUPTION
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[4583][7092]	
[4583][7092]	
[4583][7092]	
[4583][7092][18645]	WEST JAVA, 1918 ERUPTION
[4583][7092][18645]	WEST JAVA, 1982 ERUPTION
[4588]	BERTJAK, 1883 FLOW
[4588]	GUNUNG GENI, KALI CICALUK
[4588]	ALUN-ALUN, CINDER CONE
[4588]	GUNUNG ANYAR, 1898 FLOW
[4588]	GUNUNG ONGGOONGGO, CONE

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[4047]	Gerbe et al., 1992	49	1	15.5	3.7
[4047]	Gerbe et al., 1992	48.5	1	15.7	4.2
[4047]	Gerbe et al., 1992	57	0.8	17.7	5.4
[4047]	Gerbe et al., 1992	48.7	1	16.2	2.8
[4047]	Gerbe et al., 1992	54.9	0.8	17.8	4.7
[4047]	Gerbe et al., 1992	56.1	0.8	17.7	4.3
[4047]	Gerbe et al., 1992	53.5	0.9	17.5	3.9
[4047]	Gerbe et al., 1992	52.8	0.8	17.7	4.4
[4047]	Gerbe et al., 1992				
[4047]	Gerbe et al., 1992	51.2	0.8	16.5	4
[4583]	Turner and Foden, 2001	55.45	0.6	19.7	
[4583]	Turner and Foden, 2001	56.54	0.82	18.76	
[4583]	Turner and Foden, 2001	53.61	0.91	18.05	
[4583]	Turner and Foden, 2001	57.86	1.18	15.49	
[4583]	Turner and Foden, 2001	51.65	0.79	18.81	
[4583]	Turner and Foden, 2001	56.08	0.68	16.32	
[4583]	Turner and Foden, 2001	51.79	0.81	19.13	
[4583][2842]	Turner and Foden, 2001; McDermott and Hawkesworth, 1991	54.23	0.96	18.44	
[4583][2842]	Turner and Foden, 2001; McDermott and Hawkesworth, 1991	52.03	1.18	18.01	
[4583][2842]	Turner and Foden, 2001; McDermott and Hawkesworth, 1991	56.14	0.81	18.5	
[4583][3059]	Turner and Foden, 2001; Stolz et al., 1989	53.74	0.93	18.16	
[4583][3375]	Turner and Foden, 2001; Pickett and Murrell, 1997	53.61	1.01	18.32	
[4583][7092]	Turner and Foden, 2001; Turner, Black, and Berlo, 2004	61.45	1.02	17.03	
[4583][7092]	Turner and Foden, 2001; Turner, Black, and Berlo, 2004	49.01	0.7	15.09	
[4583][7092]	Turner and Foden, 2001; Turner, Black, and Berlo, 2004	52.85	0.77	17.62	
[4583][7092][18645]	Turner and Foden, 2001; Turner, Black, and Berlo, 2004; Handley et al., 2014	55.11	0.83	19.15	
[4583][7092][18645]	Turner and Foden, 2001; Turner, Black, and Berlo, 2004	49.14	0.81	16.05	
[4588]	Carn and Pyle, 2001	49.7	1.044	19.64	
[4588]	Carn and Pyle, 2001	45.48	1.415	18.38	
[4588]	Carn and Pyle, 2001	44.64	1.514	18.23	
[4588]	Carn and Pyle, 2001	47.97	1.103	19.69	
[4588]	Carn and Pyle, 2001	50.69	1.364	17.29	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[4047]	0.2	10.8	11.2	2.2	0.3				76	543				185	
[4047]	0.2	10.6	11.1	2.4	0.4				84	541				180	
[4047]	0.2	4.2	8.1	3.7	0.8				178	54				18	
[4047]	0.2	11.3	11.3	2.4	0.4				73	558				188	
[4047]	0.1	5.7	9	3.2	0.8				157	145				46	
[4047]	0.2	4.8	8.4	3.4	0.8				165	101				36	
[4047]	0.2	6.7	9.6	2.6	0.7				140	190				63	
[4047]	0.2	6.9	9.6	3.1	0.5				137	209				73	
[4047]															
[4047]	0.2	9.1	10.6	2.6	0.6				112	389				128	
[4583]	0.2	1.67	4.24	5.33	5.45	0.44			1201	5			9	6	
[4583]	0.13	3.14	7.53	4.13	0.69	0.22			150	16			3	10	
[4583]	0.19	4.05	8.08	3.48	1.77	0.21			430	13			5	11	
[4583]	0.19	2.89	6.32	3.88	2.09	0.31			321	203			6	87	
[4583]	0.23	3.45	8.38	4.08	3	0.39			1578	5			7	5	
[4583]	0.15	6.44	7.95	2.77	1.5	0.13			270	323			3	89	
[4583]	0.18	5.76	9.59	2.43	0.34	0.1			92	33			1	23	
[4583][2842]	0.19	2.62	8.37	3.79	1.53	0.33			491	7				24	
[4583][2842]	0.19	3.85	8.99	3.33	1.71	0.45			405	12				24	
[4583][2842]	0.18	2.5	7.97	3.63	2.07	0.32			421	8				17	
[4583][3059]	0.18	4.05	8.25	3.44	1.78	0.21			413	8			5.57	12	
[4583][3375]	0.18	3.25	8.49	3.47	2	0.29			432	10				19	
[4583][7092]	0.15	2.2	5.86	4.49	1.47	0.33			275	15			5	7	8.81
[4583][7092]	0.16	12.52	11.6	1.94	0.29	0.07			40	776			5	193	2.83
[4583][7092]	0.16	6.54	9.7	3.1	0.57	0.14			116	218			3	59	5.77
[4583][7092][18645]	0.14	3.47	8.17	3.95	0.59	0.17			115	17			3	12	4.82
[4583][7092][18645]	0.17	10.59	11.2	2.34	0.35	0.1			48	582			4	149	3.18
[4588]	0.189	4.56	9.83	3.03	0.88	0.171			427	9	68	19	1.6	6	7
[4588]	0.195	6.06	12.1	2.33	0.62	0.083			304	7	69	17	0	6	0
[4588]	0.19	6.4	12.7	2.15	0.64	0.081			283	9	90	17	1.7	8	0
[4588]	0.19	5.16	11.1	2.67	0.67	0.117			333	6	76	18	0	7	6
[4588]	0.207	4.81	8.79	2.71	1.47	0.405			691	24	158	19	6.3	20	17

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[4047]	6.8	333					38	3.9	8.2		1.9	0.84	0.38	1.5		0.8
[4047]	7.7	369					59	3.9	11.5		2	0.78	0.39	1.5		0.79
[4047]	17.2	248					84	8.1	16.5		2.5	0.9	0.43	1.8		1.84
[4047]	5.9	378					59	3.9	7.6		2	0.84	0.38	1.6		0.81
[4047]	14.6	333					80	6.7	12.8		2.4	0.88	0.42	1.7		1.57
[4047]	15.9	293					70	6.9	15.6		2.4	0.91	0.41	1.7		1.74
[4047]	13.8	320					68	6.1	15.4		2.3	0.9	0.42	1.9		1.35
[4047]	13.1	338					69	6	14.1		2.3	0.98	0.4	1.7		1.39
[4047]																
[4047]	9.4	337					50	5.1	10.1		2.1	0.88	0.39	1.4		1.04
[4583]	142	918	101		24		157	39.8	72.1	31.1	6.02	1.69	0.79	2.5	0.39	11.9
[4583]	9	294	139		23		117	9.4	21.1	14	3.44	1.11	0.58	2.04	0.34	1.92
[4583]	41	479	206		26		123	14.5	28.8	17.4	4.03	1.21	0.71	2.44	0.39	4.25
[4583]	59	296	200		42		185	21.2	49.4	27.7	6.48	1.66	1.09	4.06	0.62	7.45
[4583]	104	970	211		28		127	35.9	64.6	30	6.03	1.77	0.87	2.5	0.4	10.2
[4583]	50	364	199		23		107	14.6	30	16.5	3.83	0.99	0.61	2.24	0.36	5.88
[4583]	13	304	187		16		33	3.5	8.2	6.3	1.8	0.73	0.39	1.44	0.24	0.44
[4583][2842]	44	514	222					16.8	35.4	18.6	4.51	1.41	0.74	2.69	0.42	4.81
[4583][2842]	40	500	283					16.2	33	18.1	4.43	1.38	0.73	2.45	0.39	4.64
[4583][2842]	59	579	190					19.3	40.5	20.4	4.5	1.42	0.67	2.38	0.38	6.46
[4583][3059]	40	477	222		26		118	14.3	28.1	16	3.9	1.18	0.73	2.45	0.39	4.27
[4583][3375]	46	539	240					20.7	42.9	21.2	4.94	1.5	0.74	2.45	0.39	6.23
[4583][7092]	40	324	95		44		184	19.9	45.1	25.7	6.35	1.81	1.1	4.18	0.62	5.38
[4583][7092]	6	197	264		14		39	3.9	8.4	5.8	1.65	0.66	0.44	1.29	0.21	0.67
[4583][7092]	13	247	206		19		69	6.6	14.4	8.4	2.37	0.87	0.49	1.67	0.29	1.35
[4583][7092][18645]	12	285	174		22		97	7.8	17.7	11.4	3	1.05	0.57	2.02	0.32	1.55
[4583][7092][18645]	7	205	264		18		48	4.1	9.8	6.6	1.93	0.74	0.47	1.52	0.23	0.78
[4588]	12.9	397	324		22.7	90	61									0
[4588]	6.1	347	520		20.1	78	33									0
[4588]	6.7	358	578		20.2	72	27									0
[4588]	9.5	376	407		21	86	44									4
[4588]	55.5	384	311		42	113	180									10

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[4047]	0.19	0.13	1.2	37.2	0.6	44.5	0.70446						
[4047]	0.19	0.14	1.3	38.1	0.5	45.3	0.70446		0.5128				
[4047]	0.46	0.26	2.1	19.4	1.4	21.6	0.70447						
[4047]	0.2		1.3	38.7	0.5		0.70448						
[4047]	0.39	0.23	1.8	24.8	1.3	26.6	0.7045						
[4047]	0.43	0.24	2	21.6	1.4	23	0.70453		0.5129				
[4047]	0.33	0.21	1.7	29.8	1.2	32.2	0.70454						
[4047]	0.34	0.21	1.7	29.1	1.1	30.6	0.70459		0.5128				
[4047]							0.70463		0.5129				
[4047]	0.25	0.16	1.5	37.7	0.9	40.1	0.70468		0.5129				
[4583]	3.37	0.61	3.79	7	3.51		0.7039		0.5128		18.858	15.57	38.839
[4583]	0.52	0.31	2.94	18	0.5		0.70416		0.5129		18.731	15.654	38.994
[4583]	1.18	0.45	3.28	22	1.34		0.70419		0.5128		18.64	15.641	38.844
[4583]	2	0.34	4.9	24	2.25		0.70439		0.5128		18.585	15.61	38.696
[4583]	2.8	0.42	3.45	14	5.64		0.70474		0.5127		18.85	15.6	38.912
[4583]	1.31	0.28	2.91	22	1.57		0.70504		0.5126		18.666	15.659	38.941
[4583]	0.17	0.16	1.01	25	1.37		0.70528		0.5129		18.857	15.666	39.084
[4583][2842]	0.73	0.3	2.94	15	2.67		0.70514		0.5128		18.695	15.629	38.914
[4583][2842]	0.98	0.32	2.66	25	3.02		0.7052		0.5128		18.718	15.647	38.923
[4583][2842]	1.2	0.26	2.77	14	3.37		0.70535		0.5127		18.719	15.63	38.938
[4583][3059]	1.15	0.43	3.19	23	1.49		0.70386		0.5129		18.62	15.572	38.662
[4583][3375]	1.39	0.33	2.83	23	3.4		0.70504		0.5127		18.714	15.638	38.957
[4583][7092]	0.23	0.29	4.59	21	1.71		0.70443		0.5128		18.471	15.621	38.616
[4583][7092]	0.16	0.12	1.04	47	0.57		0.70449		0.5129		18.724	15.635	38.932
[4583][7092]	0.32	0.2	1.72	33	1.25		0.70455		0.5128		18.782	15.673	39.11
[4583][7092][18645]	0.42	0.28	2.47	22	0.43		0.70407		0.5129		18.7524	15.6807	39.1007
[4583][7092][18645]	0.19	0.15	1.19	42	0.57		0.70447		0.5129		18.7991	15.6987	39.1939
[4588]	0			30		33	0.7042						
[4588]	0			41		42	0.70427						
[4588]	0			47		43	0.70428						
[4588]	0			33		36	0.70432						
[4588]	0			34		34	0.70433						

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[4588]	NE GUNUNG ANYAR, 1821 FLOW
[4588]	RANU AGUNG, W END OF MAAR
[4588]	RANU WURUNG, SE END OF MAAR
[4588]	GUNUNG KENEK
[4588]	E ANTER, FLOW EDGE
[4588]	GUNUNG CILIK
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[4590]	SUMBING CONE
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Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[4588]	Carn and Pyle, 2001	54.59	0.841	19.6	
[4588]	Carn and Pyle, 2001	45.64	0.948	15.66	
[4588]	Carn and Pyle, 2001	47.4	1.053	18.89	
[4588]	Carn and Pyle, 2001	44.32	1.484	17.93	
[4588]	Carn and Pyle, 2001	47.34	1.207	20.13	
[4588]	Carn and Pyle, 2001	45.32	1.219	17.65	
[4590]	Woodhead et al., 2001	54.42	1.05	18.83	
[4590]	Woodhead et al., 2001	51	1.03	19.12	
[4590]	Woodhead et al., 2001	63.74	1.05	15.51	
[4590]	Woodhead et al., 2001	52	1.04	20.25	
[4590]	Woodhead et al., 2001	54.99	1.12	17.82	
[4590]	Woodhead et al., 2001				
[4590]	Woodhead et al., 2001				
[4590]	Woodhead et al., 2001				
[4590]	Woodhead et al., 2001	57.2	0.77	19.41	
[4590]	Woodhead et al., 2001	60.77	0.82	16.57	
[4590]	Woodhead et al., 2001	53.5	0.9	18.7	
[4590]	Woodhead et al., 2001				
[4647][2608]	Nicholls and Whitford, 1983; Whitford, 1975	45.2	1.26	13.63	
[4647][2608]	Nicholls and Whitford, 1983; Whitford, 1975	58.5	1.08	17.41	
[4647][2713]	Nicholls and Whitford, 1983; Whitford, White, and Jezek, 1981	54.5	0.29	22.8	
[4647][4590]	Nicholls and Whitford, 1983; Woodhead et al., 2001	48.3	1.16	17.38	
[4927]	Vukadinovic and Sutamidjaja, 1995	52.9	1.22	18.1	
[4927]	Vukadinovic and Sutamidjaja, 1995	50.3	1.91	17.2	
[4927]	Vukadinovic and Sutamidjaja, 1995	52.1	1.55	18.3	
[4927]	Vukadinovic and Sutamidjaja, 1995	50.4	1.62	18.3	
[4927]	Vukadinovic and Sutamidjaja, 1995	54.7	1.39	17.6	
[4927]	Vukadinovic and Sutamidjaja, 1995	58.2	0.57	18.8	
[4927]	Vukadinovic and Sutamidjaja, 1995	56.1	1.22	18.2	
[4927]	Vukadinovic and Sutamidjaja, 1995	54	1.1	18.7	
[4927]	Vukadinovic and Sutamidjaja, 1995	56.1	0.73	18.3	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[4588]	0.208	2.85	8.13	3.74	1.09	0.23			501	6	29	17	2.3	0	7
[4588]	0.193	10.95	12.2	1.75	0.31	0.085			203	153	67	16	0	59	5
[4588]	0.199	6.53	11	2.42	0.49	0.134			290	44	70	18	0	21	0
[4588]	0.188	6.61	12.7	2.16	0.62	0.077			282	9	86	17	1.8	9	0
[4588]	0.202	4.67	11.5	2.83	0.86	0.102			375	8	70	17	0	6	5
[4588]	0.193	6.96	12.4	2.21	1.19	0.181			299	61	92	15	3.3	20	0
[4590]	0.19	2.96	8.58	3.78	1.26	0.25			230	4	120	21	4.17	4	7.64
[4590]	0.2	4.23	9.04	3.29	0.92	0.18			430	4	50	20	1.88	4	7.64
[4590]	0.14	2	4.93	4.24	1.91	0.26			298	4	10	18	6.51	0	21.9
[4590]	0.16	3.55	9.84	3.26	0.7	0.2			159	12	82	21	2.97	8	6.99
[4590]	0.18	4.26	8.51	3.54	0.89	0.31			164	32	28	18	2.97	12	6.85
[4590]									898	26	46		83.9	11	20.6
[4590]									498	44	18		11.2	14	15.8
[4590]									1062	17	110		66.2	17	14.8
[4590]	0.18	2.44	7.57	3.73	1.32	0.19			585	2	64	20	2.89	0	11.9
[4590]	0.14	2.9	5.55	3.58	2.49	0.2			410	6	20	18	6.61	4	10.2
[4590]	0.21	3	8.94	3.56	2.05	0.3			471	6	28	19	4.14	2	18.2
[4590]									362				7.2		19.5
[4647][2608]	0.17	10.4	13.3	2.6	3.1	1.02			950	620	83		53	140	4.5
[4647][2608]	0.19	2.19	5.64	4	2.74	0.48			700	25	20		12	0	26
[4647][2713]	0	0.79	4.6	5.48	8	0.12			920	3	24		120	6.3	21
[4647][4590]	0.2	6.24	11.7	2.58	1.62	0.33			386	71	125		10.4	24	13.2
[4927]	4.53	0.18	8.62	3.82	1.09				183	6			16.9	14	
[4927]	4.73	0.2	8.57	3.63	1.67				290	18			23.3	20	
[4927]	4.58	0.18	8.54	3.81	1.26				239	10			17.3	13	
[4927]	4.88	0.17	9.18	3.61	1.8				260	68			15	31	
[4927]	3.69	0.17	7.87	3.72	1.89				286	4			17	10	
[4927]	2.54	0.15	8.05	3.54	1.44				346	0			4.2	7	
[4927]	3.26	0.15	7.21	3.54	1.74				267	0			14.7	10	
[4927]	3.55	0.17	8.35	3.69	1.5				305	0			11.9	5	
[4927]	3.8	0.17	8.13	3.29	1.64				300	3			3.7	11	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[4588]	17.9	467	124		25.9	85	75									0
[4588]	4	290	373		15.2	76	19									0
[4588]	6.5	392	331		19.6	78	32									0
[4588]	7.8	328	579		19.9	75	29									0
[4588]	10.5	404	369		22.2	73	37									0
[4588]	33.2	418	469		21.7	87	40									5
[4590]	20	400	206		22	86	76	11.8	24.2	14.5	3.94	1.3		2.35	0.38	2.48
[4590]	13	373	262		22	86	64	7.49	16.6	11.1	3.1	1.13		2.36	0.37	1.25
[4590]	48	240	102		50	67	242	23.5	51.7	30.9	7.8	1.86		5.16	0.82	7.36
[4590]	16	322	236		21	76	71	9.47	20.3	12.5	3.37	1.11		2.21	0.34	2.69
[4590]	19	358	188		29	75	108	14	31.1	19.7	5.01	1.5		3.1	0.47	3.1
[4590]	199	1581	170		34		304	169	276	95.3	16.5	4.41		2.95	0.45	50
[4590]	70	365	110		22		176	21.5	39	17.9	3.93	1.12		2.2	0.33	9.96
[4590]	375	1820	260		47		312	190	337	138	25.1	6.41	0.76	3	0.43	41.5
[4590]	26	399	118		26	89	97	11.5	24.9	14.7	3.92	1.23		2.78	0.43	3.41
[4590]	72	328	122		31	72	186	20	41.3	21.9	5.14	1.13		3.39	0.52	8.49
[4590]	44	545	182		26	85	99	18.7	36.7	19.5	4.82	1.41		2.77	0.42	6.95
[4590]	82	393	232		36		190	23.9	49.7	26.2	6.18	1.56		3.51	0.54	8.95
[4647][2608]	136	809	290		27		224	74.4						0.89		11
[4647][2608]	78.1	405	120		51		188	40.4						5.24		12
[4647][2713]	215	1690	130		34		367	189						1.05		49
[4647][4590]	56	480	290		22		93	23.4	45.2	22.6	5.24	1.55	0.76	2.07	0.32	7.92
[4927]	28	305	205		32	91	185	16.5	39.7	21.9	5.12	1.45	0.87	2.96		3.9
[4927]	43	288	281		41	107	242	25.9	57.9	32.4	7.57	1.92	1.13	3.67		7.59
[4927]	16	299	259		37	89	214	17.2	41.7	24.6	5.95	1.77	1.02	3.42		3.91
[4927]	42	365	260		30	85	161	25.9	57.3	28.1	6.07	1.61	0.83	2.24		6.03
[4927]	49	283	193		33	81	209	19.2	43.7	24.6	5.67	1.43	0.86	3.01		5.67
[4927]	40	332	141		15	78	94	12.5	26.1	14	3.15	0.97	0.47	2.14		5.3
[4927]	48	290	187		37	81	181	20	41.9	26.3	5.85	1.53	0.95	3.03		6.22
[4927]	37	331	223		30	121	150	19.9	44.6	23	5.27	1.55	0.84	2.89		4.71
[4927]	48	316	177		19	102	105	16	34.4	16	3.33	0.97	0.54	1.95		6.8

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[4588]	0			20		19	0.70433						
[4588]	0			51		62	0.70433						
[4588]	0			35		42	0.70433						
[4588]	0			45		40	0.70438						
[4588]	0			22		30	0.70442						
[4588]	0			41		44	0.70445						
[4590]	0.58	0.31	2.38	27	0.66		0.70401		0.5128		18.566	15.607	38.736
[4590]	0.37	0.14	1.86	24	0.78		0.70423		0.5128		18.565	15.617	38.728
[4590]	1.72	0.42	6.54	22	0.86		0.70438		0.5127		18.654	15.64	38.854
[4590]	0.54	0.21	2.08	27	1.2		0.70439		0.5127		18.774	15.68	39.106
[4590]	0.71	0.22	3.2	29	0.81		0.70439		0.5127		18.658	15.638	38.858
[4590]	10.1	4.21	5.81	10	6.75	13	0.70445		0.5126		18.68	15.6	39.108
[4590]	2.42	0.86	4.37	15	2.77	14	0.70459		0.5128		18.698	15.666	39
[4590]	7.38	2.7	6.4	23	9.23	24	0.70463		0.5126		18.672	15.598	39.083
[4590]	0.89	0.23	2.87	18	1.51		0.7047		0.5128		18.63	15.64	38.876
[4590]	2.26	0.5	5.36	17	2.71		0.7048		0.5127		18.601	15.607	38.621
[4590]	1.52	0.28	2.67	17	3.52		0.70571		0.5127		18.763	15.694	39.15
[4590]	1.72	0.74	5.3	30	2.86		0.70592		0.5125		18.904	15.717	39.332
[4647][2608]	2.1		5.2	38	3.7	44	0.70446						
[4647][2608]	2.5		5.9	20	4.7	12	0.70524						
[4647][2713]	9.8		4.4	3	8.3	6.5	0.70424		0.5127				
[4647][4590]	1.59	0.69	2.5	38	3	36	0.7049		0.5126		18.879	15.688	39.167
[4927]	0.79		4.47	24			0.70478						
[4927]	1.78		5.64	30			0.7051						
[4927]	0.9		4.6	29			0.70517						
[4927]	1		3.5	25			0.7052						
[4927]	1.16		4.34	24			0.70522						
[4927]	1.19		2.6	17			0.70542						
[4927]	1.25		4.22	19			0.70549						
[4927]	0.98		3.8	25			0.7057						
[4927]	1.27		2.81	18			0.70571						

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[4927]	
[4927]	
[4927]	
[4927]	
[5646][3092]	NEW SLAMET CONE
[5646][3092]	OLD SLAMET CONE
[6097]	SOMMA RIM
[6097]	SOMMA RIM
[6097]	SOMMA RIM
[6097]	SOMMA RIM
[6097]	SOMMA RIM
[6097]	SOMMA RIM
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][15430]	CENTRAL JAVA
[6097][18645][15430]	CENTRAL JAVA
[6097][18645][15430]	CENTRAL JAVA
[6097][18645][15430]	CENTRAL JAVA
[6097][18645][15430]	CENTRAL JAVA
[6098]	
[6098][3734][3500]	
[6098][3740][3500]	
[6098][7092]	
[6098][7092]	

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[4927]	Vukadinovic and Sutamidjaja, 1995	63.2	0.59	18.5	
[4927]	Vukadinovic and Sutamidjaja, 1995	57.5	0.62	18.6	
[4927]	Vukadinovic and Sutamidjaja, 1995	51.2	1.07	19	
[4927]	Vukadinovic and Sutamidjaja, 1995	58.4	0.65	18.3	
[5646][3092]	Reubi, Nicholls, and Kamenetsky, 2002; Vukadinovic and Nicholls, 1989	50.73	1.25	15.74	
[5646][3092]	Reubi, Nicholls, and Kamenetsky, 2002; Vukadinovic and Nicholls, 1989	50.12	1.11	16.36	
[6097]	Gertisser and Keller, 2003	51.4	0.73	21.46	
[6097]	Gertisser and Keller, 2003	51.87	0.81	20.44	
[6097]	Gertisser and Keller, 2003	54.41	0.75	18.72	
[6097]	Gertisser and Keller, 2003	54.12	0.74	18.92	
[6097]	Gertisser and Keller, 2003	52.13	0.78	19.02	
[6097]	Gertisser and Keller, 2003	53.06	0.81	18.97	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	55.58	0.79	18.45	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	55.7	0.69	18.54	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	55.41	0.76	18.69	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	54.39	0.82	18.59	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	51.7	0.84	18.77	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	52.86	0.87	18.8	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	55.62	0.71	18.63	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	51.85	0.87	18.53	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	55.88	0.69	19.05	
[6097][15430]	Gertisser and Keller, 2003; Handley et al., 2011	52.85	0.88	18.57	
[6097][18645][15430]	Gertisser and Keller, 2003; Handley et al., 2011; Handley et al., 2014	55.5	0.78	18.33	
[6097][18645][15430]	Gertisser and Keller, 2003; Handley et al., 2011; Handley et al., 2014	54.12	0.8	18.77	
[6097][18645][15430]	Gertisser and Keller, 2003; Handley et al., 2011; Handley et al., 2014	54.5	0.86	18.85	
[6097][18645][15430]	Gertisser and Keller, 2003; Handley et al., 2011; Handley et al., 2014	53.29	0.78	18.64	
[6098]	Turner et al., 2003	54.1	0.66	19.08	
[6098][3734][3500]	Turner et al., 2003; Foden and Barne, 1980; Varne and Foden, 1986	47.98	0.92	18.94	1.6
[6098][3740][3500]	Turner et al., 2003; Foden and Barne, 1980; Varne and Foden, 1986	47.2	0.83	13.16	
[6098][7092]	Turner et al., 2003; Turner, Black, and Berlo, 2004	48.35	0.99	16.89	
[6098][7092]	Turner et al., 2003; Turner, Black, and Berlo, 2004	49.73	0.87	19	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[4927]	1.36	0.12	4.63	4.02	2.75				477	0			17.8	4	
[4927]	2.78	0.16	7.42	3.87	2.11				385	0			4.5	8	
[4927]	4.63	0.19	10	2.9	1.28				178				3.5	11	
[4927]	2.78	0.16	7.3	3.73	1.87				387	0			4.5	7	
[5646][3092]	0.19	7.7	10.5	2.66	1		1719		277	256	164	26.9	12.7	63.6	15.3
[5646][3092]	0.19	7.69	10.5	2.97	0.89		1693		269	192	117	27.7	7.7	69.6	12.3
[6097]	0.17	2.56	7.69	3.09	1.25	0.25			411	6.2			3.38	1.7	15.1
[6097]	0.2	2.47	8.86	3.35	1.74	0.31			455	11				0	
[6097]	0.18	2.94	8.39	3.57	2.3	0.27			533	8.3			2.77	2.3	15.7
[6097]	0.19	2.91	8.49	3.47	2.15	0.3			512	6.6			2.85	1.4	17.6
[6097]	0.2	2.8	8.72	3.39	1.99	0.31			580	10				3	
[6097]	0.2	3.23	9.23	3.41	2.05	0.3			506	4.9			3.1	3.1	18.5
[6097][15430]	0.17	2.56	8.08	3.67	1.88	0.32			434	5.9			4.65	2.7	17.3
[6097][15430]	0.15	2.28	8.04	3.97	1.73	0.24			458	7.2			4.62	5.2	15.7
[6097][15430]	0.18	3.17	8.43	3.59	1.67	0.22			454	6.2			2.95	2.1	15.3
[6097][15430]	0.19	2.68	8.28	3.81	1.77	0.27			307	2.5	13	21	5.63	2.1	20
[6097][15430]	0.2	3.09	9.23	3.35	1.9	0.26			534	18				2	
[6097][15430]	0.19	3.2	8.94	3.48	2.14	0.24			515	8.9			2.73	2.9	18.2
[6097][15430]	0.19	2.37	7.79	3.8	2.38	0.25			602	9.2			3.27	3	13.8
[6097][15430]	0.21	3.9	9.58	3.2	1.98	0.29			431	16			2.94	2.6	14.8
[6097][15430]	0.18	2.44	8.13	3.76	2.25	0.31			522	8.2			4.06	0.8	19.8
[6097][15430]	0.18	3.51	9.41	3.36	1.98	0.25			531	12.6			2.85	4.6	24.3
[6097][18645][15430]	0.17	3.41	8.44	3.43	1.71	0.21			451	11.2			2.63	4.5	14.8
[6097][18645][15430]	0.18	3.17	8.75	3.61	1.61	0.27			445	5.5			3.65	1.6	19.6
[6097][18645][15430]	0.2	2.75	8.5	3.77	1.71	0.28			478	5.6			4.17	1.6	13
[6097][18645][15430]	0.2	3.22	8.86	3.45	2.05	0.29			535	9.7			3.25	4.1	18.9
[6098]	0.24	2.58	6.97	4.62	3.89	0.38			1764	5	112		6.7	5	
[6098][3734][3500]	0.25	4.53	10.6	3.46	2.64	0.42			1207	5	156		4.2	7	
[6098][3740][3500]	0.19	9.45	13.9	2.64	1.79	0.39			1136	232	90		7	49	
[6098][7092]	0.24	5.53	10.9	2.9	2.35	0.31			1057	24	139		6.4	20	11.5
[6098][7092]	0.24	3.89	9.54	3.48	2.72	0.37			1472	5	135		4.7	4	33

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[4927]	82	250	60		37	70	330	27.6	59.5	27.6	6.13	1.27	1	3.88		11.7
[4927]	61	314	169		22	83	121	19.1	40.4	18.2	3.8	1.15	0.56	2.1		7.57
[4927]	30	341	274		26	96	78	12.8	29	16.6	4.19	1.2	0.7	2.49		4.76
[4927]	55	351	164		18	83	125	18.5	37.7	16.7	3.56	1.02	0.5	2.13		7.76
[5646][3092]	39	279	318		35	100	179	19.6	31.1	17.3	4.33	1.24	0.96	2.43	0.48	4.81
[5646][3092]	30	412	365		31	93	129	14.9	32.7	18.5	4.56	1.55	0.84	2.88	0.44	3.52
[6097]	38.7	533	194		21.2		95	15.6	31.5	16.4	3.92	1.18	0.54	2	0.34	5.35
[6097]	47	594	182				103									
[6097]	58.1	600	229		22.7		89	18.7	36.2	17.1	3.93	1.14	0.52	1.93	0.33	6.91
[6097]	52.7	586	207		22.6		88	18.4	36.2	16.8	4.19	1.27	0.57	1.99	0.33	6.86
[6097]	52	591	187				100									
[6097]	47.4	565	220		22.1		87	18.4	36.4	18.8	4.37	1.37	0.6	2.16	0.32	6.77
[6097][15430]	47.7	520	189		21.1		113	19.2	38	18.7	4.35	1.34	0.59	2.09	0.33	6.16
[6097][15430]	49	573	239		22.3		112	20	41.1	19.3	4.4	1.42	0.62	2.1	0.34	6.2
[6097][15430]	38.3	519	213		20.9		92	14.4	28.2	14.7	3.33	1.19	0.51	1.87	0.33	5.52
[6097][15430]	20.7	531	169		24.7	75	133	14.8	33.8	21	4.97	1.45	0.77	2.59	0.43	7.14
[6097][15430]	52	575	193				94									
[6097][15430]	48.7	569	272		22.4		85	15.6	31.6	16.2	4.15	1.31	0.61	2.1	0.35	6.68
[6097][15430]	64.5	614	186		22.3		99	20.3	40.4	18.6	4.4	1.37	0.53	2.17	0.35	8.91
[6097][15430]	45.7	603	249		22.8		83	17.3	34.6	18	4.33	1.36	0.63	2.01	0.33	6.16
[6097][15430]	52.4	546	156		23.9		107	20.2	39	19.9	4.57	1.38	0.62	2.35	0.38	8.04
[6097][15430]	49.4	555	249		22.5		83	16.8	33.1	17	4.17	1.31	0.57	2.02	0.31	6.56
[6097][18645][15430]	46.1	496	243		17.9		88	14.4	29.1	13.7	3.06	1	0.47	1.7	0.28	6.27
[6097][18645][15430]	40.6	552	199		22.3		99	16.1	33.5	18	4.24	1.39	0.58	2.16	0.35	5.98
[6097][18645][15430]	42.5	532	200		24.1		107	16.5	35.3	17.6	4.22	1.4	0.62	2.24	0.39	5.92
[6097][18645][15430]	50.8	584	211		22.3		91	19	36.5	19.1	4.27	1.4	0.64	2.12	0.34	6.68
[6098]	123	987	130		31	87	149	42.7	75.5	32.1	6.52	1.78	0.9	2.73	0.42	12.4
[6098][3734][3500]	90	1155	297		26	147	103	37.5	71.7	33.9	6.7	1.93	0.82	2.33	0.3	10.2
[6098][3740][3500]	75	972	294		23	33	100	38.9	85.4	35.7	6.06	1.69	0.8	1.44	0.27	9.5
[6098][7092]	79	895	298		27	94	91	27	52.8	25.6	5.44	1.62	0.83	2.19	0.34	6.8
[6098][7092]	84	957	247		29	135	106	28.2	54.6	24.7	5.24	1.71	0.76	2.35	0.37	7.93

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[4927]	2.28		8.2	12			0.70578						
[4927]	1.36		2.76	13			0.70594						
[4927]	0.99		2.38	27			0.70602						
[4927]	1.67		3.23	15			0.7061						
[5646][3092]	1.21	0.79	3.77	40.8	3.28	44.8	0.70534						
[5646][3092]	0.97	0.51	2.99	43.6	2	46.2	0.70565						
[6097]	1.06	0.25	2.23			18.3	0.70516		0.5128				
[6097]						13	0.70554		0.5127				
[6097]	1.44	0.2	2.13			20	0.70563		0.5127		18.76	15.678	39.098
[6097]	1.22	0.21	2.01			18.8	0.70566		0.5127				
[6097]						18	0.70573		0.5127				
[6097]	1.51	0.24	2.24			20.4	0.70583		0.5127		18.78	15.699	39.175
[6097][15430]	1.53	0.36	2.64			17	0.70501		0.5127		18.74	15.689	39.11
[6097][15430]	1.42	0.36	2.66			22.2	0.70517		0.5127		18.781	15.715	39.215
[6097][15430]	1.16	0.23	2.31			19.1	0.70528		0.5128		18.771	15.709	39.17
[6097][15430]	1.09	0.41	3.62		1.83	13	0.70535		0.5128				
[6097][15430]						14	0.70556		0.5127				
[6097][15430]	1.49	0.2	2.12			21.9	0.70566		0.5127		18.763	15.688	39.13
[6097][15430]	1.71	0.25	2.45			16.9	0.7057		0.5127		18.766	15.684	39.117
[6097][15430]	1.02	0.21	2.14			27.8	0.70571		0.5127		18.727	15.671	39.038
[6097][15430]	1.43	0.34	2.74			14.2	0.70574		0.5127		18.773	15.714	39.195
[6097][15430]	1.37	0.21	2.06			23.6	0.70574		0.5127		18.769	15.685	39.125
[6097][18645][15430]	1.31	0.21	2.01			21.4	0.70526		0.5127		18.769	15.693	39.13
[6097][18645][15430]	1.28	0.31	2.45			18.7	0.70528		0.5128		18.759	15.695	39.139
[6097][18645][15430]	1.29	0.34	2.54			16.3	0.70539		0.5128		18.755	15.692	39.134
[6097][18645][15430]	1.46	0.25	2.32			19.8	0.70564		0.5127		18.771	15.697	39.156
[6098]	3.42	0.37	3.58	9	6.78	36	0.70464		0.5127		18.893	15.599	38.94
[6098][3734][3500]	2.4	0.35	2.53	19	4.74	43	0.70494		0.5126		18.925	15.635	39.07
[6098][3740][3500]	2.17	0.43	2.36	49	3.55	59	0.70502		0.5127		18.996	15.64	39.173
[6098][7092]	1.69	0.29	2.53	29	3.39	51	0.70471		0.5127		18.927	15.633	39.033
[6098][7092]	2.14	0.41	2.73	17	2.98	45	0.70473		0.5127		18.904	15.636	39.055

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
[6098][7092]	
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AS-2	Banda Arc Ambon Basalts

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
[6098][7092]	Turner et al., 2003; Turner, Black, and Berlo, 2004	51.65	0.79	18.81	
[6098][7092]	Turner et al., 2003; Turner, Black, and Berlo, 2004	51.38	0.79	19.01	
[6098][7092]	Turner et al., 2003; Turner, Black, and Berlo, 2004	49.21	0.85	19	
[8458]	Luhr and Haldar, 2006	51.5	0.68	18.12	2.71
[8458]	Luhr and Haldar, 2006	51.27	0.83	21.42	1.8
[8458]	Luhr and Haldar, 2006	54.53	1.31	17.18	2.98
[8458]	Luhr and Haldar, 2006	51.2	0.82	21.75	2.58
[8458]	Luhr and Haldar, 2006	55.98	1.18	17.45	5.81
[8458]	Luhr and Haldar, 2006	52.6	0.95	21.46	6.33
[8822]	Debaille et al., 2006	54.1	0.9	18.8	
[8822]	Debaille et al., 2006	55.2	0.62	19	
[8822]	Debaille et al., 2006	52.7	0.84	18.3	
[8822]	Debaille et al., 2006	53.7	0.78	19.1	
[8822]	Debaille et al., 2006	55.1	0.83	18.7	
[8822]	Debaille et al., 2006	55.3	0.85	18.7	
[8822]	Debaille et al., 2006	54.3	0.83	18.7	
[8822]	Debaille et al., 2006	54.1	0.83	18.6	
[8822]	Debaille et al., 2006	54.6	0.79	19.2	
[8822]	Debaille et al., 2006	48.3	1.01	19.9	
[8822]	Debaille et al., 2006	48.5	0.9	19.6	
[8822]	Debaille et al., 2006	52	0.86	19	
[8822]	Debaille et al., 2006	52.2	0.87	19	
[8822]	Debaille et al., 2006	51.6	0.94	18.4	
[8822]	Debaille et al., 2006				
[8822]	Debaille et al., 2006				
[8822]	Debaille et al., 2006	55.2	0.73	19.5	
[8822]	Debaille et al., 2006	54.9	0.73	19.2	
[8822]	Debaille et al., 2006	53.6	0.77	19	
[8822]	Debaille et al., 2006				
[8822]	Debaille et al., 2006				
[8822]	Debaille et al., 2006	49.3	0.86	19.2	
AS-2	Alloway et al., 2004	51.75	0.96	17.53	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
[6098][7092]	0.23	3.45	8.38	4.08	3	0.39			1578	5	123		7	5	19.5
[6098][7092]	0.25	3.43	8.74	3.94	3.05	0.39			1746	5	125		5	8	20.8
[6098][7092]	0.22	4.01	9.88	3.45	3.02	0.4			1298	5	153		5.5	10	17.4
[8458]	0.16	8.16	10.4	2.78	0.34	0.09			61	309	55		0.48	130	2.36
[8458]	0.14	3.96	11.3	2.94	0.41	0.1			75	51	78		0.53	28	2.01
[8458]	0.19	3.98	8.49	3.88	0.59	0.14			109	39	133		0.87	20	3.47
[8458]	0.14	3.89	11.5	2.97	0.4	0.1			74	49	87		0.53	26	2.02
[8458]	0.19	3.43	7.62	4.28	0.73	0.18			136	12	79		1.14	13	3.97
[8458]	0.14	2.8	10.5	3.21	0.43	0.12			99	21	33		0.74	16	1.91
[8822]	0.17	3.46	8.74	3.44	1.75	0.29									
[8822]	0.17	2.68	7.61	3.32	1.57	0.22									
[8822]	0.2	4	9.01	2.98	1.4										
[8822]	0.17	3.15	9.01	3.33	1.54	0.26									
[8822]	0.18	2.65	8.25	3.56	1.86	0.27									
[8822]	0.16	2.76	8.39	3.5	1.76	0.27									
[8822]	0.18	2.73	8.43	3.71	1.87	0.29									
[8822]	0.19	2.75	7.99	3.6	1.81	0.28									
[8822]	0.19	2.84	8.64	3.56	1.71	0.27									
[8822]	0.16	3.77	10.3	2.68	1	0.27									
[8822]	0.19	4.82	9.16	2.7	1.15	0.25									
[8822]	0.18	3.65	9.27	3.21	1.63	0.27									
[8822]	0.18	3.51	9.4	3.33	2.09	0.24									
[8822]	0.21	4.06	9.75	3.3	1.8										
[8822]															
[8822]															
[8822]	0.19	2.47	8.52	3.68	2.15	0.29									
[8822]	0.19	2.5	8.52	3.65	2.12	0.3									
[8822]	0.18	2.67	8.77	3.41	2.05	0.32									
[8822]															
[8822]															
[8822]	0.15	4.51	10.2	2.93	1.44	0.24									
AS-2		7.04	11.2	2.76	0.43	0.19			92						

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
[6098][7092]	104	970	211		28		127	35.9	64.6	30	6.03	1.77	0.87	2.5	0.4	10.2
[6098][7092]	100	1006	173		29	95	110	33.6	64.2	29.4	6.15	1.75	0.89	2.69	0.41	8.82
[6098][7092]	95	1146	279		26	46	113	39.3	74.3	36.6	7.2	2.01	0.88	2.15	0.34	10.3
[8458]	5.3	179	139		20	74	51	3.15	7.96	6.1	2.16	0.84	0.52	2.04	0.33	0.62
[8458]	10.4	215	181		23	71	57	4.67	11.2	8	2.64	0.98	0.61	2.28	0.37	1.31
[8458]	14	189	295		35.3	102	86	6.67	16	11.8	3.95	1.42	0.91	3.5	0.57	1.58
[8458]	10.1	217	173		22.7	70	56	4.62	11.1	7.9	2.65	0.97	0.6	2.28	0.37	1.33
[8458]	19.6	191	216		37.5	90	100	8.87	20.9	14.2	4.56	1.47	0.98	3.67	0.58	2.72
[8458]	11.5	227	195		26.1	71	69	6.52	15.1	10.3	3.24	1.17	0.7	2.58	0.41	2
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AS-2	9.2	217														

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
[6098][7092]	2.8	0.42	3.45	14	5.64	66	0.70474		0.5127		18.85	15.6	38.912
[6098][7092]	2.61	0.35	2.97	12	6.35	49	0.70479		0.5127		18.87	15.578	38.87
[6098][7092]	2.25	0.33	2.72	16	5.6	48	0.70497		0.5126		18.939	15.669	39.16
[8458]	0.13	0.04	1.52	34.3	0.08	29	0.7038		0.513		18.212	15.547	38.334
[8458]	0.21	0.05	1.73	30.6	0.35	24	0.70395		0.5129		18.28	15.559	38.41
[8458]	0.28	0.07	2.56	43.3	0.53	34	0.70395		0.5129		18.288	15.56	38.447
[8458]	0.2	0.04	1.64	31	0.34	23	0.70396		0.5129		18.284	15.562	38.446
[8458]	0.41	0.09	2.93	34.1	0.65	27	0.70405		0.5129		18.276	15.561	38.425
[8458]	0.3	0.06	2.05	28.8	0.42	22	0.70405		0.5128		18.196	15.568	38.348
[8822]							0.70504		0.5128		18.7383	15.6813	39.0935
[8822]							0.70512		0.5128		18.757	15.684	39.1172
[8822]							0.70513		0.5128		18.7606	15.6881	39.1332
[8822]							0.70516		0.5127		18.7513	15.6805	39.1078
[8822]							0.70518		0.5128		18.7544	15.6843	39.1224
[8822]							0.70522		0.5128		18.7595	15.6847	39.1257
[8822]							0.70534		0.5128		18.7374	15.6778	39.0906
[8822]							0.70536		0.5128		18.7408	15.676	39.0845
[8822]							0.70541		0.5127		18.7756	15.6886	39.1518
[8822]							0.70544		0.5127		18.8099	15.6969	39.2105
[8822]							0.70548		0.5127		18.7921	15.6908	39.1682
[8822]							0.70553		0.5127		18.7858	15.691	39.1684
[8822]							0.70565		0.5127		18.7563	15.6854	39.1231
[8822]							0.70565		0.5127		18.7467	15.6787	39.1015
[8822]							0.70567		0.5127		18.7613	15.691	39.144
[8822]							0.70569		0.5127		18.7674	15.696	39.1579
[8822]							0.70575		0.5127		18.7592	15.6835	39.1214
[8822]							0.70576		0.5127		18.7601	15.6849	39.1341
[8822]							0.70576		0.5127		18.7677	15.6907	39.1519
[8822]							0.70582		0.5127		18.818	15.6972	39.2165
[8822]							0.70582		0.5127		18.811	15.6937	39.2008
[8822]							0.70588		0.5127		18.8183	15.6975	39.2176
AS-2					0.25		0.70423						

Sample No./ Reference	Field Notes
Sunda-Banda Arc Volcanics	
AS-9	Banda Arc Ambon Basalts
N-1	Banda Arc Banda Islands
PAG-2	Banda Arc Manuk
PAG-4	Banda Arc Manuk
PAJ-1	Banda Arc Manuk
PAJ-3	Banda Arc Manuk
PAJ-5	Banda Arc Manuk
Sumatra	
75212	Lampung and Tarahan Formation
75221	Lampung and Tarahan Formation
75222	Lampung and Tarahan Formation
[4583]	
75231	Ranau Formation
Sinabung	
TS2	Sinabung
TS5	Sinabung
TS7	Sinabung
TS1	Sinabung
LT_14_010	Sinabung
LT_14_011	Sinabung
LT_14_012	Sinabung
LT_14_013	Sinabung
LT_14_014	Sinabung
Toba Plutons	
76101	Bukit Batu Granite
76100	Bukit Batu Granite
Youngest Toba Tuff	
21A5G	YTT
20A2G	YTT
6A2-G	YTT Glass

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Sunda-Banda Arc Volcanics					
AS-9	Alloway et al., 2004	50.37	0.63	17.96	
N-1	Whitford and Jezek, 1977	52.21	1.01	18.22	
PAG-2	Whitford and Jezek, 1977	57.32	0.78	17.29	
PAG-4	Whitford and Jezek, 1977	57.42	0.8	17.63	
PAJ-1	Whitford and Jezek, 1977	56.81	0.82	17.71	
PAJ-3	Whitford and Jezek, 1977	56.84	0.78	17.51	
PAJ-5	Whitford and Jezek, 1977	57.2	0.79	17.46	
Sumatra					
75212	Gasparon and Varne, 1995	75.37	0.13	13.19	1.33
75221	Gasparon and Varne, 1995	71.72	0.17	13.49	0.82
75222	Gasparon and Varne, 1995	70.8	0.17	14.12	1.18
[4583]	Turner and Foden, 2001	56.08	0.68	16.32	
75231	Gasparon and Varne, 1995	72.36	0.2	13.56	1.81
Sinabung					
TS2	Jones, 1989 (Doctoral Thesis)	55.11	0.81	18.06	8.26
TS5	Jones, 1989 (Doctoral Thesis)	59.22	0.69	17.48	7.30
TS7	Jones, 1989 (Doctoral Thesis)	57.20	0.81	17.86	7.83
TS1	Jones, 1989 (Doctoral Thesis)	72.95	0.24	14.83	2.11
LT_14_010	This Study	54.27	1.20	16.41	
LT_14_011	This Study	58.37	0.90	17.24	
LT_14_012	This Study	58.89	0.79	18.65	
LT_14_013	This Study	57.38	0.71	18.58	
LT_14_014	This Study	60.81	0.76	16.94	
Toba Plutons					
76101	Gasparon and Varne, 1995	61.05	0.51	17.32	5.42
76100	Gasparon and Varne, 1995	57.75	0.59	16.04	10.87
Youngest Toba Tuff					
21A5G	Chesner, 1988 (Doctoral Thesis)	75.73	0.09	14.45	1.24
20A2G	Chesner, 1988 (Doctoral Thesis)	77.54	0.04	12.91	1.1
6A2-G	Chesner, 1988 (Doctoral Thesis)	77.6	0.08	12.78	0.84

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Sunda-Banda Arc Volcanics															
AS-9		7.42	14.8	1.65	0.32	0.14			80.6						
N-1		4.85	10.8	2.69	0.31	0.18			106						
PAG-2		4.9	8.26	3.16	0.91	0.2			301						
PAG-4		4.26	8.49	3.19	1.01	0.18			248						
PAJ-1		4.63	8.71	3.08	0.94	0.2			234						
PAJ-3		4.72	8.67	3.08	0.92	0.19			236						
PAJ-5		4.69	8.45	3.17	1.03	0.16			251						
Sumatra															
75212	0.03	0.02	0.82	4.05	3.93	0			477	3			9	2	16
75221	0.01	0.21	1.5	3.05	4.01	0.02			870	2			12	1	9
75222	0.12	0.26	1.03	3.23	4.06	0.05			596	2			12	1	15
[4583]	0.15	6.44	7.95	2.77	1.5	0.13			270	323			3	89	
75231	0.08	0.41	1.89	3.88	3.32	0.07			432	3			6	3	13
Sinabung															
TS2	0.15	4.55	8.70	2.71	1.49	0.15			336	45	28	18	8.5	14	11
TS5	0.15	2.80	7.27	3.06	1.89	0.14			434	18	16	17	8.4	6	13
TS7	0.14	3.48	7.66	2.95	1.92	0.15			456	20	14	17	8.5	6	14
TS1	0.09	0.43	2.44	3.27	3.58	0.06			732	9	1	13	12.8	4	30
LT_14_010	0.18	5.70	8.20	2.48	1.59	0.21			388	103	13	18	10	17	12
LT_14_011	0.18	3.37	7.32	2.95	2.00	0.16			394	6	7	15	9	5	14
LT_14_012	0.15	2.65	7.42	2.64	1.66	0.13			338	4	18	14	6	7	17
LT_14_013	0.16	2.94	8.36	3.04	1.59	0.11			347	5	18	16	6	5	14
LT_14_014	0.16	2.63	6.68	3.11	2.32	0.16			446	1	7	14	9	5	17
Toba Plutons															
76101	0.18	0.55	2.19	3.64	7.38	0.12			43	1			41	1	36
76100	0.52	0.35	3.15	4.06	5.05	0.06			45	1			35	4	27
Youngest Toba Tuff															
21A5G	0.05	0.22	0.99	2.75	4.46	0.02	424		793		129		19	2	
20A2G	0.09	0.17	0.58	2.3	5.26	0.01	678		142		62		31	7	
6A2-G	0.06	0.2	0.8	2.6	5.03	0.01	484		700		98		21	3	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Sunda-Banda Arc Volcanics																
AS-9	4.9	241														
N-1	8.8	277														
PAG-2	30.8	198														
PAG-4	36.1	212														
PAJ-1	31.2	202														
PAJ-3	30.9	213														
PAJ-5	35.6	206														
Sumatra																
75212	135	83	6		17		126	26.7	43.7	15.6	2.85	0.52	0.45	1.9	0.27	17.5
75221	213	302	21		42		154	46	93.6	41.6	8.32	1.49	1.18	4.38	0.63	10.9
75222	148	165	4		24		160	27.1	55.6	22.7	4.36	0.88	0.63	2.49	0.37	11.8
[4583]	50	364	199		23		107	14.6	30	16.5	3.83	0.99	0.61	2.24	0.36	5.88
75231	142	153	17		13		113	19.6	38.9	15.8	2.39	0.42	0.47	1.73	0.22	18.5
Sinabung																
TS2	52.5	334	196		24.3	62	102									
TS5	70.3	341	125		27.9	50	137									
TS7	70	377	166		27.6	61	145	24.3	46.8	23.3	4.61	1.22	0.76	2.72	0.43	7.81
TS1	137	249	11		17.9	44	165									
LT_14_010	54	376	248		30	95	153	30.1	62.9	30.9	6.8	1.6	1.0	2.8	0.4	9.6
LT_14_011	74	358	178		26	73	122	20.3	39.1	18.4	4.4	1.3	0.8	2.9	0.5	9.2
LT_14_012	55	339	156		25	64	113	20.5	41.1	19.0	4.4	1.2	0.7	2.6	0.4	7.2
LT_14_013	56	363	163		25	57	114	19.6	39.2	18.1	4.1	1.2	0.7	2.6	0.4	6.8
LT_14_014	86	356	137		29	60	147	27.3	53.8	24.1	5.3	1.3	0.9	3.0	0.5	10.5
Toba Plutons																
76101	181	70	1		31		956	865	1240	393						151
76100	113	32	1		23		1535	718	1104	375						184
Youngest Toba Tuff																
21A5G	183	74	1		25	52	115	58	83							
20A2G	300				38	46	73	17	27							
6A2-G	212	61	1		27	39	88	34	68							

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Sunda-Banda Arc Volcanics													
AS-9					0.27		0.70435						
N-1					0.52		0.70451						
PAG-2					1.6		0.70512						
PAG-4					2.5		0.70511						
PAJ-1					1.5		0.70518						
PAJ-3					1.7		0.70528						
PAJ-5					2.5		0.70519						
Sumatra													
75212	4	1.08	3.04	2	3.25		0.70453		0.5128		18.596	15.623	38.757
75221	3	0.9	2.75	4			0.70494		0.5127		18.598	15.63	38.77
75222	5	0.96	3.73	2	4.08		0.70495		0.5127		18.605	15.636	38.805
[4583]	1.31	0.28	2.91	22	1.57		0.70504		0.5126		18.666	15.659	38.941
75231	4	1.46	2.95	4	6.9		0.70652		0.5126		18.817	15.701	39.204
Sinabung													
TS2							0.70906	0.456	0.5122				
TS5							0.70987	0.598	0.5122				
TS7	1.28	0.51	3.8	20.3	1.91	14.1	0.71075	0.538	0.5122				
TS1							0.71407	1.6	0.5121				
LT_14_010	1.0	0.6	4.2	29.4	1.3		0.71245						
LT_14_011	1.1	0.6	3.5	18.9	1.8		0.71011						
LT_14_012	0.9	0.4	3.1	16.0	1.8		0.71044						
LT_14_013	0.9	0.4	3.1	15.9	1.8		0.7093						
LT_14_014	1.4	0.6	4.0	14.2	2.6		0.7104						
Toba Plutons													
76101	8			19			0.73287		0.5122		19.289	15.788	42.427
76100	11			18			0.74036		0.5122		19.765	15.812	44.815
Youngest Toba Tuff													
21A5G							0.71342						
20A2G							0.7135						
6A2-G							0.7135						

Sample No./ Reference	Field Notes
Youngest Toba Tuff	
TT72	A
90A9	YTT
21A5	YTT
5A3	YTT
36A3G	YTT
57A1	YTT
5B1	YTT
6A2	YTT
20A2	YTT
TT1A	A
36A3	YTT
[4583]	
22A2G	YTT
22A2	YTT
TT24	B
TT25	B
100	YTT
[2608]	LAKE TOBA
[4583]	
TT12	B
94A2	YTT
97A7	YTT
Middle Toba Tuff	
8-G	MTT
99-G	MTT
44A	MTT
8	MTT
99	MTT
7-G	MTT
7	MTT
66	MTT

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Youngest Toba Tuff					
TT72	Jones, 1989 (Doctoral Thesis)	69.77	0.38	15.18	3.55
90A9	Chesner, 1988 (Doctoral Thesis)	73.21	0.27	14.07	2.81
21A5	Chesner, 1988 (Doctoral Thesis)	69.21	0.5	15.74	4.13
5A3	Chesner, 1988 (Doctoral Thesis)	69.06	0.36	17.67	3.39
36A3G	Chesner, 1988 (Doctoral Thesis)	76.61	0.05	13.62	1.12
57A1	Chesner, 1988 (Doctoral Thesis)	69.49	0.54	15.04	3.79
5B1	Chesner, 1988 (Doctoral Thesis)	74.19	0.08	15.81	1.41
6A2	Chesner, 1988 (Doctoral Thesis)	72.1	0.3	14.57	2.96
20A2	Chesner, 1988 (Doctoral Thesis)	76.38	0.08	13.27	1.47
TT1A	Jones, 1989 (Doctoral Thesis)	73.94	0.23	13.54	2.28
36A3	Chesner, 1988 (Doctoral Thesis)	73.57	0.17	14.64	2.06
[4583]	Turner and Foden, 2001	73.34	0.26	13.65	
22A2G	Chesner, 1988 (Doctoral Thesis)	77.26	0.05	13.38	0.87
22A2	Chesner, 1988 (Doctoral Thesis)	74.96	0.17	14.22	1.9
TT24	Jones, 1989 (Doctoral Thesis)	75.18	0.13	13.46	1.44
TT25	Jones, 1989 (Doctoral Thesis)	74.1	0.15	14.9	1.82
100	Chesner, 1988 (Doctoral Thesis)	71.08	0.4	14.94	3.15
[2608]	Whitford, 1975	70.6			
[4583]	Turner and Foden, 2001	74.64	0.14	13.55	
TT12	Jones, 1989 (Doctoral Thesis)	74.64	0.14	13.55	1.66
94A2	Chesner, 1988 (Doctoral Thesis)	75.31	0.18	13.19	1.76
97A7	Chesner, 1988 (Doctoral Thesis)	78.05	0.14	11.9	1.57
Middle Toba Tuff					
8-G	Chesner, 1988 (Doctoral Thesis)	76.94	0.1	12.63	1.2
99-G	Chesner, 1988 (Doctoral Thesis)	76.52	0.11	13.36	1.07
44A	Chesner, 1988 (Doctoral Thesis)	72.53	0.3	15.01	2.33
8	Chesner, 1988 (Doctoral Thesis)	74.16	0.21	13.77	2.1
99	Chesner, 1988 (Doctoral Thesis)	74.28	0.26	14.11	1.89
7-G	Chesner, 1988 (Doctoral Thesis)	75.23	0.06	13.98	1.43
7	Chesner, 1988 (Doctoral Thesis)	76.19	0.13	12.98	1.58
66	Chesner, 1988 (Doctoral Thesis)	77.87	0.12	13.46	0.76

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Youngest Toba Tuff															
TT72	0.07	0.89	3.1	3.36	3.59	0.09		2	866	7	5	17	14	<2	17
90A9	0.08	0.61	1.75	2.4	4.78	0.02	613		424		16		27		
21A5	0.09	0.98	3.16	3.02	3.1	0.06	678		912	7	5		16	1	
5A3	0.08	0.76	2.3	2.73	3.62	0.03	650		837				19		
36A3G	0.08	0.16	0.67	2.76	4.92	0.01	620		227		108		28	6	
57A1	0.08	0.94	3.23	3.21	3.64	0.04	634		966		10		17		
5B1	0.08	0.22	0.78	2.57	4.84	0.02	614		209		11		30		
6A2	0.08	0.58	2.17	2.96	4.25	0.02	610		706		7		18	2	
20A2	0.08	0.22	0.89	2.41	5.18	0.01	595		258		9		26	2	
TT1A	0.07	0.42	1.91	2.92	4.71	0		6	624	<3	1	15	15	2	26
36A3	0.07	0.38	1.43	3.02	4.63	0.02	579		671		8		20	2	
[4583]	0.07	0.47	1.83	3	4.84	0.03			675	4			15	5	
22A2G	0.05	0.15	0.65	2.7	4.88	0.01	390		179		113		28	4	
22A2	0.07	0.36	1.23	2.77	4.3	0.02	514		399		13		27	2	
TT24	0.05	0.16	1.44	3.16	4.99	0		4	289	3	1	14	15	5	30
TT25	0.06	0.23	1.34	2.77	4.63	0		7	274	5	2	15	18	5	32
100	0.06	0.92	2.34	3.03	4	0.08	471		873	8	11		16	6	
[2608]					4.36										
[4583]	0.07	0.19	1.43	3.13	5.17	0			318	5			16	3	
TT12	0.07	0.19	1.43	3.13	5.17	0		7	318	5	1	16	16	3	31
94A2	0.07	0.31	1.39	3.09	4.68	0.02	579		354		17		21		
97A7	0.06	0.27	1.01	2.35	4.64	0.01	475		345		16		32	1	
Middle Toba Tuff															
8-G	0.05	0.18	0.82	2.98	5.08	0.02	367		820		23		19	6	
99-G	0.04	0.16	0.87	2.84	5.02	0.01	280		880		26		17	7	
44A	0.1	0.46	1.9	2.92	4.34	0.11	811		1380		3		11	4	
8	0.05	0.3	1.76	3.22	4.29	0.05	401		1147	10	12		14	6	
99	0.04	0.41	1.72	2.86	4.41	0.02	335		1197		15		17	3	
7-G	0.03	0.14	0.75	3.51	4.85	0.02	211		489		28		20	4	
7	0.02	0.21	1.02	3.56	4.3	0.01	184		611		18		28	3	
66	0.01	0.18	0.58	2.56	4.44	0.02	64		640		17		25	2	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Youngest Toba Tuff																
TT72	135	202	41	<2	31	40	197									
90A9	239	101	26		38	52	156	35	52							
21A5	106	232	62		27	60	213	65	93							
5A3	147	184	48		29	57	225	45	80							
36A3G	255	26			34	55	74	24	36							
57A1	126	224	48		29	60	186	46	89							
5B1	242	31				33	101	28								
6A2	161	171	35		27	53	162	45	83							
20A2	252	47	2		33	38	85	26	36							
TT1A	186	132	24	<2	28	35	152	41.9	74	26.7	4.91	0.7	0.75	2.93	0.48	23.3
36A3	182	95	18		27	42	111	37	64							
[4583]	190	117	28		35		159	53	90.9	35.6	5.95	0.72	0.88	3.18	0.51	26.8
22A2G	266	24			33	50	68	19	33							
22A2	193	66	13		28	42	102	29	51							
TT24	226	85	14	3	37	25	114									
TT25	218	71	16	4	45	33	139	32.8	56.6	24.1	5.31	0.47	0.99	4.56	0.73	32.7
100	126	186	42		22	46	148	33	79							
[2608]	144	116														
[4583]	234	84	17		38		114	34.2	62.7	24	4.51	0.49	0.85	3.76	0.58	28.5
TT12	234	84	17	2	38	33	114	34.2	62.7	24	4.51	0.49	0.85	3.76	0.58	30.9
94A2	227	82	7			41	97	30	49							
97A7	222	73	7		33	37	125	22	50							
Middle Toba Tuff																
8-G	171	54			24	32	81	33	73							
99-G		60			23	40	89	32	81							
44A	127	161	22		20	53	143	44	120							
8	128	139	21		22	43	133	45	101							
99	131	146	21		22	45	123	35	100							
7-G		39			31	42	76	23	49							
7	145	66	4		26	36	114	28	62							
66	166	44			23	20	85	61	67							

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Youngest Toba Tuff													
TT72							0.71351	1.936	0.5122	0.1008			
90A9							0.71355						
21A5				8			0.71357						
5A3				7			0.71365						
36A3G							0.7137						
57A1				7			0.7137						
5B1							0.71373						
6A2				6			0.71377						
20A2				3			0.71378						
TT1A	4.11	1.2	4.24	4.3	5.46	2.5	0.71381	4.081	0.5122	0.113			
36A3				4			0.71381						
[4583]	3.87	1.23	4.61	5	5.96		0.71382		0.5121		18.899	15.738	39.505
22A2G							0.71383						
22A2				4			0.71385						
TT24							0.71387	7.701	0.5121	0.113			
TT25	5.74	1.95	4.37	3.3	9.48	1.6	0.7139	8.893	0.5121	0.1354			
100				6			0.71391						
[2608]							0.71392						
[4583]	4.83	1.68	3.84	3	8.12		0.71394		0.5121		18.972	15.828	39.803
TT12	5.67	1.68	3.84	2.8	8.12	1.4	0.71394	8.068	0.5121	0.1155			
94A2				3			0.71395						
97A7							0.71402						
Middle Toba Tuff													
8-G							0.71475						
99-G							0.7148						
44A							0.71482						
8				6			0.71489						
99				5			0.71492						
7-G							0.71494						
7							0.71515						
66				4			0.71523						

Sample No./ Reference	Field Notes
Middle Toba Tuff	
41A	MTT
Oldest Toba Tuff	
74A4	OTT
32B	OTT
16	OTT
74	OTT
74-6	OTT
15A	OTT
16-G	OTT
85	OTT
15A-G	OTT
85G	OTT
27	OTT
27-6	OTT
Haranggaol Dacitic Tuff	
9	HDT
Krakatau	
[16924]	SE SERTUNG ISLAND
[16924]	OLD CRATER RIM
[16924]	SE SERTUNG ISLAND
[16924]	WEST COAST CLIFF SERTUNG ISLAND, DEPOSIT FROM 1883 ERUPTION
[16924]	OLD CRATER RIM
[16924]	SHORELINE, FROM 1993 LAVA FLOW
[16924]	OLD CRATER RIM
[16924]	OLD CRATER RIM
[16924]	OLD CRATER RIM
[16924]	SE SERTUNG ISLAND
[16924]	OLD CRATER RIM
[16924]	OLD CRATER RIM
[16924]	OLD CRATER RIM

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Middle Toba Tuff					
41A	Chesner, 1988 (Doctoral Thesis)	75.42	0.14	13.35	2.17
Oldest Toba Tuff					
74A4	Chesner, 1988 (Doctoral Thesis)	67.23	0.5	16.1	3.93
32B	Chesner, 1988 (Doctoral Thesis)	73.03	0.26	13.75	2.59
16	Chesner, 1988 (Doctoral Thesis)	73.4	0.3	15.34	1.76
74	Chesner, 1988 (Doctoral Thesis)	69.94	0.38	14.8	3.51
74-6	Chesner, 1988 (Doctoral Thesis)	71.99	0.23	14.44	2.58
15A	Chesner, 1988 (Doctoral Thesis)	73.51	0.26	13.98	1.87
16-G	Chesner, 1988 (Doctoral Thesis)	75.32	0.11	14.89	0.85
85	Chesner, 1988 (Doctoral Thesis)	73.01	0.22	13.85	2.47
15A-G	Chesner, 1988 (Doctoral Thesis)	76.43	0.08	13.27	0.61
85G	Chesner, 1988 (Doctoral Thesis)	75.49	0.07	13.39	1.31
27	Chesner, 1988 (Doctoral Thesis)	72.41	0.21	14.12	2.52
27-6	Chesner, 1988 (Doctoral Thesis)	75.5	0.1	13.1	1.46
Haranggaol Dacitic Tuff					
9	Chesner, 1988 (Doctoral Thesis)	63.84	0.67	16.29	6.06
Krakatau					
[16924]	Gardner et al., 2013	69.21	0.68	14.49	
[16924]	Gardner et al., 2013	53.99	1.09	17.37	
[16924]	Gardner et al., 2013	65.65	0.65	13.97	
[16924]	Gardner et al., 2013	61.39	0.97	16.88	
[16924]	Gardner et al., 2013	54.88	1.048	17.65	
[16924]	Gardner et al., 2013	54.53	1.08	17.71	
[16924]	Gardner et al., 2013	60.16	1.05	18.53	
[16924]	Gardner et al., 2013	53.14	1.08	17.54	
[16924]	Gardner et al., 2013	55.05	1.08	17.64	
[16924]	Gardner et al., 2013	69.04	0.69	14.67	
[16924]	Gardner et al., 2013	55.16	1.09	17.67	
[16924]	Gardner et al., 2013	54.76	1.059	17.67	
[16924]	Gardner et al., 2013	65.43	0.756	16.31	

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Middle Toba Tuff															
41A	0.05	0.22	0.93	3.19	4.5	0.03	362		659		11		19	5	
Oldest Toba Tuff															
74A4	0.07	0.88	3.44	3.83	3.89	0.13	532		1048	12	16		14		
32B	0.06	0.57	2.03	3.45	4.19	0.07	453		609	2	9		19		
16	0.03	0.47	1.49	3.01	4.17	0.03	214		634	3	14		21	1	
74	0.07	0.79	2.81	3.5	4.08	0.12	518		736	13	12		17	2	
74-6	0.06	0.56	1.91	3.44	4.71	0.08	430		580		2		19	3	
15A	0.04	0.52	1.93	3.66	4.17	0.06	280		573		16		21	4	
16-G	0.02	0.18	0.82	2.9	4.88	0.03	167		321		30		16	7	
85	0.06	0.47	1.82	3.47	4.57	0.06	468		502		13		21	2	
15A-G	0.02	0.17	1.04	3.56	4.79	0.03	174		278		55		23	7	
85G	0.03	0.22	1.01	3.43	5.02	0.03	262		288		29		20	5	
27	0.07	0.58	1.94	3.1	4.99	0.06	533		519		25		21	2	
27-6	0.06	0.31	1.21	2.71	5.51	0.04	478		328		24		24	5	
Haranggaol Dacitic Tuff															
9	0.11	1.61	5.44	2.79	3	0.17	848		553	16	24		10	6	
Krakatau															
[16924]	0.12	0.93	2.51	5.02	2.32	0.14			371	0		15	11	0	12.5
[16924]	0.18	4.23	8.25	3.43	0.91	0.31			177	47		15	7	15	5.26
[16924]	0.12	0.92	2.52	5.08	2.25	0.14			381	0		14	12	0	11.9
[16924]	0.14	1.95	5.58	4.22	1.69	0.33			268	0		16	9	0	9.04
[16924]	0.168	3.98	8.19	3.45	0.927	0.266			181	29.6		0	4	13.2	4.49
[16924]	0.19	4.34	8.41	3.44	0.88	0.3			168	58		16	5	11	5.53
[16924]	0.06	1.06	4.89	4.4	0.76	0.35			323	0		17	8	3	7.71
[16924]	0.18	4.2	8.28	3.42	0.88	0.32			178	273		16	4	620	5.64
[16924]	0.18	4	8.04	3.63	0.97	0.32			194	238		16	5	570	5.66
[16924]	0.12	0.96	2.63	5.03	2.29	0.15			374	0		13	13	0	13.1
[16924]	0.18	4.15	8.2	3.59	0.93	0.31			195	53		15	5	2	5.51
[16924]	0.167	4.13	8.44	3.43	0.885	0.269			169	27		0	3.4	12.2	4.77
[16924]	0.084	1.25	4.45	4.62	1.944	0.185			311	0		62.4	6.3	0.3	3.73

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Middle Toba Tuff																
41A	141	57	4		23	46	89	27	63							
Oldest Toba Tuff																
74A4	134	242	52		31	63	227	58	109							
32B	176	125	25		30	52	129	35	66							
16	184	111	30		27	39	139	36	62							
74	150	180	41		30	55	177	38	80							
74-6		121	22		31	43	99	16	58							
15A	182	121	21		30	46	131	36	68							
16-G		50	6		38	29	85	20	39							
85	218	106	14		35	46	122	39	55							
15A-G		47			34	31	75	26	37							
85G		51			39	33	80	12	37							
27	215	113	17		33	46	132	25	59							
27-6		62	3		36	39	85	20	40							
Haranggaol Dacitic Tuff																
9	114	214	125		32	65	167	33	64							
Krakatau																
[16924]	67	187	41		54	66	290	27.6	64.7	36.1	8.52	1.93	1.44	6.05	0.93	8.48
[16924]	25	371	225		28	76	122	14.5	34.6	20.7	5.1	1.49	0.84	3.13	0.48	2.99
[16924]	63	189	38		55	66	273	26.5	61.9	34.4	8.1	1.87	1.38	5.61	0.87	8.16
[16924]	48	298	123		41	68	209	21.9	51.7	29.7	7.19	1.8	1.19	4.5	0.7	6.33
[16924]	22.8	383	197		32.8	72.3	123	15	35.4	21.5	5.29	1.53	0.87	3.06	0.49	3.03
[16924]	25	374	227		26	82	118	14.1	33.2	20.2	4.88	1.48	0.81	2.96	0.44	3.09
[16924]	15	438	154		43	46	192	19	44.8	26.4	6.46	2	1.08	4.11	0.61	4.4
[16924]	20	370	216		36	72	118	14.4	33.9	20.6	5.02	1.5	0.84	3.04	0.46	3.01
[16924]	26	367	213		33	76	129	14.8	35	21.3	5.2	1.5	0.85	3.12	0.49	3.28
[16924]	65	194	42		53	69	278	27.6	64.3	35.8	8.45	1.91	1.39	5.88	0.9	8.27
[16924]	25	371	219		29	85	123	14.5	34.4	21	5.11	1.49	0.85	3.14	0.48	3.15
[16924]	21.4	383	208		31.5	75	118	14.3	34.2	20.8	5.06	1.53	0.83	3	0.47	2.88
[16924]	50.2	270	62.4		51.6	20.6	240	23.4	55.5	31.5	7.68	1.8	1.28	5.01	0.76	6.93

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Middle Toba Tuff													
41A							0.71526						
Oldest Toba Tuff													
74A4							0.71335						
32B				6			0.7135						
16				6			0.71352						
74				7			0.71361						
74-6							0.71368						
15A				6			0.7137						
16-G							0.71373						
85				5			0.71378						
15A-G							0.71381						
85G							0.71383						
27				6			0.71435		0.5122				
27-6							0.71474						
Haranggaol Dacitic Tuff													
9				19			0.71365						
Krakatau													
[16924]	0.27	1.13	7.38			22	0.70435		0.5128				
[16924]	0.74	2.03	2.95			79	0.70438		0.5128				
[16924]	1.96	1.13	7.03			35	0.7044		0.5128				
[16924]	0.48	1.26	5.5			34	0.70441		0.5128				
[16924]	0.74	1.06	3.11			0	0.70442		0.5128				
[16924]	0.74	1.08	3.02			51	0.70442		0.5128				
[16924]	1.03	1.12	3.58			34	0.70442						
[16924]	0.77	0.3	2.97			28	0.70442		0.5128				
[16924]	0.79	0.25	3.26			26	0.70442		0.5128				
[16924]	1.99	1.48	7.03			32	0.70442		0.5128				
[16924]	0.76	0.76	3.4			42	0.70442		0.5128				
[16924]	0.68	0.21	3.01			0	0.70443		0.5128				
[16924]	1.4	0.38	4.83			0	0.70445		0.5127				

Sample No./ Reference	Field Notes
Krakatau	
[16924]	WEST COAST CLIFF PANJANG
[16924]	OLD CRATER RIM
[16924]	WEST COAST CLIFF SERTUNG ISLAND, DEPOSIT FROM 1883 ERUPTION
[16924]	OLD CRATER RIM
[16924]	OLD CRATER RIM
[16924]	WEST COAST CLIFF SERTUNG ISLAND
[16924]	WEST COAST CLIFF SERTUNG ISLAND, DEPOSIT FROM 1883 ERUPTION
[16924]	OLD CRATER RIM
[16924]	WEST COAST CLIFF PANJANG
[16924]	SE SERTUNG ISLAND
[16924]	OLD CRATER RIM
[16924]	WEST COAST CLIFF SERTUNG ISLAND
[16924]	OLD CRATER RIM
[16924]	WEST COAST CLIFF SERTUNG ISLAND, DEPOSIT FROM 1883 ERUPTION
[16924]	OLD CRATER RIM
[16924]	OLD CRATER RIM
Sibayak	
TT50	Sibayak
TT51A	Sibayak
TT53A	Sibayak
TT57	Sibayak
TT58	Sibayak
TT59	Sibayak
TT60	Sibayak
TT61	Sibayak
TT62	Sibayak
Toba's Post-Caldera Domes	
TT81	Sososaba
TT40	Sipisupisu
TT41	Sipisupisu
38-6	Dome Glass

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Krakatau					
[16924]	Gardner et al., 2013	68.2	0.71	14.71	
[16924]	Gardner et al., 2013	67.3	0.79	15.03	
[16924]	Gardner et al., 2013	68.65	0.61	14.53	
[16924]	Gardner et al., 2013	53.2	1.08	17.6	
[16924]	Gardner et al., 2013	67.79	0.8	15.33	
[16924]	Gardner et al., 2013	59.91	0.955	15.33	
[16924]	Gardner et al., 2013	70.34	0.6	14.07	
[16924]	Gardner et al., 2013	48.07	0.98	21.96	
[16924]	Gardner et al., 2013	63.55	0.6	13.36	
[16924]	Gardner et al., 2013	68.99	0.701	14.62	
[16924]	Gardner et al., 2013	68.93	0.705	15.22	
[16924]	Gardner et al., 2013	73.7	0.41	13.49	
[16924]	Gardner et al., 2013	65.33	0.88	15.07	
[16924]	Gardner et al., 2013	67.88	0.59	12.63	
[16924]	Gardner et al., 2013	66.65	0.99	18.69	
[16924]	Gardner et al., 2013	63.33	1.01	20.6	
Sibayak					
TT50	Jones, 1989 (Doctoral Thesis)	61.24	0.65	16.97	6.47
TT51A	Jones, 1989 (Doctoral Thesis)	61.03	0.67	17.45	7.00
TT53A	Jones, 1989 (Doctoral Thesis)	61.51	0.64	16.86	6.42
TT57	Jones, 1989 (Doctoral Thesis)	61.76	0.62	16.91	6.17
TT58	Jones, 1989 (Doctoral Thesis)	61.99	0.64	16.98	6.50
TT59	Jones, 1989 (Doctoral Thesis)	61.48	0.65	16.78	6.51
TT60	Jones, 1989 (Doctoral Thesis)	59.48	0.72	17.08	7.17
TT61	Jones, 1989 (Doctoral Thesis)	61.51	0.57	16.37	5.83
TT62	Jones, 1989 (Doctoral Thesis)	62.39	0.56	16.22	5.48
Toba's Post-Caldera Domes					
TT81	Jones, 1989 (Doctoral Thesis)	60.11	0.74	16.55	7.15
TT40	Jones, 1989 (Doctoral Thesis)	52.89	1.14	18.53	10.36
TT41	Jones, 1989 (Doctoral Thesis)	52.94	1.15	18.49	10.33
38-6	Chesner, 1988 (Doctoral Thesis)	75.07	0.21	13.14	1.98

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Krakatau															
[16924]	0.14	1.03	2.8	5.06	2.23	0.16			376	0		15	13	0	11.4
[16924]	0.1	1.09	3.48	4.85	1.47	0.18			298	0		16	11	10	8.57
[16924]	0.11	0.92	2.12	4.71	2.77	0.11			424	0		17	15	0	11.7
[16924]	0.18	4.25	8.43	3.45	0.9	0.3			173	266		17	6	616	5.21
[16924]	0.1	1.15	3.5	4.89	1.56	0.18			335	0		14	9	0	8.66
[16924]	0.137	1.96	4.85	5.26	1.577	0.279			244	0		0	5.5	0.7	8.81
[16924]	0.11	0.54	1.85	4.37	3.45	0.11			424	0		15	14	0	12
[16924]	0.088	2.12	9.16	3.24	0.457	0.201			135	13.2		170	5.7	28.4	3.47
[16924]	0.11	1.27	2.38	6.26	2.23	0.13			372	0		14	11	0	11.1
[16924]	0.121	0.74	2.69	5	2.266	0.113			349	0		0	7.8	0	12.2
[16924]	0.035	1.07	3.51	5.52	1.138	0.117			173	0		10.9	7	0	5.17
[16924]	0.03	0.34	2.13	5.56	1.1	0.06			210	0		13	14	0	3.69
[16924]	0.25	1.62	4.48	4.09	2.39	0.26			370	0		17	9	0	26.7
[16924]	0.08	1.73	1.27	3.44	2.35	0.1			302	19		15	10	0	10.8
[16924]	0.1	1.56	1.24	1.78	1.6	0.08			177	55		17	16	0	22.8
[16924]	0.05	1.64	0.8	1.86	2.34	0.11			289	67		19	17	52	1.22
Sibayak															
TT50	0.13	2.77	5.96	3.02	2.41	0.17			579	21	22	16	9.6	9	16
TT51A	0.13	2.95	6.06	2.90	2.34	0.17			570	18	32	17	9.1	9	13
TT53A	0.14	2.79	6.09	3.00	2.43	0.17			568	41	16	17	9	10	18
TT57	0.13	2.57	5.96	3.05	2.46	0.17			590	16	16	15	9.6	7	16
TT58	0.13	2.67	6.07	3.04	2.43	0.18			581	22	16	16	9.7	8	18
TT59	0.14	2.73	6.01	2.97	2.42	0.18			579	17	14	16	9.8	7	17
TT60	0.14	3.31	6.82	2.91	2.19	0.19			529	30	17	17	8.4	12	15
TT61	0.12	2.37	5.49	2.80	2.68	0.12			571	10	12	17	9	3	21
TT62	0.12	2.12	5.17	2.70	2.82	0.12			614	10	11	16	9	4	19
Toba's Post-Caldera Domes															
TT81	0.14	3.48	6.45	2.61	2.64	0.13			434	50	41	17	10.6	18	16
TT40	0.17	4.40	8.45	2.48	1.31	0.27			388	30	11	20	12.6	6	13
TT41	0.17	4.38	8.50	2.43	1.34	0.27			393	26	13	21	11.5	6	12
38-6	0.05	0.32	1.8	3.51	3.81	0.11	400		1012		13		19	3	

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Krakatau																
[16924]	63	206	33		51	69	279	26.3	61.8	34.5	8.09	1.9	1.37	5.66	0.87	8.1
[16924]	41	271	33		50	46	239	22.3	52.8	30.5	7.38	1.93	1.29	5.26	0.81	6.34
[16924]	76	183	0		57	91	312	29.5	68.2	37.1	8.62	1.96	1.43	5.96	0.94	9.03
[16924]	21	376	215		32	74	116	14.2	33.5	20.3	4.88	1.46	0.82	2.95	0.46	2.93
[16924]	44	273	36		50	46	234	21.7	51.5	29.6	7.25	1.83	1.27	5.12	0.79	6.17
[16924]	43.4	284	69.4		44.4	62.4	188	20.9	49.2	29.1	6.95	1.83	1.17	4.49	0.69	5.43
[16924]	91	164	0		52	66	310	29.3	68.3	33.6	8.67	1.96	1.44	5.87	0.91	8.8
[16924]	10.1	499	170		32.6	63.6	219	21.1	44.9	22.7	5.17	1.85	0.91	4.07	0.63	10.7
[16924]	60	189	30		50	64	272	24.8	57.2	31.7	7.45	1.71	1.25	5.25	0.81	7.58
[16924]	61.4	204	22.3		57.7	60.8	283	29	67.3	37.5	8.83	2.06	1.09	4.06	0.95	7.82
[16924]	43.3	290	10.9		59	14.2	263	26.9	62.2	34.6	8.14	1.66	1.4	5.52	0.82	6.39
[16924]	27	178	30		37	13	322	24.3	52.7	26.1	5.96	1.69	0.96	4.32	0.69	9.35
[16924]	52	282	58		46	151	186	22.7	53.9	31.8	8	2.07	1.35	5.11	0.78	5.36
[16924]	64	135	47		38	65	182	19.8	45	23.3	5.57	1.42	0.95	4.13	0.65	6.18
[16924]	68	110	122		28	87	258	29.4	62.8	27.4	5.59	1.29	0.82	3.01	0.46	12.5
[16924]	84	81	138		26	0	220	39.6	87.5	38.4	7.59	0.86	1.04	3.26	0.48	17.4
Sibayak																
TT50	87.2	424	113		21.7	51	122									
TT51A	79.6	436	127		24.6	56	116									
TT53A	87.8	430	116		21.9	50	126									
TT57	89	433	105		21.8	50	118									
TT58	87.3	429	124		22.1	52	126									
TT59	87.3	426	113		22.7	51	127									
TT60	76.2	449	142		23.1	57	130									
TT61	94	404	88		24	43	125									
TT62	119	391	86		22	46	127									
Toba's Post-Caldera Domes																
TT81	119	225	154		35.1	65	187	30.6	62.1	29.6	5.93	1.21	0.96	3.3	0.52	18
TT40	40.4	471	183		30.5	93	168	33.1	68.4	33.8	6.63	1.64	0.98	2.54	0.4	9.5
TT41	41.7	477	172		30.7	90	169	30.5	63.5	33.2	6.41	1.67	0.9	2.6	0.42	7.98
38-6	157	130	16		24	45	184	64	101							

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Krakatau													
[16924]	0.6	1.1	7.02			19	0.70448		0.5128				
[16924]	1.52	1.01	5.55			22	0.70449		0.5128				
[16924]	2.24	1.07	8.08			25	0.70451		0.5128				
[16924]	0.72	0.21	3.13			26	0.70452		0.5128				
[16924]	1.48	0.39	5.5			6	0.70454		0.5128				
[16924]	1.32	0.33	4.94			0	0.70454		0.5128				
[16924]	2.17	0.88	7.63			20	0.70465		0.5128				
[16924]	2.46	0.51	6.37			0	0.70466		0.5127				
[16924]	1.8	0.68	6.29			22	0.70467		0.5128				
[16924]	1.89	0.43	6.46			0	0.70469		0.5127				
[16924]	1.78	0.39	5.43			0	0.70476		0.5128				
[16924]	2.16	1.14	4.92			19	0.70481		0.5128				
[16924]	1.29	1.07	5.05			29	0.70528		0.5128				
[16924]	1.51	0.36	4.47			9	0.70713		0.5128				
[16924]	2.88	1.42	4.4			30	0.70779		0.5125				
[16924]	2.3	1.01	2.82			43	0.70872		0.5124				
Sibayak													
TT50													
TT51A													
TT53A							0.70872	0.591	0.5123				
TT57													
TT58													
TT59													
TT60							0.70851	0.491	0.5123				
TT61													
TT62							0.7087	0.881	0.5123				
Toba's Post-Caldera Domes													
TT81	2.65	0.73	4.95	21.7	3.88	18.8	0.7107	1.528	0.5123				
TT40	1.02	0.59	4.39	23	0.97	18.6	0.71259	0.248	0.5121				
TT41	0.95	0.59	4.34	22.9	0.92	18.3	0.71261	0.253	0.5121				
38-6							0.71275						

Sample No./ Reference	Field Notes
Toba's Post-Caldera Domes	
38A	Dome Lava
88A	Dome Lava
TT79	Pardepur
TT80	Pardepur
TT45	Sipisupisu
TT46	Sipisupisu
3	Dome Lava
14	Dome Lava
TT47	Sipisupisu
TT48	Sipisupisu
TT34B	Sipisupisu
TP1	Pusuk Buhit

Sample No./ Reference	Reference	SiO_2	TiO_2	Al_2O_3	Fe_2O_3
Toba's Post-Caldera Domes					
38A	Chesner, 1988 (Doctoral Thesis)	67.48	0.58	15.45	4.65
88A	Chesner, 1988 (Doctoral Thesis)	68.79	0.76	18.81	3.98
TT79	Jones, 1989 (Doctoral Thesis)	67.56	0.52	15.52	4.61
TT80	Jones, 1989 (Doctoral Thesis)	67.58	0.51	15.61	4.62
TT45	Jones, 1989 (Doctoral Thesis)	59.11	0.84	16.58	7.53
TT46	Jones, 1989 (Doctoral Thesis)	58.48	0.86	16.68	7.75
3	Chesner, 1988 (Doctoral Thesis)	72.14	0.33	13.9	2.97
14	Chesner, 1988 (Doctoral Thesis)	62.83	0.76	17.05	5.92
TT47	Jones, 1989 (Doctoral Thesis)	61.26	0.79	16.53	6.82
TT48	Jones, 1989 (Doctoral Thesis)	61.81	0.76	16.67	6.58
TT34B	Jones, 1989 (Doctoral Thesis)	70.05	0.39	15.00	3.54
TP1	Jones, 1989 (Doctoral Thesis)	68.74	0.46	15.31	4.00

Sample No./ Reference	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Mn	As	Ba	Cr	Cu	Ga	Nb	Ni	Pb
Toba's Post-Caldera Domes															
38A	0.1	0.96	4.11	3.5	2.99	0.17	776		806	10	6		14	2	
88A	0.07	0.56	1.86	2.22	2.92	0.05	549		847		7		21	6	
TT79	0.09	1.34	3.81	3.47	2.95	0.12			771	14	6	17	13.4	7	17
TT80	0.09	1.30	3.76	3.45	2.97	0.11			792	17	5	17	13.5	6	19
TT45	0.13	3.85	6.95	2.54	2.28	0.18			534	60	12	19	12.9	9	18
TT46	0.13	3.91	7.00	2.67	2.34	0.19			537	66	10	19	12.3	12	17
3	0.08	0.78	2.27	3.3	4.15	0.08	654		765	8	11		18		
14	0.11	1.58	5.98	3.05	2.54	0.18	881		709	15			9	3	
TT47	0.12	3.06	6.00	2.89	2.36	0.16			577	33	8	18	12.6	7	15
TT48	0.11	2.95	5.77	2.86	2.32	0.15			602	34	8	18	11.9	8	19
TT34B	0.08	1.09	3.08	3.34	3.32	0.10			819	40	5	15	13.2	8	21
TP1	0.08	1.19	3.47	3.46	3.18	0.11			750	11	6	16	13.2	8	20

Sample No./ Reference	Rb	Sr	V	W	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Th
Toba's Post-Caldera Domes																
38A	107	247	88		28	65	237	53	86							
88A	108	127	78		26	56	256	44	89							
TT79	117	229	50		29.3	52	221	46	84.2	34.3	5.86	1.24	0.86	2.99	0.45	16.6
TT80	119	226	48		28.8	55	213									
TT45	84.1	393	138		24.7	73	182									
TT46	86.1	407	143		24.5	73	196									
3	169	157	35		30	55	147	41	70							
14	85	328	120		26	72	182	42	74							
TT47	87.5	324	119		26.4	70	174	37.3	68.7	28.8	5.26	1.27	0.79	2.46	0.39	14.3
TT48	87.3	322	113		25.5	70	174									
TT34B	129	221	36		23.3	49	164	47.4	84.9	30.5	5.03	1.05	0.67	2.45	0.38	21.2
TP1	132	213	40		29.9	48	222	43.7	80.2	33.4	5.6	1.17	0.84	3	0.47	17.8

Sample No./ Reference	U	Ta	Hf	Sc	Cs	Co	$^{87}Sr/^{86}Sr$	$^{87}Rb/^{86}Sr$	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
Toba's Post-Caldera Domes													
38A				12			0.71281						
88A				10			0.71291						
TT79	2.6	0.91	6.22	10.3	3.35	7	0.71328	1.475	0.5121				
TT80							0.71342	1.522	0.5121				
TT45							0.71349	0.619	0.512				
TT46							0.71356	0.612	0.5121				
3				6			0.71367						
14				16			0.71384						
TT47	1.74	0.78	4.58	16.5	2.46	13.2	0.71385	0.783	0.5121				
TT48							0.71389	0.785					
TT34B	2.64	0.98	5.04	7.4	3.75	5.1	0.71401	1.694	0.5121				
TP1	2.57	0.96	5.72	9.3	3.63	5.8	0.71504	1.789	0.5121				

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Appendix Table 6.4: U-Th and U-Pb analyses on zircon surfaces

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Youngest Toba Tuff	*Weighted Average Peak Age = 95.0 ± 6.0 ka (2σ) MSWD = 3.6*							
North								
12_001-5.1	UCLA	4.05	0.06	2.21	0.19	74.5	11.82	11.21
12_001-2.1	UCLA	2.96	0.06	1.68	0.22	74.8	20.64	18.86
12_001-4.1	UCLA	3.69	0.23	2.11	0.18	79.7	15.69	14.63
12_001-8.1	UCLA	4.05	0.07	2.32	0.16	81.5	11.02	10.49
12_001-20.1	UCLA	6.98	0.28	3.91	0.34	83.1	13.91	13.07
12_001-10.1	UCLA	2.74	0.06	1.71	0.23	89.5	26.96	24.00
12_001-171	UCLA	3.58	0.21	2.18	0.24	89.6	22.53	20.42
12_001-3.1	UCLA	3.94	0.06	2.42	0.17	92.4	13.66	12.85
12_001-16.1	UCLA	4.69	0.10	2.87	0.21	94.0	14.00	13.15
12_001-13.1	UCLA	4.03	0.08	2.52	0.13	95.8	10.74	10.24
12_001-9.1	UCLA	3.83	0.07	2.44	0.20	99.0	17.60	16.29
12_001-7.1	UCLA	2.52	0.04	1.77	0.24	114.5	40.72	34.31
12_001-14.1	UCLA	3.46	0.10	2.55	0.21	134.8	30.27	26.58
12_001-11.1	UCLA	3.97	0.09	2.99	0.21	143.4	27.06	24.08
12_001-12.1	UCLA	3.26	0.09	2.52	0.33	151.5	61.40	47.87
12_001-6.1	UCLA	4.26	0.10	4.01	0.27	322.5	293.07	120.79
South								
12_012-3.1	UCLA	3.48	0.17	2.00	0.17	79.7	15.34	14.34
12_012-1.1	UCLA	3.04	0.07	1.84	0.22	85.8	22.73	20.58
12_012-4.1	UCLA	4.14	0.10	2.46	0.20	87.6	14.26	13.38
12_012-14.1	UCLA	5.90	0.16	3.51	0.28	91.3	14.04	13.19
12_012-8.1	UCLA	4.15	0.07	2.55	0.15	93.1	11.18	10.64
12_012-2.1	UCLA	3.48	0.09	2.17	0.21	93.6	19.85	18.20
12_012-10.1	UCLA	7.30	0.24	4.43	0.53	95.8	22.27	20.21
12_012-19.1	UCLA	4.11	0.06	2.61	0.19	98.9	14.71	13.78
12_012-6.1	UCLA	4.03	0.07	2.57	0.18	99.6	14.80	13.86
12_012-20.1	UCLA	4.10	0.07	2.68	0.16	105.4	13.81	12.99
12_012-17.1	UCLA	4.15	0.09	2.75	0.20	108.4	17.99	16.62
12_012-9.1	UCLA	4.12	0.08	2.81	0.18	114.9	17.20	15.95
12_012-12.1	UCLA	3.52	0.10	2.44	0.22	116.6	25.80	23.07

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Youngest Toba Tuff				
North				
12_001-5.1	*	*	*	987
12_001-2.1	*	*	*	240
12_001-4.1	*	*	*	739
12_001-8.1	*	*	*	886
12_001-20.1	*	*	*	908
12_001-10.1	*	*	*	207
12_001-171	*	*	*	270
12_001-3.1	*	*	*	630
12_001-16.1	*	*	*	523
12_001-13.1	*	*	*	1096
12_001-9.1	*	*	*	617
12_001-7.1	*	*	*	218
12_001-14.1	*	*	*	378
12_001-11.1	*	*	*	660
12_001-12.1	*	*	*	271
12_001-6.1	*	*	*	385
South				
12_012-3.1	*	*	*	454
12_012-1.1	*	*	*	252
12_012-4.1	*	*	*	476
12_012-14.1	*	*	*	667
12_012-8.1	*	*	*	958
12_012-2.1	*	*	*	316
12_012-10.1	*	*	*	340
12_012-19.1	*	*	*	728
12_012-6.1	*	*	*	674
12_012-20.1	*	*	*	754
12_012-17.1	*	*	*	674
12_012-9.1	*	*	*	652
12_012-12.1	*	*	*	324

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Youngest Toba Tuff	*Weighted Average Peak Age = 95.0 ± 6.0 ka (2σ) MSWD = 3.6*							
South								
12_012-11.1	UCLA	3.37	0.11	2.39	0.33	122.1	43.62	36.34
12_012-13.1	UCLA	3.86	0.10	2.76	0.19	126.9	22.05	20.03
12_012-16.1	UCLA	3.64	0.06	2.93	0.25	170.4	46.50	38.32
12_012-5.1	UCLA	3.10	0.05	2.52	0.21	174.2	50.41	40.93
12_012-15.1	UCLA	3.69	0.07	3.09	0.22	193.3	52.42	42.24
Samosir Lava Domes	*Weighted Average Peak Age = 103.7 ± 5.4 ka (2σ) MSWD = 2.7*							
Bukit Kerbau								
13_008-15.1	UCLA	3.719	0.081	2.127	0.204	80.0	15.310	14.000
13_008-5.1	UCLA	3.860	0.074	2.334	0.218	89.4	17.085	16.000
13_008-7.1	UCLA	3.957	0.107	2.402	0.178	90.4	14.119	14.000
13_008-10.1	UCLA	2.576	0.052	1.682	0.336	97.6	48.818	40.000
13_008-2.1	UCLA	3.891	0.074	2.478	0.231	99.2	19.716	18.000
13_008-17.1	UCLA	3.816	0.076	2.533	0.317	107.7	30.500	26.000
13_008-6.1	UCLA	6.572	0.155	4.306	0.501	109.9	26.746	24.000
13_008-9.1	UCLA	4.778	0.164	3.194	0.622	111.7	50.360	40.000
13_008-16.1	UCLA	3.991	0.083	2.795	0.247	121.3	25.602	22.000
13_008-1.1	UCLA	3.552	0.090	2.530	0.228	124.6	28.383	26.000
13_008-14.1	UCLA	2.828	0.093	2.225	0.268	156.4	63.110	48.000
13_008-3.1	UCLA	2.852	0.080	2.342	0.264	177.9	76.877	56.000
13_008-12.1	UCLA	3.114	0.078	2.729	0.437	224.1	237.175	112.000
West Tuk Tuk								
13_014-7.1	UCLA	3.179	0.062	1.896	0.410	84.2	39.955	34.000
13_014-8.1	UCLA	2.811	0.090	1.738	0.298	88.5	34.975	30.000
13_014-3.1	UCLA	4.581	0.149	2.746	0.379	89.9	25.137	22.000
13_014-5.1	UCLA	3.681	0.092	2.280	0.346	93.1	30.313	26.000
13_014-11.1	UCLA	5.449	0.124	3.375	0.649	97.3	38.467	32.000
13_014-16.1	UCLA	2.527	0.083	1.694	0.347	103.1	55.406	44.000
13_014-12.1	UCLA	3.910	0.091	2.579	0.262	106.6	24.216	22.000
13_014-10.1	UCLA	2.579	0.090	1.777	0.254	110.4	41.695	34.000

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Youngest Toba Tuff				
South				
12_012-11.1	*	*	*	322
12_012-13.1	*	*	*	534
12_012-16.1	*	*	*	505
12_012-5.1	*	*	*	330
12_012-15.1	*	*	*	407
Samosir Lava Domes				
Bukit Kerbau				
13_008-15.1	*	*	*	3438
13_008-5.1	*	*	*	3169
13_008-7.1	*	*	*	4104
13_008-10.1	*	*	*	758
13_008-2.1	*	*	*	2391
13_008-17.1	*	*	*	2744
13_008-6.1	*	*	*	2895
13_008-9.1	*	*	*	1128
13_008-16.1	*	*	*	2037
13_008-1.1	*	*	*	2902
13_008-14.1	*	*	*	956
13_008-3.1	*	*	*	1112
13_008-12.1	*	*	*	845
West Tuk Tuk				
13_014-7.1	*	*	*	830
13_014-8.1	*	*	*	1143
13_014-3.1	*	*	*	1254
13_014-5.1	*	*	*	1529
13_014-11.1	*	*	*	949
13_014-16.1	*	*	*	1163
13_014-12.1	*	*	*	3726
13_014-10.1	*	*	*	928

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Samosir Lava Domes	*Weighted Average Peak Age = 103.7 ± 5.4 ka (2σ)*				*MSWD = 2.7*			
West Tuk Tuk								
13_014-19.1	UCLA	2.726	0.086	1.895	0.372	113.9	60.368	48.000
13_014-18.1	UCLA	3.396	0.082	2.372	0.531	118.5	70.117	52.000
13_014-17.1	UCLA	3.806	0.075	2.652	0.250	119.3	26.871	24.000
13_014-15.1	UCLA	2.711	0.097	2.006	0.356	132.3	71.070	54.000
13_014-4.1	UCLA	2.501	0.050	1.911	0.389	142.6	98.490	68.000
13_014-6.1	UCLA	2.779	0.120	2.131	0.329	145.6	73.370	54.000
13_014-9.1	UCLA	3.709	0.111	2.947	0.403	164.2	74.865	56.000
13_014-20.1	UCLA	3.176	0.132	2.649	0.409	188.1	128.475	80.000
13_014-21.1	UCLA	3.847	0.082	3.259	0.343	199.4	86.359	62.000
13_014-14.1	UCLA	4.876	0.204	4.201	0.750	212.6	210.506	106.000
13_014-13.1	UCLA	3.819	0.309	3.328	0.458	220.3	202.183	104.000
13_014-1.1	UCLA	3.161	0.191	2.945	0.305	304.0	160.000	160.000
North								
12_003-1.1	UCLA	4.02	0.07	2.39	0.16	86.7	11.29	10.74
12_003-2.1	UCLA	3.87	0.06	2.36	0.20	91.0	15.40	14.39
12_003-17.1	UCLA	4.26	0.09	2.61	0.17	93.2	12.46	11.79
12_003-4.1	UCLA	4.10	0.09	2.52	0.18	93.3	13.98	13.14
12_003-15.1	UCLA	6.90	0.12	4.19	0.28	95.8	12.19	11.55
12_003-6.1	UCLA	4.45	0.08	2.80	0.23	98.5	16.71	15.52
12_003-9.1	UCLA	7.47	0.12	4.62	0.48	99.3	19.95	18.28
12_003-10.1	UCLA	4.32	0.07	2.75	0.20	100.3	15.03	14.06
12_003-19.1	UCLA	6.81	0.16	4.34	0.28	104.5	14.03	13.18
12_003-8.1	UCLA	4.26	0.11	2.93	0.23	117.2	21.98	19.97
12_003-7.1	UCLA	3.74	0.08	2.62	0.19	120.8	20.88	19.06
12_003-12.1	UCLA	3.66	0.10	2.69	0.76	133.8	117.14	75.83
12_003-13.1	UCLA	3.71	0.06	2.78	0.17	141.4	22.45	20.35
12_003-5.1	UCLA	3.94	0.07	3.06	0.20	155.3	29.34	25.86
12_003-18.1	UCLA	2.91	0.09	2.70	0.24	301.0	387.81	132.05
Tuk Tuk								
12_008-7.1	UCLA	2.78	0.06	1.58	0.21	74.7	21.71	19.74

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Samosir Lava Domes				
West Tuk Tuk				
13_014-19.1	*	*	*	825
13_014-18.1	*	*	*	472
13_014-17.1	*	*	*	2131
13_014-15.1	*	*	*	887
13_014-4.1	*	*	*	1249
13_014-6.1	*	*	*	486
13_014-9.1	*	*	*	1551
13_014-20.1	*	*	*	1140
13_014-21.1	*	*	*	2154
13_014-14.1	*	*	*	1099
13_014-13.1	*	*	*	1970
13_014-1.1	*	*	*	1223
North				
12_003-1.1	*	*	*	905
12_003-2.1	*	*	*	689
12_003-17.1	*	*	*	1144
12_003-4.1	*	*	*	776
12_003-15.1	*	*	*	742
12_003-6.1	*	*	*	529
12_003-9.1	*	*	*	497
12_003-10.1	*	*	*	590
12_003-19.1	*	*	*	760
12_003-8.1	*	*	*	671
12_003-7.1	*	*	*	580
12_003-12.1	*	*	*	680
12_003-13.1	*	*	*	686
12_003-5.1	*	*	*	602
12_003-18.1	*	*	*	297
Tuk Tuk				
12_008-7.1	*	*	*	263

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Samosir Lava Domes	*Weighted Average Peak Age = 103.7 ± 5.4 ka (2σ) MSWD = 2.7*							
Tuk Tuk								
12_008-17.1	UCLA	3.55	0.08	2.20	0.31	92.9	27.91	24.74
12_008-9.1	UCLA	2.68	0.04	1.72	0.24	94.3	31.05	27.18
12_008-5.1	UCLA	3.15	0.10	2.05	0.23	100.9	26.69	23.78
12_008-11.1	UCLA	3.97	0.14	2.59	0.23	103.9	21.33	19.43
12_008-10.1	UCLA	2.89	0.05	1.97	0.30	109.9	41.15	34.61
12_008-6.1	UCLA	2.69	0.10	1.85	0.30	111.4	47.00	38.66
12_008-4.1	UCLA	2.50	0.04	1.79	0.21	120.1	38.34	32.60
12_008-16.1	UCLA	3.99	0.08	2.87	0.20	128.6	22.66	20.53
12_008-12.1	UCLA	3.11	0.10	2.31	0.24	136.2	40.94	34.46
12_008-1.1	UCLA	3.88	0.07	2.87	0.21	137.1	26.62	23.73
12_008-15.1	UCLA	3.54	0.06	2.68	0.57	143.9	94.85	65.91
12_008-19.1	UCLA	3.93	0.08	3.06	0.18	155.7	26.97	24.00
12_008-8.1	UCLA	3.73	0.21	2.97	0.27	164.4	54.54	43.61
12_008-3.1	UCLA	2.63	0.05	2.19	0.22	184.2	73.57	54.93
12_008-13.1	UCLA	4.16	0.12	3.49	0.29	192.9	62.27	48.40
12_008-20.1	UCLA	4.19	0.07	3.57	0.24	202.4	52.23	42.12
12_008-14.1	UCLA	3.95	0.07	3.58	0.28	259.8	128.81	80.48
Pardepur Lava Domes	*Weighted Average Peak Age = 85.6 ± 9.5 ka (2σ) MSWD = 3.3*							
South								
12_015-5.1	UCLA	2.54	0.04	1.42	0.22	69.7	23.50	21.22
12_015-7.1	UCLA	2.02	0.05	1.25	0.18	80.9	28.80	25.44
12_015-10.1	UCLA	2.47	0.04	1.49	0.26	81.3	33.08	28.72
12_015-11.1	UCLA	2.72	0.05	1.73	0.21	93.1	26.29	23.47
12_015-2.1	UCLA	5.14	0.45	3.14	0.33	94.4	25.07	22.49
12_015-14.1	UCLA	2.21	0.04	1.46	0.26	97.5	45.37	37.55
12_015-9.1	UCLA	5.07	0.12	3.21	0.60	101.1	39.79	33.65
12_015-6.1	UCLA	2.51	0.05	1.69	0.23	104.5	35.91	30.83
12_015-18.1	UCLA	2.82	0.15	1.91	0.28	108.2	41.87	35.12
12_015-16.1	UCLA	2.64	0.06	1.81	0.25	108.9	39.13	33.17

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Samosir Lava Domes				
Tuk Tuk				
12_008-17.1	*	*	*	340
12_008-9.1	*	*	*	218
12_008-5.1	*	*	*	372
12_008-11.1	*	*	*	266
12_008-10.1	*	*	*	248
12_008-6.1	*	*	*	215
12_008-4.1	*	*	*	215
12_008-16.1	*	*	*	474
12_008-12.1	*	*	*	266
12_008-1.1	*	*	*	602
12_008-15.1	*	*	*	286
12_008-19.1	*	*	*	616
12_008-8.1	*	*	*	442
12_008-3.1	*	*	*	273
12_008-13.1	*	*	*	494
12_008-20.1	*	*	*	481
12_008-14.1	*	*	*	441
Pardepur Lava Domes				
South				
12_015-5.1	*	*	*	193
12_015-7.1	*	*	*	221
12_015-10.1	*	*	*	171
12_015-11.1	*	*	*	194
12_015-2.1	*	*	*	1348
12_015-14.1	*	*	*	173
12_015-9.1	*	*	*	118
12_015-6.1	*	*	*	194
12_015-18.1	*	*	*	152
12_015-16.1	*	*	*	170

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Pardepur Lava Domes	*Weighted Average Peak Age = 85.6 ± 9.5 ka (2σ) MSWD = 3.3*							
South								
12_015-13.1	UCLA	2.86	0.05	1.99	0.31	114.5	46.25	38.15
12_015-1.1	UCLA	5.03	0.27	3.43	0.71	116.6	58.57	46.14
12_015-3.1	UCLA	4.23	0.26	3.03	0.63	127.5	72.51	54.34
12_015-15.1	UCLA	4.06	0.07	3.30	0.26	175.9	46.21	38.12
12_015-20.1	UCLA	3.96	0.06	3.55	0.26	245.7	100.73	68.67
North								
12_016-4.1	UCLA	2.59	0.07	1.23	0.29	50.3	25.36	22.72
12_016-18.1	UCLA	2.35	0.06	1.19	0.18	54.7	18.63	17.16
12_016-1.1	UCLA	3.90	0.11	1.81	0.40	55.2	22.84	20.67
12_016-13.1	UCLA	2.64	0.10	1.45	0.11	67.7	11.73	11.13
12_016-11.1	UCLA	2.28	0.05	1.37	0.17	78.6	23.40	21.14
12_016-6.1	UCLA	2.29	0.05	1.43	0.19	85.3	27.33	24.29
12_016-10.1	UCLA	2.50	0.06	1.57	0.23	89.4	31.78	27.74
12_016-5.1	UCLA	29.8	1.29	17.4	0.87	94.8	10.48	10.00
12_016-16.1	UCLA	2.93	0.08	1.93	0.77	101.2	112.21	73.76
12_016-15.1	UCLA	2.82	0.05	1.90	0.22	106.4	29.76	26.19
12_016-17.1	UCLA	2.51	0.05	1.74	0.23	111.4	38.06	32.40
12_016-7.1	UCLA	2.52	0.07	1.92	0.28	141.4	65.42	50.27
12_016-19.1	UCLA	3.05	0.13	2.32	0.32	144.2	61.67	48.03
12_016-2.1	UCLA	3.88	0.06	3.23	0.34	188.2	72.43	54.30
12_016-20.1	UCLA	3.65	0.28	3.24	0.29	236.4	163.63	92.49
12_016-8.1	UCLA	2.92	0.08	2.72	0.25	305.2	505.42	140.31
Pusuk Buhit Lava Flows	*Weighted Average Peak Age (Young Flow) = 105.0 ± 19.0 ka (2σ) MSWD = 1.4*							
South								
14_002-10.1	UCLA	2.94	0.13	1.66	0.52	74.1	52.69	42.00
14_002-4.1	UCLA	2.57	0.08	1.52	0.40	79.3	50.08	40.00
14_002-6.1	UCLA	2.35	0.06	1.48	0.51	88.2	82.93	60.00
14_002-1.1	UCLA	2.58	0.11	1.73	0.44	104.0	70.76	54.00
14_002-16.1	UCLA	3.56	0.07	2.70	0.30	144.7	46.25	38.00

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Pardepur Lava Domes				
South				
12_015-13.1	*	*	*	141
12_015-1.1	*	*	*	129
12_015-3.1	*	*	*	115
12_015-15.1	*	*	*	412
12_015-20.1	*	*	*	388
North				
12_016-4.1	*	*	*	115
12_016-18.1	*	*	*	243
12_016-1.1	*	*	*	150
12_016-13.1	*	*	*	476
12_016-11.1	*	*	*	266
12_016-6.1	*	*	*	245
12_016-10.1	*	*	*	180
12_016-5.1	*	*	*	3094
12_016-16.1	*	*	*	269
12_016-15.1	*	*	*	177
12_016-17.1	*	*	*	159
12_016-7.1	*	*	*	247
12_016-19.1	*	*	*	216
12_016-2.1	*	*	*	335
12_016-20.1	*	*	*	404
12_016-8.1	*	*	*	279
Pusuk Buhit Lava Flows				
South				
14_002-10.1	*	*	*	552
14_002-4.1	*	*	*	951
14_002-6.1	*	*	*	720
14_002-1.1	*	*	*	1192
14_002-16.1	*	*	*	5879

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Pusuk Buhit Lava Flows	*Weighted Average Peak Age (Young Flow) = 105.0 ± 19.0 ka (2σ) MSWD = 1.4*							
South								
14_002-8.1	UCLA	3.98	0.23	3.20	0.37	170.6	72.96	54.00
14_002-5.1	UCLA	2.25	0.07	2.01	0.28	245.8	333.33	126.00
14_002-14.1	UCLA	3.60	0.07	3.28	0.30	265.2	183.02	98.00
14_002-15.1	UCLA	1.99	0.05	1.83	0.41	290.2	239.00	240.00
North								
14_007-6.1	UCLA	2.21	0.06	1.27	0.27	70.8	35.88	30.00
14_007-3.1	UCLA	2.55	0.11	1.46	0.39	73.3	46.51	38.00
14_007-8.1	UCLA	2.22	0.15	1.49	0.24	100.8	46.33	38.00
14_007-1.1	UCLA	2.44	0.06	1.65	0.33	103.7	55.86	44.00
14_007-5.1	UCLA	2.92	0.12	1.95	0.45	104.8	61.50	48.00
14_007-2.1	UCLA	2.96	0.07	2.28	0.48	148.3	105.29	70.00
14_007-11.1	UCLA	3.05	0.13	2.38	0.63	154.9	159.24	92.00
14_007-4.1	UCLA	3.35	0.12	2.74	0.52	176.2	137.40	84.00
14_007-7.1	UCLA	3.79	0.12	3.15	0.46	187.5	111.71	74.00
14_007-9.1	UCLA	2.88	0.16	2.43	0.37	193.1	148.40	88.00
14_007-10.1	UCLA	3.52	0.11	3.20	0.49	262.5	536.72	142.00
Old Lava Flow	*Weighted Average Peak Age = 0.91 ± 0.10 Ma (2σ) MSWD = 0.2*							
12_006-6.1	UCLA	*	*	*	*	*	*	*
12_006-4.1	UCLA	*	*	*	*	*	*	*
12_006-8.1	UCLA	*	*	*	*	*	*	*
12_006-3.1	UCLA	*	*	*	*	*	*	*
12_006-19.1	UCLA	*	*	*	*	*	*	*
12_006-10.1	UCLA	*	*	*	*	*	*	*
12_006-7.1	UCLA	*	*	*	*	*	*	*
12_006-20.1	UCLA	*	*	*	*	*	*	*
12_006-5.1	UCLA	*	*	*	*	*	*	*
12_006-18.1	UCLA	*	*	*	*	*	*	*
12_006-17.1	UCLA	*	*	*	*	*	*	*
12_006-11.1	UCLA	*	*	*	*	*	*	*
12_006-12.1	UCLA	*	*	*	*	*	*	*

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ ± 2σ	Th/U	U ppm
Pusuk Buhit Lava Flows				
South				
14_002-8.1	*	*	*	2618
14_002-5.1	*	*	*	1714
14_002-14.1	*	*	*	4576
14_002-15.1	*	*	*	982
North				
14_007-6.1	*	*	*	910
14_007-3.1	*	*	*	892
14_007-8.1	*	*	*	1779
14_007-1.1	*	*	*	1376
14_007-5.1	*	*	*	507
14_007-2.1	*	*	*	460
14_007-11.1	*	*	*	307
14_007-4.1	*	*	*	831
14_007-7.1	*	*	*	2070
14_007-9.1	*	*	*	380
14_007-10.1	*	*	*	666
Old Lava Flow				
12_006-6.1	0.777	0.419	0.343	679
12_006-4.1	0.801	0.352	0.530	252
12_006-8.1	0.804	0.354	0.409	153
12_006-3.1	0.813	0.358	0.330	318
12_006-19.1	0.875	0.384	0.360	228
12_006-10.1	0.878	0.386	0.224	952
12_006-7.1	0.900	0.396	0.481	125
12_006-20.1	0.931	0.409	0.361	484
12_006-5.1	0.952	0.553	0.345	314
12_006-18.1	0.964	0.424	0.336	309
12_006-17.1	0.967	0.425	0.354	411
12_006-11.1	0.981	0.431	0.505	211
12_006-12.1	0.984	0.434	0.176	262

Sample Name	Place of Analysis	($^{238}U/^{232}Th$)	± 2σ	($^{230}Th/^{232}Th$)	± 2σ	Th Age (ka)	+ 2σ	- 2σ
Pusuk Buhit Lava Flows	*Weighted Average Peak Age (Young Flow) = 105.0 ± 19.0 ka (2σ) MSWD = 1.4*							
Old Lava Flow	*Weighted Average Peak Age = 0.91 ± 0.10 Ma (2σ) MSWD = 0.2*							
12_006-1.1	UCLA	*	*	*	*	*	*	*
12_006-16.1	UCLA	*	*	*	*	*	*	*
12_006-14.1	UCLA	*	*	*	*	*	*	*
12_006-15.1	UCLA	*	*	*	*	*	*	*
Sinabung	*Weighted Average Peak Age = 32.0 ± 14.0 ka (2σ) MSWD = 3.6*							
Older lava flow								
14_011-UCLA-2.2	UCLA	3.14	0.06	1.01	0.60	25.4	33.93	29.36
14_011-2.1	Stanford	2.04	0.04	0.80	0.21	26.8	20.45	18.70
14_011-UCLA-1.1	Stanford	2.02	0.04	0.79	0.21	27.0	20.82	19.00
14_011-4.1	UCLA	20.71	5.98	19.24	7.40	290.1	316.74	316.74
2014 pyroclastic flow								
14_012-5.2	Stanford	1.81	0.53	0.59	0.54	10.9	57.20	45.29
14_012-1.2	Stanford	1.93	0.06	0.64	0.23	14.1	21.14	19.28
14_012-1.1	Stanford	1.97	0.06	0.70	0.23	19.7	22.39	20.31
14_012-UCLA-1.1	Stanford	2.08	0.04	0.85	0.30	30.5	29.72	26.15
14_012-UCLA-1.1	Stanford	3.45	0.07	1.51	0.64	48.0	40.70	34.30
14_012-3.1	Stanford	2.39	0.19	1.15	0.44	49.6	45.38	37.55
14_012-UCLA-2.1	UCLA	4.68	0.09	3.59	0.44	151.7	53.20	42.74
Older lahar flow								
14_013-1.1	Stanford	19.02	1.33	15.69	3.17	189.0	156.47	90.22
2013 lava flow								
14_014-11.1	Stanford	2.30	0.05	0.77	0.18	20.7	13.77	12.96
14_014-7.1	Stanford	2.07	0.03	0.94	0.23	39.8	25.03	22.46
14_014-8.1	Stanford	3.94	0.06	1.57	0.48	42.7	24.12	21.72
14_014-3.1	Stanford	1.89	0.10	1.14	0.34	73.9	62.85	48.75
14_014-4.1	Stanford	3.89	0.16	2.51	1.38	101.7	160.55	91.53
14_014-1.1	Stanford	19.14	6.68	17.12	6.28	245.5	254.24	254.24
14_014-10.1	Stanford	65.44	17.66	59.31	18.20	258.7	239.56	239.56
14_014-UCLA-1.2	UCLA	78.86	1.50	74.73	4.10	322.8	165.94	93.20
14_014-UCLA-1.1	UCLA	178.09	5.54	170.41	17.18	343.6	170.00	169.93

Sample Name	$^{206}Pb/^{238}U$ Age (Ma)	$^{206}Pb/^{238}U$ '± 2σ	Th/U	U ppm
Pusuk Buhit Lava Flows				
Old Lava Flow				
12_006-1.1	0.998	0.466	0.451	159
12_006-16.1	1.052	0.507	0.448	147
12_006-14.1	1.068	0.484	0.443	167
12_006-15.1	1.106	0.588	0.479	118
Sinabung				
Older lava flow				
14_011-UCLA-2.2	*	*	*	1065
14_011-2.1	*	*	*	93
14_011-UCLA-1.1	*	*	*	662
14_011-4.1	*	*	*	112
2014 pyroclastic flow				
14_012-5.2	*	*	*	52
14_012-1.2	*	*	*	94
14_012-1.1	*	*	*	99
14_012-UCLA-1.1	*	*	*	674
14_012-UCLA-1.1	*	*	*	210
14_012-3.1	*	*	*	63
14_012-UCLA-2.1	*	*	*	1530
Older lahar flow				
14_013-1.1	*	*	*	48
2013 lava flow				
14_014-11.1	*	*	*	139
14_014-7.1	*	*	*	92
14_014-8.1	*	*	*	57
14_014-3.1	*	*	*	31
14_014-4.1	*	*	*	19
14_014-1.1	*	*	*	331
14_014-10.1	*	*	*	474
14_014-UCLA-1.2	*	*	*	993
14_014-UCLA-1.1	*	*	*	3881

* = not analyzed
Note: All σ in data represents standard error.
MSWD: Mean Square of Weighted Deviates