AN ABSTRACT OF THE THESIS OF

Linda Ann Clark for the degree of Master of Arts in Interdisciplinary Studies in the co-departments of Anthropology, Geography, and Soil Science presented on April 22, 1988.

Title: Archaeological Investigations at the Seal Rock Site, 35LNC14: A Late Prehistoric Shell Midden Located on the Central Oregon Coast

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Richard E. Ross

Seal Rock (35LNC14) is a late prehistoric shell midden site located on the central Oregon coast. Information derived from the faunal remains, radiocarbon dates, and location and size of the midden deposits suggest the site represents a late littoral stage of cultural adaptation. Analyses of lithic artifacts, and bone and antler tools provide information on the technological and functional aspects of this stage of adaptation. The presence of certain varieties of projectile points, composite harpoon valves, and fishing implements compliment evidence of procurement activities provided by the recovered faunal remains. Comparisons of the Seal Rock tool assemblage with those from sites located along the southern Northwest Coast reveal that technological influences from archaeological cultures located to the north and south are present at the Seal Rock site.

Archaeological Investigations at the Seal Rock Site, 35LNC14: A Late Prehistoric Shell Midden Located on the Central Oregon Coast

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I. INTRODUCTION

During the summers of 1972 and 1974 excavations were conducted at the Seal Rock site (35LNC14) under the direction of Richard E. Ross of Oregon State University. The site was excavated as part of a regional research plan designed to increase the knowledge of subsistence strategies and prehistoric lifeways of human inhabitants of the central Oregon coast, a relatively unexplored region archaeologically at the time the excavations took place (Ross 1975). After the excavations at Seal Rock had been completed, analyses of samples of the pinniped and fish remains recovered from the shell midden were reported by Snyder (1978) and Zontek (1983). Lyman (1988a, 1988b) analyzed a larger sample of the mammalian remains during 1985 and 1986.

The information produced from analyses of the faunal remains from Seal Rock has helped to identify 1) the presence of a prehistoric sea lion rookery at Seal Rock, 2) the season of site occupation, and 3) some of the kinds and relative quantities of resources which were being used by human inhabitants at Seal Rock (Lyman 1988a, 1988b; Snyder 1978; Zontek 1983). However, the manner in which the resources were being extracted from the environment and the material culture of the people who were living at Seal Rock have not been previously investigated.

The Seal Rock site is somewhat of an anomaly compared to other sites which have been tested or excavated along the Oregon coast. The large number of pinniped remains located within the midden debris, especially Steller's sea lion (*Emetopias jubatus*), suggests a specialized subsistence activity area. Since a portion of the subsistence pursuits at Seal Rock appear to be different from other Oregon coastal sites, it might be expected that the prehistoric artifacts from the site will provide important information on Oregon coastal prehistory, including both subsistence strategies and adaptation to local environments.

CULTURAL ADAPTATIONS TO SOUTHERN NORTHWEST COAST ENVIRONMENTS

Lyman and Ross (1988) define three basic types of cultural adaptations to southern Northwest Coast environments: maritime, littoral, and riverine/interior. <u>Maritime</u> cultures are those cultures which focus primarily on the sea as a resource base and have the necessary technologies for exploiting distant offshore areas for hunting and fishing. <u>Littoral</u> cultures rely heavily on the sea for resources but do not have the technologies needed to use the open sea as a hunting and fishing area. Instead, people of littoral cultures exploit diverse coastal microenvironments, such as estuaries, shore rocks, offshore rocks and islands, tide pools, and surf areas. <u>Riverine/interior</u> cultures focus primarily on the upstream end of estuaries above tidewater or along rivers that enter oceans without passing through an estuarine environment. While these three categories of adaptation can involve exploitation of other resources, such as salmon runs and terrestrial mammals (e.g., deer and elk), the terms used by Lyman and Ross (1988) represent adaptational variation in how coastal cultures "focus" their subsistence pursuits.

Lyman and Ross (1988) note that almost all prehistoric Oregon coast dwellers fit within the littoral adaptation category; therefore, a model encompassing a sequence of three adaptational stages (pre-littoral, early littoral, and late littoral) was developed based on earlier work by Ross (1984, 1988) and Ross and Snyder (1986). The pre-littoral stage (generally dating before 6000 years BP) represents the first cultural adaptation. A generalist foraging strategy was used to exploit a broad range of littoral resources; however, subsistence orientation appears to have focused more on riverine and upland resources. The generalist strategy evolved into a more specialized strategy by about 5000 to 6000 years BP which has been called the early littoral stage. During this stage coastal resources (e.g., pinnipeds, shell fish, marine fish, and anadromous fish) were more intensively utilized. Pinnipeds tend to become more important than terrestrial mammals in the food quest, and assemblages of artifacts include a broader range of bone and antler implements. The late littoral stage is a continuation of the early littoral stage except shell midden sites are larger and occasionally contain the remains of houses, suggesting settlements were becoming more sedentary. A more logistically oriented collector strategy seems to have developed during the transition from the early to the late littoral stage (approximately 3000-2000 BP) and a more intense exploitation of marine resources occurred, possibly caused by increasing human populations.

A seasonal land use pattern for the late littoral stage outlined by Lyman and Ross (1988) helps to exemplify the logistically oriented collector strategy. The land use pattern suggests that during the winter people lived in villages adjacent to estuaries, from the river mouth upstream to tidewater. By spring, stored supplies were depleted and sea mammals were establishing rookeries. At this time village populations began to disperse, possibly moving to the outer coast or to upriver camps. During the spring and early summer, many of the outer coast shell midden sites were utilized as resource procurement camps for shell fish, fish and sea mammals. At the same time, trips into the adjacent uplands were probably conducted to hunt terrestrial mammals and collect plant resources. In the mid to late summer, anadromous fish (especially salmon) were running, and populations may have moved to fishing camps where fish were caught, dried, and stored for the winter. At the end of fall fish runs, people moved back to their winter villages.

The faunal remains and C14 dates suggest Seal Rock is associated with the late littoral stage of coastal adaptation where subsistence pursuits focused on a littoral environment primarily during the spring to mid or late summer months (Lyman 1988a, 1988b; Snyder 1978; Zontek 1983).

OBJECTIVES AND RATIONALE

As is apparent in the previous discussion, knowledge of cultural adaptations to littoral environments is important for our understanding of Oregon coast prehistory. Since the model pertaining to adaptation and prehistoric land use patterns is primarily based on the location and size of archaeological sites and relative quantities of certain types of faunal remains recovered, in depth studies of artifact assemblages need to be conducted in order to provide additional information on the technological components (e.g., procurement and processing strategies) for the stages of coastal adaptation. As Kirch (1980:138) notes, "artifacts are the primary point of articulation or linkage between man and environment, and as such the technological component of adaptive strategies is vital". Therefore, consideration should be given to the technological aspect of adaptation; that is, how artifacts function to help humans exploit their environment.

In order to determine whether the prehistoric artifacts from Seal Rock contain important information concerning subsistence strategies and adaptation to local environments, three research objectives have been chosen as the major focus of this study. These objectives are: 1) to analyze the prehistoric artifact assemblage recovered from the 1972 and 1974 excavations to provide information on the technological aspect of the late littoral stage of adaptation; 2) to integrate the artifact assemblage with the faunal information to help identify the subsistence and technological strategies being used at Seal Rock; 3) to determine whether the technology for obtaining resources at Seal Rock is similar to, or different from other sites of comparable age on the southern Northwest Coast.

II. ENVIRONMENTAL SETTING

The Seal Rock site (35LNC14) is located in the Coast Range Province as defined by Franklin and Dyrness (1973). The Coast Range Province extends northward from the middle fork of the Coquille River in Oregon into the Willapa Hills area of southwestern Washington. This Province is bordered on the east by the Puget Sound Trough and the Willamette Valley, on the west by the Pacific Ocean, on the south by the Klamath Mountains, and on the north by the Olympic Peninsula. In general, the central portion of the Oregon coast extending from Coos Bay north to Depoe Bay consists of broad beaches and extensive sand dunes, interspersed with basaltic headlands (Dyrness 1984). Hills and mountains of the Oregon Coast Range are located to the east of the Coastal plain.

GEOLOGY

Geologically, the southern portion of the Coast Range Province was formed during the early Eocene with the deposition of pillow basalts. In addition to small marine sedimentary deposits, sedimentary beds of the Tyee formation were deposited later in the Eocene. Localized deposits of sedimentary and volcanic rocks occurred during the Miocene, forming the coastal headlands. During the Pleistocene, primarily sandy deposits were laid down along the coast. During the Holocene, sea levels rose (Franklin and Dyrness 1973).

Along the coast from Yachats to Newport the primary geologic deposit is of a sedimentary nature, except for the presence of basaltic outcrops at Yachats and Seal Rock. The basalt at Seal Rock consists of a sill intruded between beds of the Yaquina formation and is probably of late Miocene age or younger. The sill extends for a distance of about one and a half miles along the coast. At one time the sill was continuous over the entire area where the basalt is now exposed, but wave erosion has removed large portions of the sill leaving sea stacks, reefs, and numerous rock knobs of varying sizes and shapes. A small reef has developed to the east of Seal Rock on a hard layer of sedimentary rock known as the Yaquina Formation (Lund 1972).

VEGETATION

Vegetation at Seal Rock has been identified as belonging within the *Picea sitchensis* Zone by Franklin and Dyrness (1973). This zone defines a long narrow area which stretches the length of the Washington and Oregon coasts. The *Picea sitchensis* Zone is generally only a few kilometers in width, except where it extends up river valleys. Tree species associated with this zone are: *Picea sitchensis* (Sitka Spruce), *Tsuga heterophylla* (western hemlock), *Pseudotsuga menziesii* (Douglas-fir), *Abies grandis* (grand fir), *Abies amabilis* (Pacific silver fir), *Alnus rubra* (red alder), and *Pinus contorta* (lodgepole pine). Small stands of *Sequoia sempervirens* (coast redwood), *Umbellularia californica* (California laurel) and *Chamaecyparis lawsoniana* (Port Orford cedar) are also present.

Understory species associated with the coniferous forests in areas closest to the coast include: *Polystichum munitum* (swordfern), *Gaultheria shallon* (salal), *Blechnum spicant* (deerfern), *Menziesia ferruginea* (rustyleaf), and *Oxalis oregana* (Oregon oxalis). Edible plant resources such as *Vaccinium parvifoluium* (red huckleberry), *Vaccinium ovatum* (evergreen huckleberry), *Rubus spectabilis* (salmonberry), *Rubus parviflorus* (thimbleberry), and *Sambucus racemosa* (red elderberry) are also present. According to Hansen (1947:114), analysis of pollen profiles from the Oregon coast have demonstrated that postglacial forests had species of the same identity and of approximately the same proportion as those of modern climax forests.

CLIMATE

The central Oregon coast has a mild, wet marine climate resulting from a complex interplay between maritime and continental air masses and the Coast and Cascade mountain ranges. The climate consists of wet, mild winters and cool, relatively dry summers with a long frost free season. Heavy precipitation, primarily in the form of rain occurs in amounts ranging from approximately 1,700 mm to 3,000 mm between October 1 and March 31 (Franklin and Dyrness 1973). Summer precipitation is generally limited to occasional light rainstorms and coastal fog.

Mean monthly temperatures range between 40 and 60° F. Summer temperatures generally range from a high of 65-75° F to a low of 45-

55° F. Winter temperatures range from a high of $40\text{-}50^{\circ}$ F, with lows mostly in the 30's (U.S. Department of Agriculture, 1964).

III. SITE DESCRIPTION

INTRODUCTION

The Seal Rock site (35LNC14) is situated approximately 15 km south of Newport, Oregon near Seal Rock State Park. The site is located in the NE 1/4 of the SW 1/4 of the SE 1/4 of Section 25, Township 12S, Range 12W, Lincoln County, Oregon. The site overlies a consolidated Quaternary sand dune and is situated approximately 10 meters above the current beach level. Exposure of the dune to waves is causing rapid erosion of the western edge of the site. The site has been bisected by U.S. Highway 101. On the west side of the highway a relatively deep shell midden deposit exists, while shallower deposits of shell occur on the east side of the highway, suggesting the excavated portion of the shell midden may have been a specialized activity area of a larger site. Before being bisected by U.S. Highway 101, the site may have measured approximately 100 m by 60 m (Zontek 1983).

Much of the upper 40 cm of the site has been periodically disturbed by gardening and plowing activities. In the 1850's a 4 X 4 meter (12 X 12 foot) semi-subterranean plank house was constructed into the midden. Artifacts associated with that house indicate that an Euro-American man and a native American woman occupied the dwelling (Snyder 1978).

In the early 20th century a hotel was built on the northern border of the site and during the 1930's, after abandonment of the hotel, a three hole golf course was built. Additional disturbance occurred in the mid-1960's with the construction of U.S. Highway 101 and development of a trailer park on the eastern edge of the site (Snyder 1978). During the early 1970's the northern edge of the site was mined for sea lion canines which were used for scrimshaw (Zontek 1983; Ross 1983).

FIELD METHODOLOGY

Seal Rock was excavated during the summers of 1972 and 1974, under the direction of Richard E. Ross of Oregon State University. Both 1972 and 1974 excavations were concentrated on the western portion of the shell midden located on the west side of U.S. Highway 101. Only two test pits were excavated (in 1972) on the east side of the highway (Figure 1). By the end of the 1972 and 1974 field seasons, sixteen 2 X 2 meter units and three 1 X 2 meter units were excavated into the midden, and a total of 131.6 cubic meters of sediment were excavated.

Systematic excavations were conducted using a Cartesian grid for horizontal control, and arbitrary (20 cm) levels with datums arbitrarily set at 100 meters were used for vertical control. The grid and level system was used throughout the excavation as the primary locational control for recording recovery provenience of artifacts and faunal remains. Equipment used to excavate the site included shovels and trowels. All excavated sediment was passed through 1/4-inch (6.35 mm) mesh hardware cloth screens.

Cultural materials were picked from the screens and bagged by level and unit. With the exception of shell column samples, shell

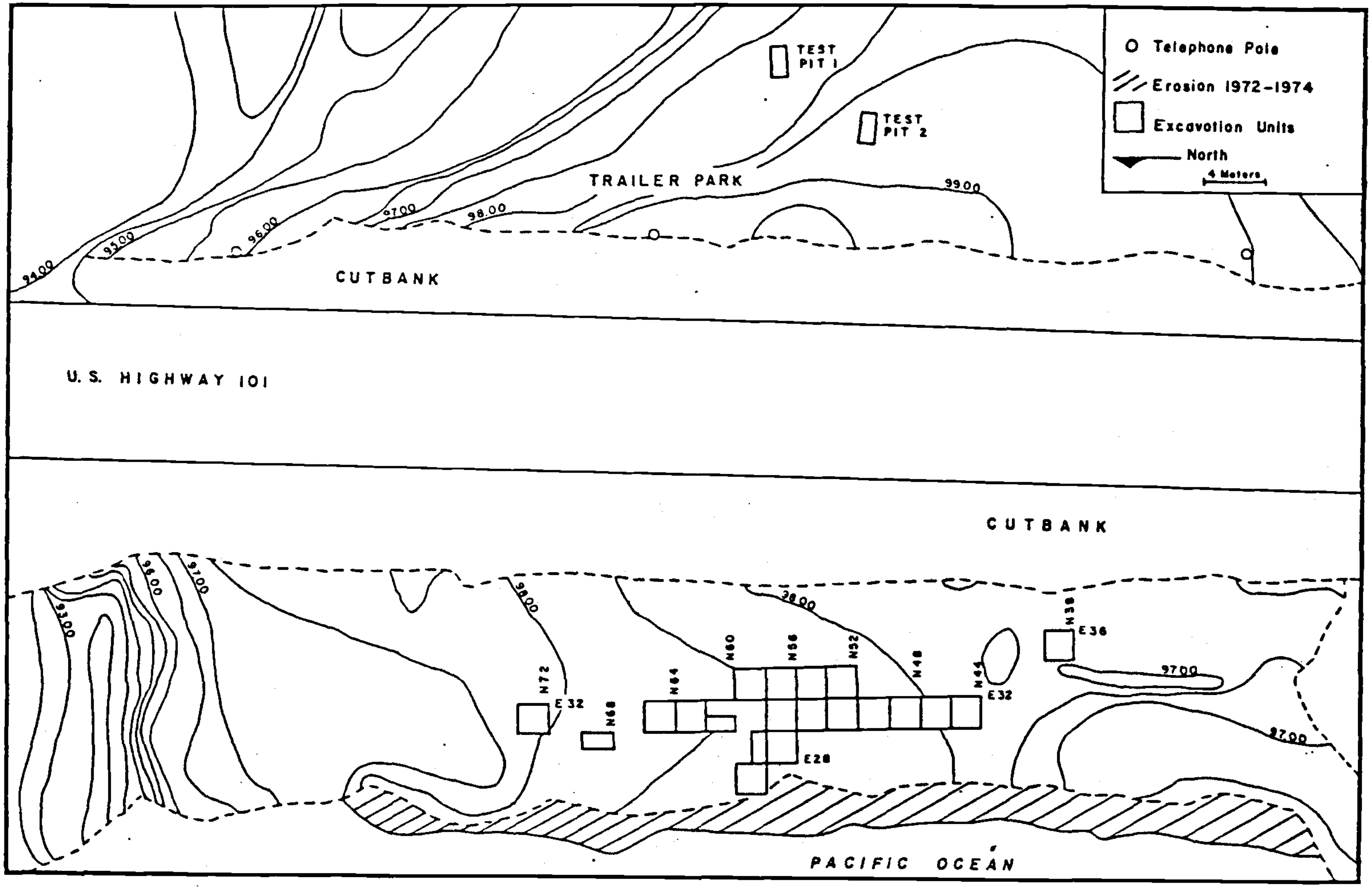

Figure 1. Plan view of 35LNC14 showing location of excavation units, test pits, trailer park, and possible erosion occurring between 1972 and 1974. Map extrapolated from original field school student maps drawn in 1972 and 1974. (Cartography by David Conca)

was not collected. Fire-cracked rocks found during excavation were not collected but were drawn onto unit/level forms. Artifacts found in-place in the site were recorded in situ by measuring their horizontal and vertical locations and mapping them onto unit/level forms.

Unit/level notes were maintained by personnel in charge of the unit. Unit/level forms were filled out during and at the completion of each level. During excavation, level maps were prepared for each unit/level and used for recording the horizontal location of artifacts, fire-cracked rocks, faunal remains, charcoal concentrations, soil changes, and potential features within the unit. Elevations of the cultural materials were also noted on the level map to provide vertical distribution data.

RADIOCARBON DATING

Two charcoal samples collected during the excavations were submitted for radiocarbon dating. These two samples established the approximate time-span of occupation at the site.

The first charcoal sample was obtained from the bottom of the shell midden in a fire hearth located on top of the consolidated sand dune. The location of the sample was N49.20/E31.10 in level 9 at elevation 96.26 below unit datum. The sample produced a date of 375 +/- 70 (WSU #1643) radiocarbon years (approximately A.D. 1575).

The second charcoal sample was located near the bottom of the shell midden approximately 10 cm above the top of the consolidated sand dune at N58.50/E26.44 in level 13 at elevation 96.64 below unit datum. A date of 160 +/- 80 (WSU #1642) radiocarbon years (approximately A.D. 1790) was obtained from this sample.

The two radiocarbon dates from Seal Rock suggest initial utilization of this site began around A.D. 1575, and the site was abandoned prior to the early nineteenth century. The absence of Euro-American trade goods found in the undisturbed portion of the midden at Seal Rock suggests a terminal occupation date of the prehistoric component sometime prior to A.D. 1830. Typically sites in use during or following the period of intense white contact and trading (about 1830-1840) along the Oregon coast contain numerous artifacts diagnostic of this era (Snyder 1978; Ross 1975). By the 1850's occupation of the site by Euro-Americans began, as the construction of a semi-subterranean plank house into the midden suggests.

SITE STRATIGRAPHY

The stratigraphy of the midden at Seal Rock, along with the C14 dates suggest a continuous late prehistoric occupation of the site. The data provided by the artifacts (discussed in Chapter 4) support the evidence of the physical strata. The stratigraphy of the shell midden is somewhat complex consisting of 1) thick layers of shell of various species and compositions intermixed with lenses of charcoal, and 2) layers of mixed shell and soil.

The profile drawing presented in Figure 2 has been extrapolated from profile maps drawn by field school students during 1972 and 1974. After examining the field notes and each profile drawing from

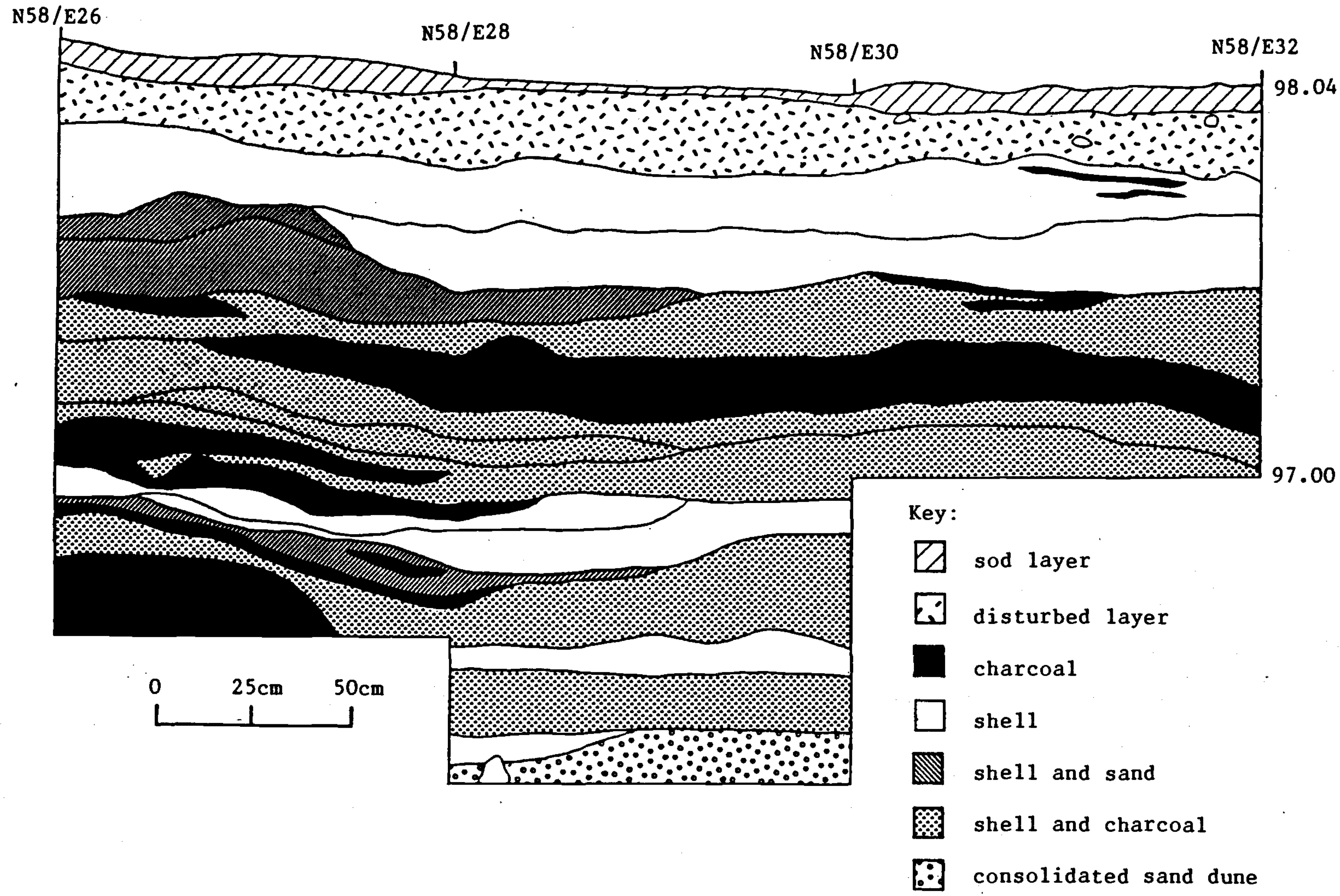

Figure 2. Composite stratigraphic profile drawing from 35LNC14.

the site, it was determined these three continuous east-west profiles provide a good representation of the site deposits.

The strata have been described based on the original notes provided by the field school students. Variation in the stippling for the profile drawing delineates each stratum on the basis of dissimilarity of composition (e.g., sand, charcoal, shell, etc.) Similar stippling represents basic agreement in the composition of the strata. Divisions within layers of the same composition (e.g., shell layers) were made by the students, however the reasons for these divisions were not adequately described. Differences in properties such as color, texture, and compactness may have been the reason for making distinctions between what appear to be homogeneous types of strata.

In general, the first 40 cm of the midden consists of two strata, a sod layer and a disturbed layer. Below these strata, the composition of the midden matrix varies primarily in the proportion of shell to soil, and shell to charcoal. The absence of sterile layers or lenses of sediment in the midden suggests that the site was not abandoned for a sufficient period of time to allow a non-cultural soil layer to accumulate.

IV. ETHNOGRAPHIC BACKGROUND

For archaeological and ethnographic purposes, the Oregon coast has been divided into three segments based on environmental, cultural, and linguistic differences (Cressman 1953: Ross 1988). The northern section extending south from the Columbia River to the Siletz River was ethnographically recorded as Salish territory, the central portion from the Siletz River to the Coquille as Penutian territory, and the southern portion of the coast as Athapascan territory.

Seal Rock is located on the central Oregon coast. The aboriginal populations that inhabited the central coast spoke languages in the Penutian Phylum and include the Yaquina, Alsea, Suislaw, Lower Umpqua, and Coos (Beckham 1976). Ethnographic accounts help place Seal Rock in Alsea territory. According to Drucker (1939), Alsea territory included the river valleys of the Alsea and Yaquina and the ocean frontage between them, while others (Barnett 1937; Berreman 1937: Dorsey 1890; Farrand 1901) indicate that the Alsea occupied the Alsea River drainage with their southern most village located at the present site of Yachats and their northern most village located at Seal Rock. Dorsey (1890:229) recorded an Alsea village named Ku-tau'-wa located at "Seal Rock" on the Pacific coast. Although, the exact location of this site was never recorded, it is possible that 35LNC14 may be the Ku-tau'-wa village of the Alsea.

Ethnographic research was not conducted among the Alsea until three decades after their removal to the Siletz Reservation in 1855. By the time the first study of the language and culture of the Alsea was conducted by Dorsey in 1884 on the Siletz reservation, Euro-American influences, decrease in population due to disease, and reservation life had already affected their traditional lifeways (Dorsey 1889). The ethnographers who studied the Alsea after Dorsey's initial research encountered similar problems with the decimation of the traditional lifestyles of the Alsea and other coastal groups (Barnett 1937; Drucker 1939; Farrand 1901; Frachtenberg 1920). In 1901 Farrand commented that while the Alsea population was "never strong in numbers, it has now shrunk to a few families and will doubtless soon be extinct" (Farrand 1901:239). Over thirty years later during an investigation of the Alsea in 1933 Drucker noted,

> "The Alsea, like other coast Oregon groups, suffered both decline of population and a shattering of their culture in the clash of aboriginal and European civilizations in this region. At the time the following data were obtained, there remained but three persons cognizant of the language and customs." (1939:81)

While many of the traditional lifeways of the Alsea were lost before they could be recorded, the accounts of these ethnographers still provide valuable information on Alsea culture.

Researchers have addressed the unique placement of the Alsea and other central coastal groups in relation to the more distinct northern Northwest Coast cultures located in Washington and British Columbia, and the more southern cultures of northwest California

(Cressman 1953; Newman 1959; Heizer 1941). The Alsea culture has been characterized by Farrand (1901:239) as being interesting because it lies at about "the southern limit of a particular type of culture where the more northern beliefs and characteristics begin to feel the influence of Californian tendencies". When speaking of the central Oregon coastal tribes Farrand (1910) later notes that their mythology and traditions are distinctly of the type of the Washington coast tribes with influences from the Californian stocks to the south. After comparing the culture element distributions for eight Oregon coast cultures, Barnett (1937) concluded that influences from northern California extended as far north as the Coos and then blended with the cultural features of the classic Northwest Coast cultures. Barnett supports this inference by listing the occurrence of different traits from south to north, such as increased use of wood, steam sweating, canoe burial, less reliance upon the acorn, head deformation (Alsea), and a change in the technique of basket making.

The following discussion focuses on ethnographic accounts of subsistence and technology for the Alsea. Subsistence pursuits and technology of the Alsea were documented by Drucker in 1933 and later used by Barnett (1937) to compile a list of the culture element distribution for the Alsea before Drucker's 1939 article was published.

Drucker (1939:82) describes the Alsea as "fisher folk", who practiced seasonal rounds. Salmon were the most important fish in their economy and when dried provided food for the winter months.

Salmon runs along the Alsea River occurred in midsummer (Chinook), early fall (coho and dog salmon), and late fall and winter (steelhead). Smelt, herring, flounders, perch, lampreys and trout were also reported as being of economic value.

Traps and harpoons were considered to be the most effective fishing devices. Fish were trapped with the aid of weirs and were then clubbed or harpooned. Salmon harpoons had a barbed head made of a bone or horn point situated between two barbed harpoon valves. The joining of the valves formed a socket for a hardwood foreshaft which was connected to a long fir or spruce shaft. Harpoons with two diverging foreshafts may also have been used. Fishing techniques for resources other than salmon included using sharp sticks, dip nets, herring rakes, sharp-angle hooks and bone gorges, and gaff hooks (Drucker 1939).

While the Alsea hunted to supplement their fish diet, hunting was not considered as important as fishing. Drucker notes:

> "Hunting was considered an adventuresome way of augmenting the fish diet. There were probably many men among the Alsea who rarely if ever hunted, while some few found the pursuit more to their liking. Strictly speaking, hunting was not a profession, however; the chief occupation of every man was fishing" (1939:83).

> "The paucity of hunting and trapping devices in a region plentifully stocked with game serves to emphasize the lack of interest in any pursuit other than fishing" (1939:84).

According to Drucker's informants elk were hunted by the men primarily in the fall with a bow and arrow. Pitfalls were also utilized, but due to the amount of labor needed to build them their use was restricted. Deer were hunted in the summer with a bow and arrow. Basketry traps were used to catch quail and grouse, and waterfowl were shot. Beaver were clubbed or speared with a salmon harpoon after they were dug out of their dens.

Plant foods and shellfish were gathered by women. Digging sticks and baskets were used to gather both resources. Beached whales were also used by the Alsea to supplement their diet. The oil rendered from the blubber was recalled by the elders as being a delicacy (Drucker 1939).

As for hunting sea mammals, Drucker felt that the Alsea did not have the technology or the ritual that other Northwest Coast peoples had for exploiting this resource and if there was such a complex among the Alsea, it had been mostly forgotten. One informant remembered hearing that sea lions were clubbed or speared on a rock off the river mouth, but Drucker (1939:84) states "it seems likely that sea hunting was known but was adjudged too difficult to be worth while".

Alsea myths gathered in 1910 and 1913 on the Siletz reservation make mention of sea mammals and give some insight into their importance to the Alsea. An Alsea creation myth recounts how seals and sea lions started to inhabit the offshore rocks:

> "Then not long (afterward) he came to a place on the ocean where there was a rock. So he stood (there) quite a long while. Then he looked at the rock and (saw that) it was full of seals. Then he said of them, "Now they will just do it thus, in order that my children may catch and eat them" (Frachtenberg 1920:91).

Not only do Alsea myths explain the creation of seals and sea lions but one myth, "The Lost Seal Hunters" gives an account of two characters from Seal Rock hunting a seal and the behavior of that seal after it had been harpooned. The myth suggests that not only did the Alsea know how to hunt these animals, but how seals acted once harpooned (Frachtenberg 1920).

Besides the hunting implements previously mentioned, the Alsea used a variety of other tools and utilitarian items. Wood, plant fibers, bone and antler, stone, hide, and shell were used to manufacture clothing, utensils, tools, and shelter.

According to Drucker (1939) the Alsea extensively used wood but they did not have the same elaborate woodworking technology as the northern cultures. Numerous utensils were made of wood including, wooden pounding blocks, clubs, bowls, bailers for canoes, spoons, ladles, serving troughs, paddle stirrers, platters, mauls, and digging sticks. The Alsea apparently had the same tool kit for working cedar as the cultures to the north, however the objects had no decoration. Yew and vine maple were used to make bows with two-ply sinew cord for the bow-string. Two to three types of canoes were used by the Alsea, but little on the technology for manufacturing them has been documented. It appears that at least one kind of canoe may have been purchased from northern traders. The only information published on the techniques of canoe manufacture by the Alsea mentions that canoes were hollowed by burning and scraping (Barnett 1937) and the outside of the finished canoe was scorched with pitch to remove splinters and rough areas (Drucker 1939).

Plant fibers were used to make baskets, mats, cordage and clothes. Spruce roots, rushes, beach grasses, and ferns were used for basketry. Mats were made of tule leaves and were sewn with a long curved wooden needle. Cordage was made from the inner bark of willow and tule leaves. The materials were dried in the sun and then soaked in freshwater to soften the fibers. Once softened, they were pounded until the fibers could be separated and spun on the thigh. Clothing was made from shredded bark or grass, and hide.

According to Drucker's informants shell, antler, and bone provided most of the cutting edges. A club-like maul of wood and a chisel of bone or antler were used to cut logs, and elk horn or yew wood wedges were used to split planks. Finishing was done with either an elbow or straight type adze. Sandstone and scouring rushes were used for polishing. Knives were made from shell (muscle or razor-clam). Awls were made of bone or wood and drills were made from bone splinters mounted in the end of a wooden shaft.

Stone was not used as much as shell, antler and bone, but such items as abraders, drills, mauls, arrow points and blades were known to have been made from stone. Drucker notes:

> "Neither informant knew anything about flintworking....blades and points already shaped were found in gravel bars along the river. It was supposed that they swam there "like fish." The finder was considered a very lucky person" (1939:87).

In summary, compared to other areas, such as the northern Northwest Coast, little ethnographic information on central Oregon coast cultures has been gathered. While the ethnographic data on the subsistence and technology of the Alsea can provide valuable information for reconstructing the late littoral stage of adaptation at Seal Rock, the limitations of the ethnographic records must be taken into account before inferences pertaining to the archaeological record can be made. The main problem with relying heavily on the ethnographic data for archaeological interpretations of the Seal Rock site, is that the ethnographic accounts may not adequately represent the traditional life of the Alsea. Ethnographic information for the Alsea and other Oregon coastal groups was not gathered until after disease had depleted the population and reservations had been established. The ethnographic information which was collected is based primarily on oral traditions collected from a small body of informants approximately two hundred years after the first European contact.

Drucker noted problems when he gathered ethnographic information for the Alsea,

> "Although there are gaps and minor inconsistencies in the account, it seems best to present it as it stands, for the opportunity of adding to it and of checking it may not present itself and there is little enough available material on the western Oregonians" (1939:81).

One way to check the accuracy of, and add information to the ethnographic record is by using materials recovered from archaeological sites. Therefore, information provided from the following analysis of lithic and bone artifacts, and faunal remains recovered from Seal Rock will help supplement ethnographic information pertaining to the subsistence and technology of the Alsea.

V. LITHIC ARTIFACT ANALYSIS

INTRODUCTION

The prehistoric lithic artifacts recovered from Seal Rock were examined from several perspectives. Emphasis was placed on determining 1) the types of raw materials used for tool manufacture and use, 2) the trajectory of the tool manufacturing process, 3) the functions of the tools, 4) the relationship between functional and technological attributes, and 5) stylistic criteria which would provide data for culture historical comparisons and the development of a local chronology. Therefore, the lithic artifacts were subjected to three separate but interrelated analyses: technological, functional, and stylistic. Classification systems were used to organize the artifacts into classes based on combinations of similar properties for the technological and functional analyses. For the stylistic analysis, broad descriptive categories were used to define stylistic types.

Classification is generally referred to as a procedure for arranging objects or things into groups on the basis of shared relationships (Thomas 1979; Vierra 1982). A classification contains definitions for the variables to be used, and definitions for the number and kind of properties which pertain to each variable. A class is defined by combinations of properties for each variable (Dunnell 1971; Voorrips 1982).

Researchers have suggested that a combination of technological and functional data will provide the best information for studying prehistoric subsistence and technology (e.g., Bordes 1969; Odell 1974; Tringham et. al., 1974). Odell (1974) and Semenov (1964) have suggested that technological and functional analyses be conducted separately and then the results synthesized. Such a procedure eliminates compounding the errors inherent in each kind of analysis being conducted, produces less danger of the outcome of one analysis predetermining the outcome of the other, and facilitates identifying whether attribute variability is associated with one analysis or the other. Therefore, separate classifications were used to gain technological and functional information from the lithic artifacts.

Paradigmatic and taxonomic classification systems were used to form technological and functional classes of artifacts from the lithic assemblage (Dunnell 1971). A paradigmatic classification uses overall definitional categories called dimensions which are divided into sub-categories called modes. The intersection of single modes from each dimension produces a class of artifacts. Figure 3 gives an example of the paradigmatic classification system used for the functional analysis of materials from Seal Rock and illustrates the process of assigning a specific artifact to a particular class. The resulting class in this example consists of 5 digits. These digits refer to specific modes from each of the five dimensions. Therefore, class 13113 is defined as:

DIMENSION I. KIND OF WEAR
MODES:
1. Chipping → 1
2. Abrasion
3. Crushing
4. Polishing
5. Chipping and abrasion
6. Crushing and abrasion
7. None

DIMENSION II. LOCATION OF WEAR
MODES:
0. Edge only
1. Surface
2. Edge and surface combination
3. Unifacial edge → 3
4. Bifacial edge
5. Point
6. Point and unifacial edge
7. Point and bifacial edge
8. Point and edge combination
9. None

DIMENSION III. SHAPE OF WORN AREA
MODES:
1. Convex → 1
2. Concave
3. Straight
4. Point
5. Notch
6. Irregular
7. None

DIMENSION IV. EDGE ANGLE
MODES:
1. Low → 1
2. Medium
3. High
4. Not applicable

DIMENSION V. ORIENTATION OF WEAR
MODES:
1. Parallel
2. Oblique
3. Perpendicular → 3
4. Diffuse
5. None

Figure 3. Example of the paradigmatic classification system used to define functional classes. The class produced in this example is 13113 (see text for description of class).

> chipping wear (dimension I, mode 1) occurring on a unifacial edge (dimension II, mode 3); worn area convex in shape (dimension III, mode 1) with a low edge angle (dimension IV, mode 1); orientation of wear is perpendicular (dimension V, mode 3)

A taxonomic classification system has a hierarchic structure which is made of an ordered set of oppositions which can be divided to form classes. Classes can be formed at any level of opposition (Dunnell 1971:76). An example of the taxonomic system used for the debitage analysis is presented in Figure 4.

For the technological analysis two separate paradigmatic classifications were used to define 1) the classes of raw material, and 2) the type of object; the location, extent, and kind of manufacture; and the relationship between manufacture and use-wear. A taxonomic classification was used to define classes of debitage for reconstructing the technological reduction sequence(s) of lithic materials recovered from Seal Rock.

A paradigmatic classification system was also used for defining functional classes of artifacts. This classification defines functional attributes rather than stylistic or technological ones and divides objects into comparable, functional categories for tabulation (Dunnell and Beck 1979). This classification is based on defining the results of use-wear on artifacts (Dunnell 1978).

The stylistic analysis was confined to artifacts identified as projectile points during the technological analysis. The projectile points from Seal Rock represent the largest number of extensively manufactured artifacts which incorporate sufficient stylistic variability to warrant inclusion into a stylistic analysis. Broad

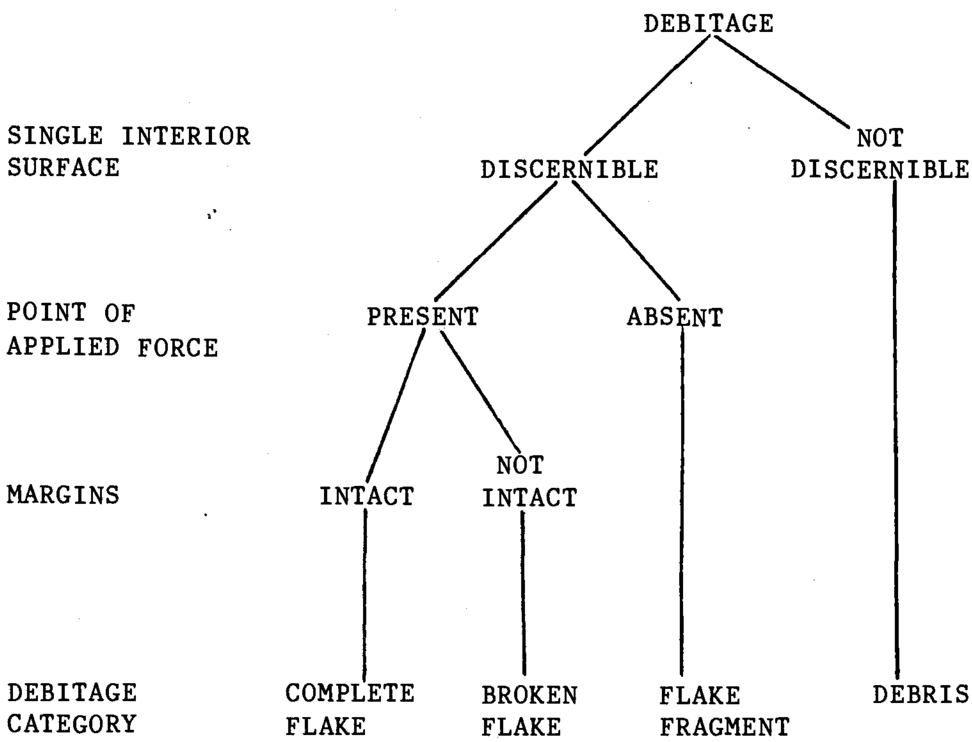

Figure 4. Example of taxonomic classification system used to define debitage classes (after Sullivan and Rozen 1985:759).

descriptive categories or types of projectile points were defined based on morphological similarities between specimens.

The following discussion of the lithic artifact analysis is divided into three main sections pertaining to the technological analysis, the functional analysis, and the stylistic analysis. While each of these analyses are treated separately for discussion purposes; technology, style, and function are interrelated concepts. Therefore, the results of these analyses will be synthesized in the chapter summary.

TECHNOLOGICAL ANALYSIS

Technological analysis of the lithic artifact assemblage was broken down into three different stages to help identify 1) the types of raw materials used for tool manufacture and use, 2) the trajectory of the tool manufacturing process, and 3) the relationship between functional and technological classes. The first stage uses a lithic material type analysis to help define different types of raw materials and variability within each material type represented in the artifacts. The second stage of analysis concentrates on defining 1) the type of artifact (i.e. flake, core, flake tool, etc), 2) the condition (broken or complete) of the artifact, 3) the relative amount of cortex present on the artifact, 4) the type, location and extent of manufacture attrition, and 5) the relationship between use-wear attributes and manufacture attributes for each artifact. All lithic artifacts recovered from Seal Rock were subjected to the first and second stages of the analysis. Artifacts defined as unmodified and unused flakes or debris were included in a lithic debitage analysis (the third stage of analysis).

As previously mentioned, the classification scheme used to define classes of artifacts in the first two stages of the technological analysis is paradigmatic in nature (Dunnell 1971). The classification system used for the debitage analysis is taxonomic in structure (Dunnell 1971).

Lithic Material Type Analysis

Consideration should be given to the kinds of raw materials in the analysis of lithic artifacts, including the explanations of functional and stylistic artifact types and the study of technologies. Semenov (1964) notes that morphological characteristics of stone tools are often dependent on the qualities and properties of the raw materials. Therefore, differences between raw material types may contribute to formal divisions of geographical areas identified through lithic technologies. Factors which may affect the choice of raw materials include texture, luster, surface character, cortex, color, hardness, fracture structure, and availability (Crabtree 1967; Semenov 1964). According to Semenov (1964), the most important factors for flaking are hardness and isotrophism of the material.

Greiser and Sheets (1979) suggest that raw material may have been selected for reasons other than "flakability", and therefore, attention should also focus on the relationship between use-wear attributes and raw material selection. That is, the selection of certain raw materials may have occurred primarily for functional reasons.

The system used to classify raw material types helps to define variations in the quality of different raw material types present at the site. This classification system was developed by Matz (1985) and applied by Lyman and Matz (1985), and Matz and Clark (1987). The classification system consists of five dimensions each containing a different number of modes. The dimensions and modes (after Matz and Clark 1987) are outlined in Table 1 and defined in Appendix A. Petrographic names were assigned to the lithic classes by S. E. Matz in the spring of 1987 at Oregon State University.

Since 96% of the lithic artifacts recovered from Seal Rock were initially defined as cryptocrystalline silicates, emphasis was placed on trying to identify variations within the cryptocrystalline silicates found at the site. In order to define characteristics within the classes associated with cryptocrystalline silicates, Dimensions V (fractures and inclusions) and VI (thermal alteration), were added to the classification system previously used by Matz (1985), and Lyman and Matz (1985).

Dimensions I through IV were used for all lithic artifacts in the Seal Rock collection. These dimensions define 72 classes of lithic materials, of which, 10 classes are present in the Seal Rock lithic assemblage. Dimension V and VI were added to the classification system for cryptocrystalline silicate (CCS) material types only (classes 3013 and 3113). When these dimensions were added to the classification system, 9 different classes of CCS were

Table 1. Outline of dimensions and modes used to classify lithic materials.

DIMENSION I. <u>TEXTURE</u>
MODES:
1. Coarse
2. Medium
3. Fine

DIMENSION II. <u>SIZE OF CONSTITUENT GRAINS</u>
MODES:
0. None
1. Fine
2. Medium
3. Coarse

DIMENSION III. <u>COMPOSITION</u>
MODES:
1. Quartzose
2. Non-quartzose

DIMENSION IV. <u>GLASS</u>
MODES:
1. Natural glass
2. Manufactured glass
3. Non-glass

DIMENSION V. <u>FRACTURES AND INCLUSIONS</u>
MODES:
1. Few
2. Common
3. Many

DIMENSION VI. <u>THERMAL ALTERATION</u>
MODES:
1. Not thermally altered
2. Thermally altered
3. Indeterminate

defined. Tables 2 and 3 summarize the frequency of artifacts per lithic class.

Since lithic classes define variations in raw material, the petrographic names are often misleading. For example CCS belongs to two general lithic classes (3013 and 3113) based on differences in the size of constituent grains. CCS also belongs to nine other lithic classes based on the presence of fractures and inclusions and thermal alteration. To avoid confusion when discussing particular raw materials by name which are associated with more than one lithic class, the class designations and petrographic names will often be used together throughout the chapter.

Ninety-six percent of the lithic assemblage is classified as 3013 cryptocrystalline silicates. The remaining 4% of the assemblage, represents nine classes of material identified as gabbro, quartzite, granitoid, basalt, feldspar, sandstone, phyllite, and obsidian.

The ten different lithic classes shown in Table 2 not only differ in their availability, location and form of occurrence, but also in their physical properties. All lithic material types present in the Seal Rock assemblage, except for feldspar, phyllite, and obsidian, can be found in close proximity to the site. Quartzite, basalt, sandstone, granitoid, gabbro, and CCS occur locally in gravel beach deposits and in the sedimentary layers present near the site. The closest source for feldspar and phyllite (metamorphic) materials is located south of Coos Bay in southwestern Oregon.

Table 2. Frequencies of general artifact types by lithic classes for Dimensions I through IV.

LITHIC CLASS	PETROGRAPHIC NAMES	DEBITAGE	CORES	TOOLS	TOTAL
1113	quartzite	7	-	1	8
1123	basalt, sandstone, phyllite	1	-	7	8
1213	quartzite	-	-	1	1
1223	feldspar, granitoid	-	-	3	3
2123	basalt, sandstone	-	2	7	9
3013	cryptocrystalline	934	63	229	1226
3021	obsidian	4	1	5	10
3023	basalt, phyllite	3	-	4	7
3113	cryptocrystalline	2	-	2	4
3123	basalt, sandstone	2	-		2
	TOTAL	953	66	260	1278

Table 3. Frequencies of general artifact types by lithic classes for cryptocrystalline silicates.

LITHIC CLASS	DESCRIPTIONS FOR CCS CLASSES	DEBITAGE	CORES	TOOLS	TOTAL
301311	few fractures and inclusions not thermally altered	130	16	29	175
301312	few fractures and inclusions thermally altered	255	8	96	359
301313	few fractures and inclusions thermal alteration unknown	105	1	31	137
301321	common fractures and inclusions not thermally altered	109	21	22	152
301322	common fractures and inclusions thermally altered	187	13	38	238
301323	common fractures and inclusions thermal alteration unknown	52	-	8	60
301331	many fractures and inclusions not thermally altered	27	2	2	31
301332	many fractures and inclusions thermally altered	60	1	3	64
301333	many fractures and inclusions thermal alteration unknown	9	1	-	10
	TOTAL	934	63	229	1226

Seven of ten obsidian artifacts recovered from Seal Rock are less than 3 cm in length. Five of these have cortex which appears to have been produced by fluvial transport. Trace element analyses of artifactual obsidian from coastal archaeological sites indicate that obsidian sources located in the Coast Range near Eugene and/or from the gravels of the Siuslaw River may have been utilized prehistorically (Skinner 1987; 1987 personal communication). These small pieces of obsidian with fluvially produced cortex, therefore, may be from a coastally-located obsidian source. The other three obsidian artifacts range in length from 6 cm to 24 cm, suggesting that these materials may have originated from a non-local obsidian source containing larger nodules, possibly one east of the Coast Range or in northern California.

Besides differences in availability of raw materials, differences in physical properties of the raw materials exist. Physical properties having the most influence on manufacture and function of the artifacts are texture (Dimension I) and size of constituent grains (Dimension II). Table 4 summarizes the frequency of object type by texture and grain size. Two percent of the lithic artifacts consist of coarse and medium textured, and coarse and medium grain-sized materials (quartzite, basalt, sandstone, phyllite, and feldspar). Fine textured material with no visible grains (CCS, obsidian, basalt, phyllite) represent 97% of the lithic assemblage, while only 1% of the assemblage consists of fine textured, fine grained materials (CCS, basalt, phyllite). These distributions

Table 4. Frequencies of artifact types by texture and grain size for lithic classes.

TEXTURE AND GRAIN SIZE	LITHIC CLASS	PETROGRAPHIC NAMES	DEBITAGE	CORES	FLAKE TOOLS	MANUFACTURED ARTIFACTS	NON-MANUFACTURED ARTIFACTS	TOTAL
COARSE TEXTURE/ COARSE GRAIN SIZE	1113	QUARTZITE	7			1		8
	1123	BASALT, SANDSTONE, PHYLLITE	1			2	5	8
COARSE TEXTURE/ MEDIUM GRAIN SIZE	1213	QUARTZITE					1	1
	1223	FELDSPAR, GABBRO, GRANITOID				1	2	3
MEDIUM TEXTURE/ MEDIUM GRAIN SIZE	2123	BASALT, SANDSTONE		2		3	4	9
FINE TEXTURE WITH NO VISIBLE GRAINS	3013	CRYPTOCRYSTALLINE	934	63	66	160	3	1226
	3021	OBSIDIAN	4	1	1	4		10
	3023	BASALT	3		2	1	1	7
FINE TEXTURE/ FINE GRAIN SIZE	3113	CRYPTOCRYSTALLINE	2			2		4
	3123	BASALT, SANDSTONE	2					2
TOTAL			953	66	69	174	16	1278

indicate that fine textured materials having no visible grains were primarily used for the lithic industry at the Seal Rock site.

Within the category of fine textured materials having no visible grains, 98% were defined as CCS, 1% as obsidian and 1% as basalt and phyllite. Cryptocrystalline silicates (class 3013) are the most common material type represented at the site. Within this class 54% of the material had been thermally altered, 29% showed no indication of thermal alteration, and 17% of the material's alteration was indeterminate.

Manufacture and Manufacture/Use-wear Relationship Analysis

The second stage of the analysis was used to classify 1) types of objects, 2) their condition, 3) relative amount of cortex, 4) type, location, and extent of manufacturing attrition, and 5) the relationship between manufacture and use-wear attributes.

Artifact types (e.g., flakes, cores, tools) can often be used as indicators for lithic industries (Lohse 1984). The manufacturing process can be seen as a trajectory or a series of indeterminate coordinate points (e.g., detachment of flakes) that has a definite end point which is represented by finished implements or rejected forms (Muto 1976). Therefore, by defining the types of objects and their relationship within the trajectory of the manufacturing process, the technology used to make tools at Seal Rock can be better defined.

The classification system used for this stage of the technological analysis was selected and modified from several sources

(Campbell 1984; Lohse 1984; Lyman et al. 1983). The classification system consists of seven dimensions presented in Table 5 and defined in Appendix A.

The classification system used for this part of the technological analysis defines 48,384 classes, of which 61 classes of artifacts were identified. Seventy-five percent of the artifacts were defined as debitage, 5% were defined as cores, 5% were defined as flake tools, 14% were defined as manufactured tools, and 1% were defined as non-manufactured tools (Table 4). Since debitage represents such a high percentage of the lithic artifacts from Seal Rock, it was subjected to a separate analysis. Therefore, the following discussion is confined to describing the cores, flake tools, manufactured tools, and non-manufactured tools.

Of the 66 cores, 17% have greater than 50% cortex, 53% have cortex ranging from 50-1%, and 30% have no cortex present. One percent of the cores show evidence of use-wear. All of the cores are classified as CCS (3013) except for 2 basalt (2123) cores and 1 obsidian (3021) core. Thirty-five percent of the CCS cores show evidence of thermal alteration. The cores from Seal Rock can be described as being both bipolar (Hayden 1980) and multidirectional (Crabtree 1982).

Flake tools are defined as flakes which show no evidence of manufacturing attrition in the form of retouch or secondary shaping of the flake after it had been detached from the core, but show evidence of use-wear attrition. The raw material for all 69 of the flake tools are fine textured materials with no visible grains (which

Table 5. Outline of dimensions and modes for the technological classification system.

DIMENSION I. ARTIFACT TYPE
MODES:
1. Flake
2. Core
3. Debris
4. Flake tool
5. Manufactured artifact
6. Non-manufactured artifact

DIMENSION II. CONDITION OF ARTIFACT
MODES:
1. Complete
2. Broken
3. Not applicable

DIMENSION III. AMOUNT OF CORTEX
MODES:
1. High
2. Medium
3. None
4. Not applicable

DIMENSION IV. PRESENCE OF MANUFACTURE/USE-WEAR ATTRITION
MODES:
1. Wear only
2. Manufacture only
3. Manufacture and use-wear
4. None

DIMENSION V. TYPE OF MANUFACTURE
MODES:
1. Chipping
2. Pecking
3. Abrasion
4. Chipping and abrasion
5. Pecking and abrasion
6. Chipping, pecking, and abrasion
7. None

DIMENSION VI. USE-WEAR/MANUFACTURE RELATIONSHIP
MODES:
1. Independent
2. Overlapping - total
3. Overlapping - partial
4. None

DIMENSION VII. LOCATION AND EXTENT OF MANUFACTURE ATTRITION
MODES:
0. None
1. Unifacial (edge)
2. Unifacial (edge and surface)
3. Bifacial (edge)
4. Bifacial (edge and surfaces)
5. Bifacial (edge and surface combination)

include lithic classes 3013, 3021, 3023; Table 4). Ninety-six percent of the flake tools are CCS (3013) and the remaining 4% are obsidian and basalt. Within the 3013 lithic class of CCS, 67% of the flake tools are thermally altered, 22% show no signs of thermal alteration, and 11% are indeterminate.

Twenty-seven percent of the flake tools are broken, and 73% are complete. Out of the 69 flakes which show evidence of use-wear attrition, 81 instances of use-wear are identified (e.g., one object can have more than one instance of use-wear). Discussion of use-wear attributes are presented in the functional discussion.

One hundred seventy-four manufactured artifacts were identified in the lithic assemblage from Seal Rock. Manufactured artifacts are defined as any object in which the original form of an object has been either slightly modified (e.g., bifacially or unifacially retouched along an edge or margin) or extensively modified into a particular tool (e.g., projectile points, bifaces). Manufactured artifacts are separated into 1) objects which show no signs of use-wear attrition and 2) objects which exhibit use-wear attrition.

Tables 6 and 7 summarize the frequency of attributes for manufactured artifacts with and without use-wear attrition. Seventy-four percent of the manufactured artifacts show no signs of use-wear attrition, while only 26% show evidence of both use-wear attrition and manufacturing attrition. The reason for the higher frequency of artifacts having only manufacture attrition may have been due to difficulty in distinguishing manufacture from use-wear attributes. If the attrition present on an artifact could not be clearly defined

Table 6. Manufactured artifacts with use-wear by condition, location and extent of manufacturing attrition, type of manufacture, cortex, and manufacture/use-wear relationship.

CONDITION	LOCATION AND EXTENT OF MANUFACTURE ATTRITION	TYPE OF MANUFACTURE: CHIPPING	TYPE OF MANUFACTURE: ABRASION	CORTEX: >50%	CORTEX: 50%-1%	CORTEX: 0	MANUFACTURE/USE-WEAR RELATIONSHIP: INDEPENDENT	OVERLAPPING: TOTAL	OVERLAPPING: PARTIAL
COMPLETE	UNIFACIAL EDGE	13	-	1	2	10	2	9	2
	UNIFACIAL SURFACE	-	-	-	-	-	-	-	-
	BIFACIAL EDGE	20	-	-	10	10	4	11	5
	BIFACIAL SURFACE	2	3	-	-	5	-	5	-
	BIFACIAL SURFACE AND EDGE	2	-	-	-	2	-	2	-
BROKEN	UNIFACIAL EDGE	13	-	-	-	13	1	11	1
	UNIFACIAL SURFACE	-	-	-	-	-	-	-	-
	BIFACIAL EDGE	9	-	-	3	6	-	8	1
	BIFACIAL SURFACE	4	-	-	-	4	-	4	-
	BIFACIAL SURFACE AND EDGE	1	-	-	-	1	1	-	-

FREQUENCIES REFLECT "TOOL" COUNTS
TOTAL TOOLS = 67
TOTAL OBJECTS = 46

Table 7. Manufactured artifacts without use-wear by condition, location and extent of manufacturing attrition, type of manufacture, and cortex.

CONDITION	LOCATION AND EXTENT OF MANUFACTURE ATTRITION	TYPE OF MANUFACTURE: CHIPPING	TYPE OF MANUFACTURE: PECKING & ABRASION	CORTEX: >50%	CORTEX: 50%-1%	CORTEX: 0
COMPLETE	UNIFACIAL EDGE	1	-	-	1	-
	UNIFACIAL SURFACE	1	-	1	-	-
	BIFACIAL EDGE	7	-	-	3	4
	BIFACIAL SURFACE	29	2	-	6	25
	BIFACIAL SURFACE AND EDGE	3	-	-	2	1
BROKEN	UNIFACIAL EDGE	2	-	-	1	1
	UNIFACIAL SURFACE	2	-	-	1	1
	BIFACIAL EDGE	28	-	4	11	13
	BIFACIAL SURFACE	38	1	-	8	31
	BIFACIAL SURFACE AND EDGE	14	-	-	7	7

FREQUENCIES REFLECT OBJECT COUNTS
TOTAL OBJECTS = 128

as use-wear related, the object was defined as having no use-wear attrition on it. This does not mean that all 128 objects defined as "manufacture only" were not used, but rather the presence of use-wear attributes could not clearly be distinguished from manufacturing attributes.

Of the artifacts defined as having manufacturing attrition only, 34% are complete and 66% are broken. The most common type of manufacture is chipping (98%) for both broken and complete artifacts, with pecking and abrasion being the only other type of manufacture defined. Sixty-five percent of the complete and broken manufactured artifacts display no cortex, 31% have 50-1% cortex, and 4% have greater than 50% cortex. Fifty-six percent of the "manufacture only" artifacts display bifacial manufacturing attrition over all or nearly all of the ventral and dorsal surfaces. Twenty-seven percent of the artifacts have bifacial manufacturing attrition along ventral and dorsal edge(s) only. Thirteen percent of the artifacts have manufacturing attrition on all or nearly all of the ventral or dorsal surface, and along an edge extending on one-half or less of the opposite surface. Two percent of the artifacts have unifacial manufacturing attrition along the ventral or dorsal edge(s) only, and another 2% showed manufacturing attrition over all or nearly all of a ventral or dorsal surface.

Forty-six artifacts were identified as displaying both manufacturing and use-wear attrition. Of these artifacts, 59% are complete and 41% are broken (Table 4). Ninety-six percent of the broken and complete objects are manufactured by chipping and 4% by abrasion. Seventy-four percent have no cortex, 24% have 50-1% cortex, and 2% have greater than 50% cortex. Thirty-nine percent of the artifacts have unifacial manufacturing attrition along a ventral or dorsal edge(s) only. Also, 39% display bifacial manufacturing attrition along a ventral and dorsal edge(s). Fifteen percent show manufacturing attrition over all or nearly all of the ventral and dorsal surfaces, while only 7% show attrition on all or nearly all of the ventral or dorsal surfaces, and along an edge extending on one-half or less of the opposite surface.

Cryptocrystalline silicates (lithic classes 3013 and 3113) are the most common material (93%) for all manufactured artifacts, including ones displaying use-wear attributes and ones which do not. The remaining 7% of the manufactured artifacts have been identified as being made from quartzite, basalt, obsidian, phyllite, sandstone and gabbro. Table 8 shows manufactured artifacts by material type, by type of manufacture and presence/absence of use-wear.

Only five out of the 174 artifacts classified as manufactured are formed by means other than chipping. Two artifacts shaped by abrasion have been grouped into lithic class 1123 (phyllite) and 3 artifacts shaped by pecking and abrasion have been classified into lithic classes 2123 (very fine sandstone) and 1223 (gabbro).

Of the 162 manufactured artifacts grouped into lithic classes 3013 and 3113 (CCS), 65% show characteristics of thermal alteration. Fourteen percent do not appear to have been thermally altered, and 20% of the material's alteration is indeterminate.

Non-manufactured tools are defined as objects in which the natural shape of the raw material has not been modified before use (e.g., hammerstones and battered cobbles). Twenty-five instances of use-wear are identified on the 16 artifacts classed as non-manufactured tools. Thirty-one percent of the non-manufactured tools are broken and 69% are complete. The majority (63%) of the artifacts have greater than 50% cortex. Table 9 shows the distribution of cortical variation and the condition of non-manufactured artifacts by lithic class.

Six lithic classes were represented in the non-manufactured tool category. Fine textured materials having no visible grains (3013, CCS and 3023, phyllite) made up 5% of the category, whereas 75% of the materials in this category are characterized as being course textured with both coarse and medium grain sizes (lithic classes 1123, 1213, 1223) and medium textured/medium grain size (2123).

In summary, since the highest frequency of lithic artifacts recovered from Seal Rock were identified as flakes and debris, a separate debitage analysis was conducted. Discussion and results of this analysis are presented in the following section.

Of the lithic artifacts not identified as debitage, the highest frequency represents manufactured artifacts, followed by cores, flake tools, and non-manufactured artifacts, respectively. Cores, flake tools, and manufactured artifacts are primarily made from fine textured materials with no visible grains, namely cryptocrystalline silicates (lithic class 3013). Non-manufactured artifacts are mostly

Table 8. Manufactured artifacts by lithic class, type of manufacture and presence/absence of use-wear.

LITHIC CLASS	PETROLOGIC NAME	TYPE OF MANUFACTURE: CHIPPING	ABRASION	PECKING & ABRASION	NUMBER OF OBJECTS WHICH HAVE USE-WEAR	TOTAL NUMBER OF OBJECTS
1113	QUARTZITE	1	-	-	-	1
1123	PHYLLITE	-	2	-	2	2
1223	GABBRO	-	-	1	-	1
2123	BASALT, SANDSTONE	1	-	2	-	3
3013	CRYPTOCRYSTALLINE	160	-	-	42	160
3021	OBSIDIAN	4	-	-	-	4
3023	BASALT	1	-	-	-	1
3113	CRYPTOCRYSTALLINE	2	-	-	2	2
	TOTAL	169	2	3	46	174

Table 9. Non-manufactured artifacts by lithic class, cortex and condition.

LITHIC CLASS	PETROLOGIC NAME	CORTEX: >50%	50%-1%	0	CONDITION: COMPLETE	BROKEN
1123	SANDSTONE	3	-	2	4	1
1213	QUARTZITE	1	-	-	1	-
1223	GRANITOID,FELDSPAR	2	-	-	1	1
2123	SANDSTONE, BASALT	1	1	2	1	3
3013	CRYPTOCRYSTALLINE	3	-	-	3	-
3023	PYHLLITE	-	-	1	1	-
		10	1	5	11	5

made from coarse to medium textured materials with coarse to medium grain sizes. This dimorphism reflects a difference in the selection of raw materials for certain artifacts. For cores and manufactured artifacts, the selection may be dependent on the "flakability" of the raw material (Semenov 1964). However, for artifacts displaying use-wear attributes such as flake tools, manufactured artifacts and non-manufactured artifacts, the selection of certain raw materials may have been primarily for functional reasons (Greiser and Sheets 1979).

The majority of artifacts which have use-wear, represent complete specimens. Artifacts defined as only having manufacturing attrition represent primarily broken specimens. This distribution may indicate that manufactured tools were used for tasks which caused them to break more frequently, and/or they represent discarded forms which were broken in the stages of manufacture.

Cortical variation between artifact types is also represented in the lithic collection from Seal Rock. The majority of the flake tools and manufactured artifacts (with and without use-wear attributes) have no cortex. Cores primarily have between 50-1% cortex, and the majority of non-manufactured artifacts have over 50% cortex.

Manufactured artifacts are produced primarily by bifacial chipping attrition located on all or nearly all of the ventral and dorsal surfaces of the object. Most of the use-wear that is present on manufactured artifacts tends to overlap completely with the manufacture attrition, suggesting that manufacture was carried out to make an object more functionally suitable (Wilmsen 1968a).

Debitage Analysis

Debitage analysis used for the Seal Rock assemblage follows that of Sullivan and Rozen (1985). Sullivan and Rozen (1985) designed an approach for debitage analysis involving two Arizona case studies, the TEP St. Johns project and the Pitiful Flats project. The debitage categories used for this analysis do not initially imply a particular method of technology or a particular reduction sequence, but rather produce objective and replicable categories of debitage through the use of a taxonomic classification system. Once debitage has been categorized, more conventional technological variables such as flake size and thickness, platform characteristics, and cortical variation can be selected to test inferences generated from the distributions within the debitage categories (Sullivan and Rozen 1985).

The taxonomic system used for defining categories or classes of debitage from Seal Rock has three dimensions of variability, each with two dichotomous attributes (Figure 5). The following definitions for the classification scheme are after Sullivan and Rozen (1985). Amount of cortex was recorded for all debitage, and lengths, widths, and thicknesses were recorded for complete flakes.

1. Single Interior Surface: defined by positive features of percussion, such as ripple marks force lines, or bulb of percussion. If there are multiple occurrences of these features, or

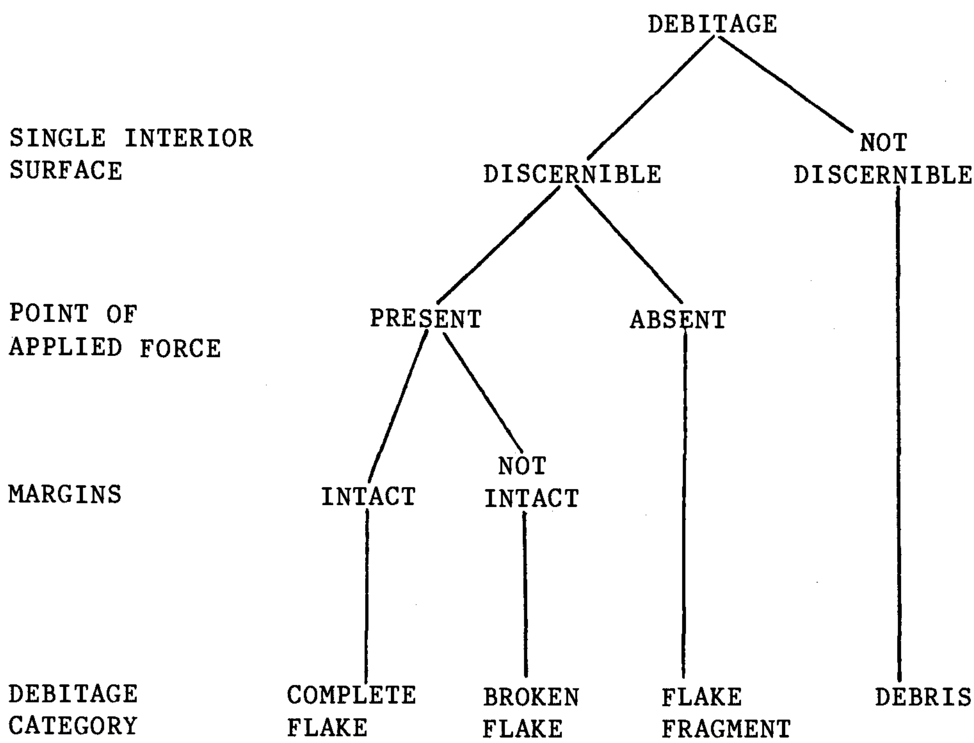

Figure 5. Technological attribute key used to define four debitage classes: complete flakes, broken flakes, flake fragments, and debris (after Sullivan and Rozen 1985:759).

they can not be easily determined, then a single interior surface cannot be identified.

2. <u>Point of Applied Force</u>: defined by the presence of a striking platform or a fragmentary striking platform where the point of applied force is indicated by the origin of force line radiation. A missing striking platform means a point of applied force is absent.

3. <u>Margins</u>: defined as intact if the distal end has a hinge or a feather termination and if lateral breaks or snaps do not interfere with accurate width measurements. Debitage margins are not intact if the piece does not have the above characteristics.

From this classification scheme, four debitage categories (complete flakes, broken flakes, flake fragments, and debris) were defined. Thirty-four percent of the 953 pieces of debitage were classified as complete flakes, 22% as broken flakes, 32% as flake fragments, and 12% as debris. The relative amount of cortex present on the dorsal surface of the flakes is presented in Table 10. Length, width and thickness of complete flakes were measured to the nearest millimeter, and the mean relative flake thicknesses (sum of the length and width divided by thickness) are summarized in Table 11.

Table 10. Debitage classes by relative amount of cortex present on the dorsal surfaces of the flakes.

	CORTEX			
DEBITAGE CLASS	>50%	50%-1%	0%	TOTAL
COMPLETE FLAKES	26	69	229	324
BROKEN FLAKES	19	51	136	206
FLAKE FRAGMENTS	43	58	204	305
DEBRIS	23	22	73	118
TOTAL	111	200	642	953

Table 11. Cortical variation by mean relative flake thickness.

CORTEX	MEAN RELATIVE FLAKE THICKNESS
>50%	9.1
50%-1%	10.1
0%	13.2

Debitage analysis reveals that both core reduction and tool manufacture were taking place at the site. According to Sullivan and Rozen (1985) and Sullivan (1987), assemblages with high percentages of cores, complete flakes, and debris in relation to broken flakes and flake fragments, represent core reduction activities. A low percent of cores, complete flakes, and debris in relation to broken flakes and flake fragments may represent tool manufacturing activities. Assemblages intermediate between these two categories can be produced from both core reduction and tool manufacturing taking place at the site. Table 12 summarizes the average artifact category percentages for Seal Rock.

Additional variables which help support the statements offered thus far include: 1) relative flake thickness, 2) cortex, 3) debitage/tool ratio, and 4) core/retouched piece ratio (Sullivan and Rozen 1985; Sullivan 1987). Relatively small, non-cortical, thin flakes tend to be more abundant in tool manufacturing and tool manufacture/core reduction groups, and large, cortical, thick flakes are more abundant in intensive core reduction groups. In addition, according to Sullivan (1987), a high debitage/tool ratio and low core/retouch piece ratio is more indicative of tool manufacture and core reduction, whereas, a low debitage/tool ratio and high core/retouched piece ratio more closely approximate intensive core reduction only.

Analysis of the Seal Rock lithics indicated a lower percentage of cores and complete flakes (33%) than broken flakes and flake fragments (43%) with a high debitage to tool ratio (5.5:1) and a low

Table 12. Average artifact category percentages for debitage, cores, and retouched pieces.

Artifact Category	Average Artifact Catagory Percentages	Total Number
Complete Flakes	27%	317
Broken Flakes	17%	203
Flake Fragments	25%	298
Debris	10%	115
Cores	6%	66
Retouched Pieces	15%	174
Total	100%	1173

core to retouch piece ratio (1:2.6). Also, most of the debitage from Seal Rock is small, non-cortical, thin flakes and the percentage of debris is relatively low. When compared with Sullivan and Rozen's (1985) and Sullivan's (1987) data, the Seal Rock collection appears to represent both core reduction and tool manufacturing activities.

Since Sullivan and Rozen's (1985) and Sullivan's (1987) studies and interpretations have been based on lithic assemblages from the southwestern United States, strict comparisons between their data and the Seal Rock data may not be completely valid. However, the lack of similar types of comparisons between lithic assemblages for sites along the Oregon coast make a regional interpretation of the Seal Rock assemblage impossible at this time. Therefore, a general comparison between the lithic assemblage from Seal Rock and Sullivan and Rozen (1985) and Sullivan's (1987) data has been made. The comparisons and inferences made from the debitage analysis will not invalidate the classes of debitage produced for Seal Rock, but interpretations can be altered, if necessary, as knowledge increases from additional debitage studies of Oregon coastal sites.

So far, the analysis of the lithic artifacts recovered from Seal Rock has helped identify 1) the types of raw material used for tool manufacture 2) the trajectory of the tool manufacturing process, and 3) the relationship between use-wear and manufacturing attributes. In order to identify how these artifacts were being used, a functional analysis was conducted.

FUNCTIONAL ANALYSIS

A functional analysis was conducted to examine the physical characteristics of the lithic artifacts in order to identify and classify patterns of wear diagnostic of specific tool uses. Traditionally, functional classifications used to identify lithic tools have been based predominately on shape. Names such as scrapers, knives, wedges, etc., have been given to artifacts based on analogy with similar shaped items from either the ethnographic record or from our own present-day technological system. Experimental research has also provided information on interpreting tool use by examining edge damage and general attrition of the working surfaces of experimental analogues to help infer both the manner of tool use and nature of the medium on which the tools were being used (cf. Tringham et al. 1974; Keeley 1980; Odell 1977, Odell and Odell-Vereecken 1980; Semenov 1964). However, according to Dunnell and Beck (1979:59), analogic approaches utilized to infer function of artifacts tend to mask limitations of the archaeological record and archaeological analyses, making it difficult if not impossible to separate inferential from empirical elements. Therefore, the functional analysis and resulting classification of the Seal Rock collection does not intermix experimental or ethnographic categories but examines only the empirical evidence of use-wear morphology.

All artifacts were examined using a 20X hand lens. High-powered microscopic investigation of the lithic artifacts from Seal Rock was not conducted due to the relatively large sample size of objects (ca. 1350 items) recovered from the site. Moreover, research on lithic use-wear (cf. Odell and Odell-Vereecken 1980) suggests low-power examinations of use-related wear provides a reliable method for deriving functional information from lithic artifacts.

A paradigmatic classification system (Dunnell 1971) is used to describe the assemblage from Seal Rock. Other, similar types of functional classifications have been used for various investigations within the Pacific Northwest (Aikens and Minor 1977; Beck 1984; Dancy 1973; Dunnell et al. 1973; Dunnell and Lewarch 1974; Dunnell and Campbell 1977; Dunnell and Beck 1979).

The classification system is organized into five dimensions each consisting of a number of modes. The dimensions describe the incidence of wear that corresponds to the use of a tool. A single object (artifact) may possess a number of discrete wear units or tools, and unless otherwise specified, tool counts in the following tables and discussion will be tool-specific rather than object-specific (i.e., the number of tool types can exceed the number of artifacts recovered).

The classificatory dimensions and modes that are used for the functional analysis are outlined in Table 13 and defined in appendix A. Definitions used for the dimensions and modes have been modified after Lyman et al. (1983, 1985) and Beck (1984).

In previous analyses using this classification system, modes for edge angle have been defined on an arbitrary basis, dividing them into low (0 to 30°), medium (31 to 60°), and high (greater than 60°). In order to define edge angle modes for the Seal Rock assemblage, edge angle measurements were recorded to the nearest degree for each

Table 13. Outline of dimensions and modes for the functional classification system.

DIMENSION I. <u>KIND OF WEAR</u>
MODES:
1. Chipping
2. Abrasion
3. Crushing
4. Polishing
5. Chipping and abrasion
6. Crushing and abrasion
7. None

DIMENSION II. <u>LOCATION OF WEAR</u>
MODES:
0. Edge only
1. Surface
2. Edge and surface combination
3. Unifacial edge
4. Bifacial edge
5. Point
6. Point and unifacial edge
7. Point and bifacial edge
8. Point and edge combination
9. None

DIMENSION III. <u>SHAPE OF WORN AREA</u>
MODES:
1. Convex
2. Concave
3. Straight
4. Point
5. Notch
6. Irregular
7. None

DIMENSION IV. <u>EDGE ANGLE</u>
MODES:
1. Low
2. Medium
3. High
4. Not applicable

DIMENSION V. <u>ORIENTATION OF WEAR</u>
MODES:
1. Parallel
2. Oblique
3. Perpendicular
4. Diffuse
5. None

tool and the frequency distribution of observed edge angles graphed. The resulting graph (Figure 6) suggests three distinct peaks can be identified. These peaks have ranges between 20-44°, 45-60°, and >60° which may represent specific classes of functionally related tools within the assemblage, and therefore, were used to define the modes for Dimension IV.

This classification system can potentially define 8820 classes of use-wear, of which 43 classes are represented in the Seal Rock collection. Descriptions for each class are based on the five digit class designation.

One hundred thirty-seven artifacts display 179 instances of use-wear, or 179 tools. Tables 14 through 18 summarize the kinds of use-wear, the shapes of the worn areas, the edge angles, the orientations of wear, and the locations of wear for each artifact type defined in the technological analysis. For all artifact types (Table 14) the highest percentage of use-wear instances are located on unifacial edges (62%). The highest frequency for the kind of wear is chipping (81%) and the highest frequency for the orientation of wear is perpendicular (91%).

Six tools were present on 5 cores. Use-wear is located on both unifacial edges and points, with the highest instances occurring on unifacial edges (83%). Use-wear found on cores was identified as chipping wear with perpendicular orientation. Shapes of the worn areas are convex, concave, straight, and pointed. Fifty percent of the tools located on cores have a medium edge angle distribution (Table 15).

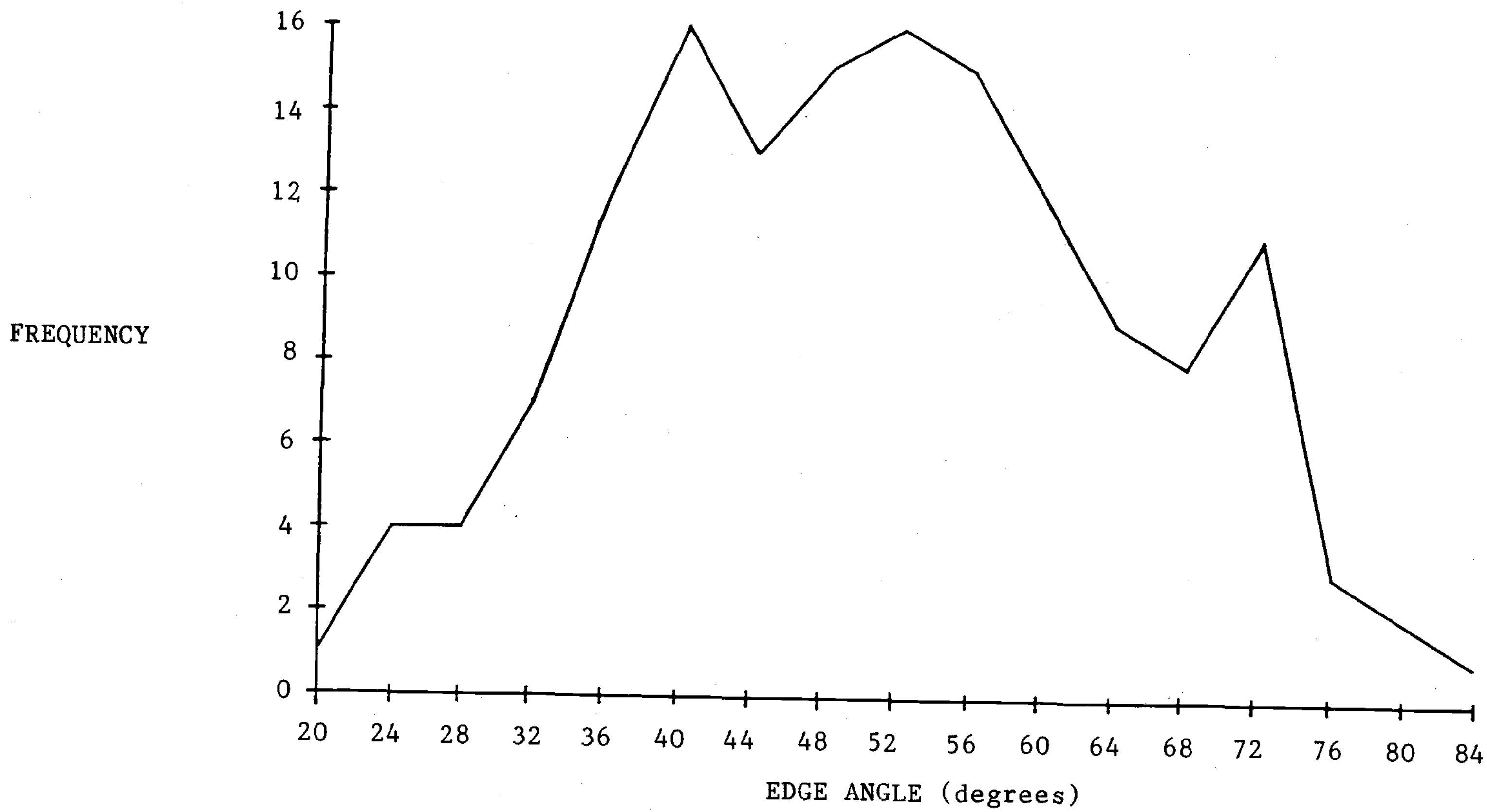

Figure 6. Frequencies of edge angle classes. The classes are 4^{o} each begining at 20^{o}. All frequencies are absolute.

Table 14. All artifact types by location of wear, kind of wear, orientation of wear, shape of worn area, and edge angle.

LOCATION OF WEAR	NUMBER OF USE-WEAR INSTANCES	KIND OF WEAR				ORIENTATION OF WEAR			SHAPE OF WORN AREA					EDGE ANGLE			
		CHIPPING	ABRASION	CRUSHING	POLISH	PARALLEL	PERPENDICULAR	DIFFUSE	CONVEX	CONCAVE	STRAIGHT	POINT	IRREGULAR	LOW	MEDIUM	HIGH	NOT APPLICABLE
EDGE ONLY	3	-	-	-	3	-	3	-	1	-	2	-	-	1	-	2	-
SURFACE	25	-	11	11	3	7	11	7	6	17	2	-	-	-	-	-	25
EDGE & SURFACE	4	-	3	1	-	2	1	1	1	1	2	-	-	-	-	1	3
UNIFACIAL EDGE	110	109	-	1	-	-	110	-	43	30	27	-	10	40	43	27	-
BIFACIAL EDGE	18	17	-	-	1	-	18	-	9	1	8	-	-	9	5	4	-
POINT	5	5	-	-	-	-	5	-	-	-	-	5	-	-	5	-	-
POINT & UNIFACIAL EDGE	6	6	-	-	-	-	6	-	-	-	-	6	-	3	2	1	-
POINT & BIFACIAL EDGE	2	2	-	-	-	-	2	-	-	-	-	2	-	2	-	-	-
POINT & EDGE COMBINATION	6	6	-	-	-	-	6	-	-	-	-	6	-	2	3	1	-
TOTAL	179	145	14	13	7	9	162	8	60	49	41	19	10	57	58	36	28

Table 15. Cores by location of wear, kind of wear, orientation of wear, shape of worn area, and edge angle.

LOCATION OF WEAR	NUMBER OF USE-WEAR INSTANCES	KIND OF WEAR	ORIENTATION OF WEAR	SHAPE OF WORN AREA					EDGE ANGLE		
		CHIPPING	PERPENDICULAR	CONVEX	CONCAVE	STRAIGHT	POINT	IRREGULAR	LOW	MEDIUM	HIGH
EDGE ONLY	-	-	-	-	-	-	-	-	-	-	-
SURFACE	-	-	-	-	-	-	-	-	-	-	-
EDGE & SURFACE	5	5	5	-	-	-	-	-	-	-	-
UNIFACIAL EDGE	-	-	-	-	-	-	-	-	-	-	-
BIFACIAL EDGE	1	1	1	1	2	1	-	1	1	3	1
POINT	-	-	-	-	-	-	-	-	-	-	-
POINT & UNIFACIAL EDGE	-	-	-	-	-	-	1	-	-	1	-
POINT & BIFACIAL EDGE	-	-	-	-	-	-	-	-	-	-	-
POINT & EDGE COMBINATION	-	-	-	-	-	-	-	-	-	-	-
TOTAL	6	6	6	1	2	1	1	1	1	4	1

Eighty-one tools were identified on 69 flakes. Use-wear is located on all types of edges, surfaces, and points defined for the modes in Dimension II of the functional classification. However, the most frequent location of use-wear appears on unifacial edges (74%). The most common type of use-wear that occurs is chipping wear (74%), but abrasion, crushing and polishing wear are also represented. Wear orientation is primarily perpendicular with only one instance being diffuse. Convex, concave and straight shaped worn areas are evenly represented, while pointed and irregular shaped worn areas are less common. Edge angle distributions for flake tools fall in the low, medium and high ranges with the highest percentage (54%) represented in the low edge angle range (Table 16).

Sixty-seven tools were defined on 46 manufactured artifacts. All wear locations defined in the Dimension II modes are represented by the tools except for wear occurring on an edge and surface combination. Unifacial edges represent the most common (67%) location for wear. Chipping, abrasion, crushing and polishing are present on the tools, with chipping wear having the highest frequency of occurrence (91%). With the exception of 2 tools which have parallel orientation of wear, perpendicular wear is most common (97%). Notch shaped worn areas are the only type not represented. Convex shaped worn areas have the largest number of tools associated with them (45%). The highest frequency of edge angles occurred in the medium and high edge angle categories (see Table 17).

Twenty-five tools were identified on 16 non-manufactured artifacts. Wear locations are on surface, and edge and surface

Table 16. Flake tools by location of wear, kind of wear, orientation of wear, shape of worn area, and edge angle.

LOCATION OF WEAR	NUMBER OF USE-WEAR INSTANCES	KIND OF WEAR				ORIENTATION OF WEAR			SHAPE OF WORN AREA					EDGE ANGLE			
		CHIPPING	ABRASION	CRUSHING	POLISH	PARALLEL	PERPENDICULAR	DIFFUSE	CONVEX	CONCAVE	STRAIGHT	POINT	IRREGULAR	LOW	MEDIUM	HIGH	NOT APPLICABLE
EDGE ONLY	1	-	-	-	1	-	1	-	-	-	1	-	-	1	-	-	-
SURFACE	1	-	1	-	-	-	-	1	-	1	-	-	-	-	-	-	1
EDGE & SURFACE	1	-	-	1	-	-	1	-	-	1	-	-	-	-	-	1	-
UNIFACIAL EDGE	60	60	-	-	-	-	60	-	18	19	17	-	6	34	16	10	-
BIFACIAL EDGE	10	10	-	-	-	-	10	-	4	-	6	-	-	5	4	1	-
POINT	1	1	-	-	-	-	1	-	-	-	-	1	-	-	1	-	-
POINT & UNIFACIAL EDGE	3	3	-	-	-	-	3	-	-	-	-	3	-	2	-	1	-
POINT & BIFACIAL EDGE	1	1	-	-	-	-	1	-	-	-	-	1	-	1	-	-	-
POINT & EDGE COMBINATION	3	3	-	-	-	-	3	-	-	-	-	3	-	1	2	-	-
TOTAL	81	78	1	1	1	0	80	1	22	21	24	8	6	44	23	13	1

Table 17. Manufactured artifacts by location of wear, kind of wear, orientation of wear, shape of worn area and edge angle.

LOCATION OF WEAR	NUMBER OF USE-WEAR INSTANCES	KIND OF WEAR				ORIENTATION OF WEAR			SHAPE OF WORN AREA					EDGE ANGLE			
		CHIPPING	ABRASION	CRUSHING	POLISH	PARALLEL	PERPENDICULAR	DIFFUSE	CONVEX	CONCAVE	STRAIGHT	POINT	IRREGULAR	LOW	MEDIUM	HIGH	NOT APPLICABLE
EDGE ONLY	2	-	-	-	2	-	2	-	1	-	1	-	-	-	-	2	-
SURFACE	2	-	2	-	-	2	-	-	-	-	2	-	-	-	-	-	2
EDGE & SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNIFACIAL EDGE	45	44	-	1	-	-	45	-	24	9	9	-	3	5	24	16	-
BIFACIAL EDGE	8	7	-	-	1	-	8	-	5	1	2	-	-	4	1	3	-
POINT	3	3	-	-	-	-	3	-	-	-	-	3	-	-	3	-	-
POINT & UNIFACIAL EDGE	3	3	-	-	-	-	3	-	-	-	-	3	-	1	2	-	-
POINT & BIFACIAL EDGE	1	1	-	-	-	-	1	-	-	-	-	1	-	1	-	-	-
POINT & EDGE COMBINATION	3	3	-	-	-	-	3	-	-	-	-	3	-	1	1	1	-
TOTAL	67	61	2	1	3	2	65	0	30	10	14	10	3	12	31	22	2

combinations only. The most frequent types of wear are abrasion (44%) and crushing (44%). Perpendicular oriented wear is the most common (44%), but parallel and diffuse orientations are also represented (Table 18).

In order to link the technological and functional classes, both formal and functional attributes were considered. Functional inferences used for assigning tool labels and functions were taken from Wilmsen's edge angle studies (1968a, 1968b, 1970), ethnographic and ethnoarchaeological studies (e.g., Gould, Koster, and Sontz 1971) and experimental lithic edge-wear analyses (e.g., Odell 1981). Inferences took into account all variables and attributes used for the functional classification. For example, an artifact which displays use-wear on an unifacially chipped convex low angle edge was assigned an inferred function of cutting/sawing and was labeled a "knife". Table 19 lists and describes the 43 functional classes and gives the tool label for each of the classes.

Manufactured artifacts defined as not having use-wear attributes were labeled based on morphology. Therefore, an artifact which is unifacially chipped or flaked along a ventral or dorsal edge is labeled a "uniface (marginally retouched)", whereas an artifact which is unifacially chipped over all or nearly all of the ventral or dorsal surface is labeled a "uniface". Table 20 summarizes the frequencies of tool-types as defined by technological and functional attributes.

In general, the highest frequency (73%) of tools displaying use-wear are associated with cutting and scraping functions and have

Table 18. Non-manufactured artifacts by location of wear, kind of wear, orientation of wear, shape of worn area, and edge angle.

LOCATION OF WEAR	NUMBER OF USE-WEAR INSTANCES	KIND OF WEAR			ORIENTATION OF WEAR			SHAPE OF WORN AREA			EDGE ANGLE
		ABRASION	CRUSHING	POLISH	PARALLEL	PERPENDICULAR	DIFFUSE	CONVEX	CONCAVE	STRAIGHT	NOT APPLICABLE
EDGE ONLY	-	-	-	-	-	-	-	-	-	-	-
SURFACE	22	8	11	3	5	11	6	6	16	-	22
EDGE & SURFACE	3	3	-	-	2	-	1	1	-	2	3
UNIFACIAL EDGE	-	-	-	-	-	-	-	-	-	-	-
BIFACIAL EDGE	-	-	-	-	-	-	-	-	-	-	-
POINT	-	-	-	-	-	-	-	-	-	-	-
POINT & UNIFACIAL EDGE	-	-	-	-	-	-	-	-	-	-	-
POINT & BIFACIAL EDGE	-	-	-	-	-	-	-	-	-	-	-
POINT & EDGE COMBINATION	-	-	-	-	-	-	-	-	-	-	-
TOTAL	25	11	11	3	7	11	7	7	16	2	25

Table 19. Artifacts by functional class, tool type, and material type.

FUNCTIONAL CLASS	DESCRIPTION	TOOL LABEL	MATERIAL TYPE(S)	TOTAL
13113	unifacially chipped convex low angle edges located on flakes (n=11), bifacially worked artifacts (n=3), and a core (n=1)	Knife	CCS	15
13123	unifacially chipped convex medium angle edges located on flakes (n=5), unifacially (n=5) and bifacially worked (n=8) artifacts	Knife/Scraper	CCS	18
13133	unifacially chipped convex high angle edges located on flakes (n=2), and unifacially (n=5) and bifacially (n=3) worked artifacts	Scraper	CCS	10
13213	unifacially chipped concave low angle edges located on flakes only	Knife	CCS	11
13223	unifacially chipped concave medium angle edges located on flakes (n=2), cores (n=2), and unifacially (n=3) and bifacially (n=2) worked artifacts	Knife/Scraper	CCS	9
13233	unifacially chipped concave high angle edges located on flakes (n=6), and bifacially worked artifacts (n=4)	Scraper	CCS	10
13313	unifacially chipped straight low angle edges located on flakes (n=7) and unifacially worked artifacts (n=2)	Knife	CCS	9
13323	unifacially chipped straight medium angle edges located on flakes (n=8) and unifacially worked artifacts (n=4)	Knife/Scraper	CCS	12
13333	unifacially chipped straight high angle edges located on flakes (n=2), unifacially (n=1) and bifacially (n=1) worked artifacts, and a core (n=1)	Scraper	CCS	5
13613	unifacially chipped irregular low angle edges located on flakes only	Knife	CCS	5

Table 19. (continued)

FUNCTIONAL CLASS	DESCRIPTION	TOOL LABEL	MATERIAL TYPE(S)	TOTAL
13623	unifacially chipped irregular medium angle edges located on a flake (n=1), unifacially worked artifacts (n=2), and a core (n=1)	Knife/Scraper	CCS	4
13633	unifacially chipped irregular high angle edge located on a bifacially worked artifact	Scraper	CCS	1
14113	bifacially chipped convex low angle edges located on a flake (obsidian) and a bifacially worked artifact	Knife	CCS Obsidian	2
14123	bifacially chipped convex medium angle edges located on flakes only	Knife/Scraper	CCS	2
14133	bifacially chipped convex high angle edges located on a flake (n=1) and bifacially worked artifacts (n=3)	Scraper	CCS	4
14213	bifacially chipped concave low angle edge located on a bifacially worked artifact	Knife	CCS	1
14313	bifacially chipped straight low angle edge located on flakes (n=4), and unifacially (n=1) and bifacially (n=1) worked artifacts	Knife	CCS	6
14323	bifacially chipped straight medium angle edges located on flakes only	Knife/Scraper	CCS	2
15423	chipped medium angle point located on a flake (n=1), bifacially worked artifacts (n=3), and a core (n=1)	Graver	CCS	5
16413	chipped point and adjacent unifacial low angle edge located on flakes (n=2) and a bifacially worked artifact (n=1)	Graver	CCS	3
16423	chipped point and adjacent unifacial medium angle edge located on bifacially worked artifacts only	Graver	CCS	2

Table 19. (continued)

FUNCTIONAL CLASS	DESCRIPTION	TOOL LABEL	MATERIAL TYPE(S)	TOTAL
16433	chipped point and adjacent unifacial high angle edge located on a flake	Graver	CCS	1
17413	chipped point and adjacent bifacial low angle edge located on a flake and a bifacially worked artifact	Graver	CCS	2
18413	chipped point and two or more adjacent low angle edges located on a flake and a unifacially worked artifact	Drill	CCS	2
18423	chipped point and two or more adjacent medium angle edges located on flakes (n=2) and a bifacially worked artifact (n=1)	Drill	CCS	3
18433	chipped point and two or more adjacent high angle edges located on a bifacially worked artifact	Drill	CCS	1
21141	abraded convex surface with parallel striations located on a non-manufactured artifact	Grinding Stone	sandstone	1
21144	abraded convex surface with diffuse striations located on a non-manufactured artifact	Abrader	phyllite	1
21241	abraded concave surface with parallel striations located on non-manufactured artifacts	Abrader	phyllite, sandstone	4
21244	abraded concave surfaces with difuse striations located on a flake (n=1) and non-manufactured artifacts	Abrader	sandstone, basalt	3
21341	abraded straight surface with parallel striations located on a bifacially worked artifact	Abrader	phylitte	2
22144	abraded convex edge and surface with diffuse striations located on a non-manufactured artifact	Abrader	sandstone	1
22341	abraded straight edge and surface with parallel striations located on non-manufactured artifacts	Miscellaneous/ Unknown	sandstone	2

Table 19. (continued)

FUNCTIONAL CLASS	DESCRIPTION	TOOL LABEL	MATERIAL TYPE(S)	TOTAL
31143	crushed convex surfaces located on non-manufactured artifacts	Hammerstone	CCS, feldspar, quartzite, basalt	4
31243	crushed concave surfaces located on non-manufactured artifacts	Hammerstone	CCS, feldspar, granitoid, basalt	7
32233	crushed concave edge and surface located on a flake	End battered flake/split cobble	CCS	1
33333	unifacially crushed straight high angle edge located on a bifacially worked artifact	Scraper	CCS	1
40133	polished convex high angle edge located on a unifacially worked artifact	Scraper	CCS	1
40313	polished straight low angle edge located on a flake	Knife	CCS	1
40333	polished straight high angle edge located on a bifacially worked artifact	Scraper	CCS	1
41144	polished convex surface located on a non-manufactured artifact	Miscellaneous/ Unknown	sandstone	2
41244	polished concave surface located on a non-manufactured artifact	Miscellaneous/ Unknown	sandstone	1
44123	polished convex bifacial medium angle edge located on a bifacially worked artifact	Adze	phyllite	1

Table 20. Frequencies of tool types as defined by technological and functional attributes.

TOOL LABEL	TOTAL
MANUFACTURED TOOLS	
Knife	9
Scraper and/or knife	24
Scraper	21
Core - knife	1
Core - scraper and/or knife	3
Core - scraper	1
Core - graver	1
Graver	7
Drill	3
Adze	3
FLAKE TOOLS	
Knife	40
Scraper and/or knife	20
Scraper	11
Graver	5
Drill	3
Abrader	1
End battered split cobble	1
NON-MANUFACTURED TOOLS	
Grinding stone	1
Abrader	8
Hammerstones	10
Pestle	1
Miscellaneous polished and shaped cobble tools	5
MANUFACTURED ARTIFACT LABEL	
Uniface (marginal retouch)	3
Uniface	3
Biface (marginal retouch)	31
Biface	37
Projectile point	39
Projectile point fragments	12
Pestle fragment	1
Shaped round objects	2
TOTAL	307

been labeled knives, scrapers, or multifunctional tools (e.g., knives and/or scrapers) based on use-wear and morphological characteristics. Gravers, drills, and adzes make up 12% of the tools exhibiting use-wear characteristics, whereas 15% of the tools are labeled abraders, end battered cobbles, grinding stones, pestles and miscellaneous polished and shaped cobble tools. The highest frequency of manufactured tools not associated with use-wear attributes are projectile points and bifaces (93%).

The projectile points from Seal Rock represent the highest frequency of extensively manufactured artifacts which contain sufficient stylistic variability to warrant a separate analysis. Therefore, a stylistic analysis was conducted for this class of artifacts.

STYLISTIC ANALYSIS

Projectile points not only carry technological and functional information, but also have stylistic attributes which can provide temporal and spatial information on social groups. In general, the purpose of a stylistic analysis of projectile points is to identify combinations of morphological traits which have specific temporal distributions, and/or reflect distinct geographic areas. Projectile point typologies which demonstrated temporal significance can then be used to develop culture-histories or chronologies. Well established cultural chronologies based on coastal site projectile point styles are lacking for the Oregon coast (Lyman and Ross 1988).

Since the stratigraphy of the midden deposits and C14 dates at Seal Rock suggest a continuous late prehistoric occupation of the site (see sections on Site Stratigraphy and Radiocarbon Dating in Chapter II), the cultural-historical significance (or change through time) of the projectile points will not be addressed. Broad descriptive categories are presented to define types of projectile points so comparisons of stylistic and morphological attributes can be made with other late prehistoric Oregon coastal sites. Also, different variables and attributes defined by Thomas (1981) have been measured and are presented in Table 21. Figure 7 presents the standardized attributes measured for the projectile points from Seal Rock. The descriptive types for Seal Rock are as follows:

<u>Type 1: Triangular (n=20)</u>

Specimens are unnotched, triangular in outline; bases are straight (40%), convex (30%), and slightly concave (35%); blade edges are straight (60%) or excurvate (40%); cross sections are represented as biconvex (75%), plano-convex (20%), and biplano (5%); tips are acute (55%) or broken (45%).

The material type represented is CCS (lithic class 3013); specimens are thermally altered (50%), not thermally altered (15%), or their thermal alteration is indeterminate (35%); fractures and inclusions are few (90%) and common (10%) and appear to be due to heat crazing and pot-lidding of the material.

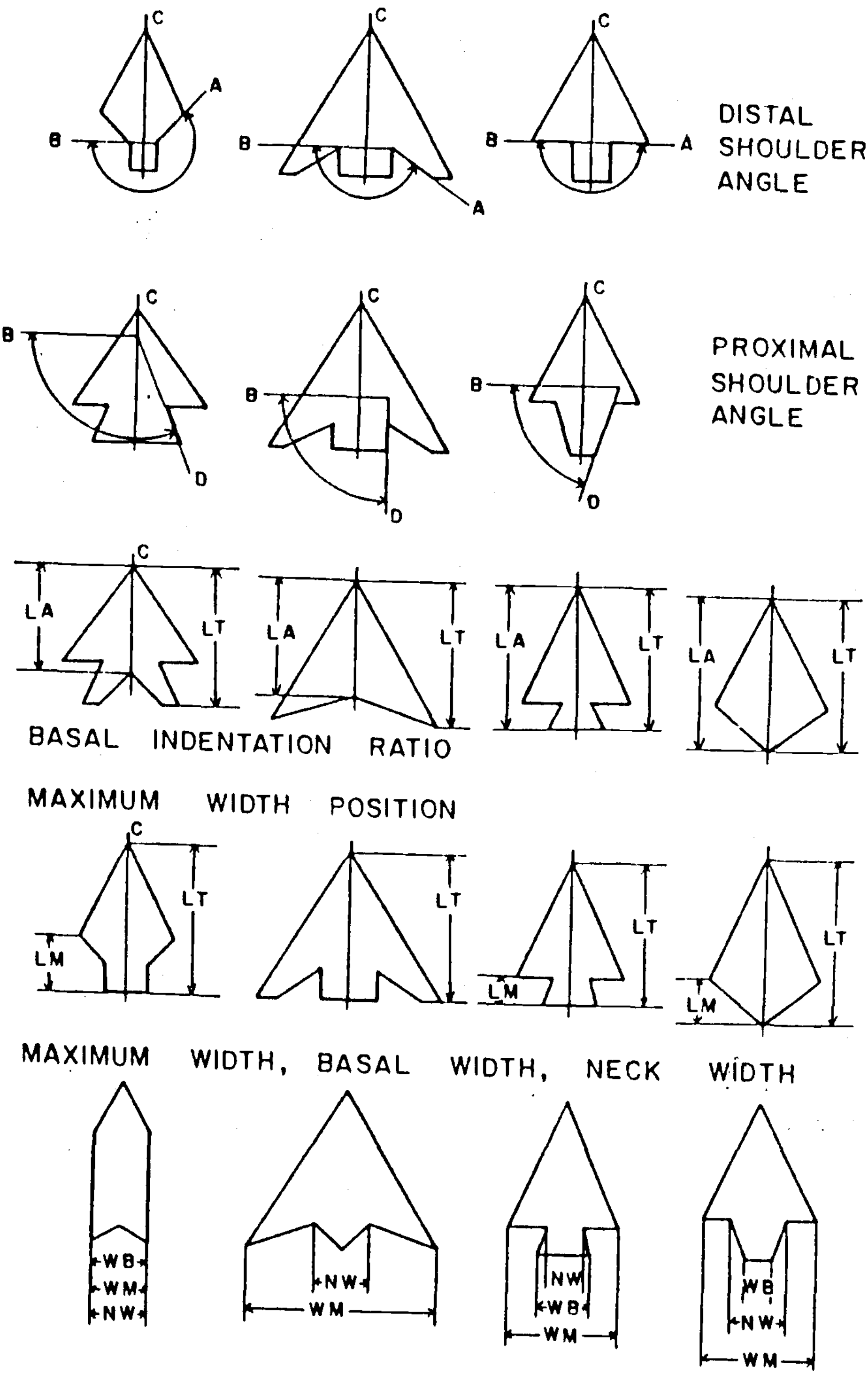

Figure 7. Definitions of attributes for projectile point measurements. Abbreviations are: DSA, distal shoulder angle; PSA, proximal shoulder angle; BIR, basal indentation ratio; LA, length of longitudinal axis; LT, total length; LM, length between proximal end and maximum width position; WB, basal width; WM, maximum width; NW, neck width; TM, maximum thickness (after Lyman et al. 1983:163).

Table 21. Measurements of projectile points. All measurements, except angles are in millimeters. * denotes measurement is an estimate. See Figure 7 for abbreviation definitions.

Specimen Number	LT	LA	WM	WB	WMP(%)	BIR Ratio	DSA(°)	PSA(°)	TM	NW	Material	Type Designatior
N46/E30 1-2	29	29	26	26	0.0	1.0	-	-	9	26	CCS	Type 1
N46/E30 1-79	-	-	24	24	0.0*	1.0*	-	-	15	24	CCS	Type 1
N46/E30 97.56	49	45	21	20	16.3	.92	-	-	11	20	CCS	Type 1
N48/E30 8-11c	52	52	24	24	0.0	1.0	-	-	11	24	CCS	Type 1
N50/E30 4-45	42	40	20	14	30.9	.95	-	-	8	14	CCS	Type 1
N50/E30 5-113	45	45	22	19	22.2	1.0	-	-	9	19	CCS	Type 1
N52/E30 3-11a	39	39	20	18	28.2	1.0	-	-	8	18	CCS	Type 1
N54/E30 6-11a	40	38	26	23	25.0	.95	-	-	8	23	CCS	Type 1
N54/E33 4-4	47	47	23	23	0.0	1.0	-	-	11	23	CCS	Type 1
N56/E28 1-27	-	-	22	18	-	1.0*	-	-	7	18	CCS	Type 1
N56/E30 2-11b	-	-	28	28	0.0	-	-	-	13	28	CCS	Type 1
N58/E26 4-11	-	-	21	19	-	-	-	-	9	19	CCS	Type 1
N58/E26 4-11a	-	-	25*	-	-	-	-	-	7	22*	CCS	Type 1
N58/E26 7-1a	48	44	26	26	0.0	.92	-	-	10	26	CCS	Type 1
N58/E26 7-1c	-	-	17	17	0.0*	1.0	-	-	10	17	CCS	Type 1
N64/E30 1-11a	32	31	17	15	53.1	.97	-	-	11	15	CCS	Type 1
N68/E30 2-11i	-	-	20	19	-	1.0*	-	-	7	19	CCS	Type 1
N68/E30 5-11a	-	-	17	12	-	1.0*	-	-	5	12	CCS	Type 1
N68/E30 5-11b	40	37	20	18	50.0	.93	-	-	10	18	CCS	Type 1
N72/E30 2-6	29	29	18	18	0.0	1.0	-	-	8	18	CCS	Type 1
PH-2	27	27	19	19	0.0	1.0	-	-	7	19	CCS	Type 1
OH-4	48	45	25	23	27.1	.94	-	-	9	23	CCS	Type 1
N44/E30 6-69	23	23	19	4	13.0	1.0	160	88	4	5	CCS	Type 2a
N46/E30 8-11b	-	-	15	-	-	-	159*	-	4	5*	CCS	Type 2a
N54/E30 4-11a	22	19	15	3	13.6	.86	166	65	3	4	BASALT	Type 2a
N58/E32 4-109	25	25	-	0	-	1.0	153	45	5	4	CCS	Type 2a
N52/E32 2-35	28	26	23*	7	0.0*	.93	144	83	4	7	CCS	Type 2b
N56/E30 2-11a	-	-	-	4	-	-	143	113	3	6	CCS	Type 2b
N46/E30 1-1	35	30	-	-	0.0*	.86	-	-	3	-	CCS	Type 3
N48/E30 4-11d	-	-	-	16	-	-	-	-	-	16	CCS	Type 3
N52/E30 1-11a	-	-	13*	13*	0.0*	-	-	-	4	13*	CCS	Type 3
N56/E28 2-89	-	26	-	-	-	-	-	-	3	-	CCS	Type 3
N56/E30 6-11a	40	32	15	15	0.0	.80	-	-	4	15	CCS	Type 3
N56/E30 9-?	-	19	-	-	-	-	-	-	2	-	CCS	Type 3
N58/E32 3-52	32	28	19	19	0.0	.88	-	-	4	19	CCS	Type 3
PH-1	26	21	19*	19*	0.0*	.81	-	-	3	19*	CCS	Type 3
N46/E30 1-19	28	28	-	-	0.0	1.0	133	133	2	-	CCS	Type 4
N50/E30 10-59	35	35	13	10	28.6	1.0	141	118	5	10	CCS	Type 4
N56/E30 4-11	15	12	-	-	0.0	.80	148	124	3	-	OBSIDIAN	Type 4
N58/E26 7-1b	-	-	28*	13	-	-	146	64	10	19	CCS	Type 5
N64/E30 5-11e	-	-	-	19	-	-	-	-	14	22	CCS	Type 5

Type 2: Basal-notched Barbed (n=6)

Variety 2a: (n=4)

Specimens are basal notched; contracting stems predominate; shoulder definition is well defined; bases tend to be pointed, however the base is absent from one specimen; barbs are pointed; blade edges are incurvate (2) or excurvate (2); cross sections are represented as plano-convex (1), or biconvex (3); tips are acute.

Material types represented are basalt (lithic class 3023) n=1 and CCS (lithic class 3013) n=3. CCS specimens are either thermally altered (1) or the thermal alteration is indeterminate (2); few fractures and inclusions are predominate.

Variety 2b: (n=2)

Specimens are basal notched; stems are straight; bases are straight and slightly convex; shoulder definition is well defined; barbs are broken on both sides of one specimen and on one side of the other specimen, the one barb represented is pointed; blade edges are incurvate and straight; cross sections are biconvex and biplano; one tip is acute and one is broken.

The material type represented is CCS (lithic class 3013); thermal alteration is indeterminate; specimens show few fractures and inclusions.

Type 3: Concave base (n=8, 1=base fragment only)

Specimens have concave bases with triangular shaped blades; barbs are pointed, although one specimen is broken; blade edges are straight (4) to slightly incurvate (3); cross sections are biconvex; tips are either acute (5) or broken (3).

The material type represented is CCS (lithic class 3013); specimens are thermally altered (1), not thermally altered (1), or their thermal alteration is indeterminate (6); fractures and inclusions are few (7) and common (1).

Type 4: Side-notched (n=3)

Specimens are side-notched; stems are expanding; bases are either straight or concave; shoulder definition is not well defined; blade edges are straight, incurvate, and asymmetrical; cross sections are biconvex; tips are acute.

The material types represented are CCS (lithic class 3013) and obsidian (lithic class 3021). Thermal alteration of the CCS is indeterminate; all specimens have few fractures and inclusions.

Type 5: Contracting-stem (n=2 base fragments)

Specimens are unnotched; the stems are contracting going into a pointed or rounded base; shoulder definition is moderate to well defined; blades are missing; cross-sections are biconvex.

The material type represented is CCS (lithic class 3013); the thermal alteration of the specimens is indeterminate; both specimens have common fractures and inclusions.

Type 6: Fragments (n=12)

Miscellaneous, unclassifiable projectile point fragments and segments; specimens represented are tips (n=9); mid-sections (n=2); and bases (n=1). The material type represented is CCS (lithic class 3013).

Use-wear attributes were not identified on the projectile points. As previously mentioned, manufacturing attrition tended to mask use-wear attributes; thus, functional categories (i.e. projectile point/knife) were not assigned to the projectile points from Seal Rock.

Projectile points from Seal Rock are similar in form to those reported for other late prehistoric sites excavated on the Oregon coast (cf. Minor and Toepel 1983; Pullen 1982). Therefore, both projectile point styles and carbon 14 dates from Seal Rock suggest a late prehistoric occupation.

SUMMARY

The goals of the lithic artifact analysis included identifying: 1) the types of raw materials used for tool manufacture and use, 2) the trajectory of the tool manufacturing process, 3) the functions of the tools 4) the relationship between functional and technological attributes, and 5) the types of projectile points represented at the site. From the preceding analyses several statements pertaining to these goals can be made.

The most abundant raw material present in the Seal Rock lithic assemblage consists of fine textured materials with no visible grains present, with the greatest occurrence of these materials being cryptocrystalline silicates (lithic class 3013). Only 4% of the lithic assemblage is comprised of materials defined as gabbro, quartzite, granitoid, basalt, feldspar, sandstone, phyllite, and obsidian. While the greatest majority of debitage, cores, flake tools, and manufactured tools are made from fine textured materials with no visible grain sizes, the highest frequency of non-manufactured tools is represented by coarse to medium textured materials with coarse to medium grain sizes. This distribution suggests certain raw materials were being selected for specific tool types and uses. In general, manufactured and non-manufactured artifacts which display crushing and abrasion kinds of use-wear, such as hammerstones, grinding stones, pestles, and abraders are made from coarse to medium textured and grain sized materials. Whereas, manufactured artifacts and flake tools which display chipping and polishing use-wear are made from more fine-textured materials having no visible grains. Similarly, artifacts manufactured by chipping are commonly associated with fine-textured materials having either fine or no visible grains, and artifacts manufactured by pecking and abrasion are commonly made from coarse to medium textured materials with coarse to medium grain sizes.

Over 50% of the CCS materials are thermally altered. Thermal alteration of CCS materials has been noted by researchers at several archaeological sites on the Oregon coast, but none have presented counts of thermally altered materials per artifact type. Table 22 lists the frequency of thermal alteration for each artifact type. Since non-manufactured tools are predominately cobble tools with no modification, they appear to lack thermal alteration and therefore are not included in the discussion of thermal alteration.

With the exception of cores, all chipped-stone artifact types show over 50% thermal alteration for the 3013 CCS lithic class. This

Table 22. Artifact type by occurrence of thermal alteration of cryptocrystalline silicate materials.

THERMAL ALTERATION	DEBITAGE	CORES	FLAKE TOOLS	MANUFACTURED ARTIFACTS	NON-MANUFACTURED ARTIFACTS	TOTAL
YES	502	22	33	104	-	661
NO	266	39	26	24	3	358
INDETERMINATE	166	2	6	33	-	207
TOTAL	934	63	65	161	3	1226

disparity between the frequency of thermal alteration on non-core versus core artifacts suggests flakes were removed from the core before thermal alteration. Once a flake had been thermally altered, it may have either been shaped into a tool, used without further modification, or discarded. This sequence of thermal alteration of the materials at Seal Rock not only suggests a generalized flake tool technology may have been used at the site, but also that thermal alteration of CCS materials was a regular part of the lithic technology of the Seal Rock inhabitants. In addition, distributions of the debitage categories in relation to such attributes as flake thickness, cortical variation, debitage/tool ratio and core/retouched piece ratio suggest both tool manufacture and and core reduction activities were taking place at the site.

As previously discussed in the functional analysis, functional meanings (e.g., cutting, scraping) were assigned to the artifacts recovered from Seal Rock by using both technological and functional attributes. Most of the lithic tools identified at Seal Rock appear to be associated with the processing of food resources (e.g., scraping, cutting). Flake tools appear to be primarily associated with cutting activities; whereas, scraping and scraping/cutting activities are mostly associated with manufactured tools (see Tables 20 and 21). The majority of the non-manufactured cobble tools are associated with abrading and hammering/pounding activities.

Projectile points from Seal Rock are similar to those reported from other late prehistoric sites excavated on the Oregon coast. Projectile points associated with late prehistoric sites are commonly characterized by the presence of small, narrow-necked and concave base projectile points of the kind generally associated with the use of the bow and arrow (Draper 1980; Minor and Toepel 1983; Pettigrew 1981; Pullen 1982). Projectile points identified as Types 2, 3, and 4 at Seal Rock were probably associated with the use of the bow and arrow. However, size-shape criteria for large triangular projectile points (Type 1) found at Seal Rock and other sites located on the southern Northwest Coast have been recently evaluated by Lyman and Clark (1988); this research suggests that many of the triangular points recovered from Seal Rock may have been used to tip bone/antler harpoons.

The two base fragments described as Type 5 (contracting-stem) projectile points do not conform with the late prehistoric time-frame of the other point types recovered from Seal Rock. This projectile point type is usually found in association with leaf-shaped points in deposits dated between 3000-2000 B.P. in southwestern Oregon and northwestern California (Draper 1980; Pullen 1982) and in deposits dated between approximately 1750 BP and 700 BP in the lower Columbia Valley (Pettigrew 1981). However, a similar shaped point was recovered from upper levels of another central Oregon coastal site (35LA3); a site reported to be approximately the same age as Seal Rock (Barner 1982).

The information gained from the preceding analyses is important for our understanding of the reduction sequence, manufacture, use, and stylistic variability of lithic artifacts from Seal Rock; however, stone is not the only medium from which tools were being made. Bone and antler artifacts make up a large portion of the total artifact assemblage recovered from Seal Rock.

VI. BONE AND ANTLER ARTIFACT ANALYSIS

INTRODUCTION

The bone and antler artifacts from Seal Rock provide information on the use of these raw materials by prehistoric people on the central Oregon coast. Drucker (1939) states that ethnographically the Alsea used little stone for tools and that shell, antler, and bone provided most of the cutting edges. This preference in raw materials has also been reported for the northern Northwest Coast area (Drucker 1943). Although analysis of the Seal Rock artifacts does not entirely support this statement, with a 1.6:1 ratio of lithic to shell, bone and antler tools, differences in the taphonomy between these material types probably accounts for the discrepancy between the archaeological and ethnographic records. Also, considering the quantity of shell excavated, and little modification required for most shell artifacts, it may be that shell tools went unnoticed. In any case, the bone and antler tool industry at Seal Rock appears to have been an important part of the overall tool technology at the site.

In general, two broad technological categories are recognized for the manufacture of bone and antler artifacts; preforming, and shaping and finishing techniques (Gilbert 1980; Semenov 1964). Bone or antler preforms can be made by flaking or fracturing the material to produce required shapes for tool manufacture (Gilbert 1980). Preforms can also be made by using a groove and splinter technique in which splinters are produced by cutting V-shaped, parallel grooves into the bone or antler and forcing out strips of material with a chisel or wedge (Semenov 1964). Shaping and finishing techniques can be accomplished by flaking, whittling, grinding and polishing the material into a finished implement (Newcomer 1974; Semenov 1964). The basic reduction sequence for making bone and antler tools is similar to that for making stone tools. First the type of raw material is selected and then shaped into a workable form which can then be made into a finished tool. While the reduction sequence is similar for stone, and bone and antler, techniques used for shaping and manufacturing are usually different. For stone, final shaping and finishing is primarily accomplished by percussion and pressure flaking (with the exception of some groundstone implements) and for bone and antler tools the final stages of manufacture are commonly done by whittling, grinding and polishing (Gilbert 1980; Semenov 1964; Stewart 1973). Since the techniques for making bone and antler tools are different from those for stone, a different approach for studying technology and use-wear on bone and antler tools must be applied.

Unfortunately, little experimental research has been done on the properties of manufacture and use-wear attrition on bone and antler tools. Newcomer (1974) suggests that the main problem with conducting experimental research on the technology of bone and antler tools is that many different manufacturing techniques can be used to achieve the same general tool morphology. A major problem with conducting use-wear analyses of bone and antler objects is that natural processes can result in cuts, polishes, abrasion scars and edge damage on the surface of these objects which can be confused with use-wear attrition. In addition, technological features such as polish, and striations created during tool production can also be confused with use-wear attrition (Gilbert 1980). Without being able to empirically study use-wear on bone and antler tools, it is difficult to assign functional meaning to these objects. According to Friedman (1976) relatively few bone and antler tools can be assigned a single specific function because a range of artifact types can be used for similar purposes, and further, the same artifact type can be used for a number of different functions.

Two hundred three bone and antler artifacts were recovered from Seal Rock and have been divided into nine analytical categories based on overall morphology: wedge/chisel shaped artifacts, pointed bone artifacts, composite toggling harpoon valves, antler tine artifacts, modified bird bone, fishing implements, ornamental artifacts, and miscellaneous bone and antler artifacts. Due to diversification of forms, these categories have been divided into sub-categories to facilitate identification of smaller groups sharing more specific morphological traits. Variations in material (bone or antler), overall shape, length, width and/or diameter, tip form, shape of the base, degree of polish and extent of overall modification of the object are some of the criteria used to define sub-categories. Length, width and thickness of each bone and antler artifact have been measured and are presented in Table 23. Illustrations of artifact categories are provided in Appendix B.

Table 23. Measurements for bone tools. All measurements are in millimeters.

ARTIFACT TYPE	PROVENIENCE	LENGTH	WIDTH	THICKNESS	COMMENTS
WEDGE/CHISEL					
Split Antler	N40/E30 5-12a	72	26	19	midsection
	N44/E30 2-34	160	49	31	proximal end
	N44/E30 2-52	120	45	22	complete
	N46/E30 4-52	150	34	13	midsection
	N46/E30 8-7	142	44	20	midsection
	N48/E30 3-12b	105	38	17	proximal end
	N48/E30 5-12c	54	30	12	distal end
	N48/E30 3-12a	41	32	9	distal end
	N50/E30 10-49	120	119	40	complete
	N50/E30 4-23	100	21	13	complete
	N50/E30 9-16	64	26	9	distal end
	N50/E30 7-64	59	18	10	distal end
	N52/E28 1-12c	79	17	13	midsection
	N52/E30 2-12a	44	26	12	distal end
	N52/E30 7-12f	36	19	13	distal end
	N52/E32 4-165	124	43	23	midsection
	N52/E32 2-11	20	27	7	distal end
	N52/E32 2-17	32	15	7	distal end
	N54/E32 2-63	40	33	9	distal end
	N54/E32 6-19	171	42	20	midsection
	N54/E32 3-44	106	33	17	proximal end
	N56/E28 2-11	29	20	7	distal end
	N56/E28 1-31	57	40	15	distal end
	N56/E30 10-12a	73	37	14	complete
	N56/E32 4-53	129	50	18	complete
	N58/E26 11-12a	33	18	12	distal end
	N58/E26 6-12a	43	20	13	distal end
	N58/E26 13-12a	60	37	14	distal end
	N58/E26 14-9	135	35	31	midsection
	N58/E32	32	30	5	distal end
	N58/E32 8-12	44	22	7	distal end
	N59/E28 5-14a	42	12	7	distal end
	N64/E30 7-12c	67	12	8	distal end
	N64/E30 10-12a	74	22	10	distal end
	N64/E30 7-12f	31	20	11	distal end
	N63/E30 7-12b	84	30	21	proximal end
	N64/E30 8-12c	71	33	11	midsection
	N72/E30 5-12a	97	33	17	distal end
	N72/E30 4-12b	60	32	13	distal end
	N72/E30 3-23	78	38	14	distal end
	N72/E30 4-12	180	45	16	midsection
	PH-4	83	34	8	complete
	PH-4a	160	36	27	midsection
	PH-5	110	53	28	complete
	PH-7	38	11	9	distal end
	PH-9	95	37	14	proximal end
	Unknown	135	54	17	complete

Table 23. (continued)

ARTIFACT TYPE	PROVENIENCE	LENGTH	WIDTH	THICKNESS	COMMENTS
WEDGE/CHISEL					
Antler Tine	N50/E30 10-58	70	27	22	distal end
	N50/E30 5-13	28	15	9	distal end
	N50/E30 7-133	41	12	9	distal end
	N52/E28 1-12c	123	30	26	complete
	N54/E32 9-94	142	38	28	complete
	N54/E32 5-9	105	44	24	complete
	N54/E33 9-15	115	40	30	complete
	N56/E30 3-12c	56	20	19	distal end
	N56/E32 8-16	112	29	18	complete
	N58/E26 3-12a	122	41	27	complete
	N58/E26 13-12b	118	29	23	complete
	N58/E26 5-12e	29	17	11	distal end
	N64/E30 8-12b	129	29	23	complete
	N64/E30 4-12c	163	28	29	complete
	N72/E30 5-12h	144	39	31	complete
WEDGE/CHISEL					
Bone	N46/E30 2-30	121	41	22	complete
	N50/E30 10-33	111	20	11	distal end
	N56/E28 2-207	70	40	15	distal end
	N58/E26 5-12	113	38	24	complete
	N58/E26 9-12c	92	20	11	distal end
	N64/E30 6-12b	70	28	12	distal end
POINTED BONE					
Bipoint	N56/E30 3-12d	45	3	3	complete
Unipoints	N44/E30 2-59	34	5	4	complete
	N46/E30 6-39	43	7	5	complete
	N52/E30 4-12j	34	4	4	complete
	N56/E30 3-12a	69	8	8	complete
	N58/E26 7-12a	53	8	4	complete
	N58/E26 5-12b	47	7	5	broken
	N58/E32 10-26	35	3	3	complete
	N60/E30 5-9	73	9	5	complete
POINTED BONE					
Bipoint or	N46/E30 8-1	31	8	5	
Unipoint	N52/E30 7-12g	55	7	5	preform ?
Fragments	N52/E30 7-12d	45	7	7	
	N58/E26 10-12d	50	8	7	
	N58/E32 10-32	26	3	2	
	N60/E30 2-20	71	9	7	preform ?
	N72/E30 5-12d	110	10	7	preform ?
	N72/E30 4-12a	48	7	5	preform ?

Table 23. (continued)

ARTIFACT TYPE	PROVENIENCE	LENGTH	WIDTH	THICKNESS	COMMENTS
POINTED BONE					
Awls/perforators	N48/E30 4-12a	110	10	5	complete
	N50/E30 5-8	82	11	5	complete
	N52/E30 4-121	85	6	2	broken
	N54/E32 2-32	50	10	4	broken
	N56/E30 3-12b	65	7	2	broken
	N56/E32 10-17	74	9	3	complete
	N58/E26 2-12	53	11	5	broken
	N58/E32 7-24	50	10	4	broken
	N59/E33 4-119	64	7	5	broken
	N72/E30 4-12g	132	11	8	complete
POINTED BONE (MISC)					
Sea Mammal					
Phalanges	N46/E30 2-6	70	19	14	complete
	N54/E29 1-10	136	56	34	complete
	N72/E30 4-34	48	15	15	complete
Sea Mammal					
Ribs	N50/E30 7-15	62	13	9	complete
	N54/E32 2-53	39	12	6	broken
	N56/E32 4-8	91	13	7	complete
	N56/E32 10-21	88	15	10	broken
	N58/E26 7-12b	135	16	9	broken
	N58/E26 F4-12a	76	10	7	broken
	N58/E32	113	17	10	complete
	N64/E30 4-12a	56	13	7	refit
	N64/E30 5-12a	118	14	7	refit
Triangular					
Point	N52/E28 1-12a	38	17	1	complete
Netting Tool?	N52/E28 1-12d	23	12	3	broken
HARPOON VALVES					
Type I	N44/E30 2-60	45	8	5	complete
	N48/E30 5-126	51	9	6	complete
Type II	N50/E30 8-30	40	20	10	tip
	N50/E30 6-88	44	16	19	tip
	N54/E32 3-68	26	16	8	tip
	N56/E28 2-149	32	12	10	tip
	N56/E30 4-12	23	17	18	tip
	N58/E31 8-7	89	18	9	complete
	N58/E32 8-8	86	20	11	complete
	N72/E30 2-12	45	14	11	tip/decorated
	N44/E30 2-33	56	17	9	tip/preform ?
Spur/Body					
Fragments	N44/E30 1-3	22	6	4	
	N50/E30 4-47	63	15	12	preform
	N54/E29 2-142	48	13	9	
	N54/E30 5-12b	49	11	10	
	N54/E30 6-12b	37	12	7	
	N54/E32 2-6	16	9	4	

Table 23. (continued)

ARTIFACT TYPE	PROVENIENCE	LENGTH	WIDTH	THICKNESS	COMMENTS
HARPOON VALVES					
Spur/Body	N56/E32 4-7	57	14	10	
Fragments cont.	N56/E32 4-7	49	12	18	
	N64/E30 8-23	29	19	5	
	N72/E30 5-12e	57	12	12	
ANTLER TINE					
ARTIFACTS	N46/E30 2-12	78	20	20	complete
	N48/E30 4-17c	50	13	1	distal end
	N50/E30 6-2	130	27	28	complete
	N50/E30 5-35	64	13	12	complete
	N54/E30 2-17	41	14	13	distal end
	N60/E30 5-11	110	18	14	distal end
	N64/E30 9-12a	158	20	18	complete
	N72/E30 4-12c	78	15	11	complete
	N72/E30 4-12e	97	26	20	complete
	N72/E30 5-12	63	16	15	complete
	PH-5	66	17	14	distal end
MODIFIED BIRD					
BONE	N48/E30 8-12a	28	10	10	
	N48/E30 6-12a	33	7	7	
	N50/E30 3-12	46	8	8	whistle
	N50/E30 6-18	69	7	7	
	N58/E32 4-8	28	7	7	
	N60/E30 3-13	49	8	8	
	N72/E30 4-15a	192	10	10	
FISHING					
IMPLEMENTS	N52/E32 4-180	165	18	16	composite hook
	N54/E30 6-12a	25	4	4	broken
	N56/E30 8-12a	61	3	4	complete
	Unknown	59	4	5	complete
ORNAMENTS	N46/E30 3-139	23	20	4	
	N48/E30 4-12b	47	10	3	
	N50/E30 5-12	64	11	2	pendant (ovate)
	N50/E30 6-87	57	11	2	
	N50/E30 4-1	32	12	2	
	N54/E30 2-12a	45	7	2	
	N54/E30 1-12b	41	7	1	
	N54/E30 1-12c	19	10	1	
	N58/E32 4-24	41	12	2	
MISCELLANEOUS					
Antler Handle	N52/E28 1-12b	76	14	14	
Split Bone	N52/E32 6-8	88	16	10	
	N58/E26 12-12b	97	26	4	
	N72/E30 5-12c	124	23	11	
	PH-12	125	40	4	
Whale Vertebrae	Unknown	310	190	160	

ARTIFACT DESCRIPTIONS

Wedge/Chisel Shaped Artifacts (n=68)

Morphological distinctions between wedges and chisels have been made by researchers on the Northwest Coast. Loy and Powell (1977:69) define a wedge as an object with two converging planes (double beveled edge) at the distal end and a chisel as an object with a single beveled edge at the distal end of the object. However, the distinction between these two morphological traits is not commonly made by other researchers on the Northwest coast (e.g., Stewart 1973), making an assignment of the artifacts from Seal Rock to these two classes difficult. Drucker (1943) notes that wedges of bone and antler are common Northwest Coast tools and variation in size may be due to different functions, where small forms were used for fine work and larger forms were used for heavier work, such as splitting logs.

Forty-seven wedge/chisel shaped artifacts are represented in the bone and antler tool assemblage from Seal Rock and have been divided into three subcategories: split antler, antler tine, and split bone wedge/chisels. Miscellaneous midsection and base fragments associated with this category are represented in the split antler sub-category.

Thirty-two wedge/chisel shaped artifacts are made out of split antler. Distal ends of these specimens are single-tapered (12) and double-tapered (20). Polishing (18), crushing (4), and a combination of polishing and crushing (10) are present on the distal ends of the artifacts. Proximal ends are missing on 14 of the artifacts, while

10 are missing both proximal ends and portions of distal ends. Eight are complete specimens. Complete specimens, with the exception of one, contain battering or crushing at the proximal end of the artifact. A total of 15 fragments of split antler wedge/chisel midsections (8) and proximal ends (7) have been identified.

Fifteen specimens are made from antler tines. The distal ends of these artifacts are both single-tapered (8) and double-tapered (7). They display polishing (6), and a combination of polishing and crushing (9). A notch-like indentation is present on the distal edge of five specimens. Distal ends are the only portion represented by five of the specimens. Three have partially fragmented proximal ends and seven represent complete specimens. All specimens which retain some portion of the proximal end have flake scars radiating from the proximal end and evidence of battering or crushing.

Six wedge/chisel shaped artifacts from Seal Rock are made of split bone. Single-tapered (3) and double-tapered (3) distal ends are equally represented. Polishing (4), and both polishing and crushing (2) are located on the distal ends of the artifacts. A notch-like indentation is present on the distal edge of one example. Proximal ends are missing on two of the specimens and two specimens represent only portions of distal ends. Both complete specimens show evidence of crushing on the proximal ends.

The presence of wedge/chisels usually implies woodworking activities. Drucker states that the Alsea workman,

> "chipped away at his log with a club-like maul of wood and a chisel of bone or horn. The same maul was used to drive elkhorn or yewwood wedges when splitting out planks." (1939:87)

While woodworking seems to be the most frequently noted use for these objects, there is little archaeological evidence besides the presence of wedge/chisels to suggest a developed woodworking technology was being used at Seal Rock. However the poor preservation of wood in archaeological sites may account for this discrepancy.

Pointed Bone Artifacts (n=41)

Pointed bone artifacts from Seal Rock represent the second largest defined category of bone/antler tools. This category exhibits a wide range of variation of artifact forms. Therefore, the pointed bone artifacts from Seal Rock have been divided into four sub-categories: bipoints, unipoints, awls/perforators, and miscellaneous artifacts displaying pointed ends. Sub-categories are based on size, extent of manufacture, tip form, and type of bone the artifacts are manufactured from.

One small narrow bone bipoint is represented in the collection. It has a rhomboidal cross-section and quadri-tapered acute tips. The specimen is more or less symmetrical with the widest portion located near the midsection of the object.

Unipointed objects are represented by a total of eight nearly symmetrical artifacts. Six of the artifacts have sides which gradually taper into conical (4) and tri-tapered (2) sharp, acute tips and into flat to rounded bases. The cross-sections are biplano (3), round (1), or concave on one surface and flat on the other surface (2). The maximum width of these specimens is near the midsection. Two smaller unipointed specimens have parallel sides at the base which gradually taper into quadri-tapered tips. The bases are slightly rounded and have conical cross-sections. Both of these specimens have broken tips and one is missing one-half of its base.

Eight fragmented specimens of either unipoints or bipoints have been identified. Four fragments may represent either unipoints or bipoints in the partial stage(s) of manufacture.

Bone bipoints and unipoints are usually associated with fishing technology by researchers along the southern and northern Northwest Coast (Bennyhoff 1950; Kroeber and Barrett 1960; Stewart 1973). These items are believed to represent such implements as fish hook barbs, fish rake teeth, fish gorges, and points for arming composite toggling harpoons.

Ten bone awls/perforators from Seal Rock are manufactured from split mammal ribs (2) and split mammal long bone fragments (8). Split rib awls are extensively modified over the entire surface of the object. The proximal ends of the artifacts are missing. The sides of the midsection gradually taper into double-tapered tips. Cross-sections for the split rib awls are biplano.

Awls/perforators manufactured on split mammal long bone fragments are modified only on the distal end. Sides gradually taper into conical (3) and quadri-tapered (5) tips. Proximal ends retain the natural shape of the bone splinter. All of the specimens appear to be complete.

A miscellaneous sub-category was created for four kinds of pointed bone artifacts found at Seal Rock which do not fit with any other sub-category due to variations in shape and morphology of the points. The first type represents a flat triangular bone point (possibly a pendant preform) with straight parallel sides tapering into an abrupt tip. The base of this point is slightly convex.

The second kind of pointed bone artifact consists of three worked sea mammal phalanges. The distal ends of the phalanges are removed and the remaining shafts are shaped into blunt rounded points. The point of one specimen is not finished and has cut marks perpendicular to the long axis of the bone, possibly used to weaken the bone before breaking it.

The third kind of miscellaneous artifact represents 9 specimens manufactured from split sea mammal ribs. Modification extends over the entire surface of the specimens. Two specimens were refitted into one tool and are from the same excavation unit but from different excavation levels. The shape of the bases are rounded (5), squared (1), or broken (2). The sides of the artifacts are parallel and gradually taper into a base, and the tip portion is formed abruptly. Cross-sections are rhomboidal. The specimens represent midsection and base portions (3), midsection and tip portions (1), and complete artifacts (4).

The forth kind of pointed bone artifact is the tip portion of a possible netting tool. The specimen has parallel sides which taper into an abrupt tip. Four circular holes are drilled into the specimen.

Composite Toggling Harpoon Valves (n=21)

Roll (1974) identified 3 types of composite toggling harpoon valves from the Minard site in southwest Washington. The types and nomenclature for the composite toggling harpoons offered by Roll are presented in Figure 8. A total of 10 complete and fragmentary harpoon valves recovered from Seal Rock can be identified as either Types I or II as defined by Roll (1974).

Type I toggling harpoon valves are "identified by a smooth body and spur with ventral surface grooved to accept a small bone or wooden bipoint and another groove near the juncture of the body and spur to accept a foreshaft or harpoon shaft" (Roll 1974:107). Two specimens which correspond with Type I valves described by Roll were recovered from Seal Rock. This type of composite harpoon valve is frequently found in sites along the California, Oregon, and Washington coasts and is usually attributed to Salmon fishing by various researchers (Bennyhoff 1950; Friedman 1976; Kroeber and Barrett 1960; Roll 1974)

Type II composite harpoon valves "have a constriction on the body with an expanding tip, apparently designed to enhance affixation of the armament. Armament for these is typically a thin slate or shell blade; specimens are stepped at the tip to accommodate such a blade" (Roll 1974:108). Eight specimens from Seal Rock represent Type II composite toggling harpoons. One of the specimens has three incised geometric designs extending horizontally across the tip.

One harpoon valve from Seal Rock does not fit any of the types defined by Roll (1974). This specimen is similar in shape to Types

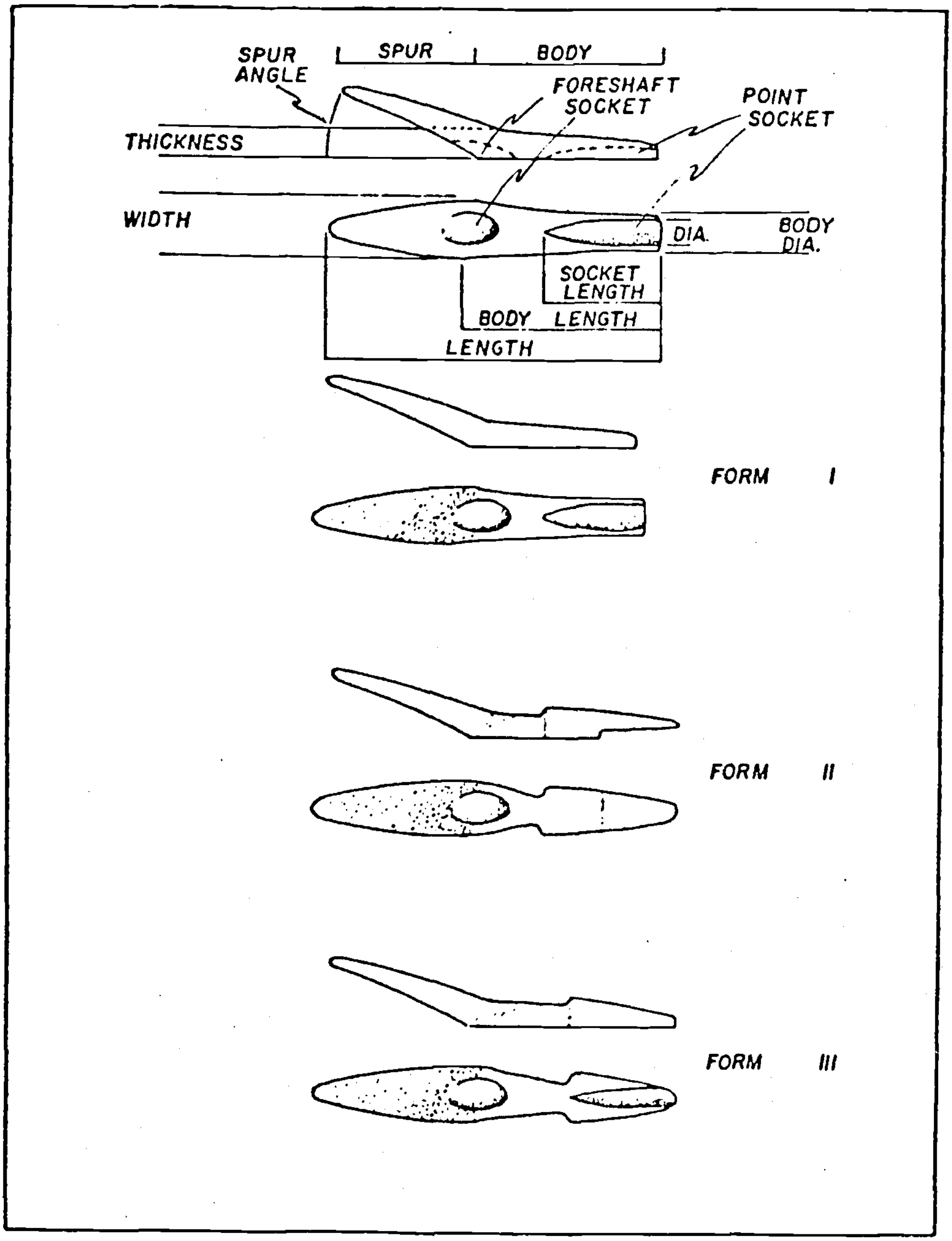

Figure 8. Forms (types) and nomenclature of composite toggling harpoon valves from the Minard site, 45GH15 (after Roll 1974:106).

II and IV but is not stepped or grooved on the ventral side of the tip. Whether this valve fragment represents another type not identified by Roll or an unfinished Type II or IV valve is unknown.

Ten specimens are identified as composite toggling harpoon spur/body fragments and can not be assigned to a specific type. However, the size-range of these fragments are similar to Type II composite toggling harpoons. One specimen lacks a pronounced socket and appears to be in the partial stage(s) of manufacture and another specimen represents the tip portion of the barb only.

Type II composite toggling harpoon valves have not been found elsewhere on the Oregon coast. They are commonly found in more northern sites located on the Washington and British Columbia coasts. As Friedman notes "Type II valves have a slightly more restricted range (than Type I), from Minard to Hesquiat on the Pacific Coast and to the Fraser Delta on the inland waters" (1976:175).

Roll (1974) took 8 measurements on each of the harpoon valves he identified, but felt that length was the most significant attribute. A trimodal distribution of harpoon lengths was found in Roll's data, which he related to the type of game hunted. In short, he suggested harpoon valves which cluster around 50 mm in length were possibly used for obtaining Salmon. The group ranging from 70 to 85 mm may have been used in the pursuit of fur seal, and those that cluster around 124 mm in length used for whale hunting. If Roll's inferences are correct, the measured lengths for the Type I harpoon valves from Seal Rock correspond with obtaining Salmon resources, and the complete Type II harpoon valves are correspond with hunting pinnipeds.

Antler Tine Artifacts (n=11)

Eleven antler tines have abrasion (6), or a combination of abrasion, polishing and crushing (5) located on the tip sections. Four examples show incisions on the proximal ends where the antler tine was cut from the main antler beam. The remaining specimens appear to have been broken after the tine was removed from the beam. Most of the specimens have been modified only on the tip section of the antler tine, although one specimen has striations over most of its surface.

This type of antler tine artifact is commonly associated with removing small pressure flakes from stone tools during the final stages of manufacture. In describing flaking tools for the northern Northwest Coasts Culture Area Drucker states, "some are of antler tine, usually hacked or whittled off, some with unworked (but worn) points, others with reduced, but heavy, shouldered tips" (1943:54). Whether these objects were used as flaking tools or other functions is unknown.

Modified Bird Bone (n=7)

Six pieces of bird bone display incisions perpendicular to the long axis of the bone. Many of the incisions are truncated, suggesting they were used to thin and weaken the bone before breaking it. These specimens may represent the early stages or resulting debris from whistle manufacture.

One complete bird bone whistle was recovered from Seal Rock. The whistle has a single rectangular hole cut into the center section of artifact. The proximal and distal ends of the bone have been cut.

Fishing Implements (n=4)

In addition to the Type I composite toggling harpoon valves previously mentioned, four other fishing implements were recovered from Seal Rock. Three fish hooks made from bone are represented in the collection. The shanks of the fish hooks are straight and the barbs are both straight (1) and slightly curved (2). A groove is present at the intersection of the shank and barb on the outside of the hook. Two of the specimens are complete and the third is broken above the midsection of the shank.

Another specimen which may have been used for fishing is made from charred antler. This artifact appears to represent a composite fish hook as discussed by Berreman (1944:25). The shank is slightly curved and circular in cross-section. The larger end has a concave sloping groove with a carved indentation (1.5 cm long) at the end of the shaft on the opposite side. The smaller end is similar in morphology, but instead of a sloping groove a flat to slightly concave surface is present.

Ornamental Artifacts (n=9)

Two types of bone objects appear to represent ornaments. The first type consists of eight undecorated (3) and decorated (5) thin curved pieces of bone, possibly rib portions. The decoration is an incised linear pattern. Three specimens have small holes drilled into one end. All pieces are fragmented and are possibly portions of bracelets, bands, or pendants. Two specimens from the same excavation unit, but from different levels have been refitted.

The second type of ornamental artifact is an ovate shaped pendant with a bipointed design carved into the center. A single hole is drilled into one end of the pendant.

Miscellaneous Bone and Antler Artifacts (n=42)

Four unmodified split bone artifacts with polished edges occur in various sizes and shapes. One specimen has a black substance located on the proximal end of the bone with a notch formed on the distal end.

One whale vertebrae displays diffuse striations (cut marks) on one surface. Negative flake scars are randomly dispersed along the edges of the vertebrae. The object appears to have been used as a cutting block.

Eighteen modified bone fragments unidentifiable to type of object are present in the collection. Several of these objects may be fragmented portions of wedge/chisels. All of the fragments display striations and/or polish.

Eighteen pieces of antler have intentionally cut ends. These specimens vary in size from 23 mm to 320 mm and may represent antler tool preforms. One antler section has a round hole formed in the cortical portion of one end and may have served as a handle or hafting element.

SUMMARY

Bone and antler materials represent a large portion of the total artifact assemblage recovered from Seal Rock. While the technology and use of these artifacts is rather speculative at this time, several summary statements can be made. The large frequency of wedge/chisel artifacts recovered from Seal Rock may indicate a developed woodworking technology. Whether this technology was used for such activities as the manufacture of canoes or cedar planks is unknown. There is little other evidence from the artifact assemblage at Seal Rock to suggest a highly developed woodworking technology. However, ethnographic records indicate that the Alsea had the necessary technology for working wood,

> "The Alsea woodworker, although proficient in his craft, was a long way from achieving the high artistic plane of his northern contemporaries. The objects he made were neatly finished, but showed no attempt at decoration. Yet he worked in the same medium, soft straight-grained cedar (hardwoods were used only where essential), and had nearly the same kit of tools"...."The workman chipped away at his log with a cub-like maul of wood and a chisel of bone or horn. The same maul was used to drive elkhorn or yewwood wedges when splitting out planks." (Drucker 1939:87)

While house remains were not recovered during the excavations at Seal Rock, if the wedge/chisels found at the site were used for making planks for house construction then the high frequency of wedge/chisels in the artifact assemblage may provide indirect corroborative evidence for the presence of living structures at the site. High relative frequencies of bone and antler wedge/chisels are reported for several late prehistoric sites on the Oregon coast in which house remains were recovered during excavation. For example, the Par-tee and Palmrose sites, 35CLT47 and 35CLT20 (Phebus and Drucker 1979); the Netarts Sand Spit site, 35TI1 (Newman 1959); the Lone Ranch Creek site, 35CU37 (Berreman 1944); and the Pistol River site, 35CU61 (Heflin 1966).

Pointed bone artifacts recovered from Seal Rock probably represent the most functionally diverse artifact category. These items may have been used for fishing gear, as points for Type I composite harpoon valves, as perforators or awls, or netting tools. However, many of the uses of these objects can not be determined.

Non-utilitarian items are represented in the bone and antler artifact assemblage and include such items as pendants, bracelets or bands, and a bird bone whistle. Other miscellaneous artifacts including a utilized whale vertebrae, modified bone fragments, cut antler pieces, and split bone artifacts with polished edges occur in the Seal Rock artifact assemblage.

The presence of fish hooks and Type I composite toggling harpoons in the Seal Rock artifact assemblage indicates that fish resources were being obtained at the site. Poor preservation of other implements used to acquire fish, such as nets and traps, may account for their absence in the archaeological record at Seal Rock.

Studies of composite harpoon valves from sites on the Washington coast have indicated that valves which cluster around 50 mm in length were probably used to obtain Salmon, whereas, valves which range from 70 to 85 mm in length may have been used to hunt pinnipeds (Friedman 1976; Roll 1974). If these length distributions are correct, then the measured lengths for the Type I harpoon valves correspond with obtaining Salmon resources, and the measured lengths for the two complete Type II harpoon valves correspond with hunting pinnipeds. Five tip portions are identified as Type II valves and the ten harpoon valve spur/body fragments represented in the assemblage appear to be commensurate in size and shape to the complete Type II composite harpoon valves. Therefore it appears that 19 out of 21 complete and fragmented harpoon valves recovered from Seal Rock represent Type II valves which cluster in the length range of 70 mm to 85 mm suggesting an emphasis on hunting pinnipeds at the site.

Type II composite toggling harpoon have not been reported for any other site on the Oregon coast. To date, Seal Rock represents the southern most site on the Southern Northwest Coast which has this type of harpoon valve. Table 24 gives the archaeological occurrence of Type II composite harpoon valves on the Central and Southern Northwest Coast as reported by Friedman (1976).

The lithic, bone and antler artifact assemblage has been described and summarized. In order to understand subsistence strategies and land use patterns for the late littoral stage of adaptation at Seal Rock, the faunal remains from the site will be discussed.

Table 24. Archaeological occurrence of Type II composite harpoon valves on the Central and Southern Northwest Coast (after Friedman 1976:176).

General Area	Presence of Type II Harpoon Valves	Site Date	Reference
Southern Washington Coast	+	Minard (1080±110 BP)	Roll (1974:105)
Central Washington Coast	+	Toleak Pt (c 550 BP)	Newman (1959:38)
Northern Washington Coast	+	White Rock (387±42 BP)	Guinn (1962:15)
Northern Washington Coast	+	Ozette A (1495±300 BP)	McKenzie (1974:80)
Northern Washington Coast	+	Ozette A75	Friedman (n.d.)
Northern Washington Coast	+	Tatoosh	Friedman (1973:51)
W. Coast Vancouver Island	+	Yuquot (c 2000 BP)	Dewhirst (1969:234)
W. Coast Vancouver Island	+	Hesquiat	Boehm (p.c. 1976)
Point Roberts Peninsula	+	Beach Grove (2-3000 BP)	Abbott (1962)
Gulf Islands	+	New Castle Island	Monks (1971)

VII. VERTEBRATE FAUNAL REMAINS

INTRODUCTION

Analyses of samples of pinniped and fish remains recovered from Seal Rock were reported by Snyder (1978) and Zontek (1983). Lyman (1988a, 1988b) identified a larger sample of the mammalian remains during 1985 and 1986. Results of Snyder's (1978) analysis of the pinniped remains suggested the Seal Rock location had been used as a rookery by Steller's sea lions (*Eumetopias jubatus*) between approximately 400 and 150 years ago. The subsequent analysis of a larger sample of mammalian remains from Seal Rock by Lyman (1988a, 1988b) confirmed Snyder's conclusions. In addition to the large number of Steller's sea lion remains found at Seal Rock, other pinnipeds identified by Snyder (1978) and Lyman (1988a, 1988b) include: harbor seal (*Phoca vitulina*), northern fur seal (*Callorhinus ursinus*), and California sea lion (*Zalophus californianus*). Lyman also identified several other mammal taxa, including: harbor or common porpoise (*Phocoena phocoena*), sea otter (*Enhydra lutris*), North American beaver (*Castor canadensis*), Cottontail rabbit (*Sylvilagus floridanus*), dog/coyote/wolf (*Canis* sp.), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), elk (*Cervus elaphus*), deer (*Odocoileus* sp.) mole (*Scapanus townsendi*), and small-eared vole (*Microtus* sp.).

Zontek (1983) reported the major fish taxa at Seal Rock as including Surfperch (Embiotocidae), Greenlings (Hexagrammidae), Flatfish (Pleuronectidae), Rockfish (Scropaenidae), Sculpins (Cottidae), and Salmon (Salmonidae). He concluded that fish remains indicated highly localized fisheries which emphasized the rocky intertidal zone and nearshore rocky reefs were being used at Seal Rock.

The sample of faunal materials used for this discussion is based primarily on the large sample of the mammalian remains identified by R. Lee Lyman. All mammalian faunal remains excavated from Seal Rock were identified by Lyman except whale bone, and the phalanges, metapodials, lesser tarsals, carpals and vertebrae (excluding 1st and 2nd cervical) of Steller's sea lions. The mollusc, bird bone, and whale bone are the only portions of the overall faunal assemblage from Seal Rock which have not been analyzed in some form. The number of identified specimens (NISP) and the presence-absence data for age-sex categories are summarized in Table 25.

TERRESTRIAL MAMMALS

The terrestrial mammal assemblage from Seal Rock is dominated by deer (*Odocoileus* sp.) and elk (*Cervus elaphus*). Other terrestrial mammals represented at the site include: North American beaver (*Castor canadensis*), Cottontail rabbit (*Sylvilagus floridanus*), dog/coyote/wolf (*Canis* sp.), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), mole (*Scapanus townsendi*), and small-eared vole (*Microtus* sp.). Since deer and elk represent the highest frequency (96% of the NISP) of terrestrial mammalian remains in the

Table 25. Number of identified specimens (NISP) and presence/absence data for age/sex categories for terrestrial and marine mammals.

TAXON	NISP	PRESENCE/ABSENCE OF AGE CATEGORIES			PRESENCE/ABSENCE OF SEX CATEGORIES	
		Adult	Juvenile	Infant	Male	Female
TERRESTRIAL MAMMALS:						
Cervus elaphus	248	+	+	+	+	-
Odocoileus sp.	257	+	+	+	+	+
Castor canadensis	5	-	-	-	-	-
Sylvilagus floridanus	2	-	-	-	-	-
Canis sp.	3	+	+	-	-	-
Procyon lotor	1	-	-	-	-	-
Lutra canadensis	7	+	+	-	-	-
Scapanus townsendi	1	-	-	-	-	-
Microtus sp.	1	-	-	-	-	-
MARINE MAMMALS:						
Phoca vitulina	33	+	+	+	-	-
Emetopias jubatus	986	+	+	+	+	+
Zalophus californianus	31	+	+	+	+	+
Callorhinus ursinus	97	+	+	+	+	+
Enhydra lutris	140	+	+	+	+	+
Phocoena phocoena	5	-	-	-	-	-

Seal Rock assemblage their distribution and habitats will be discussed.

Order: Artiodactlya - Even-toed Ungulates
Family: Cervidae - Elk, Caribou, Moose, and Deer

Cervus elaphus
Elk (Wapiti)

Two subspecies of elk are known to occur in Oregon, Roosevelt elk (*C. e. roosevelti*) and Rocky Mountain elk (*C. e. nelsoni*). Rocky Mountain elk occur in the northeastern part of Oregon, primarily in the Blue and Wallowa Mountains, while Roosevelt elk are present throughout the Coast and Cascade Ranges in western Oregon (Mace 1956; Maser 1984; Ingles 1965). The specimens recovered from 35LNC14 probably represent the subspecies *C. e. roosevelti*. Compared to Rocky Mountain elk, Roosevelt elk are generally larger in size, darker in color, and the antlers of the bulls are shorter and more massive with a narrower spread (Mace 1956; Ingles 1965). Roosevelt elk are herding animals with a limited home range occupied by each herd. Little migration or dispersal to other areas occurs (Maser 1984; Ingles 1965). The rutting or breeding season starts in late August and extends to approximately mid-November in western Oregon. Calves are born from late May through June. In the coastal region, *C. e. roosevelti* use to some extent all habitats except the beach, foredune, moving dune, deflation plain, stabilized dune, lodgepole pine, headland prairie, headland shrub, coastal lake and tideland river environments (Maser 1984).

The number of identified specimens (NISP) for elk is 248. The presence of calves in the collection suggest at least an early summer occupation; adults and juveniles could be present year round.

Odocoileus sp.
Mule deer and While-tailed deer

Two subspecies of *Odocoileus hemionus* occur in Oregon, the Rocky Mountain mule deer (*O. h. hemionus*) and the Columbian black-tailed deer (*O. h. columbianus*). Presently the range of the Columbian black-tailed deer extends from central California in the coastal mountains up through Oregon and Washington, mostly west of the Cascade Mountains (Ingles 1965). One subspecies of White-tailed deer (*Odocoileus virginianus lecurus*) is currently represented in Oregon by two remnant populations located in the lower Columbia river and the interior valleys of the Umpqua River basin in southwestern Oregon (Smith 1987). White-tailed deer were once present in the Pacific coastal region in southwestern Washington and in northwestern Oregon, south of the Columbia river along the coast to the Umpqua River Valley (Allen 1942; Kellogg 1956). Their coastal range appears to have diminished during the mid to late 20th century (Allen 1942).

Rutting season for *Odocoileus* sp. usually occurs during November and December. Young are born once a year in early to mid-June (Maser 1984). These deer are not herd animals, but may temporarily form large feeding bands and small family groups (Ingles 1965; Maser 1984).

The NISP of *Odocoileus* sp. is 257. The presence of fawn-aged specimens in the assemblage suggests an early summer occupation; adults and juveniles occur in the area year-around.

MARINE MAMMALS

Six taxa of marine mammals were identified by Lyman. These included harbor seal (*Phoca vitulina*), Steller's sea lion (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), northern fur seal (*Callorhinus ursinus*), harbor or common porpoise (*Phocoena phocoena*), and sea otter (*Enhydra lutris*). In addition to the above mentioned marine mammals, whale remains were also present in the Seal Rock faunal collection but have yet to be identified or counted. While records indicate that organized hunting of whales did not take place on the Oregon coast, it has been noted that beached whales were used by coastal inhabitants (Drucker 1939).

Order: Pinnipedia - True Seals and Eared Seals
Family: Phocidae - True Seals

Phoca vitulina
Harbor seal

Harbor seals are presently found in the northern hemisphere in subtropical to subpolar areas. In the eastern North Pacific they extend from Herschel Island in the Bering Sea, south to islands off Baja California, Mexico (Scheffer 1958; Bonner 1979). This species is considered non-migratory and commonly inhabits protected harbors and bays (Ingles 1965). Harbor seals tend to haul out on tidal sand bars, mudflats, small rocks, islands, and reefs only where water is constantly available (Mate 1984). These seals do not display dominance or territoriality, there is little social structure in the group on land and no evidence of aquatic gregariousness (Bonner 1979; Mate 1984). While pupping season varies geographically, on the Oregon coast most pups are born in April and May; live births can occur as early as mid-February and as late as mid-June (Mate 1984). Mating takes place in the September and November (Ingles 1965; Mate 1984). According to Lyman (1988a), there appears to be no major modifications to coastal use or demographic patterns of the Harbor seal in Oregon during the last 3000 years.

The NISP for harbor seals is 33. While adult and juvenile male and females of this species are currently present on the coast throughout the year, the availability of infant harbor seals would be from late winter to early summer.

Family: Otariidae - Eared Seals

Eumetopias jubatus
Steller's sea lion or northern sea lion

The distribution of the Steller's sea lion (the largest of the eared seals) in the eastern North Pacific ranges from San Miguel Island in California along the west coast north to the Bering Sea (Ingles 1965; Mate 1984). This species is considered to be migratory in that adult males in California, Oregon, and Washington move north into British Columbia and Alaska at the end of the breeding season (mid-July) and by the end of October no adult males are found on the

Oregon coast (Mate 1984). Females and pups tend to stay along the Oregon coast through the winter, but a decline in the number of females during the winter months suggests that some females may also move north (Mate 1984).

Males are polygynous and begin forming territories in early May on a rocky semi-exposed area (Mate and Gentry 1979). Soon after territories are established, females start to fill the rookery and give birth. The pupping season occurs from June to mid-July. Within two weeks of giving birth, females come into estrus and mate (Mate 1984).

The NISP for Steller's sea lions is 986. The large abundance of adult males (n=735) and females (n=168), and infant (n=59) Steller's suggest that a rookery was located near Seal Rock from approximately 400 to 150 years ago (Lyman 1988a, 1988b; Snyder 1978). If the inference that a rookery was previously located near the site is correct, then the site appears to have been used during the pupping and mating season (late spring/early summer), and possibly into the fall when the last of the adult males migrate north.

Zalophus californianus
California sea lion

The present range of the California seal lion extends from the coast of central Mexico to Vancouver Island in British Columbia (Ingles 1965). Today *Zalophus* breeds primarily from the California Channel Islands south to Baja California. After the breeding season (approximately mid-July), adult males move north to British Columbia and can be seen along the Oregon coast during the fall and winter.

The pupping and breeding season occurs from the end of May to the end of June on rocky and sandy beaches primarily located on off-shore islands (Mate 1984; Mate and DeMaster 1986). After males have established territories on rookeries in a manner similar to that observed in Steller's sea lions, females arrive and give birth. They then come into estrus and breed within ten days after giving birth (Mate 1984).

The NISP for *Zalophus* is 31. All age-sex classes are present, suggesting that a prehistoric rookery for both Steller's and California sea lions may have been located in the vicinity of Seal Rock (Lyman 1988a, 1988b). This assumption can be further supported by recent observations of California sea lions using the same haul out locations as Steller's sea lions (Mate and DeMaster 1986) and observations by Scammon (1874:125) that both Steller's and California sea lions used the same rookeries off the coast of California in the later part of the nineteenth century. If a rookery for California sea lions was prehistorically located in the vicinity of Seal Rock, then it appears that the site may have been occupied during the pupping and breeding period which currently corresponds to late spring/early summer in California.

Callorhinus ursinus
Northern Fur Seal

The present range of the fur seal extends across the subartic waters of the North Pacific and seasonally extends as far south as the California - Mexico border (Fiscus 1986). Breeding grounds are currently found on San Miguel Island, California and in the Bering

Sea. The population in California appears to be non-migratory, whereas in the Bering Sea adult females and subadults of both sexes migrate south as far as southern California in the beginning of October. Adult males tend to remain in northern waters, although a few may migrate south with the females (Fiscus 1986; Mate 1984). The northward migration of females and subadults from southern waters begins in March with rookeries in the Bering Sea reached in June and July (Fiscus 1986). Adult males establish their territories at rookeries in early June and females arrive in mid-June. Approximately two days after females come to shore they give birth and about a week later they come into estrus and mate (King 1983). Northern fur seals are pelagic most of the year and are usually seen 16 to 160 km offshore. Presently they are rarely seen on the shores of the Oregon coast (Mate 1984).

For northern fur seals the NISP equals 97. The presence of all age-sex classes for this taxon suggests that fur seals once utilized rookeries in the vicinity of Seal Rock. If the present mating and pupping season of the northern fur seal populations in the Bering sea and California are similar to late prehistoric populations, then the availability of all age classes at Seal Rock would correspond to the mating and breeding season in the late spring/early summer.

Order: Carnivora - Flesh Eaters
Family: Mustelidae - martens, weasels, skunks, otters and allies

Enhydra lutris
Sea Otter

The former range of *Enhydra lutris* extended from central Baja California, Mexico north to Prince William Sound in Alaska. During a century and a half of intensive exploitation the sea otter disappeared from much of its original range. Two remnant populations which survived are located in California and Alaska, however, sea otter populations have been reintroduced into areas on the Washington and British Columbia coasts (Kenyon 1986; Kenyon 1982).

Pupping season varies geographically. In warm climates births occur in every month of the year whereas in the Aleutians the peak pupping season occurs in the spring and early summer, and in California it occurs in February. Mating takes place in the water and births occur both on land and in the water (Kenyon 1982).

An NISP of 140 sea otters are represented at Seal Rock. All age and sex classes are present in the sample.

Order: Cetacea - Whales, Dolphins, and Porpoises
Family: Phocoenidae - Porpoise

Phocoena phocoena
Harbor or Common Porpoise

Harbor porpoises occur in the northern hemisphere in ice-free waters. In the eastern Pacific they range from Point Barrow, Alaska to San Diego, California (Mate 1984). The harbor porpoise inhabits waters near shore and on shelves and banks shallower than 270 feet (Leatherwood and Reeves 1986). An NISP of 5 are represented in the Seal Rock collection.

FISH REMAINS

Zontek (1983) identified 601 fish bones representing 12 species from three 2 X 2 meter excavation units (N56/E32, N48/E30, N46/E30) at Seal Rock. While recovery methods (use of 1/4 inch mesh screens) limited the analysis and probably produced a biased sample of the fish remains (possibly accounting for the under-recovery of small species), the analysis conducted by Zontek (1983) provides a source for constructing a tentative species list for the fish remains represented at the site. According to Zontek (1983), the fish remains suggest that highly localized fisheries located near intertidal zones and possibly nearshore rocky reefs were being used.

SEASONALITY

Seasonality studies try to estimate the time of year in which a particular event or series of events took place. Monks (1981) presents an outline of the methodological and theoretical basis of seasonality studies. Problems which plague seasonality studies have been discussed by several authors (Grayson and Thomas 1983; Grayson 1984; Monks 1981; Lyman 1982). These problems include: 1) assumptions that physiological events and migration patterns of certain taxa have remained constant through time, 2) quantitative variation among seasonal indicators (i.e. a single item of one seasonal indicator has often been weighted as much as one hundred of another), 3) the effects of sample size on seasonal indicators causing a direct relationship between the size of the floral and faunal assemblage and number of seasonality estimates, and 4) seasonal indicators may or may not correspond with the season of site occupation due to storage and transport of food resources. The most important problem with estimating seasonality from the faunal assemblage from Seal Rock is that the physiological and migration patterns of certain taxa have not remained constant through time (Lyman 1988a, 1988b)

Lyman (1982, 1985) and Monks (1981) have suggested that the problems with seasonality studies may be, in part, controlled by using as many different kinds of seasonal indicators as possible. According to Lyman (1982), such an approach might include examining several different taxa of animals and/or different kinds of seasonally sensitive information recorded in one taxon. If the assumption that scheduling of resource exploitation across different taxa and seasons may result in different abundances of taxa is correct and if all the taxa indicate the same season(s), Lyman (1982, 1985) argues that the data are not only reliable, but valid indicators of seasonality of site occupation.

Seasonally sensitive information for the mammalian fauna was evaluated in order to estimate the season of occupation at Seal Rock. Fish remains reported by Zontek (1983) are not included in this discussion due to the lack of seasonality indicators. For the mammalian fauna, migratory patterns of the pinnipeds and season of birth are the most useful indicators. Several taxa represented in the Seal Rock faunal assemblage contained no seasonal information due to the lack of age-sex categories, and/or variability in birth season, and/or their year-round availability. These taxa include: *Castor canadensis*, *Sylvilagus floridanus*, *Canis* sp., *Procyon lotor*, *Lutra canadensis*, *Scapanus townsendi*, *Microtus* sp., *Enhydra lutris*, and *Phocoena phocoena*. The remaining six taxa used to determine season of site occupation constituted 91% of the total NISP for the site.

The seasonal availabilities of each taxon have previously been explained. In general, an early to late spring/summer occupation is suggested by the pinniped remains. While deer, elk and harbor seals are present throughout the year on the Oregon coast, the presence of infants for these taxa suggests that the site was at least occupied during the late spring/early summer months.

SUMMARY

The faunal remains from Seal Rock suggest the human inhabitants focused on a littoral adaptation; that is, an adaptation strategy which centered on exploiting the diverse coastal microenvironments located near the ocean shore (Lyman and Ross 1988; Roll 1974). Fish from rocky intertidal zones and nearshore rocky reefs, pinnipeds (especially Steller's sea lion), and deer and elk represent the majority of the faunal remains recovered from the site. There is no archaeological or ethnographic evidence from Seal Rock to suggest a developed maritime or riverine/interior adaptation taking place at the site (Lyman 1988a, 1988b; Zontek 1982).

The age-sex categories and relative frequencies of Steller's sea lion, California sea lion, and northern fur seal remains suggest Seal Rock was prehistorically used as a rookery for these three taxa of pinnipeds (Lyman 1988a, 1988b). The seasonality indicators of the faunal remains indicate that the site was at least occupied during the late spring/early summer months.

VIII. SUMMARY AND CONCLUSIONS

Lyman and Ross (1988) have defined three variations of cultural adaptations to southern Northwest Coast environments which help to explain how coastal cultures focus their subsistence pursuits on maritime, littoral, or riverine/interior resources. Faunal remains from Seal Rock suggest subsistence pursuits were focused on a littoral environment. Fish from rocky intertidal zones and near-shore rocky reefs, pinnipeds (especially Steller's sea lion), and deer and elk represent the highest frequency of faunal remains analyzed from the site. There is no archaeological or ethnographic evidence from Seal Rock to suggest a developed maritime or riverine/interior adaptation.

Based on the artifact assemblage, C14 dates and faunal remains, the Seal Rock site corresponds with what Lyman and Ross (1988) term the late littoral stage of adaptation. This stage is characterized by: 1) more permanent and sedentary settlements represented by larger shell midden sites which occasionally contain the remains of houses; 2) a logistically oriented collector strategy which primarily focuses on coastal environments, especially the inter-tidal resources, during certain times of the year; 3) increased exploitation of pinnipeds over terrestrial mammals; and 4) increased use of bone and antler artifacts.

Since Seal Rock represents a deep, relatively large shell midden site, it would be characterized as a more permanent and sedentary village by Lyman and Ross (1988). While prehistoric house remains were not encountered during site excavations, this does not preclude their existence since the entire site was not excavated. If house remains are (or were) present at Seal Rock they could be located in the area of the site that is presently being used as a trailer park, or may have been located in the area that was destroyed for the construction of U.S. Highway 101. Furthermore, the high relative frequency of bone and antler wedge/chisels recovered from the site may provide indirect evidence for the presence of house remains. Several extensively sampled, late prehistoric sites on the Oregon coast which have house remains, produced high relative frequencies of bone and antler wedge/chisels (cf. Berreman 1944; Heflin 1966; Newman 1959; Phebus and Drucker 1979).

While Dorsey (1890) mentions that Seal Rock was the northernmost village of the Alsea, he does not indicate whether this site was permanently occupied throughout the year or whether it was utilized seasonally year after year. The large size of the shell midden does indicate intense use of the site; however, there is not enough archaeological evidence to conclude whether it was intensively used on a seasonal or year-round basis. Some of the taxa at Seal Rock can be found year-round which does not mean the site was necessarily inhabited all year. The presence of more restricted age-sex categories for some of the terrestrial and marine mammals suggest the site was at least inhabited during the spring/summer. The site stratigraphy does not help to delineate the annual time-span of occupation. The absence of sterile layers or lenses of sediment in the midden suggest the site was not abandoned for a sufficient period of time to allow a non-cultural soil layer to accumulate; although, this does not mean the site could not have been abandoned for short periods of time during the fall and winter.

Faunal remains from Seal Rock indicate there was a heavy reliance on sea mammal resources. Given the composition of the faunal assemblage and the known seasonal availability of some of the taxa, it appears that the Seal Rock inhabitants practiced a logistically oriented collector strategy in which they were present at the site at least during the spring/summer months primarily to exploit pinnipeds, and to a lesser degree a variety of land mammals (especially deer and elk), localized fishery resources, birds, beached whales and molluscs. While all these resources seem to have been used by the Seal Rock inhabitants, pinnipeds (especially Steller's sea lions) appear to have been the major focus of resource acquisition.

The seasonality information from the Seal Rock faunal assemblage does not refute the proposed seasonal settlement and subsistence model proposed by Lyman and Ross (1988) which suggests that during the spring and early summer many of the outer coast shell midden sites were utilized as resource procurement camps for shell fish, fish and sea mammals.

Since the physical location of the site, the size of midden deposits, and the faunal remains support a late littoral stage of adaptation, the artifact assemblage from Seal Rock provides information on the technological aspect of this stage of adaptation. The artifact assemblage from Seal Rock indicates that the site inhabitants were accomplished in stone, bone and antler tool manufacture. Stone tools represent the highest frequency (60%) of items recovered from the site, whereas bone and antler tools make up the second highest frequency (40%). However, this distribution of lithic, bone and antler tools may be due to differences in preservation between the material types.

Several kinds of lithic, bone and antler artifacts directly correspond with resource procurement activities at Seal Rock. Projectile point types recovered from the site are similar to those associated with other late prehistoric Oregon coastal sites which are commonly characterized as small, narrow-necked and concave base projectile points generally associated with the use of the bow and arrow (Draper 1980; Minor and Toepel 1983; Pettigrew 1981; Pullen 1982). However, a recent study of size-shape criteria for stone harpoon tips suggests the large triangular projectile points from Seal Rock (described as Type 1 points) may have been used to tip bone/antler harpoons for hunting large pinnipeds, especially Steller sea lions (Lyman and Clark 1988).

Bone and antler composite toggling harpoon valves from Seal Rock were most likely used to hunt both salmon and pinnipeds. Type I harpoon valves from Seal Rock which have a grooved ventral surface for accepting a small bone or wooden bipoint (or unipoint) are commonly found in southern Northwest Coast sites and are usually associated with salmon fishing (Bennyhoff 1960; Kroeber and Barrett 1960; Friedman 1976; Roll 1974). Type II harpoon valves characterized by an expanding, stepped tip used to enhance affixation of the armament have been attributed to hunting pinnipeds (Friedman 1976; Roll 1974). The armament for the Type II harpoon valves is usually characterized as being thin slate or shell blades (c.f. Drucker 1943; Stewart 1973); however, the large triangular (Type 1) projectile points found at Seal Rock probably served as the armament for Type II harpoon valves. The high relative frequency of Type 1 triangular projectile points and Type II composite harpoon valves helps emphasize the importance of the technological component used to exploit pinnipeds (especially Steller's sea lions) at or near the site.

Implements not directly associated with exploiting pinnipeds are not as common in the artifact assemblage. Type I composite toggling harpoon valves, acute angle fish hooks, bone unipoints and bipoints, and a composite fish hook are included in the technological component for procuring fish resources. Projectile points from Seal Rock which appear to have been used as arrow tips may be associated with extracting fish, terrestrial and/or marine mammal resources.

Technological components of the late littoral stage not directly associated with procurement or resource acquisition activities are well represented in the Seal Rock artifact assemblage. Analysis of the lithic artifacts indicates that thermal alteration of CCS materials was a regular part of the technology for manufacturing stone tools. While this technology has been noted at other late prehistoric sites on the Oregon coast (cf. Draper 1980; Minor et al. 1985) its presence/absence has not been consistently reported. Therefore, it is unknown whether the technology for thermal alteration of CCS materials is characteristic of the pre-, early, and/or late littoral stages of adaptation.

The lithic artifact assemblage at Seal Rock contains a variety of artifacts used for processing food resources (e.g., scrapers, knives, grinding stones) and for manufacturing tools and implements (e.g., gravers, drills, adzes, abraders, hammerstones). The bone and antler artifact assemblage is mostly comprised of wedge/chisels, pointed bone artifacts (e.g., perforator/awls, miscellaneous bone points), and non-utilitarian items (e.g., pendants, bracelets or bands, whistles). The large number of bone and antler wedge/chisels represented in the Seal Rock assemblage may reflect a technological component for woodworking which could provide indirect evidence for the existence of house remains at the site.

In general, the artifacts from Seal Rock are similar to those recovered from other late prehistoric sites on the southern Northwest Coast. However, the distribution of the Type II composite harpoon valves and the Type 3 concave base projectile points help to exemplify the unique placement of the Alsea culture in relation to the more distinct northern Northwest Coast cultures in Washington and British Columbia and the southern cultures of northwest California and southwest Oregon. The relationship between the central Oregon coastal tribes and their northern and southern neighbors is not a new concept. Early researchers have suggested that the Alsea and other central coastal groups are at the southern boundary for influences from the more northern Northwest Coast cultures, and at the northern boundary for influences from the more southern cultures of northwest

California (Barnett 1937; Cressman 1953; Farrand 1901, 1910; Newman 1959). The Type II composite toggling harpoons found at Seal Rock are similar to ones found in British Columbia and Washington coastal sites (see Table 24). According to Friedman (1976) and Roll (1974) these harpoons were probably used to hunt pinnipeds. Since pinnipeds are the main focus of resource acquisition at Seal Rock, it appears that the technology for exploiting pinnipeds was adopted from the northern cultures. To date, composite toggling harpoon valves of this type have not been found in sites to the south of Seal Rock and the closest site to the north containing this type of harpoon valve is the Minard site, (45GH15) located on the central Washington coast (Roll 1974).

Concave base projectile points of the kind found at Seal Rock (Type 3) are commonly found in late prehistoric shell midden sites on the northern California coast (as far south as Humboldt Bay) and the southern Oregon coast (as far north as the Coquille River). This point style is infrequently found outside this region; a few have been found in the Rogue River drainage area (Draper 1980; Pullen 1982; Schreindorfer 1988). Distribution of these points has been used to suggest a regional technological development confined almost exclusively to the southern Oregon and northern California coast (Draper 1980), and the presence of concave base projectile points is often associated to close ties with cultures in northwest California (Draper 1980; Pullen 1982). The occurrence of concave base projectile points at Seal Rock suggests technological influences from northwest California extended into Alsea territory.

As suggested by ethnographers who worked with the Alsea in the late 19th and early 20th centuries (Barnett 1937; Drucker 1939; Farrand 1901, 1910), and as is indicated by the archaeological record at Seal Rock, the Alsea culture does appear to be near the southern and northern boundary for influences from cultures in Washington and British Columbia, and cultures in northwest California. This distribution of Type II harpoon valves and Type 3 projectile points suggests that aspects of technological components from other regions were being used at Seal Rock.

The Seal Rock site offers valuable data for explaining subsistence strategies and technological components for the late littoral stage of adaptation for prehistoric cultures along the central Oregon coast. Research at Seal Rock has shown that subsistence pursuits were focused on a littoral environment, with pinnipeds being the primary focus of resource acquisition due to the presence of a rookery in the close vicinity of the site (Lyman 1988a, 1988b; Snyder 1978). The technological component(s) used to exploit and process the resources are well represented in the artifact assemblage from Seal Rock.

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APPENDICES

APPENDIX A

DEFINITIONS OF DIMENSIONS AND MODES FOR PARADIGMATIC CLASSIFICATION SYSTEMS

MATERIAL TYPE CLASSIFICATION

Dimension I. Texture. This dimension discriminates between the various crystalline materials by the abundance of discrete visible constituents.

Modes:

1. Coarse: the constituent grains that are macroscopically visible make up 50 to 100 percent of the material's surface. The surface may be rough and irregular with numerous crystal faces or grains visible. Conchoidal fracture is poor.
2. Medium: the constituent grains that are macroscopically visible make up 10 to 50 percent of the material's surface. The surface may be smooth to rough. Crystals or grains are surrounded by a fine matrix or groundmass showing little or no structure. Conchoidal fracture is fair to good.
3. Fine: the constituent grains which are macroscopically visible make up 0 to 10 percent

of the material's surface. The surface is generally smooth and appears to be essentially homogeneous. Conchoidal fracture is good to excellent.

Dimension II. Size of Constituent grains. This dimension involves the measurement of the dominant visible grains along the longest axis.

Modes:

0. None: no visible grains.
1. Fine: visible constituents are less than 1mm.
2. Medium: visible constituents are 1-5mm.
3. Coarse: visible constituents are greater than 5mm.

Dimension III. Composition. This dimension discriminates quartz rocks from other lithologies. Quartz is generally colorless, white, purple, yellow, or red in macroscopic mineral crystals. Crystals may have a glassy to quite dull luster. The microscopic and cryptoscopic varieties may be almost any color in homogeneous, banded, or mottled patterns. These quartz rocks generally have a slightly waxy or greasy luster and may be quite dull upon weathering. Quartz is characterized by good to excellent conchoidal fracture, and quartz rich rocks depending on texture and grain size, can be used for almost any function or technology.

Modes:

1. Quartzose: 85 percent or more of the material consists of quartz.
2. Nonquartzose: less than 85 percent of material consists of quartz.

Dimension IV. Glasses. The glasses are more brittle than quartz and in the vitropheres may have easily visible mineral constituents. Most natural glasses are black, quite lusterous, and may be transparent. Upon weathering or with increasing mineral inclusions the glasses may have a pitch-like luster and can be completely opaque. Manufactured glass comes in many colors and can often exhibit manufacture marks, cut surfaces, bubbles and other identifying characteristics.

Modes:

1. Matrix is natural glass.
2. Matrix is manufactured glass.
3. Matrix is not glass.

Dimension V. Fractures and Inclusions. This dimension involves the determination of the amount of fractures and inclusions in the material. This dimension measures the volume of the material based on all surfaces. Fractures consist of natural cleavage planes, crazing due to heat or cold, and other natural features which tend to make the material less flakable. Inclusions include weathering rind, coarser crystals or fragments as seams or pockets in a finer matrix, and other inclusions which may affect the flakability of the material. The amount of fractures and inclusions may be a general indication of the quality of the stone for flaking. That is, the fewer the fractures and inclusions the better the material will flake.

Modes:

1. Few: 0-10% of the volume consists of fractures or inclusions.
2. Common: 10-50% of the volume consists of fractures or inclusions.
3. Many: 50-100% of the volume consists of fractures and inclusions.

Dimension VI. Thermal Alteration. This dimension involves the determination of whether the material has been thermally altered. Thermal alteration can be a sign of an intentional technological treatment used to produce better flaking characteristics.

Modes:

1. Not thermally altered
2. Thermally altered: presence of potlidding, crazing, greasy luster instead of dull luster, color change (determined by comparing outside surface with inner fresh surface) (Crabtree and Butler 1964; Odell 1979), a darkened outer surface.

TECHNOLOGICAL CLASSIFICATION

Dimension I. Artifact Type. The overall morphology of the artifact is qualitatively described.

Modes:

1. Flake: any piece of stone removed from a larger mass by applied force which has a platform and bulb of force at the proximal end (Crabtree 1982:36)
2. Core: a mass of material which has negative flake scars, or scar and can be formed into various shapes to allow the removal of definite types of flakes or blades (Crabtree 1982:30)
3. Debris: waste material having little or no definitive characteristics (e.g. chunks, shatter) (Crabtree 1982:32)
4. Flake Tool: a flake in which the original shape has not been modified and use-wear attributes can be defined
5. Manufactured artifact: the original form of an object has been either slightly modified (e.g. bifacially or unifacially retouched) or extensively modified (e.g. projectile points, bifaces)

6. Non-Manufactured Tool: artifacts in which the original shape of the raw material was or unmodified (e.g. anvils, hammerstones, battered cobbles)

Dimension II. Condition of the Artifact. The condition of the artifact can help indicate where the artifact lies in the trajectory of the manufacturing process (Muto 1976) or within the systemic context (Schiffer 1976). If the artifact is broken, the final point of the trajectory may be represented by a rejected form or if the artifact is complete the trajectory could be represented by a finished, usable implement (Muto 1976).

Modes:

1. Complete
2. Broken
3. Not applicable

Dimension III. Amount of Cortex. The relative amount of cortex is recorded. The presence of cortex on flakes can often indicate the stage of the reduction process. Variables such as core/nodule size, technology used, and desired product may control the amount of cortex that is present on an artifact (Lyman et al. 1983).

Modes:

1. High: cortex is present on over 50 percent of the external or dorsal surface.

2. Medium: cortex is present on 50 to 1 percent of the external or dorsal surface
3. None: cortex is not present
4. Not applicable or indeterminate

Dimension IV. Presence of Manufacture/Use-Wear Attrition. The co-occurrence and presence/absence of manufacture and use-wear attributes is recorded. Manufacturing of an object can often be related to the intended function of an object, and therefore, this dimension attempts to link the functional and the technological analyses by trying to relate how technological attributes correlate with functional attributes (Lyman et al. 1983).

Modes:

1. Wear Only: an object shows signs of use-wear attrition, but not manufacturing attrition
2. Manufacture Only: an object shows signs of manufacturing attrition, but not use-wear attrition
3. Manufacture and Use-Wear: an object shows signs of both manufacture and use-wear attrition
4. None: no manufacture or use-wear attrition is evident

Dimension V. Type of Manufacture. This dimension records the physical attribute of tool manufacture attrition by indicating the process involved in shaping the object.

Modes:

1. Chipping: shaping an object by removing small pieces of material by the application of force (e.g. flaking)
2. Pecking: shaping an object through a percussion technique used to form overlapping cones. Application of force is usually perpendicular to the objects surface.
3. Abrasion: grinding or shaping an object with a abrasive stone or material
4. Chipping and Pecking
5. Pecking and Abrasion
6. Chipping, Pecking, and Abrasion
7. None: no manufacturing attrition is evident

Dimension VI. Use-Wear/Manufacturing Relationship. This dimension records whether use-wear and manufacturing attrition occur together on the same object and whether they overlap with one another.

Modes:

1. Independent: use-wear attrition does not overlap with manufacture attrition, but both are present on the same object
2. Overlapping-Total: use-wear attrition only occurs on areas which also exhibit manufacturing attrition

3. Overlapping-Partial: use-wear attrition occurs on areas which which are both manufactured and non-manufactured

4. None: no manufacture and/or use-wear attrition is evident

Dimension VII. <u>Location and Extent of Manufacture Attrition</u>. This dimension records the location and extent of an object's manufacturing attrition.

Modes:

0. No manufacture attrition is present
1. Manufacture attrition is unifacial, along ventral or dorsal edge(s) only
2. Manufacture attrition is unifacial, over all or nearly all of the ventral or dorsal surface
3. Manufacture attrition is bifacial, along ventral and dorsal edge(s) only
4. Manufacture attrition is bifacial, over all or nearly all of ventral and dorsal surfaces
5. Manufacture attrition is on all or nearly all of the ventral or dorsal surface, and along an edge possibly extending on one-half of the opposite surface

USE-WEAR CLASSIFICATION

Dimension I: Kind of Wear. This dimension records the physical expression of wear on an object. The type of wear depends on the manner of use, kind of material used, and the geometry of the area of contact. The areal limits of a certain type of wear are defined as an area with contiguous wear of the same kind.

Modes:

1. Chipping: small conchoidal fracture scars along an edge, point, or surface. These fracture scars can be overlapping or contiguous with feathered or abrupt terminations
2. Abrasion: smoothed surface, edge, or point sometimes associated with striations. An abraded area can be either dull or glossy
3. Crushing: includes a combination of multiple overlapping stepped, hinged or irregular fractures which leave irregular shaped pits on an edge, point, or surface
4. Polishing: smooth glossy appearance, striations no longer visible due to highly abraded nature of use
5. Chipping and Abrasion
6. Crushing and Abrasion
7. None: no wear is evident

Dimension II. Location of Wear. This dimension records the geometry of an object at the site that wear occurs. Since the location of the first traces of wear may be obliterated by subsequent wear related attrition, only the location of attritional features which were visible at the time of analyses were recorded under this dimension.

Modes:

0. Edge Only: damage is confined at the intersection of two plane surfaces creating an abrupt angle (single edge)
1. Surface: wear occurs on a single flat or rounded plane and does not extend over an abrupt edge
2. Edge and surface combination: wear occurs on a edge and extends onto an surface
3. Unifacial edge: wear is confined to the intersection of two plane surfaces and extends onto one of the surfaces forming the edge
4. Bifacial edge: wear is confined to the intersection of two plane surfaces and extends onto both of the surfaces forming the edge
5. Point: wear occurs at the intersection of three or more planes such that the interior angle of the intersection is acute

6. Point and Unifacial edge: wear occurs on a point and extends onto an adjacent unifacial edge.
7. Point and Bifacial edge: wear occurs on a point and extends onto an adjacent bifacial edge
8. Point and edge combination: wear occurs on a point and extends onto two or more adjacent edges (edge only, unifacial edge, or bifacial edge)
9. None: no wear is evident

Dimension III: Shape of Worn Area. This dimension describes the planimetric configuration of the wear at the edge or surface of the tool. The body of the tool is taken as the referent for the direction of the curve.

Modes:

1. Convex: the plan of wear has a gradual convex arc away from the body of the object
2. Concave: the plan of wear has a gradual concave arc toward the body of the object
3. Straight: the plan of wear closely resembles a straight line or flat surface
4. Point: the plan of wear has an abrupt convex arc/angle
5. Notch: the plan of wear has an abrupt and concave arc

6. Irregular: the plan of wear has an abrupt directional change and angularity due to use attrition or other fractures of the tool edge
7. None: no wear is evident

Dimension IV: <u>Edge Angle</u>. This dimension is defined as the angle formed by the intersection of two surfaces on the area of wear. Due to attrition of an edge from use, the angle of the used edge will change as the duration of use increases. This dimension attempts to estimate the edge angle prior to use.

Modes:

1. Low: 20 to 44 degrees
2. Medium: 45 to 60 degrees
3. High: greater than 60 degrees
4. None: no wear is evident or the angle is not measurable.

Dimension V. <u>Orientation of Wear</u>. This dimension describes the direction from which force was applied to an edge or surface to produce wear. Almost all chipping wear is identified as perpendicular for technological reasons.

Modes:

1. Parallel: the main axis of wear is located parallel to an edge/surface. On a surface, striations or grooves run primarily in one direction.
2. Oblique: the main axis of wear lies oblique (30 to 60 degree) to an edge. This does not apply to wear on a point or surface.
3. Perpendicular: the axis of wear is located perpendicular to an edge (60 to 90 degree angle) or on a surface. This includes: all chipping wear, striations running perpendicular to one another, and crushing wear on a surface.
4. Diffuse: the axis of wear is not discernible. There is no apparent direction of wear, or wear pattern is formed in multiple directions.
5. None: no wear is evident

APPENDIX B

ARTIFACT ILLUSTRATIONS

Figure 9. Type 1 projectile points.

A. N58/E26 4-11a

B. N46/E30 1-79

C. N54/E33 4-4

D. N52/E30 3-11a

E. N64/E30 1-11a

F. N58/E26 7-1c

G. N46/E30 1-2

H. N56/E28 1-27

I. OH-4

J. N54/E30 6-11a

K. N68/E30 5-11b

L. N68/E30 2-11i

M. N72/E30 2-6

N. N46/E30 97.56

O. N68/E30 5-11a

P. N58/E26 4-11a

Q. N56/E30 2-11b

R. N50/E30 5-113

S. PH-2

T. N58/E26 7-1a

U. N48/E30 8-11c

V. N50/E30 4-45

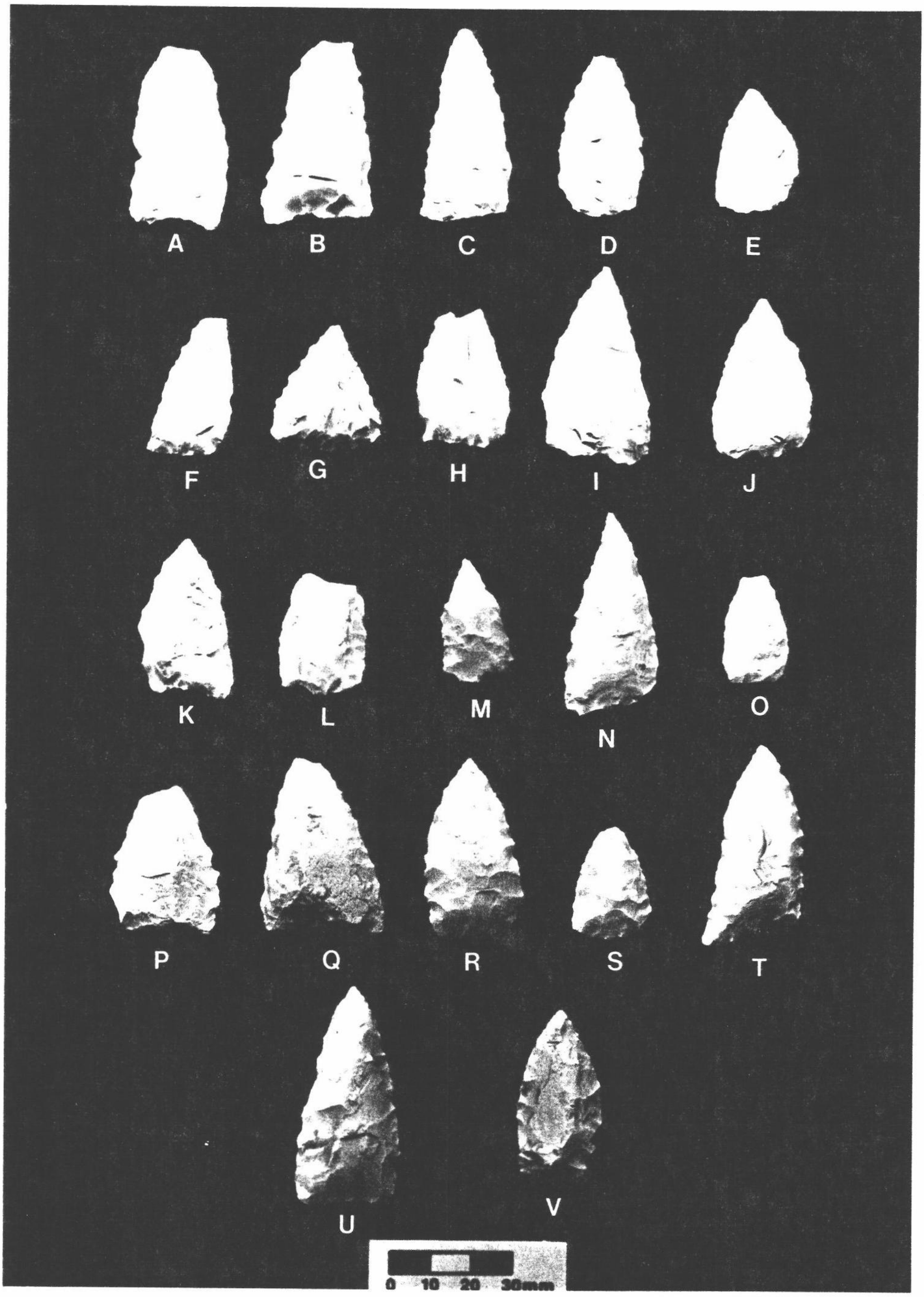

Figure 9. Type 1 projectile points.

Figure 10. Types 2, 3, 4, and 5 projectile points.

Type 2:

A. N52/E32 2-35 (Type 2b)

B. N56/E30 2-11a (Type 2b)

C. N58/E32 4-109 (Type 2a)

D. N54/E30 4-11a (Type 2a)

E. N44/E30 6-69 (Type 2a)

F. N46/E30 8-116 (Type 2a)

Type 3:

G. PH-1

H. N56/E28 2-89

I. N46/E30 1-1

J. N58/E32 3-52

K. N56/E30 6-11a

L. N52/E30 1-11a

M. N48/E30 4-11d

N. N56/E30 9-?

Type 4:

O. N56/E30 4-11

P. N46/E30 1-19

Q. N50/E30 10-59

Type 5:

R. N58/E26 7-1b

S. N64/E30 5-11e

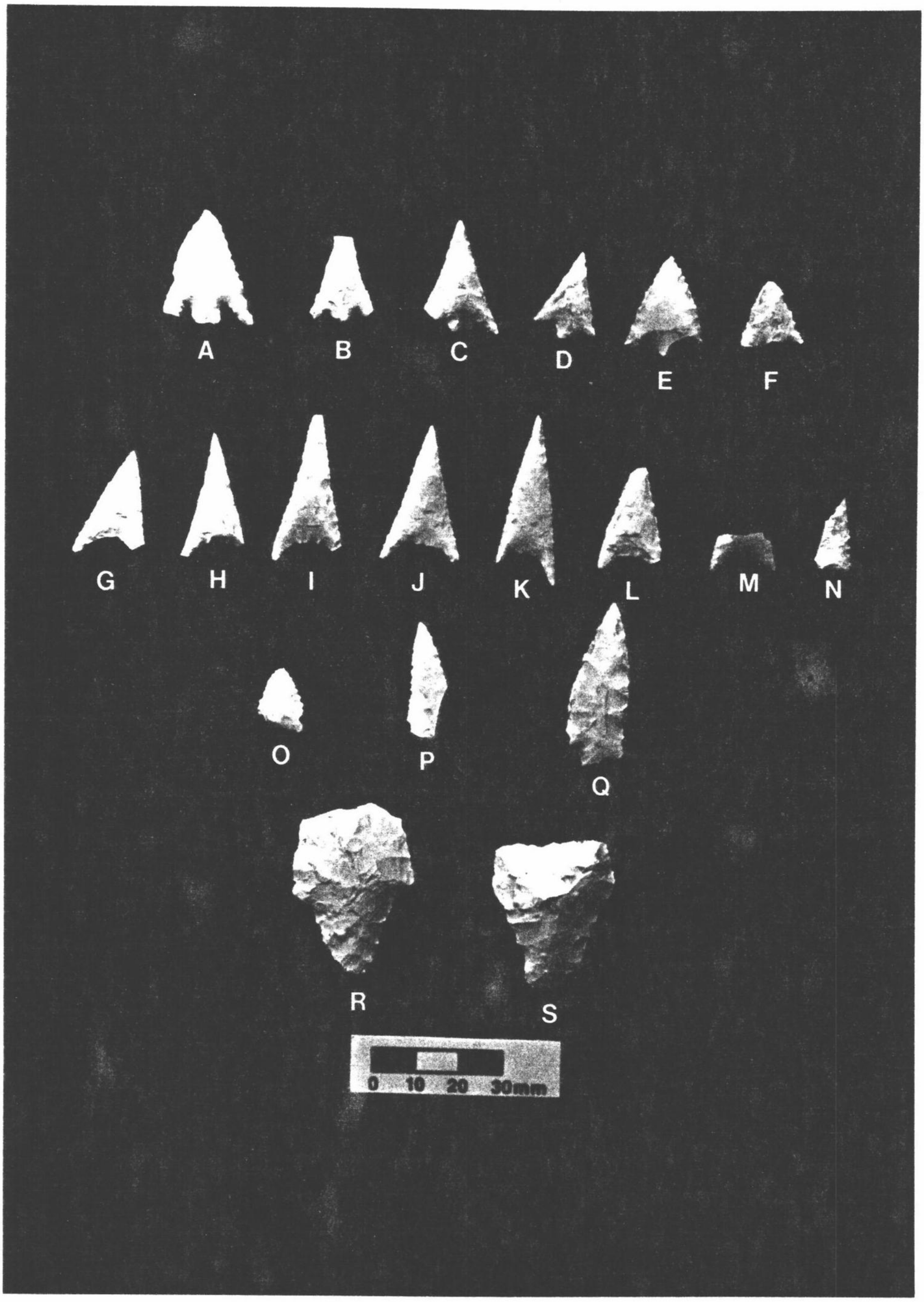

Figure 10. Types 2, 3, 4, and 5 projectile points.

Figure 11. Split antler wedge/chisels.

A. N44/E30 2-52

B. Unknown

C. N50/E30 40-49

D. N56/E30 10-12a

Figure 11. Split antler wedge/chisels.

Figure 12. Antler tine wedge/chisels.

A. N54/E33 9-15

B. N64/E30 4-12c

C. N64/E30 8-12b

D. N54/E32 3-94

E. N54/E32 5-9

F. N72/E30 6-12h

Figure 12. Antler tine wedge/chisels.

Figure 13. Bone wedge/chisels.

A. N46/E30 2-30

B. N58/E26 5-12

C. N64/E30 6-12b

D. N50/E30 10-33

E. N56/E28 2-207

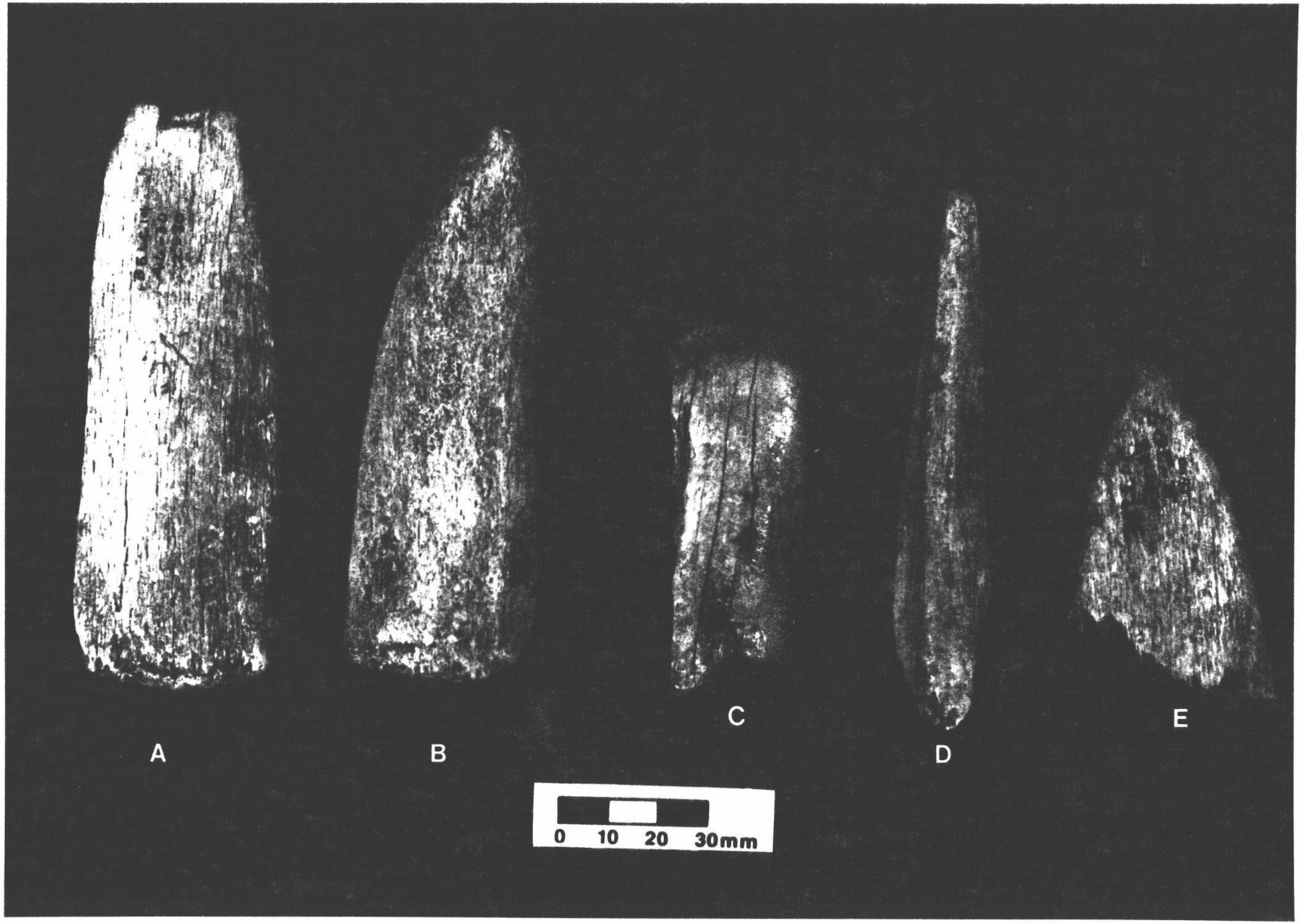

Figure 13. Bone wedge/chisels.

Figure 14. Bone unipoints and bipoint.

Unipoints:

A. N56/E30 3-12a

B. N60/E30 5-9

C. N58/E26 7-12a

D. N58/E26 5-12b

E. N46/E30 6-39

F. N44/E30 2-59

G. N52/E30 4-12j

H. N58/E32 10-26

Bipoint:

I. N56/E30 3-12d

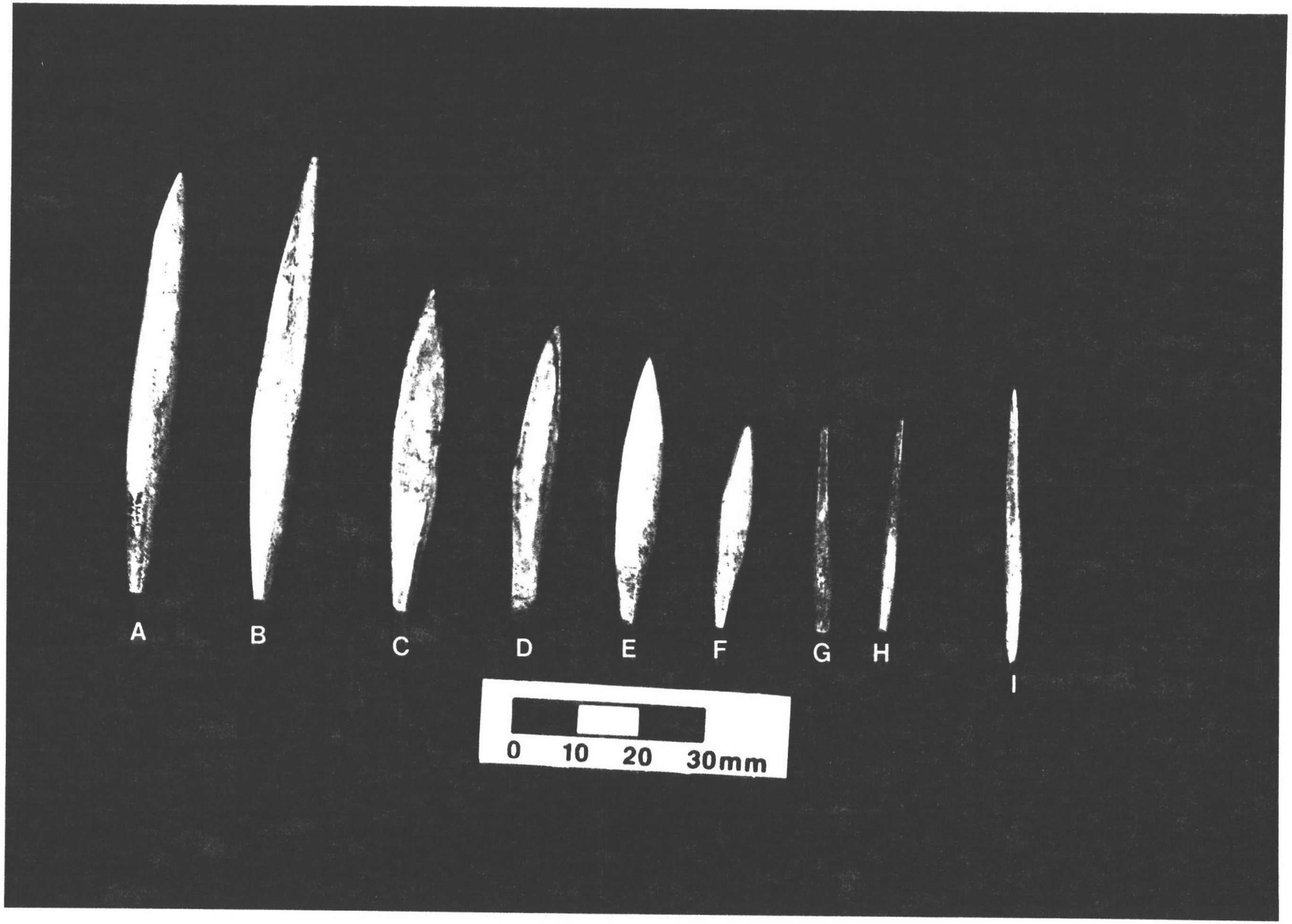

Figure 14. Bone unipoints and bipoint.

Figure 15. Bone awls/perforators.

Split Rib:

A. N56/E30 3-12b

B. N52/E30 4-121

Split Bone:

C. N59/E33 4-119

D. N54/E32 2-32

E. N58/E32 7-24

F. N58/E26 2-12

G. N56/E32 10-17

H. N50/E30 5-8

I. N72/E30 4-12g

J. N48/E30 4-12a

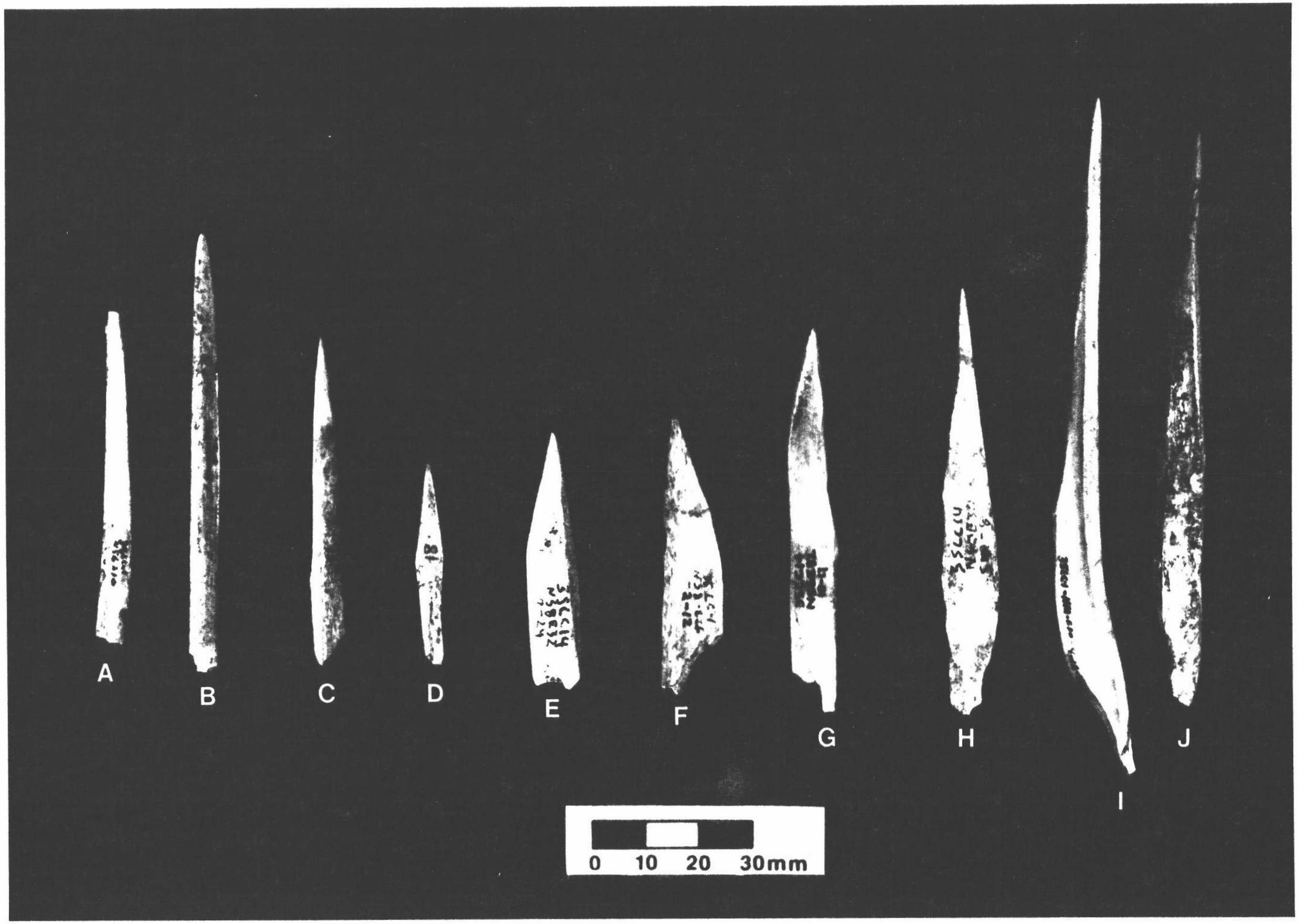

Figure 15. Bone awls/perforators.

Figure 16. Sea mammal phalange tools.

A. N54/E29 5-10

B. N72/E30 4-34

C. N46/E30 2-6

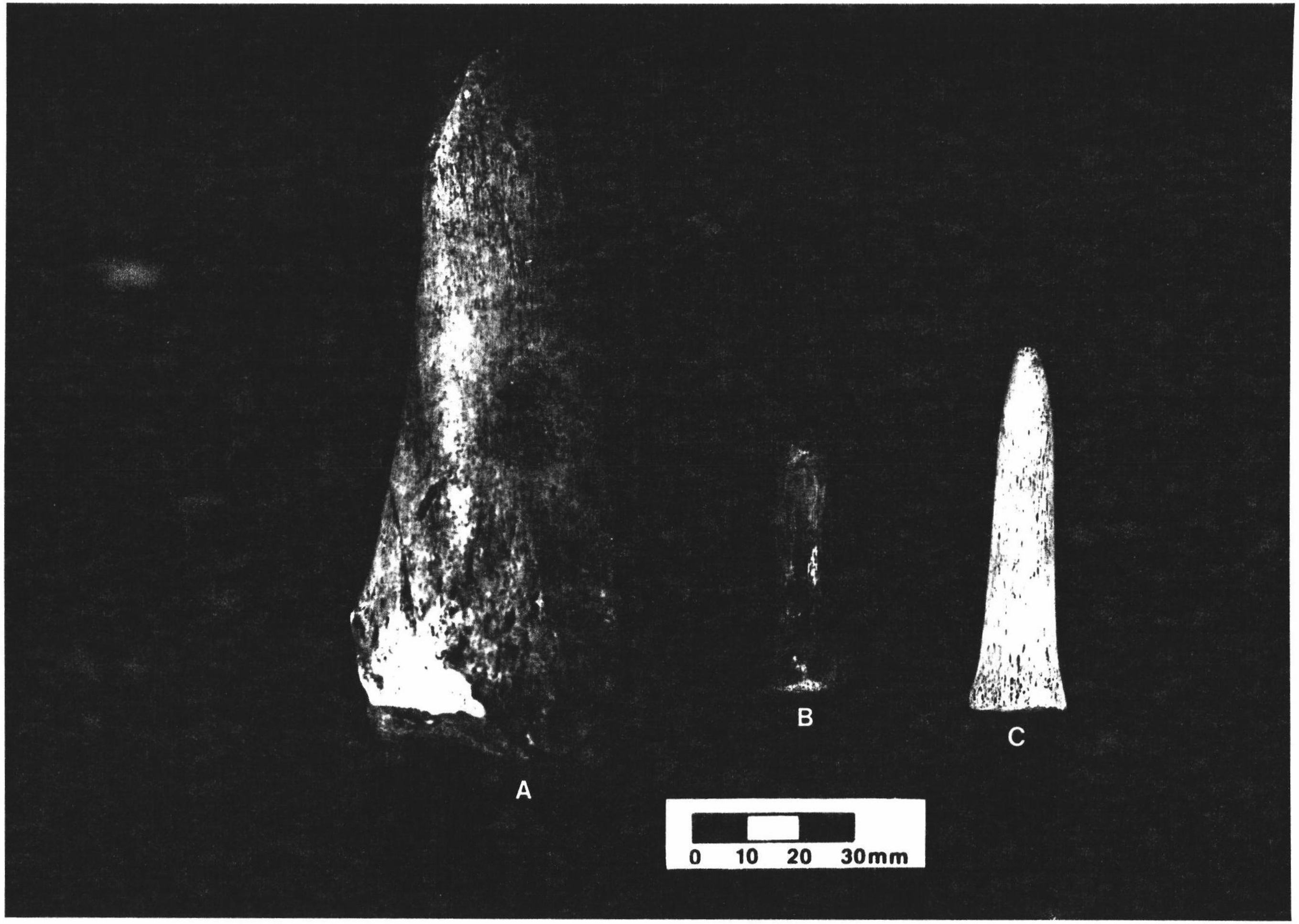

Figure 16. Sea mammal phalange tools.

Figure 17. Sea mammal rib tools.

A. N56/E32 10-21 (distal end)

B. N58/E26 4-12a (distal end)

C. N58/E26 7-12b (distal end)

D. N64/E30 5-12a (distal end) N64/E30 4-12a (proximal end)

E. N58/E32 9-1 (complete)

F. N56/E32 4-8 (complete)

G. N50/E30 7-15 (complete)

H. N54/E32 2-53 (proximal end)

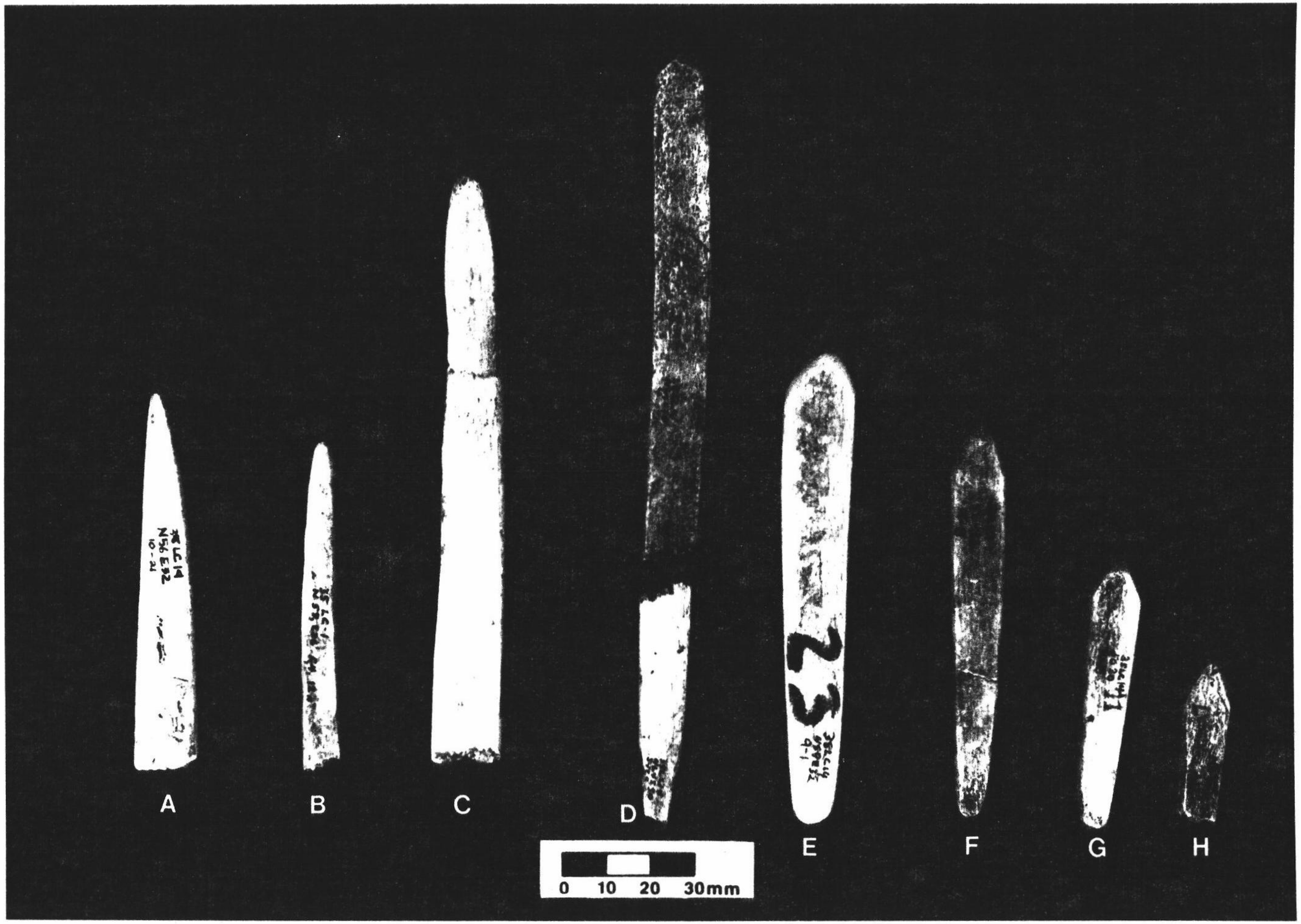

Figure 17. Sea mammal rib tools.

Figure 18. Type II composite toggling harpoon valves.

A. N50/E30 6-88

B. N56/E28 2-148

C. N50/E30 8-30

D. N54/E32 3-68

E. N56/E30 4-12

F. N72/E30 2-12

G. N44/E30 2-33

H. N58/E32 8-8

I. N58/E32 8-7

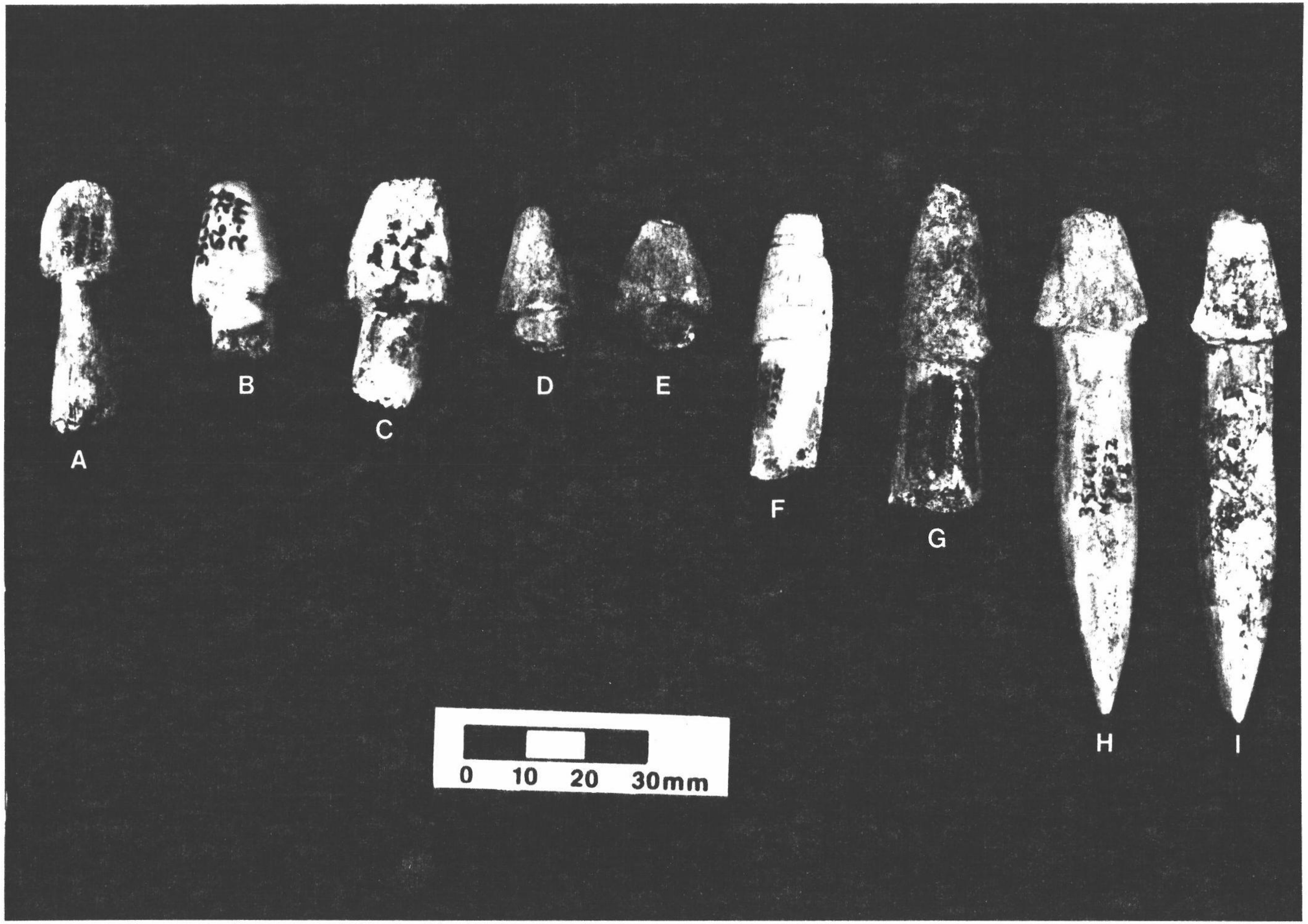

Figure 18. Type II composite toggling harpoon valves.

Figure 19. Type I harpoon valves and (Type II) spur/body fragments.

Spur/Body Fragments:

A. N56/E32 4-7

B. N50/E30 4-47

C. N72/E30 5-12e

D. N54/E29 2-142

E. N54/E30 5-12b

F. N54/E32 2-6

G. N44/E30 1-3

H. N64/E30 8-23

I. N54/E30 6-12b

J. N56/E32 4-7

Type I Harpoon Valves:

K. N44/E30 2-60

L. N48/E30 5-126

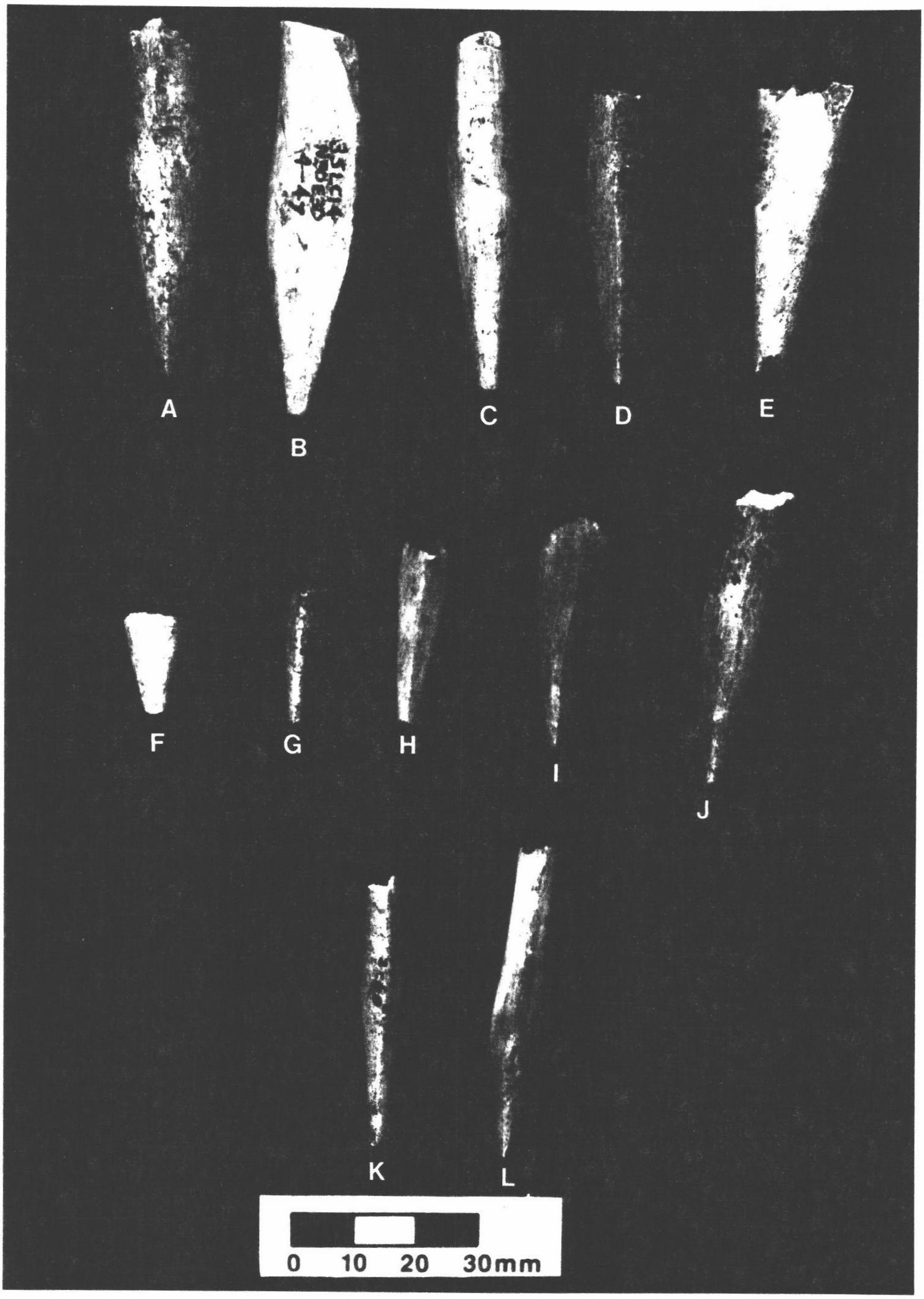

Figure 19. Type I harpoon valves and (Type II) spur/body fragments.

Figure 20. Antler tine artifacts.

A. N64/E30 9-12a

B. N50/E30 6-2

C. N60/E30 5-11

D. N46/E30 2-12

E. N50/E30 5-35

Figure 20. Antler tine artifacts.

Figure 21. Fishing implements.

A. N52/E32 4-180 - Composite fish hook

B. Unknown provenience

C. N56/E30 8-12a

D. N54/E30 6-12a

Figure 21. Fishing implements.

Figure 22. Bone ornaments.

A. N50/E30 5-12

B. N58/E32 4-24

C. N48/E30 4-12b

D. N46/E30 3-139

E. N50/E30 6-87

F. N54/E30 2-12a and N54/E30 1-12b

G. N54/E30 1-12c

H. N50/E30 4-1

Figure 22. Bone ornaments.

Figure 23. Miscellaneous bone tools.

Split Bone with Polished Edges:

A. Ph-12

B. N58/E26 12-12b

C. N52-E32 6-8

D. N72/E30 5-12c

Netting Tool:

E. N52/E28 1-12d

Triangular Point (Pendant Preform?):

F. N52/E28 1-12a

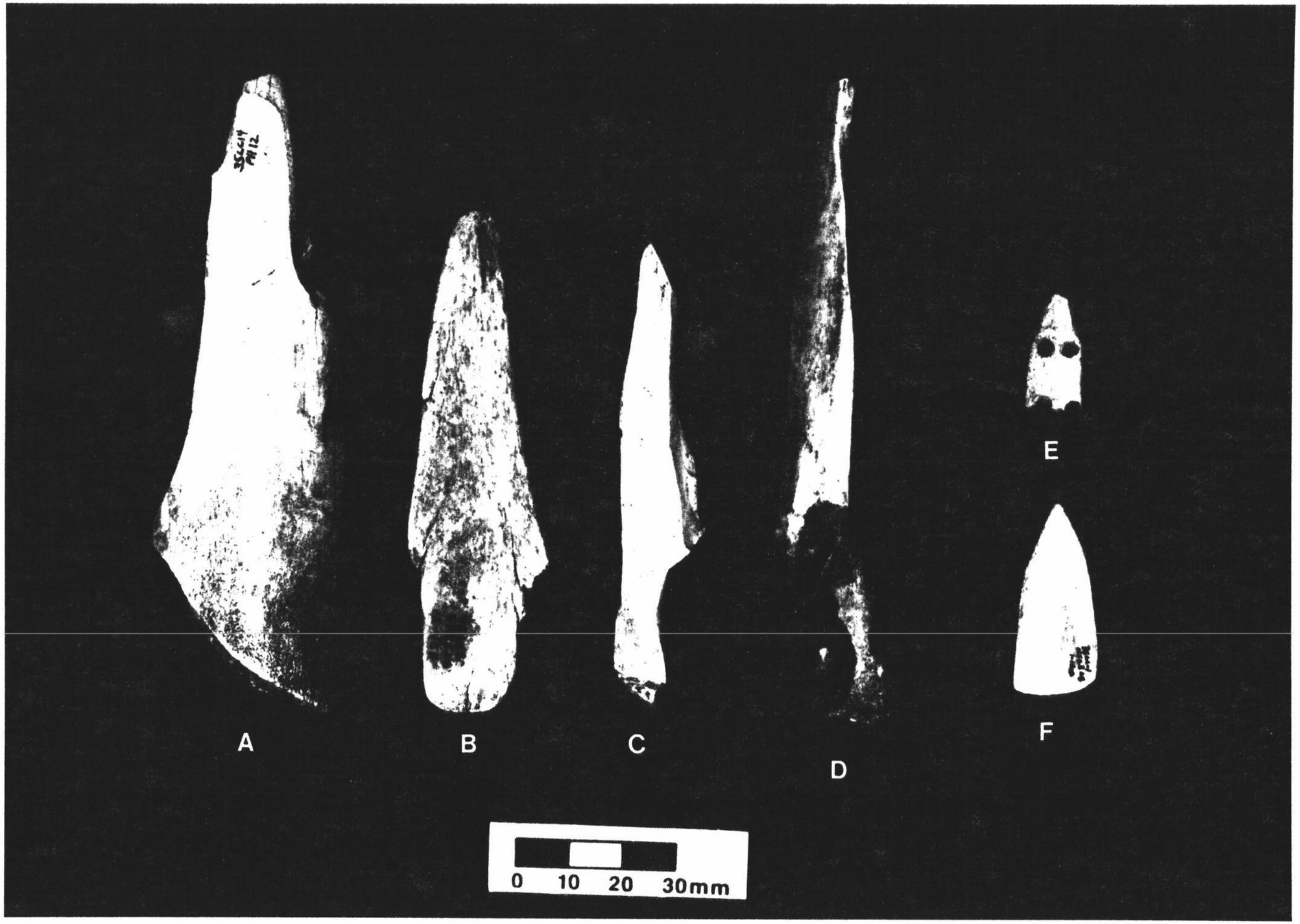

Figure 23. Miscellaneous bone tools.

Figure 24. Sandstone abraders.

A. N52/E32 4-117

B. N72/E30 4-11c

C. N64/E30 6-1i

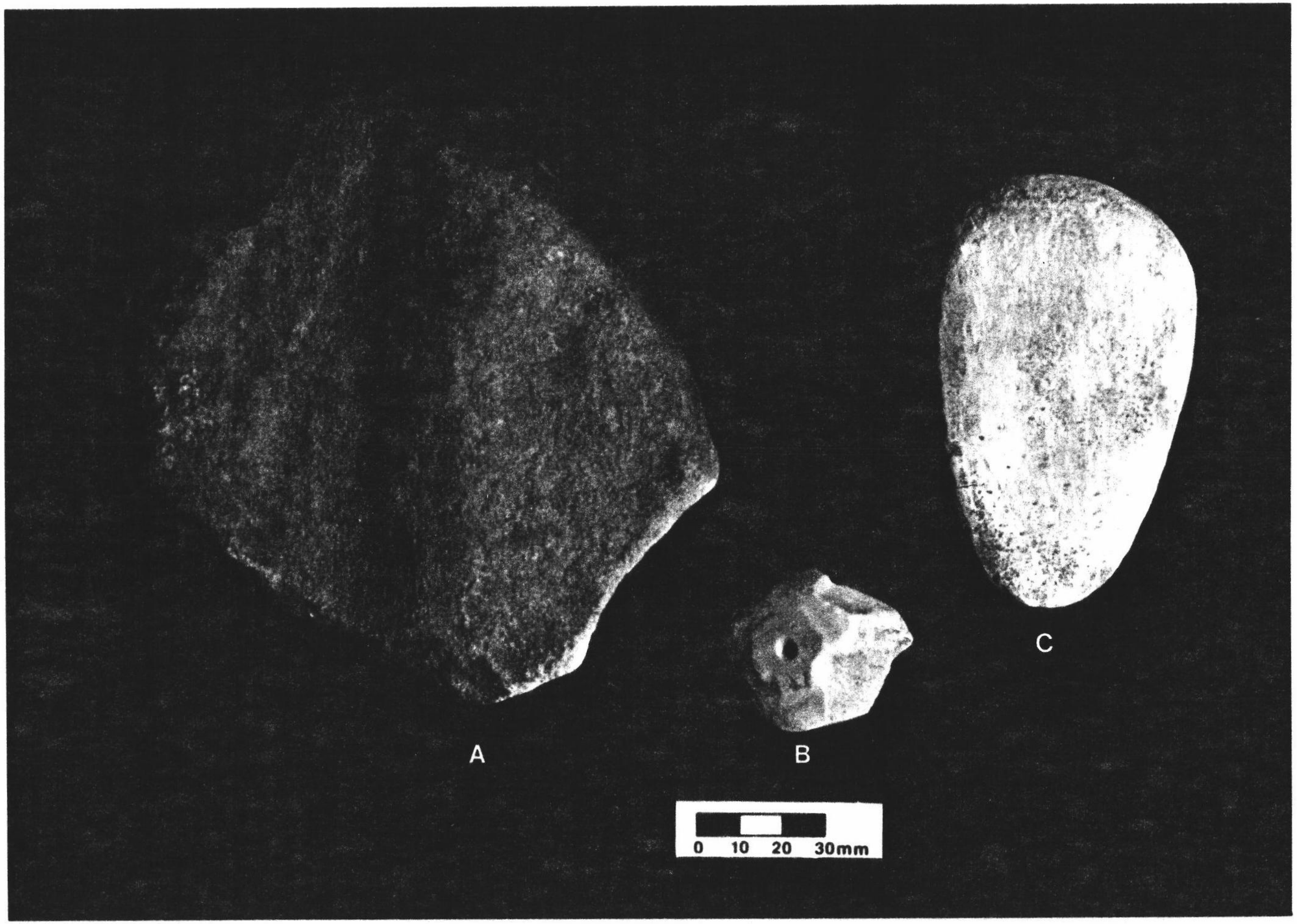

Figure 24. Sandstone abraders.