

Plio–Pleistocene evolution of water mass exchange and erosional input at the Atlantic–Arctic gateway

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Introduction

Neodymium, lead and strontium isotope data of down core leachate and bulk digest of Site 911A (leg 151; Yermak Plateau, 906 m water depth, 80°28.466'N 8°13.640'E). We applied the method of Gutjahr et al. [2007] to extract the Nd, Pb, and Sr isotope composition of past bottom water incorporated into authigenic ferromanganese oxyhydroxide coatings on the sediment particles. The detrital fraction was rinsed with deionized water three times, dried, and ground to prepare for the total digestion of the detrital fraction. 50 mg of the ground sediment were weighed and dissolved in a mixture of concentrated HNO₃ + HF at 180°C over three days. The samples were evaporated to dryness and treated with a mixture of HNO₃ + HClO₄ at 190°C to destroy remaining organic material prior to the ion chromatographic separation and purification steps. Afterwards standard ion chromatography was carried out (see Chapter 2 in the manuscript). All measurements were carried out on a Nu Plasma Multicollector ICP-MS at GEOMAR, Kiel.

Table S1. Down core leachate and bulk digest isotope data of Site 911A (leg 151; Yermak Plateau, 906 m water depth, 80°28.466'N 8°13.640'E)

Table S1: Down core leachate and bulk digest isotope data of **Site 911A** (leg **151**; *Yermak Plateau*, 906 m water depth, **80°28.466'N 8°13.640'E**)

Core section	Depth [m]	Age [ka]	ϵ_{Nd}	<i>leach fraction</i>				<i>detrital fraction</i>				
				$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
1H-1/0-3	0.00	0	-11.0	0.709181	18.851	15.646	38.755	-	-	-	-	-
2H-1/75-77	10.26	111	-12.1	-	19.064	15.645	39.000	-	0.724322	19.038	15.634	39.012
4H-4/100-102	34.01	369	-11.7	0.709303	19.133	15.656	38.994	-12.2	0.722994	19.016	15.639	38.961
5H-5/100-102	45.01	488	-10.4	0.710515	18.851	15.620	38.794	-	-	-	-	-
6H-5/100-102	54.51	591	-11.0	0.710529	18.925	15.630	38.850	-	-	-	-	-
<i>duplicate</i>			-11.1	0.709132	18.925	15.629	38.849					
8H-1/75-77	65.96	715	-6.9	0.708907	-	-	-	-8.4	0.716076	18.711	15.593	38.896
<i>duplicate</i>			-6.8	-	18.616	15.578	38.482					
8H-1/79.5-81.5	66.01	716	-9.9	-	18.646	15.591	38.630	-	-	-	-	-
8H-3/41-42.5	68.62	744	-9.1	0.70936	18.626	15.590	38.593	-	-	-	-	-
9H-3/100-102	77.81	848	-10.1	-	18.754	15.610	38.749	-10.8	0.718050	18.754	15.595	38.756
<i>duplicate</i>			-10.8	0.709309	18.752	15.606	38.736					
10H-5/100-102	91.21	997	-11.4	0.710211	18.984	15.638	38.856	-	-	-	-	-
10H-CC/27.5-29	93.49	1015	-11.0	-	18.692	15.603	38.706	-	-	-	-	-
11H-4/124-126	100.45	1068	-11.5	-	18.872	15.622	38.849	-	-	-	-	-
12H-5/100-102	108.91	1113	-11.0	0.710943	18.972	15.637	38.982	-	-	-	-	-
13H-2/58-60	113.49	1137	-9.9	0.709024	18.627	15.586	38.633	-	-	-	-	-
15H-2/100-102	132.9	1239	-10.8	-	19.053	15.649	38.963	-12.2	0.720313	18.905	15.625	39.017
15H-6/93-95	138.84	1270	-9.4	-	18.659	15.596	38.650	-	-	-	-	-
16X-1/91.5-93	140.83	1280	-10.7	-	18.729	15.605	38.741	-	-	-	-	-
16X-2/99-101	142.4	1289	-10.0	-	18.794	15.613	38.769	-	-	-	-	-
16X-2/126-127.5	142.67	1290	-10.6	0.709072	18.735	15.603	38.722	-	-	-	-	-
16X-4/18-19.5	144.59	1300	-7.8	-	18.786	15.611	38.598	-	-	-	-	-
16X-5/58-60	146.49	1310	-11.5	-	19.051	15.642	38.919	-	-	-	-	-

Table A (continued)

Core section	Depth [m]	Age [ka]	<i>leach fraction</i>					<i>detrital fraction</i>				
			ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
16X-CC/45-47	148.4	1320	-11.9	0.709243	18.996	15.637	38.943	-	-	-	-	-
17X-1/91-92.5	150.32	1330	-9.7	-	18.613	15.597	38.617	-	-	-	-	-
17X-2/131-132.5	152.23	1340	-9.1	-	18.620	15.588	38.624	-	-	-	-	-
17X-3/100-102	153.41	1346	-9.7	0.709673	18.655	15.582	38.634	-	-	-	-	-
17X-4/25-26.5	154.16	1350	-9.4	0.709026	18.636	15.584	38.627	-	-	-	-	-
17X-CC/30-31.5	156.05	1360	-7.0	0.708916	18.682	15.597	-	-	-	-	-	-
18X-1/0-2	157.96	1370	-11.0	-	18.940	15.637	38.920	-	-	-	-	-
18X-2/124-125.5	161.75	1390	-10.1	-	18.996	15.637	38.825	-	-	-	-	-
18X-4/45-47	163.69	1400	-10.9	0.709430	18.903	15.620	38.751	-	-	-	-	-
18X-5/99-100.5	165.59	1410	-10.5	-	18.710	15.603	38.706	-	-	-	-	-
18X-5/100-102	165.61	1410	-10.9	0.709961	18.897	15.625	38.799	-11.1	0.719787	18.920	15.635	38.903
19X-1/85-86.5	169.46	1430	-11.4	-	18.876	15.620	38.861	-	-	-	-	-
20X-1/77-78.5	179.08	1480	-10.6	0.709365	18.891	15.634	38.808	-	-	-	-	-
21X-1/87-88.5	188.78	1531	-9.8	-	18.831	15.615	38.773	-	-	-	-	-
21X-4/100-102	193.41	1555	-11.2	0.712495	18.910	15.618	38.855	-	-	-	-	-
24X-3/100-102	219.71	1693	-10.7	0.709425	18.680	15.600	38.726	-11.1	0.720894	18.747	15.598	38.823
27X-2/65-66	247.96	1840	-9.8	-	18.695	15.585	38.652	-	-	-	-	-
30X-5/65-66.5	281.26	2035	-11.1	-	18.883	15.619	38.843	-	-	-	-	-
31X-4/111-112	289.92	2094	-10.6	-	18.709	15.598	38.712	-	-	-	-	-
31X-6/69.5-71	292.51	2112	-9.4	0.709117	18.700	15.591	38.663	-	-	-	-	-
33X-3/108-109	307.69	2215	-9.5	-	18.583	15.586	38.629	-	-	-	-	-
35X-1/123-124	324.13	2328	-10.2	-	18.660	15.590	38.665	-	-	-	-	-
36X-1/68.5-70	333.3	2390	-6.8	-	18.616	15.577	38.484	-	-	-	-	-
37X-1/72-73.5	342.93	2456	-11.7	-	18.820	15.607	38.840	-	-	-	-	-

Table A (continued)

Core section	Depth [m]	Age [ka]	<i>leach fraction</i>					<i>detrital fraction</i>				
			ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
37X-6/12-14	349.05	2497	-10.0	0.709460	18.751	15.600	38.739	-10.7	0.720409	18.808	15.609	38.825
38X-1/62-64	352.53	2521	-9.7	0.709667	18.728	15.616	38.731	-	-	-	-	-
38X-8/9-11	361.33	2581	-8.8	0.709251	-	-	-	-	-	-	-	-
39X-2/39-41	363.25	2594	-10.1	-	18.641	15.564	38.580	-10.9	0.719379	18.738	15.589	38.751
40X-1/28-30	371.19	2645	-8.1	-	18.555	15.573	38.543	-	-	-	-	-
40X-6/28-30	377.84	2688	-8.0	0.708993	18.613	15.601	38.589	-9.2	0.716004	18.615	15.588	38.608
41X-6/31-33	388.22	2756	-11.4	-	18.697	15.595	38.718	-	-	-	-	-
42X-7/82-84	397.86	2879	-11.1	-	18.724	15.591	38.702	-	-	-	-	-
43X-5/37-39	405.05	2999	-10.8	-	18.755	15.620	38.807	-	-	-	-	-
44X-3/28-30	412.59	3125	-11.0	0.709855	18.696	15.597	38.720	-12.9	0.718175	18.717	15.592	38.796
45X-2/138-140	421.66	3276	-10.3	-	18.602	15.570	38.588	-	-	-	-	-
45X-5/105-107	425.48	3327	-11.0	-	18.737	15.598	38.785	-	-	-	-	-
46X-2/85-87	430.96	3396	-10.9	-	18.687	15.591	38.747	-12.0	0.718576	18.698	15.588	38.772
46X-4/128-130	434.21	3436	-10.8	-	18.621	15.582	38.641	-	-	-	-	-
47X-2/64-66	440.35	3513	-9.0	-	18.602	15.577	38.586	-	-	-	-	-
47X-2/121-124	440.92	3520	-8.5	0.709125	-	-	-	-	-	-	-	-
47X-7/26-29	446.56	3591	-10.8	-	18.668	15.592	38.679	-	-	-	-	-
48X-2/144-146	450.32	3750	-10.8	-	18.735	15.610	38.765	-	-	-	-	-
49X-2/74-76	459.75	4187	-9.1	-	18.590	15.577	38.590	-	-	-	-	-
50X-3/3-5	470.24	4654	-9.7	0.709732	18.635	15.587	38.656	-11.4	0.716791	18.672	15.583	38.745
51X-1/145-147	478.26	4778	-10.0	-	18.632	15.611	38.721	-	-	-	-	-
51X-6/ 68.5-70	484.99	4882	-10.6	-	18.672	15.586	38.676	-	-	-	-	-
52X-3/28-30	489.04	4945	-11.4	-	18.703	15.596	38.784	-	-	-	-	-
52X-5/73-75	492.42	4997	-10.6	-	18.724	15.619	38.821	-12.8	0.718896	18.719	15.583	38.911

Table A (continued)

Core section	Depth [m]	Age [ka]	<i>leach fraction</i>					<i>detrital fraction</i>				
			ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	ϵ_{Nd}	$^{87}Sr/^{86}Sr$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
52X-7/105-107	495.4	5042	-9.8	-	18.648	15.587	38.674	-	-	-	-	-
53X-1/41-43	496.62	5061	-9.7	0.710127	18.686	15.582	38.684	-11.8	0.718673	18.541	15.564	38.617
53X-2/23-25	497.18	5069	-10.5	-	18.674	15.546	38.568	-	-	-	-	-
53X-2/140-142	498.35	5087	-9.4	-	18.683	15.601	38.740	-	-	-	-	-
53X-3/39-41	498.84	5094	-11.5	-	18.723	15.599	38.768	-	-	-	-	-
53X-5/36-38	501.55	5136	-10.9	-	18.680	15.594	38.772	-	-	-	-	-
53X-6/65-67	503.21	5161	-9.7	-	18.662	15.577	38.668	-	-	-	-	-
53X-7/67-69	504.49	5180	-11.0	0.710144	18.731	15.562	38.631	-12.4	0.718226	18.732	15.598	38.808
53X-8/37-39	505.65	5198	-10.9	-	18.669	15.577	38.685	-	-	-	-	-

Repeated measurements of this standard yielded a long term reproducibility for the JNdi-1 standard solution of $\pm 0.3 \epsilon_{Nd}$ (2σ ; $n=120$). The long term reproducibility of the radiogenic Sr isotope measurements of NIST NBS987 standard was ± 0.000032 (2σ ; $n=70$). The long term reproducibility (2σ ; $n=88$) for the standard NIST NBS981 was ± 0.008 for $^{206}Pb/^{204}Pb$, ± 0.009 for $^{207}Pb/^{204}Pb$, ± 0.033 for $^{208}Pb/^{204}Pb$, ± 0.0009 for $^{208}Pb/^{206}Pb$, and ± 0.0002 for $^{207}Pb/^{206}Pb$.

S2. Table S2. Age-depth fix-points for ODP Holes 911A (from *Mattingsdal et al.* [2013]).

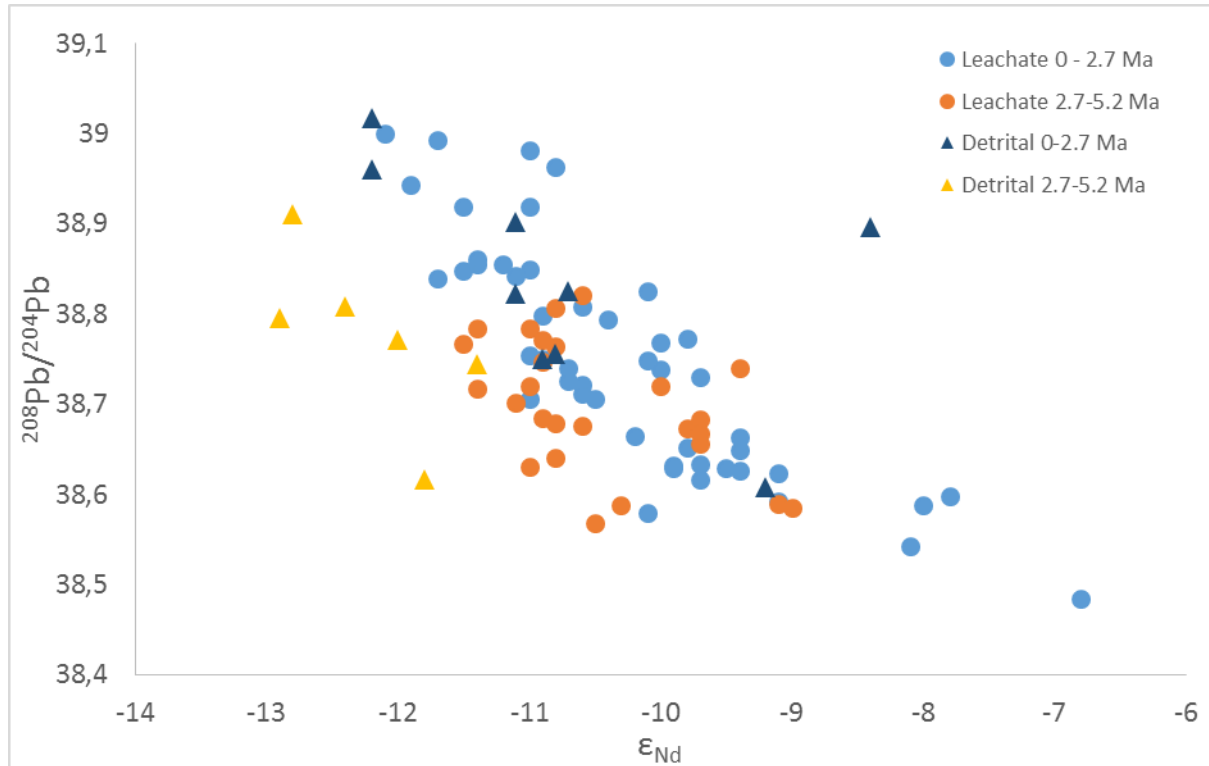
Table S2. Age-depth fix-points for ODP Holes 911A (from *Mattingsdal et al.* [2013])

Age (Ma)	911A (mbsf*)	Datum	Source
0.78	72	Brunhes/Matuyama	Lourens et al., 2005
1.07	101	Jaramillo Base	Lourens et al., 2005
1.78	236	Olduvai Top	Lourens et al., 2005
1.95	268	Olduvai Base	Lourens et al., 2005
2.58	361.33	Matuyama/Gauss	Lourens et al., 2005
2.78	391.9	“Datum A”	Sato and Kameo, 1996
3.3	423		Knies [personal communication]
3.6	447	Gauss/Gilbert	Lourens et al., 2005
4.2	459.8	Cochiti Top	Knies [personal communication]
4.6	468.8	Nunivak Base	Knies [personal communication]
5	492.4	Thvera Top	Lourens et al., 2005
≤5.8	505.6	LO§ L. crista	De Schepper and Head, 2013
5.2	505.8	Base 911A	Mattingsdal et al. 2013

*mbsf = meters below seafloor.

§LO = lowest occurrence.

S3. Figure S1. Comparison of the radiogenic Nd and Pb isotope composition of reductive leachates (dots) and detrital fraction (triangles) of Site 911 prior (yellow) and after (blue) 2.7 Ma.



S4. References cited in the supplementary materials

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