21. INTERSTITIAL WATER STUDIES ON SMALL CORE SAMPLES, LEG 14[1]

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The interstitial waters from the sediments cored on Leg 14 exhibit characteristic compositional trends with three important exceptions. At most of the sites, the changes in Na and Cl are very small while enrichment of Ca and Sr and depletion of Mg and SO_4 is typical of patterns observed in similar types of sediment recovered on previous legs. At Sites 139 and 140, off the African coast, and Site 144, off the coast of South America, systematic increases in concentration with depth are found for Na and Cl. At these sites, the concentration changes, in Ca, Mg, SO_4 and Sr generally follow diagenic patterns observed previously, but there is some indication of other factors affecting Mg concentrations.

All analyses reported here, with the exception of bulk water content and pH, were carried out on water samples which were squeezed from the sediments on board ship and preserved by heat-sealing in lengths of polyethylene tubing. Analytical methods were identical to those outlined in earlier volumes of this series. We wish to thank Wen Chang, James O'Neill and Irene Uhlitzsch for their assistance in conducting the laboratory determinations and data reduction.

RESULTS

At Sites 135, 137, and 141, potassium concentrations decrease with depth to about half ocean water values (0.14-0.19 °/₀₀) at the limits of sampling. Likewise, increases in calcium and simultaneous decreases in magnesium occur with depth at all four sites. This effect is most evident at Site 137 where the calcium enrichment is eight fold and the magnesium concentration is reduced to about half the ocean water value. At Site 136, K and Mg levels are somewhat lower than normal, while Ca is about twice the ocean-water value. Strontium concentrations increase strongly at Site 135, weakly at 137, and are irregularly higher than ocean water at Site 141. At Site 136 strontium concentrations decrease from 80 ppm at 136 meters to 33 ppm at 282 meters.

At Site 142, the first 311 meters, comprising the upper reflective zone, is clay-rich continental margin type sediment similar to those recovered on Leg 11. Interstitial solutions exhibit significant depletions of potassium, calcium, magnesium, and sulfate which are characteristic of rapidly deposited, terrigenous derived sediments. Solutions from the interval 380 to 587 meters, by contrast, are characteristic of biogenic sediments with the calcium and magnesium levels increasing to the 0.8 to 1.0 °/oo range. Sulfate, which is close to the threshold of detection in the top interval, increases to about half the concentration of ocean water (1.42 °/oo) at the bottom of the hole.

The most striking feature of Sites 139, 140, and 144 is the increase in Na and Cl with depth (Figure 1). Chlorinities increase to values of 44, 32, and 28 °/oo respectively. Corresponding increases in Na concentrations occur at all three sites. A single sample (144-5-cc) does not fit the trend. The shipboard salinity determination of 41.8 indicates that the analysis is correct and that the concentration decrease in the sample is real. This reversal of the concentration trend is thought to reflect contamination of the sediment with seawater prior to squeezing.

Depletion of K and enrichment of Ca at Sites 140, and 144 are comparable to the changes noted above for other Leg 14 sites and in earlier initial reports for similar types of sediment. Both K and Ca are enriched at Site 139. The depletion of SO_4 at all three sites likewise resembles previously observed diagenic patterns. Magnesium is depleted at Sites 140 and 144, but is slightly enriched at Site 139. The enrichment of Mg at Site 139 and the increase in Mg at the bottom of Site 144 are unusual for sediments in which interstitial SO_4 has been strongly depleted. Previous experience (Legs 1, 4, 10, 11, 12) has led us to expect depletions of Mg on the order of 50 to 60 per cent of ocean water concentrations in sediments where interstitial SO_4 is nearly exhausted with depth. Further, Mg concentration has been found almost invariably to decrease with increasing depth under conditions of SO_4 reduction. The Sr concentrations at depth at Site 144 are the highest yet reported.

DISCUSSION

The compositional trends of the type seen in the interstitial water at Sites 136, 137, 138, 141, and 142 have been discussed in previous leg reports. Changes in the composition of pore solutions from primarily biogenic sediments have been considered in the initial reports for Legs 6, 7, 8 and 9. Sediments containing considerable amounts of relatively rapidly deposited terrigenous silicate detritus were cored on Legs 10, 11, and 12; the chemistry of interstitial solutions of such sediment is discussed in these reports. No attempt will be made in this report to review, or further pursue these discussions.

The concentration gradients of both Na and Cl at Sites 139, 140, and 144 indicate that evaporite deposits exist at depth at all three locations. Previously, such NaCl enrichment has been found only in sediments where evaporites are known or suspected at depth cf initial reports, Legs 1, 10 and 13. While evaporation of the samples would produce NaCl enrichment, such artifacts could not be expected to produce the consistent concentration depth trends of Figure 1. The concentration of both Na and Cl increase fairly smoothly with depth at Sites 140 and 144. While there is considerable scatter in the data, this does not obscure a similar trend at Site 139. Further, salinity

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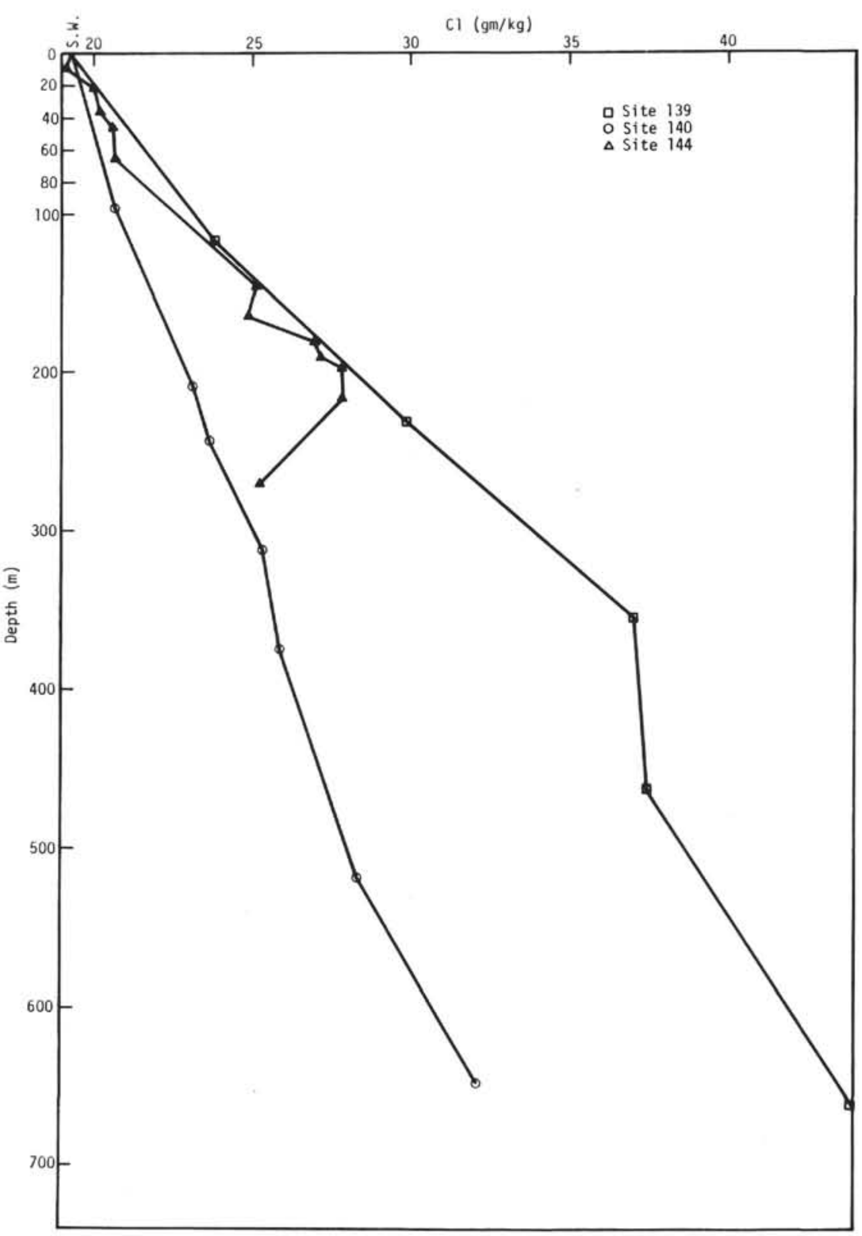

Figure 1. *Salinity gradients at Sites 139, 140 and 144.*

measurements made on the ship tally well with measurements made in the laboratory thereby ruling out evaporation during storage. Evaporation prior to processing cannot be a factor as sampling of the sediments was done immediately upon recovery of the cores. Similar scatter in Cl as a function of depth has been reported by Manheim and Bischoff (1969) in deep cores from the Gulf of Mexico. There is little reason, therefore, to doubt that the observed NaCl enrichments at all three sites result from dissolution of deeply buried evaporites.

The existence and dissolution of evaporites at depth does not appear to have influenced the concentration of K, Ca and SO_4. The concentration changes in these three constituents are similar in direction and in magnitude to changes seen in similar types of sediment where no evaporites exist. Mg, on the other hand, appears to exhibit somewhat unusual behavior. The absence of the usual Mg depletions accompanying strong SO_4 reduction at 139 and the slight increase in Mg noted at the bottom of 144 may be due to diffusive addition of Mg along with Na and Cl.

REFERENCES

Manheim, F. T. and Bischoff, J. L., 1969. Geochemistry of pore waters from Shell Oil Company drill holes on the continental slope of the Northern Gulf of Mexico. *Chem. Geol.* 4, 63.

TABLE 1
Major Constituents of Pore Fluids. Values in g/kg (°/₀₀) Except as Noted.

Sample Designation	Depth (m)	Age	Description	Na[a]	Na[b]	K	Ca	Mg	Total Cations (meq/kg)	Cl	SO_4	Alk. (meq/kg)	HCO_3[c]	Total Anions (meq/kg)	Sum[d]	Refractometer	H_2O (°/₀₀)[e]	pH
Hole 135 (32° 20.8′N, 10° 25.5′W, water depth 4152 m, topographic high SE of Horseshoe Abyssal Plain)																		
Surface ocean water				11.3	11.0	0.40	0.43	1.32	617	20.16	2.90	2.7	0.16	632	36.7	36.8	–	–
135-1-2	3	Pleistocene	Varicolored light brownish gray nanno chalk ooze.	10.9	10.7	0.46	0.39	1.22	597	19.60	2.55	2.4	0.14	608	35.3	35.5	37	7.4
2-6	82	Late Miocene	Light gray nanno chalk ooze, some black streaks.	10.9	10.7	0.41	0.39	1.11	587	19.62	2.02	1.4	0.08	596	34.5	34.6	32	7.2
3-2	176	Late Miocene	Varicolored light gray nanno chalk ooze.	11.0	10.8	0.34	0.55	1.02	588	19.72	1.87	2.1	0.13	597	34.6	34.4	29	7.4
4-2	260	Middle Miocene	Varicolored light gray nanno chalk ooze.	11.1	10.8	0.30	0.70	0.97	595	20.16	1.71	2.1	0.13	607	34.1	34.6	26	7.3
7-3	435	Lower Campanian	Green, olive gray, dark brown silty mudstone, sand and "red clay" layers, intercalated.	10.9	10.8	0.19	0.80	0.87	584	19.99	1.25	2.2	0.13	592	34.1	34.1	21	7.8
Hole 136 (34° 10.1′N, 16° 18.2′W, water depth 4169 m, abyssal hills N of Madeira and SW of Gibraltar)																		
Surface ocean water				11.3	11.2	0.41	0.43	1.36	632	20.44	2.72	3.2	0.20	636	36.9	37.4	–	–
136-1-5	136	Early Pliocene	Very pale orange nanno chalk ooze.	10.8	10.6	0.29	0.90	1.01	596	19.68	2.28	2.4	0.15	604	35.1	35.8	27	5.4
2-6	224	Middle Early Miocene	Very pale orange and pale brown nanno chalk ooze.	11.0	10.8	0.30	0.83	1.06	605	19.95	2.39	2.0	0.12	614	35.6	35.8	27	6.9
3-4	238	Early Miocene	Very pale brown to pale brown nanno chalk ooze with light gray lenses and mottles.	11.0	10.6	0.29	0.83	1.02	594	19.76	2.39	3.0	0.18	609	35.5	35.2	24	6.8
4-3	248	Early Miocene(?)	Brown and grayish brown brown silty clay.	10.8	10.6	0.28	0.83	1.06	597	19.71	2.38	1.6	0.10	606	35.2	35.2	32	6.9
6-1	264	Santonian to Campanian	Brownish red and pale yellowish brown silty clay.	10.0	9.8	0.21	0.84	1.12	564	18.58	2.31	1.9	0.11	574	33.2	33.0	40	6.6
8-2	282	Unknown	Reddish brown marl mud.	10.3	10.1	0.22	0.90	1.09	578	19.12	2.36	1.0	0.06	589	34.0	34.1	35	6.5
Hole 137 (25° 55.5′N, 27° 03.6′W, water depth 5361 m, abyssal hills 1000 Km. W of Cap Blanc, West Africa)																		
Surface ocean water				11.5	11.4	0.41	0.44	1.40	642	20.76	2.90	2.8	0.17	649	37.6	37.4	–	–
137-1-5	58	Unknown	Yellowish brown and dark grayish brown silty clay.	10.4	10.5	0.39	0.57	1.24	608	19.40	2.57	2.6	0.16	603	34.7	35.2	39	6.9
2-1	100	Unknown	Brick red silty zeolitic clay.	11.1	10.8	0.40	0.66	1.20	612	20.17	2.66	1.8	0.11	626	36.3	36.3	57	7.1
2-CC	104	Unknown	Brown clay.	10.7	10.6	0.38	0.74	1.19	604	19.80	2.53	1.8	0.11	612	35.4	35.2	57	7.0
3-6	143	Unknown	Varicolored brown clay, slightly zeolitic	10.5	10.3	0.33	0.93	1.12	593	19.69	2.21	1.3	0.08	602	34.9	35.5	36	6.7
4-2	168	Unknown	Reddish brown clay, slightly silty, zeolitic.	10.0	9.9	0.27	1.15	1.17	591	19.45	2.33	1.1	0.07	598	34.4	35.2	38	7.0
6-CC	225	Turonian-(?) Coniacian	Reddish brown clay, zeolitic.	9.9	9.6	0.23	1.62	1.04	591	19.66	2.31	0.8	0.05	603	34.8	35.8	36	6.7

TABLE 1 – *Continued*

Sample Desig-nation	Depth (m)	Age	Description	Na[a]	Na[b]	K	Ca	Mg	Total Cations (meq/kg)	Cl	SO_4	Alk. (meq/kg)	HCO_3[c]	Total Anions (meq/kg)	Sum[d]	Refrac-tometer	H_2O (°/₀₀)[e]	pH
137-7-CC	265	Cenomanian-Early Turonian	Varicolored alternations of dark carbonaceous clay, nanno marl ooze and nanno chalk ooze.	9.7	9.6	0.22	2.28	0.76	601	19.99	1.91	0.8	0.05	604	34.9	36.0	33	–
8-CC	274	Late Cenomanian	Dark gray foram-nanno chalk ooze.	10.0	9.8	0.24	2.16	0.82	608	20.23	2.01	2.8	0.17	615	35.6	36.3	32	7.0
9-5	282	Late Cenomanian	Pale red and light greenish gray nanno marl ooze to chalk ooze.	9.5	9.6	0.19	2.34	0.79	602	19.88	1.83	1.2	0.07	600	34.6	35.8	26	6.0
10-5	287	Cenomanian	Reddish brown and greenish gray nanno marl to chalk ooze.	9.5	9.4	0.19	2.51	0.76	605	20.09	1.86	1.1	0.07	606	35.0	36.3	27	6.4
16-5	381	Late Albian	Gray and brown nanno marl ooze and foram-nanno chalk ooze.	9.2	9.2	0.14	3.20	0.68	622	20.47	1.92	0.5	0.03	618	35.6	37.4	27	5.7
Hole 138 (25° 55.4′N, 25° 33.8′W, water depth 5288 m, foot of continental rise 870 Km. W of Cap Blanc)																		
138-1-5	58	Early Miocene	Pale yellowish green and pale yellowish brown clay and sand.	10.9	10.7	0.40	0.46	1.26	604	19.71	2.49	2.7	0.17	612	35.4	35.2	62	–
2-5	116	Oligocene	Greenish gray and olive gray silty clay.	10.4	10.3	0.33	0.54	1.24	585	19.25	2.09	4.5	0.27	590	34.1	35.2	47	–
Hole 139 (23° 31.1′N, 18° 42.3′W, water depth 3047 m, middle continental rise 250 Km. W of Cap Blanc)																		
139-1-2	116	Early Pliocene	Light olive gray to light gray foram nanno chalk ooze; H_2S odor	13.1	12.9	0.47	0.29	1.07	674	23.78	0.22	10.2	0.62	686	39.6	39.6	37	7.3
2-4	229	Early Pliocene	Light gray foram nanno chalk ooze.	16.1	15.8	0.49	0.59	1.25	830	29.87	<.01	4.4	0.27	847	48.6	49.5	31	7.3
3-CC	354	Middle Miocene	Greenish gray nanno marl chalk ooze.	20.0	19.4	0.61	1.03	1.39	1022	37.14	<.01	1.0	0.06	1049	60.2	61.6	–	7.1
4-CC	463	Middle Miocene	Greenish gray nanno marl ooze.	20.0	19.8	0.56	1.36	1.37	1058	37.51	0.11	3.1	0.19	1063	61.1	62.2	–	7.1
7-3	659	Early Miocene	Olive to olive gray quartz sand and diatom mud.	23.3	24.0	0.53	2.15	1.31	1278	43.99	0.08	0.8	0.05	1242	74.1	78.1	28	7.1
Holes 140 and 140A (21° 45.0′N, 21° 47.5′W, water depth 4483 m, foot of continental rise 450 km W of Cap Blanc)																		
140-1-6	96	Late Pliocene	Very light yellowish gray foram-nanno chalk ooze.	11.4	11.4	0.43	0.34	1.27	627	20.66	2.07	4.0	0.24	630	36.4	36.9	39	7.4
2-6	209	Early Miocene	Grayish olive diatom mud/ooze, quartz bearing.	12.8	12.5	0.39	0.65	1.18	684	23.16	1.89	2.3	0.14	695	40.2	40.2	43	7.5
140A-2-6	243	Middle Eocene	Varicolored green and gray clay, slightly siliceous, firm	12.6	12.3	0.28	0.79	1.20	680	23.66	1.08	3.2	0.20	693	39.8	40.7	38	7.5
140-3-2	313	Middle Eocene	Greenish gray silty clay slightly siliceous.	13.6	13.4	0.31	0.86	1.18	731	25.45	0.79	3.0	0.18	737	42.4	43.4	43	7.4

TABLE 1 – *Continued*

Sample Desig-nation	Depth (m)	Age	Description	Na[a]	Na[b]	K	Ca	Mg	Total Cations (meq/kg)	Cl	SO_4	Alk. (meq/kg)	HCO_3[c]	Total Anions (meq/kg)	Sum[d]	Refrac-tometer	H_2O (°/₀₀)[e]	pH
140-4-3	374	Middle Eocene	Varicolored gray silty clay, interbedded layers.	13.6	13.6	0.26	0.89	1.19	739	25.92	0.30	4.1	0.25	741	42.4	43.4	42	7.5
6-CC	519	Paleocene to Late Cretaceous	Dark olive gray silicified claystone.	15.3	15.2	0.25	0.85	1.22	811	28.44	0.48	2.6	0.16	815	46.7	47.3	39	7.5
8-2	647	Unknown	Dark greenish gray clay, very firm.	17.4	17.2	0.20	1.32	1.07	907	32.17	0.34	2.6	0.16	917	52.7	52.8	38	7.5
Hole 141 (19° 25.2'N, 23° 59.9'W, water depth 4148 m 200 km N of Cape Verde Islands)																		
141-1-6	13	Early Pleistocene	Varicolored gray and brown foram-nanno chalk ooze	10.9	10.8	0.40	0.44	1.25	604	19.67	2.43	3.3	0.20	608	35.3	35.5	43	7.4
2-5	20	Late Pliocene	Varicolored gray and brown foram-nanno chalk ooze.	10.9	10.7	0.39	0.44	1.24	602	19.68	2.50	3.5	0.21	610	35.4	35.2	41	7.4
3-6	31	Middle Pliocene	Varicolored gray and brown foram-nanno chalk ooze.	10.9	10.7	0.39	0.46	1.22	601	19.63	2.40	3.4	0.21	606	35.2	35.2	41	7.4
4-4	36	"Late Early" Pliocene	Light gray, yellowish gray and white foram-nanno chalk ooze.	11.0	10.7	0.39	0.46	1.21	599	19.71	2.46	3.7	0.23	610	34.5	35.2	36	7.5
5-6	49	"Middle Early" Pliocene	White and light yellowish gray foram-nanno chalk ooze, slightly clayey.	10.9	10.7	0.38	0.50	1.19	598	19.69	2.32	3.0	0.18	607	35.2	35.2	35	7.4
7-6	87	Early Pliocene	Yellowish brown silty clay, slightly zeolitic.	10.8	10.4	0.30	0.57	1.14	584	19.47	2.28	2.4	0.14	598	34.7	34.6	35	6.8
8-CC	123	Unknown	Brown to dark grayish brown clay, slightly zeolitic.	10.8	10.6	0.31	0.67	1.08	592	19.69	2.05	1.7	0.07	599	34.7	35.2	43	6.8
9-5	197	Unknown	Reddish brown zeolitic silty clay.	10.2	10.1	0.17	1.18	0.80	568	19.35	1.31	0.7	0.04	574	33.1	33.0	30	6.8
Hole 142 (3° 22.2'N, 42° 23.5'W, water depth 4372 m, Ceara Abyssal Plain)																		
142-1-6	115	Pleistocene	Very dark gray to black and olive gray to olive black terrigenous silty sand and silty clay.	10.6	10.6	0.32	0.24	0.81	547	19.32	0.05	4.3	0.26	550	31.6	31.4	33	7.8
2-4	214	Early Pleistocene	Olive gray terrigenous silty sand and gray slightly silty calcareous mud.	10.7	10.5	0.25	0.30	0.73	538	19.28	<0.01	2.9	0.17	546	31.4	31.9	28	7.7
3-CC	311	Early Pleistocene	Gray and dark gray silty clay.	10.9	10.6	0.22	0.30	0.71	541	19.48	0.05	1.9	0.12	552	31.8	31.4	21	7.6
4-3	380	Pliocene	Varicolored gray foram-nanno chalk ooze.	11.1	11.0	0.25	0.26	0.88	568	19.89	0.61	2.3	0.14	576	33.1	33.0	27	6.8
5-CC	439	Pliocene	Light gray calcareous clay and foram sand.	10.8	10.8	0.24	0.33	0.89	564	19.61	0.45	3.2	0.20	565	32.5	33.0	–	7.5

TABLE 1 – *Continued*

Sample Designation	Depth (m)	Age	Description	Na[a]	Na[b]	K	Ca	Mg	Total Cations (meq/kg)	Cl	SO_4	Alk. (meq/kg)	HCO_3[c]	Total Anions (meq/kg)	Sum[d]	Refractometer	H_2O (°/₀₀)[e]	pH
142-6-CC	467	Late Miocene	Brown to olive gray nanno marl mud, light gray nanno chalk ooze, allochthonous silty foram sands.	10.9	10.8	0.27	0.36	0.96	574	19.76	0.89	2.5	0.15	578	33.3	33.0	22	7.4
7-6	496	Late Miocene	Pale yellow, v. pale brown, light gray foram-nanno marl to chalk ooze.	11.0	10.8	0.29	0.40	0.99	580	19.89	1.13	3.6	0.22	588	33.9	34.1	18	7.2
8-CC	548	"Late Early" Miocene	Bluish gray clay.	9.8	9.7	0.19	0.88	1.04	558	19.04	1.09	–	–	559	32.0	–	–	7.6
9-1	587	Early Miocene	Varicolored gray nanno marl mud, indurated.	10.5	10.2	0.26	1.02	0.91	577	19.68	1.42	5.8	0.36	590	34.1	34.4	21	7.1
Hole 144, 144A, 144B (9° 27.2'N, 54° 20.5'W, water depth 2957 m, northern flank of Demerara Rise)																		
Surface ocean water				10.6	10.3	0.38	0.39	1.25	582	18.92	2.64	4.0	0.24	593	34.4	34.1	–	–
144B-1-6	8	Middle Oligocene	Pale yellow foram-nanno chalk.	10.7	10.4	0.52	0.39	1.23	588	19.20	2.60	2.9	0.18	598	34.8	35.2	39	7.4
2-5	16	Middle Oligocene	Pale yellow foram-nanno chalk slightly siliceous.	11.0	10.8	0.51	0.42	1.25	607	19.73	2.67	3.3	0.20	615	35.8	35.5	40	7.3
144A-1-2	22	Middle Oligocene	Pale yellow green foram-nanno chalk.	11.2	11.0	0.55	0.42	1.21	611	20.06	2.44	3.6	0.22	620	36.1	35.8	40	7.5
144B-3-6	35	Early Oligocene	Pale yellowish green to pale green foram-nanno chalk.	11.3	11.1	0.53	0.42	1.18	615	20.24	2.38	2.2	0.13	623	36.2	36.3	40	7.8
144A-2-6	46	Early Oligocene	Pale yellowish green foram-nanno chalk.	11.5	11.3	0.52	0.43	1.20	627	20.62	2.34	2.8	0.17	633	36.8	36.3	40	7.4
144-1-6	64	Late Middle Eocene	Light greenish gray foram-nanno-rad marl/ooze.	11.5	11.4	0.41	0.49	1.19	630	20.67	2.12	4.8	0.29	632	36.7	36.6	–	–
144A-3-4	144	Late Paleocene	Greenish gray zeolitic foram-nanno marl/chalk.	13.6	13.4	0.34	0.75	1.02	710	25.24	0.40	0.9	0.05	721	41.4	41.8	18	7.0
144-3-2	164	Early Maestrichtian to Late Campanian	Light greenish gray marl mudstone.	13.6	13.4	0.32	0.76	0.99	709	24.94	0.56	2.1	0.13	717	41.3	41.2	–	–
144A-4-CC	180	Early Maestrichtian to Late Campanian	Greenish gray zeolitic nanno marl.	14.5	14.4	0.31	0.91	0.94	758	27.00	0.01	0.8	0.05	762	43.7	44.0	25	6.9
5-CC	189	Senonian	Olive green foram glauconitic and phosphoritic limestone.	14.8	14.7	0.31	0.97	0.86	766	27.17	0.15	1.8	0.11	771	44.4	45.1	–	7.0
6-CC	197	Senonian	Olive black zeolitic calcareous carbonaceous shale.	15.2	15.1	0.29	1.09	0.84	786	27.94	0.12	1.9	0.11	792	45.6	45.9	–	6.9

TABLE 1 – *Continued*

Sample Designation	Depth (m)	Age	Description	Na[a]	Na[b]	K	Ca	Mg	Total Cations (meq/kg)	Cl	SO_4	Alk. (meq/kg)	HCO_3[c]	Total Anions (meq/kg)	Sum[d]	Refractometer	H_2O (°/₀₀)[e]	pH
144-4-3	216	Cenomanian to Early Turonian	Dark olive gray carbonaceous clay.	15.1	14.7	0.28	1.03	0.93	776	27.92	0.09	1.9	0.12	791	45.5	46.2	–	–
5-CC	270	Late Albian to Early Turonian	Olive gray marl semi-indurated to plastic.	–	13.5	0.18	0.88	1.10	726	(25.28)[f]	0.50	2.5	0.15	(726)	41.6	–	–	–

[a]Sodium determined by differences between anions and cations excluding Na.
[b]Sodium determined directly.
[c]HCO_3 is calculated from total alkalinity, assuming this is entirely due to bicarbonate ion.
[d]The sum incorporates the calculated Na values. Minor constituents are not included, but with the exception of strontium in some samples contribute less than 0.1 °/₀₀ to the sum.
[e]pH and water content are taken from shipboard summaries.
[f]Cl determined by difference in the absence of an analytical value.

TABLE 2
Minor Constituents. Concentrations in mg/kg (ppm)

Sample Designation	Depth (m)	Age	Description	B	Sr	Ba	Si (col.)[a]	Si (spec.)[b]
Hole 135								
Surface ocean water				–	7.7	<0.5	–	<5.0
135-1-2	3	Pleistocene	Varicolored light brownish gray nanno chalk ooze.	?	10.7	<0.5	6.2	<5.0
2-6	82	Late Miocene	Light gray nanno chalk ooze, some black streaks.	4	33.0	<0.5	8.2	<5.0
3-2	176	Late Miocene	Varicolored light gray nanno chalk ooze.	4	69.0	<0.5	3.1	<5.0
4-2	260	Middle Miocene	Varicolored light gray nanno chalk ooze.	6	61.0	<0.5	6.2	14.0
7-3	435	Lower Campanian	Green, olive gray, dark brown silty mudstone, sand and "red clay" layers, intercalated.	5	58.0	<0.5	4.1	≤5.0
Hole 136								
Surface ocean water					7.6	<0.5	–	≤5.0
136-1-5	136	Early Pliocene	Very pale orange nanno chalk ooze.	5	80.0	<0.5	5.0	7.1
2-6	224	Middle Early Miocene	Very pale orange and pale brown nanno chalk ooze.	6	46.0	<0.5	13.7	10.3
3-4	238	Early Miocene	Vary pale brown to pale brown nanno chalk ooze with light gray lenses and mottles.	6	42.0	<0.5	9.1	8.3
4-3	248	Early Miocene (?)	Brown and grayish brown silty clay	5	41.0	<0.5	20.0	22.0
6-1	264	Santonian to Campanian	Brownish red and pale yellowish brown silty clay.	8	36.0	<0.5	7.0	6.4
8-2	282	Unknown	Reddish brown marl mud	5	33.0	<0.5	12.8	13.2
Hole 137								
Surface ocean water				–	7.3	<0.5	–	<5.0
137-1-5	58	Unknown	Yellowish brown and dark grayish brown silty clay.	6	8.0	<0.5	10.2	5.7
2-1	100	Unknown	Brick red silty zeolitic clay.	4	8.6	<0.5	10.0	7.8
2-CC	104	Unknown	Brown clay.	4	10.1	<0.5	18.3	21.0
3-6	143	Unknown	Varicolored brown clay, slightly zeolitic	5	10.5	<0.5	13.4	14.9
4-2	168	Unknown	Reddish brown clay, slightly silty, zeolitic.	4	10.5	<0.5	17.3	23.0
6-CC	225	Turonian (?) Coniacian	Reddish brown clay, zeolitic	2	10.1	<0.5	26.0	24.0
7-CC	265	Cenomanian-Early Turonian	Varicolored alternations of dark carbonaceous clay, nanno marl ooze and nanno chalk ooze.	2	19.1	<0.5	2.6	<5.0
8-CC	274	Late Cenomanian	Dark gray foram-nanno chalk ooze.	4	16.0	<0.5	7.1	<5.0
9-5	282	Late Cenomanian	Pale red and light greenish gray nanno marl ooze to chalk ooze.	2	19.5	<0.5	4.3	<5.0
10-5	287	Cenomanian	Reddish brown and greenish gray nanno marl to chalk ooze.	4	14.9	<0.5	8.7	<5.0
16-5	381	Late Albian	Gray and brown nanno marl ooze and foram-nanno chalk ooze.	2	21.1	17.6 (?)	5.9	<5.0
Hole 138								
138-1-5	58	Early Miocene	Pale yellowish green and pale yellowish brown clay and sand.	7	7.7	<0.5	18.5	28.0
2-5	116	Oligocene	Greenish gray and olive gray silty clay.	4	9.0	<0.5	28.0	44.0
Hole 139								
139-1-2	116	Early Pliocene	Light olive gray to light gray foram nanno chalk ooze; H_2S odor	5	45.0	<0.5	25.0	15.9

TABLE 2 – *Continued*

Sample Designation	Depth (m)	Age	Description	B	Sr	Ba	Si (col.)[a]	Si (spec.)[b]
139-2-4	229	Early Pliocene	Light gray foram nanno chalk ooze.	7	66.0	333.0	13.4	14.4
3-CC	354	Middle Miocene	Greenish gray nanno marl/ chalk ooze.	7	93.0	295.0	18.8	23.0
4-CC	463	Middle Miocene	Greenish gray nanno marl ooze.	10	61.0	14.2	20.0	24.0
7-3	659	Early Miocene	Olive to olive gray quartz sand and diatom mud.	2	90.0	6.6	20.0	19.1
Holes 140 & 140A								
140-1-6	96	Late Pliocene	Very light yellowish gray foram-nanno chalk ooze.	4	17.7	<0.5	3.4	<5.0
2-6	209	Early Miocene	Grayish olive diatom mud/ooze quartz bearing	4	15.7	1.6	20.0	21.0
140A-2-6	243	Middle Eocene	Varicolored green and gray clay, slightly siliceous, firm	4	19.1	<0.5	24.0	26.0
140-3-2	313	Middle Eocene	Greenish gray silty clay slightly siliceous	3	24.0	<0.5	20.0	8.6
4-3	374	Middle Eocene	Varicolored gray silty clay, interbedded layers.	7	26.0	1.4	18.0	18.4
6-CC	519	Paleocene to Late Cretaceous	Dark olive gray silicified claystone.	4	38.0	0.8	22.5	20.3
6-2	647	Unknown	Dark greenish gray clay, very firm.	3	37.0	1.7	5.2	5.9
Hole 141								
141-1-6	13	Early Pleistocene	Varicolored gray and brown foram-nanno chalk ooze.	4	12.3	<0.5	3.4	<5.0
2-5	20	Late Pliocene	Varicolored gray and brown foram-nanno chalk ooze.	4	16.9	<0.5	3.4	<5.0
3-6	31	Middle Pliocene	Varicolored gray and brown foram-nanno chalk ooze.	6	11.8	<0.5	4.3	<5.0
4-4	36	"Late Early" Pliocene	Light gray, yellowish gray and white foram-nanno chalk ooze.	8	16.1	<0.5	2.1	<5.0
5-6	49	"Middle Early" Pliocene	White and light yellowish gray foram-nanno chalk ooze, slightly clayey.	7	14.4	<0.5	3.5	10.3
7-6	87	Early Pliocene	Yellowish brown silty clay, slightly zeolitic.	9	16.2	<0.5	6.8	<5.0
8-CC	123	Unknown	Brown to dark grayish brown clay, slightly zeolitic.	8	15.5	<0.5	13.8	23.0
9-5	197	Unknown	Reddish brown zeolitic silty clay.	8	17.1	<0.5	9.9	7.8
Hole 142								
142-1-6	115	Pleistocene	Very dark gray to black and olive gray to olive black terrigenous silty sand and silty clay.	4	3.9	7.9	4.7	<5.0
2-4	214	Early Pleistocene	Olive gray terrigenous silty sand and gray slightly silty calcareous mud.	4	8.6	6.7	6.5	<5.0
3-CC	311	Early Pleistocene	Gray and dark gray silty clay.	5	34.0	8.36	2.1	<5.0
4-3	380	Pliocene	Varicolored gray foram-nanno chalk ooze.	7	63.0	0.79	4.6	<5.0
5-CC	439	Pliocene	Light gray calcareous clay and foram sand.	14	44.0	<0.5	2.5	<5.0
6-CC	467	Late Miocene	Brown to olive gray nanno marl mud, light gray nanno chalk ooze, allochthonous silty foram sands.	5	80.0	<0.5	2.0	5.2
7-6	496	Late Miocene	Pale yellow, v. pale brown, light gray foram-nanno marl to chalk ooze.	5	94.0	<0.5	7.5	<5.0
8-CC	548	"Late Early" Miocene	Bluish gray clay.	–	–	–	8.2	–
9-1	587	Early Miocene	Varicolored gray nanno marl mud, indurated.	4	120.0	<0.5	23.4	21.0

TABLE 2 – *Continued*

Sample Designation	Depth (m)	Age	Description	B	Sr	Ba	Si (col.)[a]	Si (spec.)[b]
Hole 144, 144A, 144B								
Surface ocean water				–	6.4	<0.5	4.2	<5.0
144B-1-6	8	Middle Oligocene	Pale yellow foram-nanno chalk.	6	6.8	<0.5	10.7	7.7
2-5	16	Middle Oligocene	Pale yellow foram-nanno chalk slightly siliceous.	7	6.8	<0.5	19.9	13.4
144A-1-2	22	Middle Oligocene	Pale yellow green foram-nanno chalk.	3	10.9	<0.5	13.2	10.1
144B-3-6	35	Early Oligocene	Pale yellowish green to pale green foram-nanno chalk.	3	12.5	<0.5	9.2	7.2
144A-2-6	46	Early Oligocene	Pale yellowish green foram-nanno chalk.	3	13.6	<0.5	13.4	9.8
144-1-6	64	Late Middle Eocene	Light greenish gray foram-nanno-rad marl/ooze	3	17.8	<0.5	18.5	11.0
144A-3-4	144	Late Paleocene	Greenish gray zeolitic foram-nanno marl/chalk.	6	76.0	<0.5	16.4	13.2
144-3-2	164	Early Maestrichtian to Late Campanian	Light greenish gray marl mudstone.	5	79.0	4.2	18.3	21.0
144A-4-CC	180	Early Maestrichtian to Late Campanian	Greenish gray zeolitic nanno marl.	6	94.0	22.3	19.8	18.9
5-CC	189	Senonian	Olive green foram glauconitic and phosphoritic limestone	9	99.0	10.6	16.4	17.2
6-CC	197	Senonian	Olive black zeolitic calcareous carbonaceous shale.	8	96.0	10.3	24.0	9.6
144-4-3	216	Cenomanian to Early Turonian	Dark olive gray carbonaceous clay.	7	124.0	12.4	18.3	14.8
5-CC	270	Late Albian to Early Turonian	Olive gray marl semi-indurated to plastic.	3	123.0	1.0	4.5	<5.0

[a](col.) = Colorimetric determination.
[b](spec.) = Emission spectrographic determination.