

32. INTERSTITIAL WATER CHEMISTRY, LEG 12¹

Bob J. Presley,² Chari Petrowski and Ian R. Kaplan, Department of Geology and Institute of Geophysics and Planetary Physics, University of California, Los Angeles, California

INTRODUCTION AND PROCEDURES

The interstitial water received at UCLA from Leg 12 consisted of twenty-one 5-millimeter samples intended for analysis of carbon isotope and minor element constituents. No large volume samples for trace element analysis were collected. The samples were obtained at five different drilling sites from sediment dominated by carbonate ooze and glacial-marine clays.

All water was forced through a 0.45 membrane filter onboard ship immediately after squeezing. The samples were then sealed in plastic syringes, and were kept refrigerated except for time in shipment. Analysis was started as soon as the samples arrived at UCLA, nevertheless, as much as three months had then elapsed since collection.

The analytical procedures currently being used in our pore water program are essentially those described in some detail elsewhere (Presley, 1971; Presley and Claypool, 1971). These procedures have evolved as we have sought to get more and better data from the small samples provided by the Deep Sea Drilling Project. Therefore, the procedures used for Leg 12 analyses may, in some instances, be modifications of those described in the references, but any changes are considered not sufficiently significant to warrant a separate description here.

RESULTS AND DISCUSSION

All data that we have obtained to date from the water samples is given in Table 1 except major cation concentrations, which were omitted as they were discussed in the report by Manheim, et al. (1972). The shipboard ΣCO_2 values, which were given in our previous reports, have been omitted here because, as on previous legs, the laboratory and shipboard values show moderately good agreement, and the laboratory values are more reliable.

The chloride and bromide values given in Table 1 were each determined on approximately 0.2 ml of water, and there was in no case sufficient sample for replicate determinations. For this reason, some scatter in the data is to be expected, and one might legitimately question an isolated odd value, for example the apparent low Cl and high Br in Sample 116-5-6. All samples from Site 118 proved to be slightly enriched in Br relative to Cl, and it is unlikely that this is an analytical artifact. The maximum enrichment is only about 10 per cent, much less than at some sites on previous legs. The Br enrichment here could

be related to the basaltic intrusion encountered at depth rather than to any proximity to evaporite deposits.

The Li concentration at Site 118 was much more anomalous than was Br. The Li concentration steadily increased with depth, leading to an enrichment of more than twenty-fold in the deepest sample analyzed. This sample came from a depth of 448 meters and a basaltic intrusion was encountered at a depth of 750 meters. Shipboard workers reported visual evidence of chemical alteration of the sediment for at least 65 meters above the intrusion. The altered zone may extend much further and upward diffusion would extend the interval over which pore water chemistry would be affected by any such alteration. Li concentrations show sharp increases at Site 119, which was drilled very near Site 118, and at Site 112, where basalt overlain by baked sediment was recovered at depth. It seems likely that the intrusion resulted in a release of Li to the pore water here too.

Boron concentrations show no obvious trends and differ everywhere from seawater values by less than a factor of two. Silica, on the other hand, shows considerable variation, but, as in previous samples, remains between saturation with respect to quartz and amorphous silica.

Ammonia was greatly enriched in all pore water samples from 200 to more than 1000 times higher than is typical for seawater. Similar concentrations have been found at many sites on previous legs, and here, as in previous samples, the increase in ammonia is much greater than the corresponding increase in total dissolved CO_2 . This does not necessarily imply that N and C were released in abnormal ratios from decomposing organic matter; it is more likely due to subsequent removal of the more reactive dissolved carbonate.

The reactivity of the dissolved carbonate is also seen in carbon isotope ratios. At all sites but one, the carbon becomes more C^{13} -rich with depth, probably due to interaction with solid carbonates. Leg 12 samples show a general increase in total dissolved carbonate with depth. In samples showing a decrease in δC^{13} , the excess CO_2 probably results from biological decomposition of organic matter at shallow depths of burial (Presley and Kaplan, 1968). In samples where δC^{13} approaches $\pm 1\text{‰}$, the excess CO_2 probably results from solution of carbonate tests.

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²Present address: Department of Oceanography, Texas A&M University, College Station, Texas 77843.

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TABLE 1
Selected Major and Minor Constituents and δC^{13} , Interstitial Water, Leg 12

Sample Number ^a	Depth ^b m	Age and Description of Sediment ^c	Cl g/Kg	Br mg/Kg	B mg/Kg	Si mg/Kg	NH ₃ mg/Kg	Li μg/Kg	ΣCO ₂ mM/Kg	δC ¹³ PDB
112-2-5	108	U. Pliocene gray silty clay	19.0	62	4.4	7.3	14.1	230	1.78	-11.5
112-4-2	202	L. M. Miocene gray mottled clay	19.5	66	2.7	16.6	12.0	970	1.29	-3.8
112-5-5	278	U. Oligocene gray mottled clay	19.7	68	2.8	24.9	11.1	1560	2.13	-
112-9-4	311	L. Oligocene gray marly clay	19.5	66	2.3	26.2	12.6	1640	2.27	-2.9
112-11-4	327	L. Oligocene gray sandy silt	19.4	69	3.2	24.7	12.9	1645	-	-2.7
114-5-5	508	Unknown Age hard banded silt	19.5	66	4.1	11.6	30.0	330	6.70	-9.2
116-1-4	70	U. Pliocene gray carbonate ooze	19.5	65	5.4	18.2	10.9	90	2.99	+0.5
116-3-5	162	U. Miocene mottled carbonate ooze	19.5	65	4.8	22.9	9.6	55	4.59	-3.4
116-5-6	268	Miocene white carbonate ooze	19.3	71	5.6	29.1	14.4	75	5.03	-1.0
116-6-4	313	Miocene white carbonate ooze	19.4	64	5.5	28.8	16.6	80	4.34	+1.0
116-7-3	362	Miocene white carbonate ooze	19.5	65	3.6	30.3	17.1	110	4.92	-0.8
118-2-6	208	Pleistocene mottled blue clay	19.5	70	3.3	5.0	48.2	345	3.84	-3.4
118-3-3	306	U. L. Pliocene firm gray clay	19.6	73	3.6	4.5	37.1	410	3.54	-4.0
118-4-3	353	L. Pliocene firm gray silt	19.5	75	4.2	5.6	35.0	985	5.51	-3.8
118-5-3	401	Miocene (?) blue-gray clay	19.6	76	4.6	6.0	28.7	2225	5.59	-3.8
118-6-1	448	U. Miocene light gray sandstone	19.8	71	5.1	24.2	29.7	3990	9.75	+1.2
119-2-2	51	Pleistocene gray silty clay	19.3	66	5.0	5.9	7.5	220	4.52	-4.9
119-3-2	101	U. Pliocene gray carbonate ooze	19.4	68	4.6	4.0	7.8	430	3.94	-5.8
119-4-2	151	U. Miocene gray carbonate ooze	19.4	67	5.1	5.6	7.3	940	3.29	-1.2
119-5-2	199	M. L. Miocene firm gray carbonate ooze	19.0	66	4.5	16.6	6.7	1525	3.41	+0.9
119-6-3	243	L. Miocene dense gray clay	19.2	67	4.5	24.8	7.7	2210	6.02	+1.3

^aHole, barrel, section

^bDepth in sediment column

^cFrom preliminary hole summaries