

34. INTERSTITIAL WATERS GEOCHEMISTRY, LEG 116¹

Jacques J. Boulègue²

INTRODUCTION

As a part of the shipboard scientific program, interstitial waters were routinely analyzed for pH, alkalinity, salinity, chlorinity, calcium, and magnesium during Leg 116. Unfortunately, the tables containing these data for Sites 718 and 719 were inadvertently omitted from the *Initial Results* volume (Cochran, Stow et al., 1989). The missing data are presented here (Tables 1–3) along with the Site 717 data, reproduced for completeness.

METHOD

The method used to obtain interstitial waters from the cored sediments, using a stainless-steel press, has been described in detail by Manheim and Sayles (1974). International Association of Physical Science Organizations (IAPSO) standard seawater was used as the primary standard for water analyses.

Alkalinity and pH were determined using a Metrohm titrator with a Brinkmann combination pH electrode. The pH value of the sample was calibrated with 4.01, 6.86, and 7.41 buffer standards. Readings were taken in millivolts and converted to pH. The pH measurements were made immediately prior to the alkalinity measurements. After being tested for pH, the 1- to 5-mL interstitial water sample was titrated with 0.1 N HCl as a potentiometric titration.

Salinity was determined using a Goldberg optical refractometer, which measures the total dissolved solids. Chlorinity was determined by silver nitrate titration of a 0.1-mL sample diluted with 5 mL of deionized water. The Mohr titration method uses potassium chromate as an indicator.

Calcium was determined by complexometric titration of a 0.5-mL sample with ethylene-bis-(oxyethylene-nitrib)-tetracetic acid (EGTA) using 2, 2'-ethane-diyl-idine-dinitrilo-diphenol (GHA) as an indicator. To enhance the determina-

tion of the end point, the calcium-GHA complex was extracted into a layer of butanol. No correction was made for strontium, which is also included in the result.

Magnesium was determined by ethylene diimine tetracetic acid (EDTA) titration for total alkaline earths. Subsequent subtraction of the calcium value (which also includes strontium) yields the magnesium concentration in the interstitial water sample.

For the determination of SO_4^{2-} by ion chromatography, a 0.2/100 dilution of the samples was prepared using deionized water. The samples were analyzed on the Dionex ion Chromatograph, which is equipped with both anion and cation separation columns. The samples were compared to a series of standards containing concentrations of species varying from 0 to 61.4 mM/L (SO_4^{2-}) by a curve-fitting routine on a HP-97 calculator. Samples and standards were run in triplicate, and a water blank was run after each set of three to decrease the water carry-over from set to set.

Silica was determined by production of Silicomolybdate complex on a 0.1-cm³ sample and reduction of this complex to give a blue color. Absorption at 812 nm was measured after 3 hr. Ammonia was determined by the phenol hydrochlorite method followed by absorption measurements at 640 nm. Phosphate was determined by reaction with a reagent containing molybdic acid, ascorbic acid, and trivalent antimony. The resulting complex was reduced to give a blue solution. The absorption was measured at 885 nm.

REFERENCES

- Manheim, F. T., and Sayles, F. L., 1974. Composition and origin of interstitial waters of marine sediments based on deep sea drill cores. In Goldberg, E. D. (Ed.), *The Sea (Vol. 5), Marine Chemistry*: New York (Wiley Interscience) 527–568.
- Cochran, J. R., Stow, D.A.V., et al., 1989. *Proc. ODP, Init. Repts.*, 116: College Station, TX (Ocean Drilling Program).

¹ Cochran, J. R., Stow, D.A.V., et al., 1990. *Proc. ODP, Sci. Results*, 116: College Station, TX (Ocean Drilling Program).

² Laboratoire de Geochemie, Universite de Pierre et Marie Curie, 4 Place Jussieu, 75252 Paris Cedex 05 France.

Date of initial receipt: 16 February 1990

Date of acceptance: 12 March 1990

Ms 116B-157

Table 1. Interstitial water geochemical data, Site 717.

Core, section, interval (cm)	Depth (mbsf)	Vol. (mL)	pH	Alkalinity (mM)	Salinity (g/kg)	Cl (mM)	SO ₄ (mM)	PO ₄ (μM)	NH ₄ (μM)	SiO ₂ (μM)	Mg (mM)	Ca (mM)	Mg/Ca
717A-1H-04, 145-150	5.95	60	7.41	9.52	34.0	557	21.7	20.1	640	505	49.1	10.25	4.8
717C-5X-01, 145-150	37.95	17	8.35	14.50	33.2	560	0.6	19.3	2100	215	41.7	6.00	7.0
717C-8X-01, 140-150	66.40	64	7.60	8.69	33.8	560	2.9	20.4	2300	330	40.2	6.53	6.2
717C-14X-01, 140-150	104.40	75	7.48	7.38	33.3	558	4.3	16.6	2900	340	40.4	6.80	5.9
717C-20X-03, 140-150	154.90	12	8.40	16.31	32.5	551	1.4	40.1	2900	410	44.2	4.05	10.9
717C-23X-03, 140-150	183.40	14	8.25	15.00	33.1	552	2.9	11.1	1500	465	45.2	5.15	8.8
717C-26X-04, 140-150	213.40	20		11.70	32.0	553	1.4	9.8	1800	645	40.7	6.75	6.0
717C-29X-04, 140-150	241.90	30		8.90	31.7	556	2.0	6.2	1800	575	36.7	7.34	5.0
717C-32X-04, 140-150	270.40	9	8.15	5.45	31.7	532	4.3		1600	255	39.6	9.49	4.2
717C-35X-03, 140-150	297.40	16	8.05	5.07	32.2	545	2.9	2.5	1900	305	34.8	10.38	3.4
717C-38X-03, 140-150	325.90	71	7.88	5.09	32.4	544	4.3	3.1	1140	203	33.1	12.18	2.7
717C-42X-04, 140-150	365.40	10	8.10	3.90	29.8	521	1.4	4.2	850	260	33.3	14.27	2.3
717C-45X-04, 140-150	393.90	7	8.15	3.40	31.9	542	7.2	6.5	1170	253	32.9	15.26	2.2
717C-48X-04, 140-150	422.40	7	8.00	3.45	31.3	528	3.7	3.4	820	215	33.3	16.23	2.1
717C-51X-03, 140-150	449.40	12	8.00	2.80	31.2	529	4.1	4.4	860	195	30.9	16.71	1.9
717C-54X-04, 140-150	479.40	8	8.05	3.24	30.0	505	1.5	2.9	1510	160	29.4	17.17	1.7
717C-57X-04, 140-150	507.90	61	8.07	2.55	32.1	552	3.0	0.6	1800	132	26.5	16.03	1.7
717C-60X-02, 140-150	533.40	6	7.95	2.90	29.2	508	3.7	1.7	1290	157	32.3	17.77	1.8
717C-64X-02, 130-140	571.30	20	7.95	3.23	32.3	559	6.1	2.8	1210	222	30.0	17.09	1.8
717C-67X-01, 140-150	598.40	36	7.95	4.74	32.3	563	5.3	4.6	610	200	28.5	17.00	1.7
717C-70X-04, 130-140	631.30	44	8.07	1.41	32.7	554	2.8	2.1	1020	160	25.7	16.57	1.6
717C-74X-01, 140-150	664.90	48	7.95	2.55	33.0	568	3.7	2.0	750	188	26.3	17.13	1.5
717C-77X-04, 130-150	697.80	3	8.05		27.2	472	2.5			100	22.7	17.28	1.3
717C-80X-02, 140-150	723.40	20	8.05	2.92	32.4	569	3.4	2.5	510	217	25.3	18.84	1.3
717C-84X-02, 140-150	761.40	30	8.10	1.86	32.8	568	2.3	2.0	410	215	21.2	18.34	1.2
717C-87X-01, 140-150	788.40	25	7.90	3.00	33.7	570	2.3	2.2	580	195	21.0	18.85	1.1
717C-91X-03, 140-150	823.10	27	7.45	16.81	33.9	557	3.2	2.1	650	1085	18.7	22.46	0.8
717C-2H-05, 80-140	-999.99	4		11.20	36.2	568	18.8				51.3	9.98	5.1

Table 2. Interstitial water geochemical data, Site 718.

Core, section, interval (cm)	Depth (mbsf)	Vol. (mL)	pH	Alkalinity (mM)	Salinity (g/kg)	Cl (mM)	SO ₄ (mM)	PO ₄ (μM)	NH ₄ (μM)	SiO ₂ (μM)	Mg (mM)	Ca (mM)	Mg/Ca
718A-1H-01, 40-50	0.40	87	7.59	3.33	34.6	555	28.4	5.7	0	395	52.3	10.61	4.9
718A-1H-01, 140-150	1.40	49	7.58	5.22	35.4	552	27.4	46.9	0	495	49.9	10.53	4.7
718A-1H-02, 140-150	2.90	72	7.95	4.38	34.2	548	26.5	71.0	10	390	48.4	10.05	4.8
718A-1H-03, 140-150	4.40	78	7.40	6.62	34.4	548	24.2	13.0	330	320	50.0	10.40	4.8
718A-1H-04, 140-150	5.90	39	7.68	7.39	34.3	552	22.3	5.9	790	260	47.8	10.51	4.6
718A-1H-05, 130-140	7.30	52	7.68	8.96	34.8	558	21.5	6.4	710	247	49.5	10.45	4.7
718A-1H-06, 0-10	7.50	65	7.37	8.99	35.0	554	21.7	3.6	800	225	50.1	10.34	4.8
718A-1H-06, 140-150	8.90	99	7.64	9.14	34.6	553	21.5	15.0	400	283	48.9	10.13	4.8
718C-3X-02, 145-150	31.25	30	7.73	13.21	35.0	561	14.1	4.5	1560	260	49.6	9.45	5.3
718C-11X-02, 140-150	107.20	32	7.65	7.63	34.5	558	17.7	2.8	720	225	47.1	10.75	4.4
718C-13X-01, 140-150	124.70	49	7.66	6.81	34.5	569	16.9	2.2	350	232	44.9	10.63	4.2
718C-15X-01, 140-150	143.70	30	7.64	6.30	33.4	558	13.2	2.4	390	223	42.5	10.67	4.0
718C-17X-04, 140-150	167.20	10	7.84	4.82	31.5	531	8.4	4.5	440	180	42.3	10.70	4.0
718C-19X-03, 140-150	184.70	11	8.02	4.29	33.0	543	8.7	3.0	470	190	40.5	12.14	3.3
718C-20X-01, 140-150	191.20	11	8.11	4.37	32.6	540	6.6	4.4	750	175	41.9	12.72	3.3
718C-25X-01, 140-150	238.70	40	7.95	3.91	31.7	555	1.3	2.6	730	160	30.3	11.24	2.7
718C-29X-01, 128-138	276.58	48	7.72	3.49	33.0	570	3.1	2.1	730	170	32.0	11.75	2.7
718C-32X-02, 140-150	306.70	54	7.75	2.79	33.7	569	6.1	1.9	500	150	32.7	11.98	2.7
718C-36X-01, 130-140	343.10	40	7.91	3.13	32.3	561	2.9	2.4	720	225	29.5	13.27	2.2
718C-41X-04, 140-150	395.20	9	8.23	3.60	32.0	538	1.3	2.7	480	175	28.0	14.73	1.9
718C-44X-01, 103-113	418.83	27	7.72	2.80	33.8	570	7.4	2.3	460	255	29.8	14.45	2.1
718C-45X-01, 140-150	428.70	28	7.73	2.93	33.0	571	6.0	2.0	560	265	30.3	14.71	2.1
718C-49X-01, 140-150	466.70	32	7.61	4.50	32.5	575	1.7	2.3	440	360	26.3	16.42	1.6
718C-52X-02, 35-45	495.65	27	7.36	3.51	33.5	569	6.9	2.1	430	163	28.8	14.66	2.0
718C-55X-02, 140-150	525.20	48	7.62	2.49	33.9	584	6.7	2.1	600	178	28.3	15.08	1.9
718C-62X-03, 140-150	593.20	36	7.63	2.69	33.7	584	1.9	2.0	760	212	25.3	15.52	1.6
718C-63X-04, 140-150	604.20	27	7.67	2.55	33.8	582	4.4	2.1	740	180	26.1	15.16	1.7
718C-65X-04, 125-135	623.05	3	7.87	3.50	31.8	534	8.7		680	198	30.5	16.67	1.8
718C-68X-01, 140-150	647.20	17	7.52	3.31	34.4	578	5.9	2.1	300	342	26.2	16.94	1.6
718C-71X-02, 133-143	677.13	25	7.50	2.32	34.3	583	5.6	2.2	460	188	24.2	15.73	1.5
718C-74X-01, 140-150	704.20	33	7.34	4.95	33.5	583	4.3	2.2	490	342	24.7	17.54	1.4
718C-78X-04, 140-150	746.70												
718C-81X-01, 140-150	770.70	31	6.78	11.95	34.6	578	6.9	1.9	580	468	22.4	20.53	1.1
718C-84X-01, 140-150	799.20	23	7.36	2.73	33.8	586	3.4	1.8	470	234	20.4	17.42	1.2
718C-87X-01, 140-150	827.70	7	6.89	7.50	33.7	582	3.6	2.0	720	318	20.7	18.38	1.1
718C-90X-01, 140-150	856.20	50	7.37	4.98	34.4	563	9.3	1.9	580	242	28.5	16.71	1.7
718C-94X-04, 140-150	893.40	5	7.77	4.45	34.0	556	11.3		530	314	27.4	20.06	1.4
718C-97X-01, 71-81	916.71	17	7.21	5.25	33.7	584	2.5	2.1	650	310	18.7	19.55	1.0
718E-1R-01, 140-150	934.50	15	7.22	1.61	33.2	580	6.8	2.1	640	148	20.1	18.00	1.1
718E-3R-01, 140-150	953.50	29	7.40	1.81	32.7	556	6.1	2.0	710	178	21.0	16.77	1.3
718C-54X-03, 140-150	-999.99	40	8.25	1.56	32.5	579	0.0	1.9	850	120	24.4	14.82	1.7
718D-2X-01, 0-1	-999.99	59	8.00	2.33	35.0	561	29.0	2.5	50	10	54.1	10.43	5.2
718D-3X-01, 0-1	-999.99	59	7.75	8.25	34.5	560	19.4	1.6	970	211	50.0	11.19	4.5

Table 3. Interstitial water geochemical data, Site 719.

Core, section, interval (cm)	Depth (mbsf)	Vol. (mL)	pH	Alkalinity (mM)	Salinity (g/kg)	Cl (mM)	SO ₄ (mM)	PO ₄ (μM)	NH ₄ (μM)	SiO ₂ (μM)	Mg (mM)	Ca (mM)	Mg/Ca
719A-1H-02, 145-150	2.95	25	7.65	5.81	34.7	555	24.7	37.2	230	497	49.5	10.30	4.8
719A-5X-01, 43-53	33.13	58	7.43	12.52	32.2	566	0.0	38.5	2000	202	41.2	5.64	7.3
719A-7X-01, 53-58	52.23	15	7.48	8.89	32.3	558	3.2	17.3	2600	109	41.7	6.71	6.2
719A-11X-01, 110-120	90.80	72	7.74	9.65	33.7	558	2.9	64.6	3400	250	43.3	6.62	6.5
719A-14X-01, 0-10	118.20	52	7.55	13.06	32.2	556	0.0	18.6	2200	169	43.0	5.74	7.5
719A-14X-01, 140-150	119.60	47	7.44	12.35	32.7	554	1.1	17.4	1900	286	40.7	5.11	8.0
719A-17X-04, 140-150	152.60	8	7.57	15.95	31.8	535	1.1	9.3	980	359	46.1	5.70	8.1
719A-20X-04, 140-150	181.10	10	7.71	11.79	32.4	539	4.8	9.1	1200	194	43.9	7.71	5.7
719A-23X-01, 140-150	205.10	8	7.73	8.84	31.6	525	2.1	2.8	1000	188	42.1	8.48	5.0
719A-26X-01, 77-87	232.97	75	7.57	7.43	31.6	562	2.1	2.4	1400	210	35.0	9.48	3.7
719A-29X-02, 140-150	263.60	8	7.65	4.27	29.8	528	0.0	2.9	1200	270	34.7	11.13	3.1
719A-32X-02, 140-150	292.10	12	7.70	5.37	32.0	551	0.0	2.5	1300	194	31.1	12.70	2.5
719A-35X-02, 140-150	320.60	39	7.76	4.20	31.6	559	0.0	2.5	1400	162	28.9	14.04	2.1
719A-38X-04, 140-150	352.10	8	7.73	2.59	30.9	522	2.3	2.6	1600		29.8	15.01	2.0
719A-42X-01, 93-103	385.13	49	7.51	2.77	33.9	564	2.4	2.0	1100	136	26.9	15.71	1.7
719A-47X-01, 70-75	432.40	22	7.55	3.27	32.0	568	1.3	1.9	800	220	25.3	16.13	1.6
719A-49X-01, 61-66	451.31	18	7.29	3.49	32.0	569	2.6	3.1	900	132	26.1	15.81	1.7