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45. ROCK-MAGNETIC STRATIGRAPHY OF SITE 645 (BAFFIN BAY) FROM ODP LEG 105[1]

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ABSTRACT

We present the rock-magnetic stratigraphy for Ocean Drilling Program (ODP) Leg 105, Site 645 (Baffin Bay). Variations in magnetic mineral concentration (X) and particle size (X_{ARM}/X) are used to correlate advanced piston corer (APC) cores from several holes at Site 645. Downsite variations in rock-magnetic parameters and carbonate content are placed within the framework of inferred changes in sedimentation. These results suggest an initiation of Northern Hemisphere ice rafting in Baffin Bay in the early-late Pliocene (approximately 3.4 Ma).

INTRODUCTION

Rock magnetism is the study of the physical properties of magnetic minerals in rocks. We define magnetic minerals as those capable of maintaining remanence at room temperature. The composition and concentration of magnetic minerals within a sediment are often directly related to source area and site of deposition.

Variations in rock-magnetic parameters can be related to environmental changes (Thompson et al., 1980; Thompson and Oldfield, 1986). Positive correlations between rock-magnetic and oxygen-isotope variations within Quaternary deep-sea sediments were reported by King (1986) for the Gulf of Mexico, by Robinson (1986) from the North Atlantic, and by Bloemendal et al. (1988) in the eastern equatorial Atlantic. The rock-magnetic results of Bloemendal et al. also correspond to variations in river influx and eolian dust production. Doh et al. (1988) correlated magnetic mineral parameters, plotted as accumulation rates, with major paleoceanographic events during the last 70 m.y. in their Pacific Core LLGPC-3.

Rock-magnetic studies have the advantage of allowing one to analyze rapidly a large number of samples with equipment that is readily available, relatively inexpensive, and often portable. In addition, rock-magnetic analyses do not physically harm the samples.

Here, we present the results of rock-magnetic analyses performed on sediment samples from Site 645 (Baffin Bay; Fig. 1).

Rock-Magnetic Parameters

A detailed discussion of rock magnetism is beyond the scope of this paper. To assist the reader, we present a brief discussion of the rock-magnetic parameters used here and recommend more detailed accounts found in other texts (e.g., O'Reilly, 1984; Thompson and Oldfield, 1986).

Magnetic mineral assemblages are usually composed of complex mixtures, and detailed studies of magnetic mineral extractions are required to determine their compositions. However, rock-magnetic parameters are useful for determining relative changes in magnetic mineralogy, grain size, and concentration.

Low-field magnetic susceptibility (X) for a magnetic mineral is defined by the equation:

$$X = J/(H \cdot \text{mass}), \quad (1)$$

where J is the induced magnetization of a sample, and H is the intensity of the applied magnetic field. The volume susceptibility, k, is determined by replacing mass with volume in Equation #1. The susceptibility of a sediment sample is primarily a measure of the concentration of magnetic minerals (e.g., Collinson, 1983). The spinel-group (ferrimagnetic) of minerals (e.g., magnetite and titanomagnetite) has susceptibilities that are up to two orders of magnitude stronger than the canted-antiferromagnetic type (e.g., hematite and goethite). Studies of synthetic samples with known concentrations of magnetite and hematite show that hematite must be present in proportions of 80% to 90% to influence magnetic properties significantly (King et al., 1982a). For these reasons, ferrimagnetic minerals dominate the magnetic properties of naturally occurring sediments. The presence of diamagnetic, paramagnetic, and canted-antiferromagnetic minerals can influence the measured susceptibility when ferrimagnetic mineral concentration is low.

Superparamagnetic minerals are ultrafine-grained magnetic minerals unable to maintain stable remanence at room temperature. These will contribute to anomalously high susceptibility values and can be detected by examining the frequency dependence of susceptibility (Stephenson, 1971; Bloemendal et al., 1985): the contribution of superparamagnetic minerals decreases with increasing frequency of the applied field. We measured at two frequencies; the ratio of high-frequency susceptibility (X_{hf}) to low-frequency susceptibility (X_{hf}) defines frequency dependence.

X_{ARM}/X is the ratio of anhysteretic susceptibility to magnetic susceptibility. Anhysteretic remanence (ARM) results when a magnetic mineral is placed in the presence of a strong, decaying alternating (AC) magnetic field with a biasing direct (DC) magnetic field. Anhysteretic susceptibility (X_{ARM}) is the ARM divided by the intensity of the DC magnetic field.

X_{ARM}/X is an indicator of the relative particle-size variation of magnetic minerals, with higher (lower) values representing finer (coarser) grains (King et al., 1982b; King, 1986). Superparamagnetic minerals will not effect ARM, but can increase X, resulting in data that falsely indicate coarse magnetic material.

Hall et al. (this volume) suggest that ARM/X can be, in some instances, used as an indicator of the relative grain-size variation of both the magnetic and nonmagnetic fraction of sediments.

SIRM (saturation isothermal remanence) is the maximum room-temperature remanence that a mineral can acquire. Low-coercivity ferrimagnetic minerals are saturated in magnetic fields of less than 0.3 T, whereas high-coercivity canted-antiferromagnetic minerals often require 1 T or higher.

BIRM (back-isothermal remanence) is an isothermal remanence antiparallel to the SIRM. We apply a BIRM with a mag-

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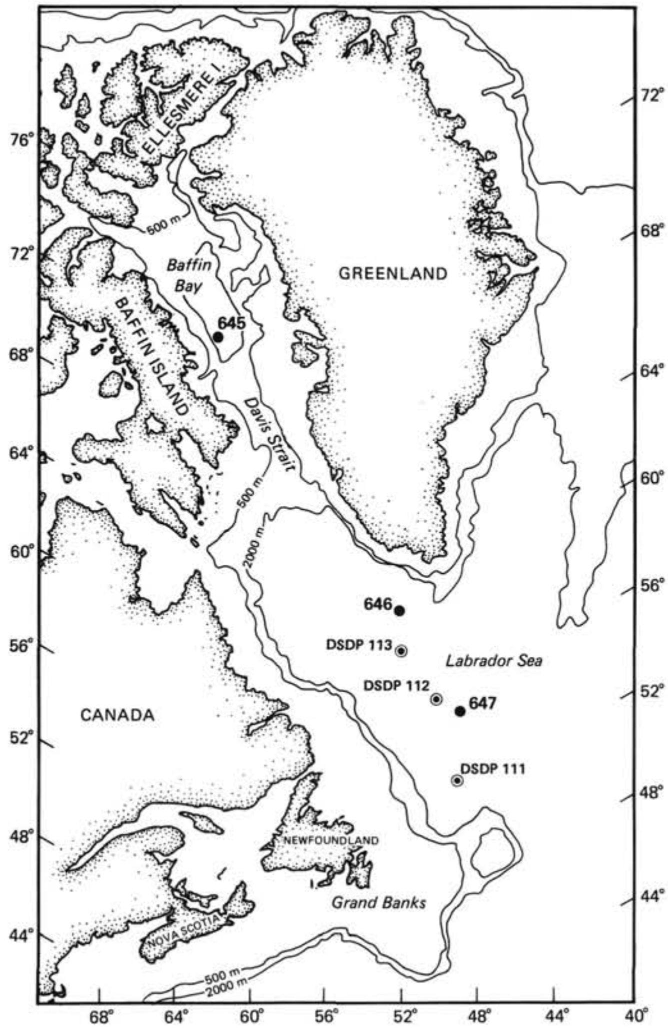

Figure 1. Location of Site 645 (Baffin Bay).

netic field strength that is strong enough to saturate ferrimagnetic minerals, but too weak to saturate canted-antiferrimagnetic minerals.

HIRM is defined by the equation:

$$\text{HIRM} = (\text{SIRM} + \text{BIRM})/(2 \cdot \text{sample mass}), \quad (2)$$

and is indicative of the relative concentration of canted-antiferromagnetic minerals.

S is defined as

$$S = \text{BIRM}/\text{SIRM} \quad (3)$$

and expresses the concentration of canted-antiferromagnetic minerals with respect to ferrimagnetic minerals.

If the magnetic mineral assemblage was composed of only ferrimagnetic minerals, then we would expect HIRM values near zero, and S values near one. Deviations from these values are attributed to the presence of canted-antiferromagnetic minerals.

Units for rock-magnetic analyses used here are given in the Appendix.

METHODS

Samples were collected during Leg 105 and on shore. A square chimney was inserted into the sediment, and a sample exhumed from the core. The bottom of the sample adjacent to the core liner was removed because of the possibility of sediment disturbance. The samples were placed in 5-cm^3 cubes, stored in plastic containers, and refrigerated to minimize desiccation. Samples were weighed, including the plastic cubes, using an electronic balance accurate to 0.01 g. A total of 3 g, the average of 100 cubes with ODP sample labels attached, was subtracted from each sample.

Low-field magnetic susceptibility (X) was measured on each archive half of the APC cores using a Bartington whole-core susceptibility sensor during Leg 105, to the base of Chronozone C1N. In addition, the susceptibilities of all discrete samples were measured using a Bartington Instruments dual-frequency magnetic susceptibility meter (low frequency = 0.47 kHz, high frequency = 4.7 kHz). Details of these measurements were discussed in Srivastava, Arthur, et al. (1987).

All samples were demagnetized at 1 T using a Schoenstedt GSD-1 alternating-field demagnetizer before application of an ARM. We used a peak AC field intensity of 100 mT and a DC field of 0.05 mT (Site 645 APC core) or 0.1 mT (downhole Site 645).

SIRM and BIRM were applied at 1 T (the limit of the DC electromagnet) and −0.3 T, respectively. Both $\text{ARM}_{0.1\text{ T}}$ and IRM measurements were performed using a DIGICO slow-spin fluxgate magnetometer. $\text{ARM}_{0.05\text{ T}}$ measurements were performed using the cryogenic magnetometer.

Using the X_{ARM}/X records of Holes 645A, 645C, and 645F and the visual core correlation points in Srivastava, Arthur, et al. (1987, p. 81), nine tie-points were determined (Fig. 1). We used only six tie-points with Hole 645A because of evidence of core disturbance at the bottom. These tie-points were put into the CORPAC correlation program of Martinson et al. (1982, 1987). Using these tie-points, the CORPAC program allowed us to stack the rock-magnetic records, develop a composite downhole curve for each rock-magnetic parameter, and determine the degree of between-hole correlation for each parameter we studied. With the CORPAC program, we were also able to make Shaw diagrams (plots of equivalent depths of paired cores from a given area). Shaw diagrams were made to relate Holes 645A and 645F with Hole 645C.

RESULTS AND DISCUSSION

Shipboard rock-magnetic results of whole-core and discrete-sample magnetic susceptibilities were discussed in Srivastiva, Arthur, et al. (1987) and thus are not discussed here in detail. Data reported here are primarily from post-cruise sampling. Results are tabulated in the Appendix.

Because of the large number of data points collected from whole-core susceptibility logs, these results are not in the Appendix, but may be obtained by contacting the authors or ODP.

Site 645

Advanced Piston Cores (APCs)

In Srivastava, Arthur, et al. (1987), whole-core susceptibilities were used to correlate between holes. In addition, the frequency dependence of susceptibility was shown to be unimportant.

Figures 2 through 5 show rock-magnetic results from discrete samples. Nine tie-points are shown in Figure 2.

Figure 6 shows the composite records of the stacked rock-magnetic data using the same nine tie-points in Figure 2 and other rock-magnetic parameters. These data have good correlation coefficients (R) between holes for X_{ARM}/X (R = 0.846) and X (R = 0.673). However, the correlations are poor with respect to HIRM (R = 0.324) and S (R = 0.028). These data suggest magnetic mineral concentration and grain size may be potentially useful for between-hole correlation in the upper few meters of sediment in Baffin Bay, whereas magnetic mineralogy is not.

Shaw diagrams correlating the depths of Holes 645A and 645F with respect to 645C are shown in Figure 7.

Hole 645G was sampled below the sediment-water interface at a suggested depth of 1 m (Srivastava, Arthur, et al., 1987). We cannot correlate this hole with the other APCs using rock-

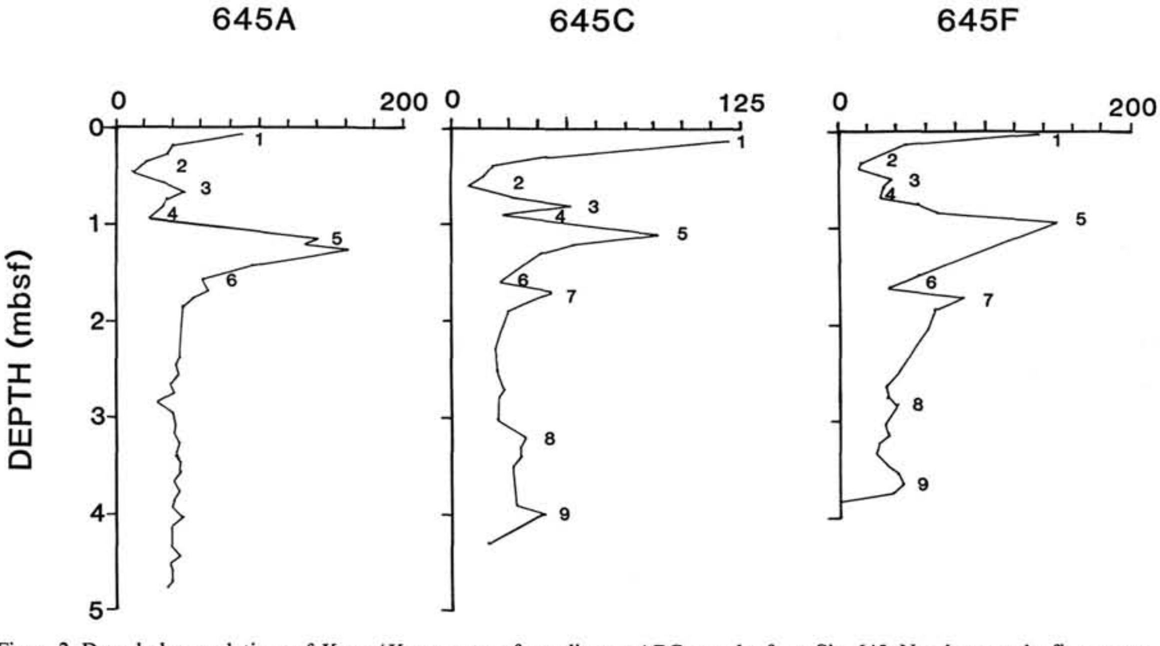

Figure 2. Downhole correlations of X_{ARM}/X parameters from discrete APC samples from Site 645. Numbers on the figures are the tie-points.

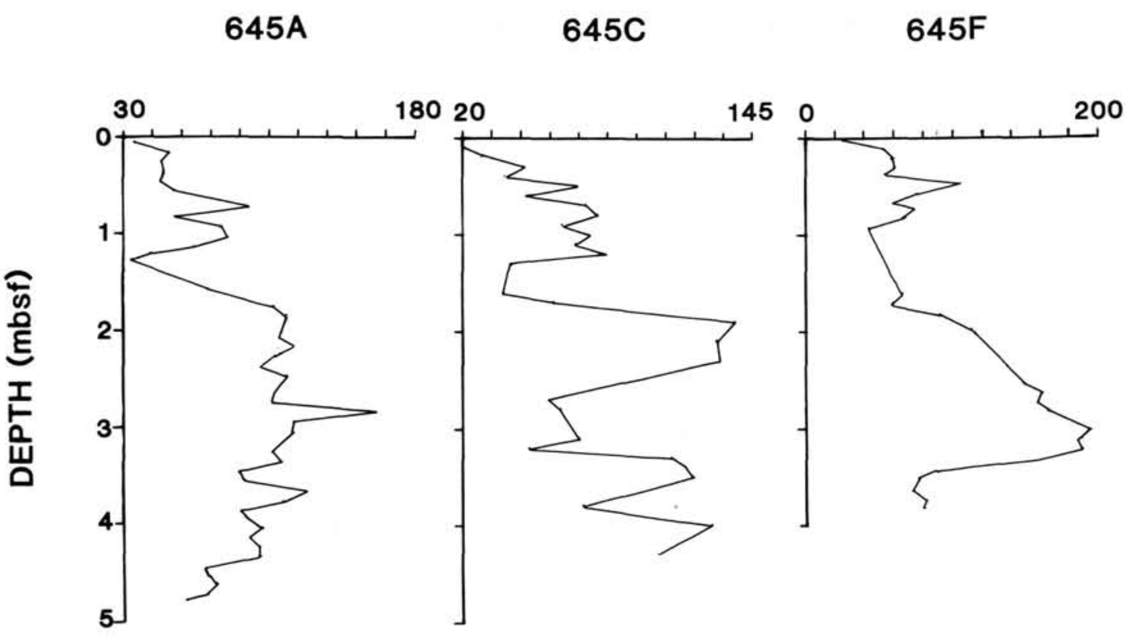

Figure 3. Downhole variations in susceptibility (X).

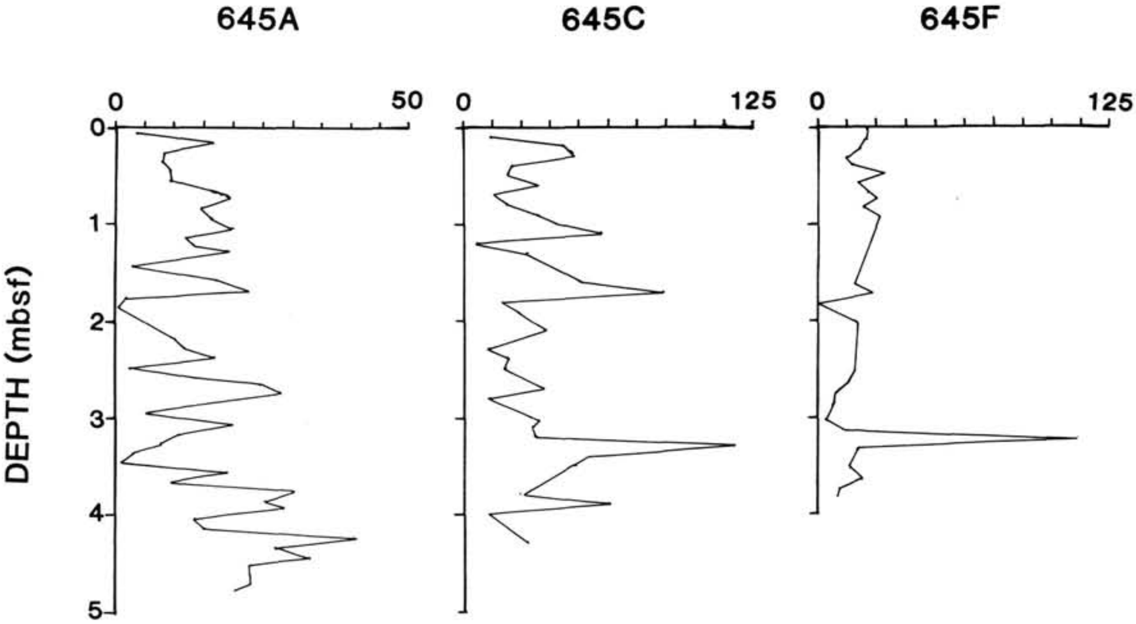

Figure 4. Downhole variations in HIRM.

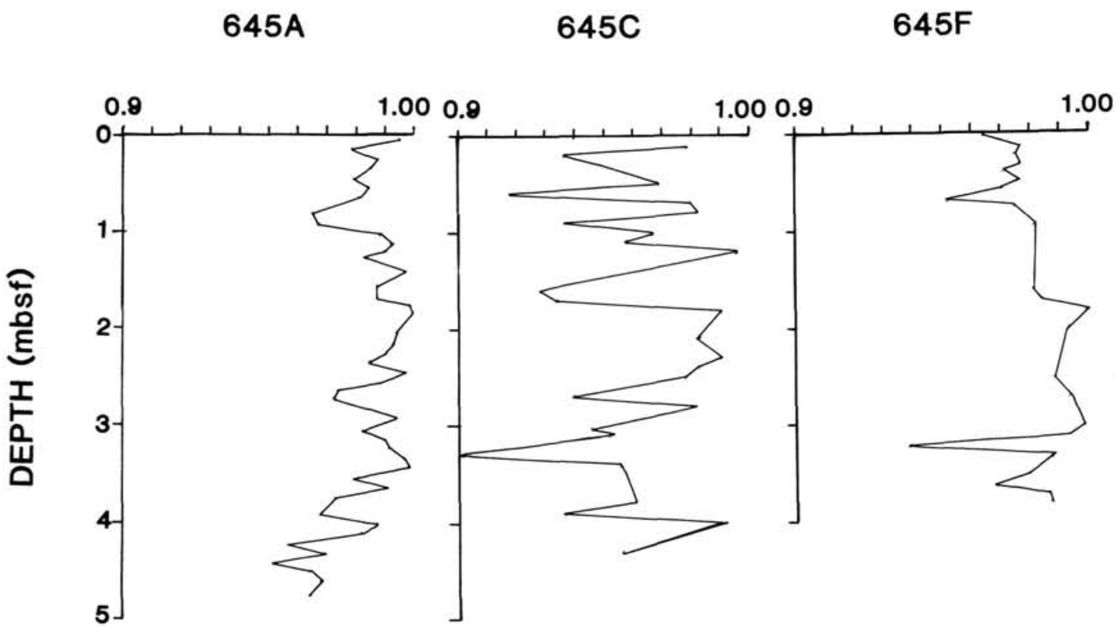

Figure 5. Downhole variations in *S*.

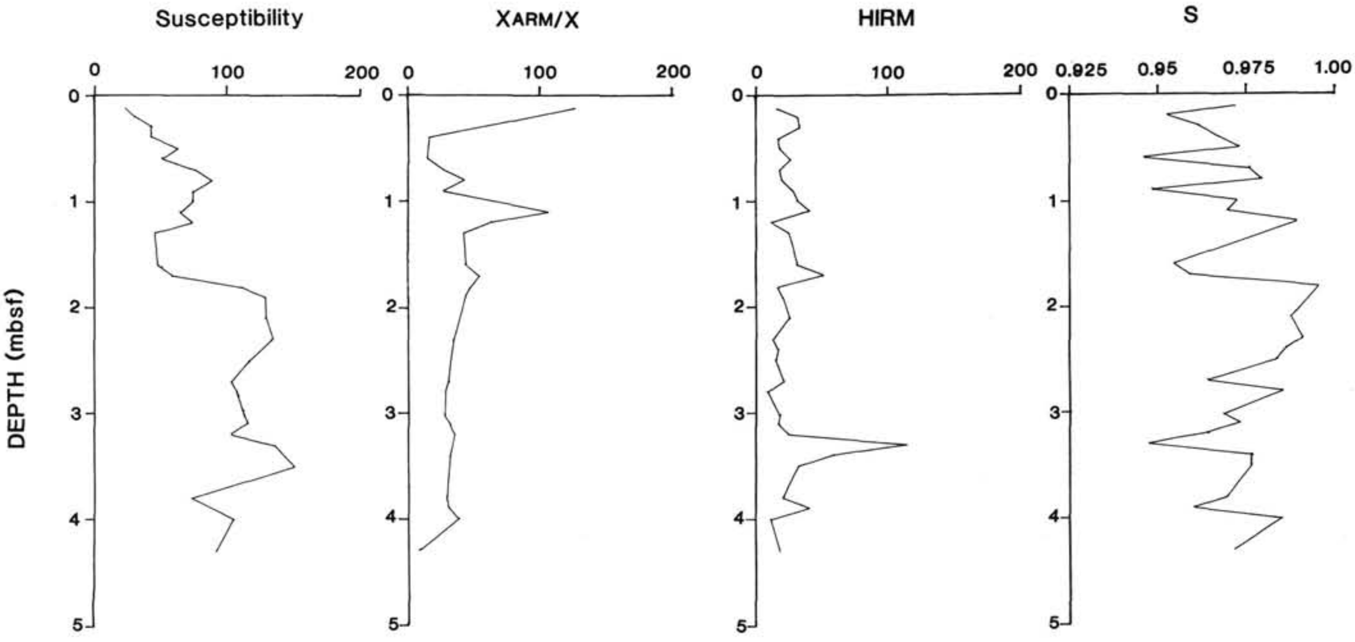

Figure 6. Stacked records of rock-magnetic parameters.

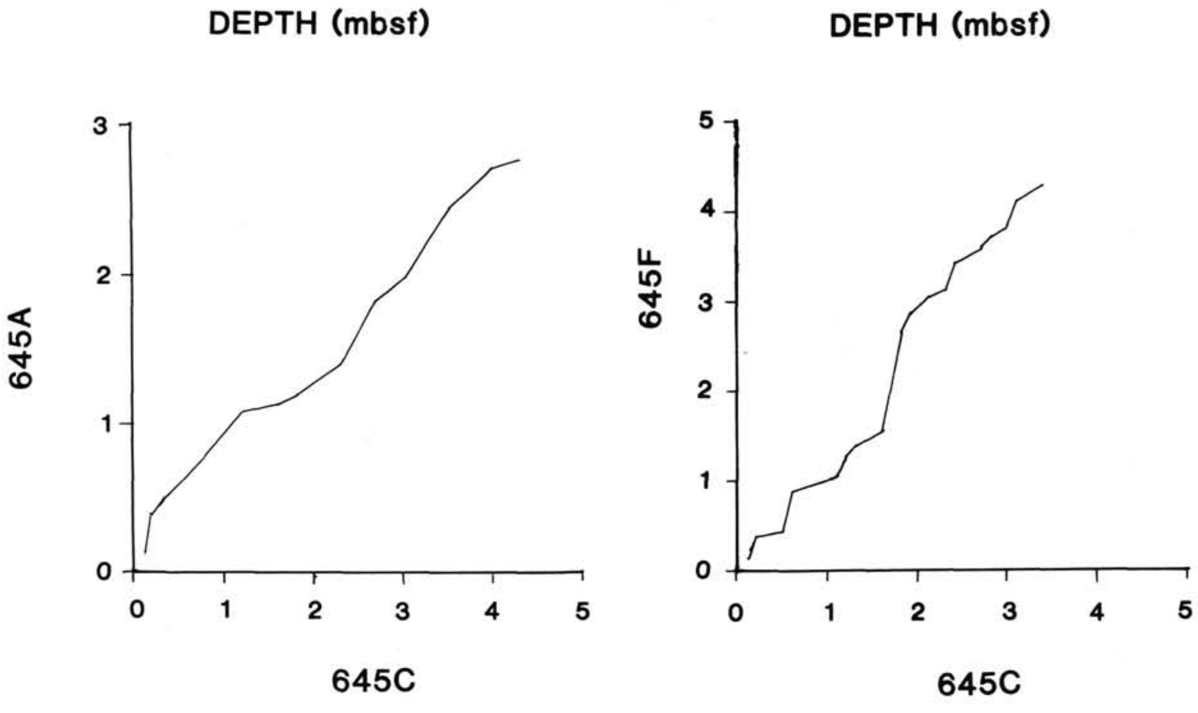

Figure 7. Shaw diagrams for APC cores at Site 645. Depths of tie-points from Figure 1 were used to correlate the cores.

magnetic parameters and did not include Hole 645G in our correlations.

Downhole Variations of Site 645

The deposition of magnetic minerals in Baffin Bay reflects variations in the mode of transport and source area of sediments. X, X_{ARM}/X, and HIRM show marked differences between pre-glacial (lithologic Unit III: lower-middle Miocene to upper Pliocene) and glacial (lithologic Units I and II: upper Pliocene to Holocene) sequences.

Variations in the rock-magnetic parameter X follow the same trend as $CaCO_3$ downhole (Fig. 8). Previous comparisons of X with $CaCO_3$ in other regions (Robinson, 1986; Bloemendal et al., 1988) have shown an inverse relationship, with X being diluted by pelagic carbonate. However, much of the carbonate in the upper part of Site 645 is detrital (Srivastava, Arthur, et al., 1987). Therefore, variations in carbonate with respect to susceptibility will reflect the source area, not pelagic deposition alone.

Lithologic Unit III has been divided into three subunits: IIIA (335–753.4 mbsf), IIIB (753.4–916.8 mbsf), and IIIC (916.8–

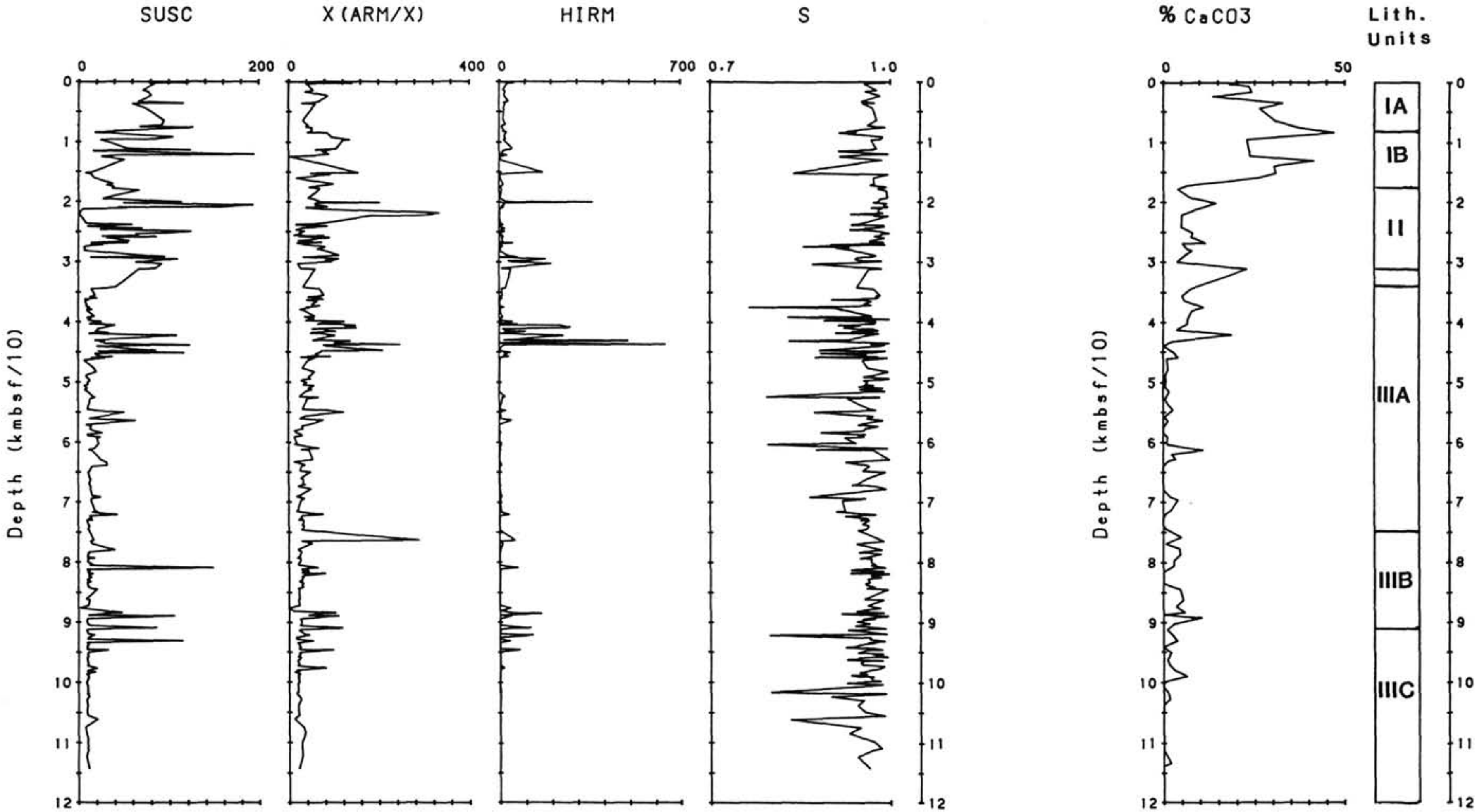

Figure 8. Downsite variations in rock-magnetic parameters and carbonate concentration at Site 645. The gap between lithologic Units II and III is an area of no recovery. HIRM values over 700 mA/m · kg were not included in the figure.

1147.1 mbsf). The coarseness and lack of bioturbation and evidence of soft-sediment deformation in one of the cores (645E-66R) suggest that the lowermost portion of Subunit IIIC was influenced by downslope processes. The landmass near Site 645 consists of granite and granitic gneiss. Rocks of this type often contain low concentrations of magnetic minerals. The influx of carbonate in the uppermost section of Subunit IIIC must reflect a source other than nearby land, and it is not of biogenic origin. Aksu and Piper (1987) suggested that the source of carbonate being deposited in Baffin Bay today may be derived from the Paleozoic and Mesozoic sedimentary rocks north of Site 645. This may also be the source of carbonate in the upper part of Subunit IIIC.

The development of geostrophic currents that are initially strong and then wane into Subunit IIIB has been postulated to explain the change in lithology from Subunit IIIC into Subunit IIIB (Arthur et al., this volume). As the geostrophic currents waned, magnetic minerals, because they are denser than matrix minerals (e.g., quartz and calcite/dolomite), would be deposited farther upcurrent; and the magnetic mineral concentration at the site of deposition would be reduced.

Through Subunits IIIB to the upper part of Subunit IIIA, the rock-magnetic and $CaCO_3$ signatures appear as peaks superimposed on a low background. However, from 460 mbsf to the top of Subunit IIIA, there is an abrupt increase in X, X_{ARM}/X, HIRM, and carbonate content. Cremer and Legigan (this volume) also show an increase in the $>250\mu m$ bulk-sediment size fraction at this level.

Srivastava, Arthur, et al. (1987) suggested that the upper part of Subunit IIIA may contain ice-rafted material. The X and carbonate signals of the upper part of Subunit IIIA, from 460 mbsf to the top of Subunit IIIA, resemble those of Unit II, which supports the hypothesis of early initiation of ice rafting. If this part of Subunit IIIA has been influenced by ice rafting, then from the age-depth profile of Site 645 (Srivastava, Arthur, et al., 1987) and the apparent location of the base of the Gauss magnetic normal at 460 mbsf (Clement et al., this volume), we infer an early-late Pliocene age (approximately 3.4 Ma) as the initiation of glaciation in the Northern Hemisphere.

The distinction between lithologic Units I and II is based on the decrease in detrital carbonate in Unit II. We do not see a distinct change in rock-magnetic parameters at the Unit I/Unit II boundary. However, there is an apparent change at the Subunit IA/Subunit IB boundary as X and X_{ARM}/X show less fluctuation in Subunit IA. The change in carbonate content and rock-magnetic parameters probably reflects the increasing significance of ice rafting in Baffin Bay. The change in rock-magnetic signal at the Subunit IA/Subunit IB boundary probably reflects the increased coarseness of Subunit IA, coincidental with increased ice rafting.

CONCLUSIONS

From the data presented, we reach the following conclusions:

1. Whereas the concentration and grain size of magnetic minerals can be used to correlate lithologic changes in the upper part of Site 645 (APC cores), magnetic mineral variations cannot.

2. At Site 645, variations in rock-magnetic parameters can be related to depositional changes that have occurred from the early-middle Miocene (Subunit IIIC to Subunit IA). The rock-magnetic parameters also reflect variations in carbonate content. Peaks at approximately 460 mbsf in X, X_{ARM}/X, HIRM, and carbonate content are interpreted to reflect an early episode of deposition by ice rafting at Site 645 that was initiated at approximately 3.4 Ma.

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APPENDIX
Rock-magnetic data collected for Site 645.

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645A	1H 1	6	0.06	7.44	35.52	3171.10	89.28	9.52	3.30	0.995
645A	1H 1	16	0.16	8.53	53.60	2158.06	40.26	12.87	16.55	0.978
645A	1H 1	26	0.26	9.58	49.32	1807.18	36.64	13.09	8.16	0.988
645A	1H 1	36	0.36	9.94	50.44	1050.90	20.84	11.02	8.07	0.985
645A	1H 1	46	0.46	10.96	49.46	535.30	10.82	9.84	9.29	0.979
645A	1H 1	56	0.56	8.67	56.32	1910.94	33.93	10.76	9.34	0.985
645A	1H 1	66	0.66	9.86	77.53	3736.86	48.20	17.26	16.52	0.981
645A	1H 1	73	0.73	9.60	95.84	3365.26	35.11	15.13	19.72	0.975
645A	1H 1	83	0.83	9.46	55.86	1823.07	32.63	7.74	14.26	0.965
645A	1H 1	94	0.94	10.52	80.46	1825.55	22.69	10.55	16.47	0.967
645A	1H 1	104	1.04	8.02	84.45	7623.22	90.27	27.17	20.23	0.988
645A	1H 1	114	1.14	7.99	65.93	9356.07	141.91	28.18	11.74	0.993
645A	1H 1	121	1.21	7.80	42.95	5620.09	130.87	20.22	13.33	0.990
645A	1H 1	127	1.27	7.75	33.44	5377.69	160.83	16.61	19.45	0.982
645A	1H 1	142	1.42	8.74	54.84	5316.49	96.95	24.08	2.49	0.998
645A	1H 2	7	1.57	9.76	73.16	4441.65	60.71	24.79	16.99	0.987
645A	1H 2	19	1.69	8.97	92.60	6087.99	65.74	31.25	22.80	0.987
645A	1H 2	26	1.76	9.50	107.98	5810.37	53.81	34.41	1.67	0.999
645A	1H 2	35	1.85	9.56	113.99	5323.82	46.70	34.60	0.33	1.000
645A	1H 2	57	2.07	10.28	109.75	4968.54	45.27	25.09	6.88	0.994
645A	1H 2	67	2.17	9.65	117.68	5280.42	44.87	26.08	10.10	0.993
645A	1H 2	77	2.27	10.01	106.50	4728.06	44.40	22.54	11.70	0.990
645A	1H 2	87	2.37	9.66	100.28	4490.75	44.78	20.50	17.11	0.984
645A	1H 2	97	2.47	10.18	114.83	4837.05	42.12	22.66	2.00	0.998
645A	1H 2	107	2.57	9.87	110.36	4784.05	43.35	21.48	13.39	0.988
645A	1H 2	115	2.65	10.33	107.69	4086.99	37.95	19.69	24.39	0.974
645A	1H 2	124	2.74	10.44	105.63	4402.88	41.68	21.15	28.12	0.972
645A	1H 2	134	2.84	10.26	159.77	4550.65	28.48	22.65	16.01	0.985
645A	1H 2	144	2.94	10.07	117.44	4644.25	39.55	21.39	5.27	0.995
645A	1H 3	6	3.06	10.07	116.87	4828.26	41.31	22.24	20.04	0.982
645A	1H 3	16	3.16	10.31	110.70	4535.16	40.97	21.52	10.61	0.990
645A	1H 3	26	3.26	10.41	105.77	4658.98	44.05	21.36	7.87	0.992
645A	1H 3	36	3.36	10.58	111.78	4727.68	42.30	21.93	2.95	0.997
645A	1H 3	46	3.46	9.63	88.19	3973.01	45.05	19.04	1.16	0.999
645A	1H 3	56	3.56	10.05	92.22	4104.35	44.50	18.43	19.19	0.979
645A	1H 3	66	3.66	10.01	124.64	5005.17	40.16	22.98	9.35	0.992
645A	1H 3	76	3.76	10.22	113.17	5032.62	44.47	22.60	30.37	0.973
645A	1H 3	86	3.86	10.47	88.85	3580.70	40.30	16.85	25.02	0.969
645A	1H 3	93	3.93	10.57	92.56	3632.52	39.25	17.85	28.67	0.966
645A	1H 3	104	4.04	9.18	101.45	4739.52	46.72	19.73	13.10	0.988
645A	1H 3	114	4.14	10.11	93.86	3585.56	38.20	17.26	15.02	0.982
645A	1H 3	124	4.24	10.14	99.83	3824.35	38.31	18.50	41.00	0.955
645A	1H 3	134	4.34	10.32	100.61	3907.50	38.84	19.09	26.69	0.971
645A	1H 3	144	4.44	10.58	71.56	3182.86	44.48	14.47	33.24	0.951
645A	1H 4	2	4.52	10.75	73.64	2813.02	38.20	13.78	22.47	0.965
645A	1H 4	12	4.62	11.00	78.29	3063.27	39.13	16.28	22.85	0.969
645A	1H 4	22	4.72	10.80	73.14	2805.70	38.36	14.59	22.75	0.966
645A	1H 4	28	4.78	10.92	62.70	2272.53	35.29	12.33	20.23	0.964
645C	1H 1	12	0.12	6.24	20.94	2507.50	119.76	6.48	10.82	0.979
645C	1H 1	20	0.20	7.20	29.14	2534.51	86.98	9.66	43.06	0.936
645C	1H 1	30	0.30	5.53	47.25	1946.88	41.20	10.37	48.15	0.949
645C	1H 1	40	0.40	8.63	37.70	678.36	17.99	8.71	20.86	0.959
645C	1H 1	50	0.50	9.66	69.97	1009.98	14.44	12.18	18.63	0.970
645C	1H 1	60	0.60	10.37	46.64	346.12	7.42	8.30	33.03	0.917
645C	1H 1	70	0.70	8.66	73.40	1881.60	25.63	11.00	12.70	0.980
645C	1H 1	80	0.80	7.59	79.12	4169.87	52.70	16.54	18.77	0.983
645C	1H 1	90	0.90	10.19	62.01	1359.27	21.92	10.18	31.89	0.936

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645C	1H 1	100	1.00	8.44	75.02	4164.20	55.51	21.40	40.72	0.968
645C	1H 1	110	1.10	7.96	67.39	6075.23	90.15	22.24	60.46	0.957
645C	1H 1	120	1.20	8.53	79.97	4256.33	53.22	21.91	4.40	0.997
645C	1H 1	130	1.30	7.74	40.25	1541.97	38.31	19.92	26.65	0.979
645C	1H 2	10	1.60	8.43	37.11	790.70	21.31	11.96	51.16	0.928
645C	1H 2	20	1.70	7.53	61.40	2724.54	44.38	19.76	86.99	0.934
645C	1H 2	31	1.81	8.61	103.89	3290.80	31.68	29.45	15.97	0.991
645C	1H 2	40	1.90	9.43	137.88	3370.51	24.44	36.64	23.86	0.988
645C	1H 2	60	2.10	10.39	129.50	2758.17	21.30	41.10	36.09	0.982
645C	1H 2	80	2.30	10.09	131.36	2532.75	19.28	22.72	9.91	0.991
645C	1H 2	90	2.40	9.58	113.17	2264.34	20.01	20.95	19.57	0.982
645C	1H 2	100	2.50	9.99	91.30	1827.25	20.01	16.21	17.52	0.978
645C	1H 2	120	2.70	10.50	56.59	1316.10	23.26	12.38	35.71	0.939
645C	1H 2	130	2.80	9.00	62.81	1310.72	20.87	10.88	10.42	0.983
645C	1H 3	2	3.02	11.10	68.13	1382.30	20.29	13.22	32.66	0.945
645C	1H 3	10	3.10	10.69	70.63	1804.43	25.55	13.34	29.23	0.953
645C	1H 3	20	3.20	9.58	47.86	1527.98	31.92	8.76	30.66	0.933
645C	1H 3	30	3.30	9.24	109.72	3317.45	30.24	21.31	117.01	0.899
645C	1H 3	40	3.40	7.87	115.57	3463.95	29.97	19.35	54.00	0.956
645C	1H 3	50	3.50	9.65	119.12	3215.56	26.99	22.06	47.93	0.958
645C	1H 3	80	3.80	9.69	71.05	1990.56	28.02	11.65	23.22	0.961
645C	1H 3	90	3.90	9.16	101.76	2851.92	28.02	18.30	64.14	0.936
645C	1H 3	100	4.00	8.86	128.18	5161.40	40.27	24.67	9.88	0.993
645C	1H 3	130	4.30	9.76	103.49	1621.81	15.67	12.38	28.18	0.956
645C	3H 1	20	14.20	9.47	78.53	2156.68	27.46	12.31	9.24	0.986
645C	3H 1	30	14.30	10.38	74.31	3069.61	41.31	14.90	25.89	0.964
645C	3H 1	50	14.50	12.59	64.46	2265.10	35.14	24.16	20.84	0.978
645C	3H 1	60	14.60	9.53	126.29	4468.83	35.39	26.16	38.69	0.972
645C	3H 1	70	14.70	11.83	35.36	1038.09	29.36	6.59	8.77	0.969
645C	3H 1	83	14.83	10.86	37.60	914.55	24.33	5.59	12.78	0.950
645C	3H 1	90	14.90	11.09	34.32	973.23	28.35	6.11	15.33	0.944
645C	3H 1	100	15.00	10.19	30.70	884.76	28.82	4.88	13.98	0.942
645C	3H 1	110	15.10	9.42	95.89	4467.31	46.59	18.60	37.02	0.962
645C	3H 1	120	15.20	9.61	91.12	4627.72	50.79	22.85	29.92	0.975
645C	3H 1	130	15.30	9.27	125.90	5403.40	42.92	21.00	34.39	0.970
645C	3H 1	140	15.40	11.08	62.47	1443.37	23.10	8.69	7.90	0.980
645C	3H 2	0	15.50	10.32	60.50	1947.84	32.20	9.66	17.56	0.962
645C	3H 2	10	15.60	10.86	70.10	2207.26	31.49	10.35	18.99	0.960
645C	3H 2	20	15.70	10.91	87.05	3719.33	42.72	21.75	15.47	0.984
645C	3H 2	50	16.00	10.05	79.75	4649.24	58.30	19.10	20.52	0.978
645C	3H 2	60	16.10	9.78	68.34	2059.70	30.14	14.50	70.94	0.904
645C	3H 2	70	16.20	9.99	59.98	1888.00	31.47	10.80	17.52	0.968
645C	3H 2	80	16.30	11.06	47.82	1255.75	26.26	8.74	2.83	0.993
645C	3H 2	90	16.40	10.49	60.60	1262.29	20.83	8.40	13.11	0.967
645C	3H 2	102	16.52	10.18	45.91	1011.34	22.03	6.92	13.26	0.961
645C	3H 2	120	16.70	10.39	37.48	1264.18	33.73	8.11	15.40	0.961
645C	3H 3	44	17.44	9.20	96.41	2990.50	31.02	17.44	35.33	0.963
645C	3H 3	54	17.54	8.96	178.91	3648.16	20.39	20.82	46.74	0.960
645C	3H 3	64	17.64	9.26	96.73	5056.56	52.27	25.39	12.83	0.991
645C	3H 3	71	17.71	10.67	46.74	906.26	19.39	8.25	16.40	0.958
645C	3H 3	94	17.94	10.83	38.74	795.66	20.54	6.47	17.77	0.940
645C	3H 3	101	18.01	10.69	52.65	1023.70	19.44	8.33	12.86	0.967
645C	3H 3	105	18.05	7.74	52.43	1857.10	35.42	8.54	14.53	0.974
645C	3H 3	124	18.24	9.55	135.63	2963.90	21.85	20.95	15.71	0.986
645C	3H 3	141	18.41	9.01	121.17	2249.94	18.57	14.96	2.77	0.997
645C	3H 4	25	18.75	10.30	145.39	2473.40	17.01	18.81	16.99	0.981
645C	3H 5	0	20.00	9.93	114.12	4780.71	41.89	26.59	17.62	0.987

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645C	3H 5	16	20.16	10.54	38.98	1516.60	38.91	10.21	10.08	0.979
645C	3H 5	24	20.24	11.41	41.18	781.09	18.97	8.20	9.86	0.973
645C	3H 5	35	20.35	10.50	54.68	909.25	16.63	9.00	15.48	0.964
645C	3H 5	44	20.44	11.55	71.46	1092.95	15.29	10.66	12.99	0.972
645C	3H 5	73	20.73	10.92	77.08	1277.89	16.58	10.86	26.33	0.947
645C	3H 5	82	20.82	8.74	69.14	2354.54	34.06	13.79	14.30	0.982
645C	3H 5	97	20.97	9.65	65.35	1823.25	27.90	11.32	12.31	0.979
645F	1H 1	2	0.02	7.42	25.99	3531.64	135.87	8.93	21.67	0.964
645F	1H 1	12	0.12	7.43	53.37	2437.49	45.67	13.47	20.91	0.977
645F	1H 1	22	0.22	9.92	59.30	1742.96	29.39	14.04	17.75	0.975
645F	1H 1	32	0.32	10.62	60.86	911.45	14.98	11.37	12.29	0.977
645F	1H 1	38	0.38	10.96	53.21	705.28	13.26	11.15	14.99	0.971
645F	1H 1	48	0.48	9.73	104.78	3936.69	37.57	24.50	29.19	0.977
645F	1H 1	58	0.58	8.91	76.62	2350.98	30.68	10.23	16.99	0.970
645F	1H 1	68	0.68	11.16	59.24	1731.44	29.23	10.05	21.49	0.952
645F	1H 1	74	0.74	9.16	74.84	4072.77	54.42	18.98	25.86	0.975
645F	1H 1	83	0.83	8.29	67.74	4736.44	69.92	14.71	19.18	0.978
645F	1H 1	93	0.93	7.62	42.41	6339.28	149.28	23.16	27.02	0.982
645F	1H 2	12	1.62	9.81	65.94	2242.23	34.00	16.09	15.81	0.981
645F	1H 2	22	1.72	8.90	58.04	5067.61	87.31	26.85	24.19	0.984
645F	1H 2	32	1.82	8.66	90.20	6111.39	67.75	33.01	0.20	1.000
645F	1H 2	52	2.02	8.38	115.35	7148.21	61.97	37.79	16.98	0.992
645F	1H 2	104	2.54	9.75	148.04	5848.22	39.50	24.46	15.30	0.988
645F	1H 2	114	2.64	10.09	160.98	5381.59	33.43	27.93	13.03	0.991
645F	1H 2	124	2.74	9.66	157.67	5477.18	34.74	26.22	7.66	0.994
645F	1H 2	134	2.84	9.28	165.29	6700.80	40.54	25.53	6.93	0.995
645F	1H 3	3	3.03	9.77	192.05	6152.56	32.04	32.08	3.25	0.998
645F	1H 3	13	3.13	9.92	184.68	6546.47	35.45	31.28	11.17	0.993
645F	1H 3	23	3.23	10.15	189.01	5266.11	27.86	36.44	111.65	0.938
645F	1H 3	33	3.33	9.45	157.14	4073.68	25.92	25.46	16.34	0.988
645F	1H 3	43	3.43	9.62	89.13	2888.27	32.41	16.23	14.40	0.983
645F	1H 3	53	3.53	9.24	75.92	3155.52	41.56	12.29	13.71	0.979
645F	1H 3	64	3.64	10.98	72.39	3265.99	45.12	13.25	19.75	0.967
645F	1H 3	74	3.74	11.19	82.11	3083.00	37.55	14.96	9.32	0.986
645F	1H 3	82	3.82	11.04	80.19	0.00	0.00	14.40	8.38	0.987
645G	1H 2	11	1.61	9.19	129.27	4853.29	37.54	19.43	20.12	0.981
645G	1H 2	25	1.75	9.32	117.59	4937.24	41.99	20.15	29.38	0.973
645G	1H 2	34	1.84	9.85	129.60	5258.53	40.57	22.73	24.74	0.979
645G	1H 2	45	1.95	9.97	123.54	5460.22	44.20	23.48	28.00	0.976
645G	1H 2	52	2.02	9.74	125.93	4935.35	39.19	21.74	28.21	0.975
645G	1H 2	64	2.14	10.16	84.23	3119.81	37.04	15.36	20.68	0.973
645G	1H 2	74	2.24	10.69	91.42	3858.98	42.21	17.71	26.10	0.968
645G	1H 2	85	2.35	10.48	89.19	3618.28	40.57	17.17	27.94	0.966
645G	1H 2	93	2.43	10.33	79.49	3415.92	42.97	14.85	21.68	0.970
645G	1H 2	108	2.58	10.13	96.59	3628.58	37.57	22.03	24.17	0.978
645G	1H 2	113	2.63	8.44	222.91	7102.75	31.86	29.28	19.77	0.989
645G	1H 2	130	2.80	10.18	107.55	5345.00	49.70	21.27	22.26	0.979
645G	1H 3	9	3.09	7.98	115.42	8369.23	72.51	26.01	50.53	0.969
645G	1H 3	33	3.33	10.19	55.11	2184.01	39.63	11.75	21.49	0.963
645G	1H 3	44	3.44	9.66	62.90	2437.65	38.75	11.50	18.22	0.969
645G	1H 3	52	3.52	9.73	74.12	2032.13	27.42	12.45	22.72	0.964
645G	1H 3	67	3.67	10.03	57.98	1891.31	32.62	11.12	19.98	0.964
645G	1H 3	74	3.74	10.72	66.06	2305.14	34.90	12.64	21.64	0.963
645G	1H 3	84	3.84	10.06	59.38	2708.37	45.61	12.46	22.85	0.963
645G	1H 3	93	3.93	8.44	128.98	9221.31	71.49	30.31	34.40	0.981
645G	1H 3	113	4.13	8.40	82.54	6650.07	80.56	23.36	27.86	0.980
645G	1H 3	129	4.29	9.86	71.82	4077.05	56.77	16.21	30.17	0.963

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645G	1H 4	0	4.50	10.01	57.98	3398.36	58.61	14.26	35.17	0.951
645G	1H 4	17	4.67	10.36	44.07	1405.56	31.89	9.14	16.28	0.963
645G	1H 4	23	4.73	10.04	53.00	1020.42	19.25	8.12	18.48	0.954
645G	1H 4	35	4.85	10.98	57.10	1349.53	23.64	9.69	19.48	0.956
645G	1H 4	44	4.94	10.04	62.50	1495.40	23.93	9.67	17.70	0.963
645G	1H 4	53	5.03	9.18	221.02	11912.50	53.90	46.96	10.46	0.996
645G	1H 4	62	5.12	9.32	647.50	7932.90	12.25	47.76	103.33	0.960
645G	1H 4	74	5.24	5.71	31.33	1877.60	59.93	5.13	13.85	0.969
645G	1H 4	84	5.34	10.55	55.60	1438.11	25.86	10.14	18.70	0.961
645G	1H 4	103	5.53	11.04	63.32	1503.67	23.75	9.96	18.51	0.959
645G	1H 4	118	5.68	10.75	70.05	1789.41	25.55	11.24	22.23	0.957
645G	1H 4	125	5.75	11.18	58.36	1567.21	26.85	10.69	21.71	0.955
645G	1H 4	133	5.83	10.56	67.00	1528.36	22.81	10.55	18.93	0.962
645G	1H 4	142	5.92	9.60	62.64	1544.18	24.65	9.20	19.67	0.959
645G	1H 5	10	6.10	10.75	60.43	2074.79	34.33	12.17	22.38	0.960
645G	1H 5	36	6.36	8.75	92.16	6068.05	65.85	19.97	28.32	0.975
645B	1X 1	80	0.80	6.46	118.63	10729.54	90.45	23.16	14.94	0.992
645B	1X 2	48	1.98	5.31	78.07	11098.10	142.15	23.99	56.80	0.975
645B	1X 3	29	3.29	9.74	85.13	3493.98	41.04	13.19	29.33	0.957
645B	3X 1	28	13.78	8.81	71.30	3985.88	55.90	11.63	14.79	0.978
645B	3X 2	90	15.90	7.68	76.88	2831.70	36.83	8.93	23.73	0.959
645B	4X 1	29	23.09	8.55	80.81	7151.69	88.50	20.01	19.27	0.984
645B	5X 1	37	32.57	7.41	66.12	4491.42	67.93	11.77	36.95	0.953
645B	5X 2	104	34.74	6.58	116.46	3408.95	29.27	8.78	16.92	0.975
645B	5X 3	55	35.75	8.56	60.17	3665.96	60.92	9.15	24.20	0.955
645B	6X 1	54	43.14	9.03	73.74	3919.24	53.15	11.30	18.24	0.971
645B	8X 2	27	63.77	6.77	94.64	3016.00	31.87	8.89	14.76	0.978
645B	9X 1	61	72.21	9.08	92.70	4143.93	44.70	12.55	25.48	0.963
645B	9X 2	68	73.78	9.61	67.98	2609.43	38.39	8.90	11.52	0.975
645B	9X 3	55	75.15	9.31	126.84	6710.65	52.91	19.60	8.45	0.992
645B	10X 1	104	82.34	7.91	39.71	2081.04	52.41	4.38	20.02	0.928
645B	10X 2	47	83.27	9.05	40.26	1693.55	42.07	4.66	14.20	0.945
645B	10X 3	6	84.36	9.11	17.93	1548.49	86.38	6.09	28.50	0.915
645B	11X 1	53	91.43	8.50	104.94	10074.93	96.01	27.84	20.10	0.988
645B	11X 3	130	95.20	7.88	84.50	11547.90	136.67	27.63	26.01	0.985
645B	11X 4	14	95.54	9.18	24.63	3003.31	121.92	10.32	17.38	0.969
645B	13X 1	56	110.86	6.68	54.54	5854.31	107.34	31.91	52.06	0.978
645B	13X 2	139	113.19	7.79	124.18	7433.03	59.86	21.11	43.06	0.968
645B	13X 3	9	113.39	8.79	81.47	6843.09	84.00	17.30	26.75	0.973
645B	13X 3	9	113.39	6.35	79.14	7345.39	92.82	12.97	28.58	0.972
645B	13X 4	66	115.46	9.40	16.04	1193.87	74.44	3.34	15.32	0.914
645B	14X 1	48	120.38	5.99	195.05	17654.21	90.51	28.91	7.05	0.997
645B	14X 2	74	122.14	7.26	50.18	2839.61	56.59	7.77	30.37	0.943
645B	14X 3	101	123.91	8.41	25.39	84.25	3.32	0.14	0.72	0.916
645B	15X 1	68	130.18	9.54	51.36	2123.43	41.35	8.23	5.41	0.987
645B	17X 2	34	150.64	8.32	15.10	2356.58	156.07	17.78	169.22	0.842
645B	17X 3	10	151.90	8.19	7.67	376.88	49.14	7.04	69.11	0.839
645B	17X 4	74	154.04	9.06	13.87	1305.51	94.15	17.49	2.54	0.997
645B	18X 2	9	159.99	10.24	17.18	311.37	18.13	3.06	4.04	0.973
645B	19X 2	60	170.20	9.46	38.51	3909.74	101.52	12.28	16.05	0.975
645B	19X 3	107	172.17	9.20	31.41	2688.44	85.60	9.09	16.38	0.967
645B	19X 5	102	175.12	9.26	39.34	1860.68	47.29	15.45	4.87	0.994
645B	20X 1	114	178.24	8.58	38.07	2708.91	71.16	8.01	9.50	0.980
645B	20X 3	109	181.19	8.82	68.37	4640.98	67.88	29.84	10.09	0.994
645B	21X 4	87	192.77	8.52	32.44	1413.91	43.59	11.34	2.81	0.996
645B	21X 5	120	194.60	9.43	26.64	1542.84	57.90	6.83	5.84	0.984
645B	22X 2	131	199.61	9.00	114.46	8006.14	69.95	24.76	27.63	0.980

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645B	22X 3	92	200.72	9.76	90.10	18437.47	204.63	254.44	361.22	0.972
645B	22X 4	57	201.87	8.56	49.90	2951.38	59.15	33.91	12.86	0.994
645B	22X 6	104	205.34	8.61	194.06	11708.95	60.34	32.65	19.92	0.989
645B	23X 1	135	207.95	6.46	157.52	13825.51	87.77	37.55	8.80	0.997
645B	23X 2	52	208.62	8.00	43.97	1738.07	39.53	8.81	17.24	0.969
645B	23X 3	37	209.97	8.62	53.92	3219.26	59.70	11.47	8.37	0.987
645B	23X 4	105	212.15	7.15	5.27	389.18	73.83	1.21	1.51	0.982
645B	24X 1	71	216.91	8.10	1.55	482.35	311.00	1.16	1.46	0.980
645B	24X 2	44	218.14	7.67	1.64	550.01	335.80	1.25	0.93	0.989
645B	24X 3	106	220.26	7.51	1.67	523.92	313.20	0.72	3.11	0.935
645B	24X 4	18	220.88	7.69	1.63	525.55	321.70	1.21	1.46	0.982
645B	24X 5	36	222.56	8.30	1.51	417.75	276.00	1.01	1.60	0.974
645B	24X 5	36	222.56	5.40	2.33	425.97	183.10	0.75	0.19	0.997
645B	26X 1	69	236.29	7.29	8.62	674.50	78.28	2.62	8.27	0.954
645B	26X 2	102	238.12	7.27	60.48	1010.55	16.71	4.02	17.76	0.936
645B	26X 3	87	239.47	7.77	45.27	1593.72	35.20	9.68	6.16	0.990
645B	26X 4	86	240.96	8.72	10.08	888.19	88.07	6.90	3.58	0.991
645B	26X 5	103	242.63	7.86	41.56	1896.41	45.63	10.11	15.24	0.976
645B	26X 6	81	243.91	9.13	71.55	2110.36	29.49	10.65	24.04	0.959
645B	26X 7	27	244.87	8.42	53.71	1505.75	28.03	6.58	12.25	0.969
645B	27X 1	124	246.44	8.71	24.52	534.82	21.81	1.95	7.36	0.934
645B	27X 2	33	247.03	7.65	59.12	1006.34	17.02	4.40	9.67	0.966
645B	27X 3	130	249.50	8.43	125.18	4716.05	37.67	25.80	23.14	0.985
645B	27X 5	118	252.38	8.46	98.01	2370.30	24.18	19.73	1.17	0.999
645B	27X 6	39	253.09	7.84	64.10	1945.95	30.36	11.76	9.68	0.987
645B	28X 1	98	255.88	7.53	66.73	772.96	11.58	4.09	4.25	0.984
645B	28X 2	76	257.16	8.20	26.04	2071.79	79.55	10.19	16.31	0.974
645B	28X 3	54	258.44	7.38	78.30	1967.83	25.13	12.14	14.23	0.983
645B	28X 3	54	258.44	5.80	86.64	1913.66	22.09	9.33	16.29	0.980
645B	28X 4	54	259.94	8.82	31.34	2874.78	91.74	18.37	9.82	0.991
645B	29X 1	39	264.99	8.14	57.10	1190.38	20.85	6.48	13.66	0.966
645D	1R 1	105	266.75	8.50	39.91	2227.76	55.83	24.58	16.60	0.989
645B	29X 2	108	267.18	9.46	27.89	869.97	31.20	6.18	5.51	0.983
645D	1R 2	99	268.19	7.20	13.96	1052.14	75.38	5.00	3.41	0.990
645B	29X 3	63	268.23	8.65	55.19	2781.97	50.41	29.46	53.87	0.968
645D	1R 3	23	268.93	7.65	31.20	1442.51	46.23	7.95	15.81	0.970
645B	29X 4	27	269.37	7.25	24.26	457.63	18.86	1.24	2.37	0.972
645D	1R 4	76	270.96	7.64	13.15	620.58	47.18	1.48	9.60	0.901
645B	29X 5	86	271.46	8.22	27.51	842.87	30.64	4.10	2.04	0.992
645D	2R 1	82	273.72	6.11	8.22	595.65	72.43	1.26	14.89	0.855
645D	2R 2	53	274.93	7.58	6.63	544.44	82.13	1.09	4.84	0.933
645D	2R 3	44	276.34	6.57	5.74	464.27	80.93	0.80	5.45	0.910
645D	2R 4	121	278.61	8.35	7.52	486.72	64.70	0.89	3.47	0.935
645D	2R 6	19	280.59	6.37	5.92	462.08	78.10	0.64	2.87	0.942
645B	31X 4	85	289.15	6.69	73.24	8276.06	113.01	19.72	33.29	0.977
645B	31X 5	138	291.18	8.75	96.20	7234.46	75.21	41.17	70.53	0.970
645B	31X 5	138	291.18	5.47	89.57	6155.78	68.73	17.59	42.65	0.973
645B	30X 6	60	291.70	7.44	13.51	608.05	45.01	0.99	3.13	0.953
645B	30X 6	60	291.70	5.55	18.11	588.08	32.48	0.75	3.56	0.947
645B	32X 1	114	294.64	8.67	110.12	12383.28	112.45	54.10	181.42	0.942
645B	32X 3	123	297.73	8.21	82.63	8073.41	97.71	40.88	110.49	0.956
645B	32X 4	38	298.38	8.52	84.05	6909.55	82.21	44.18	34.40	0.987
645B	32X 5	17	299.67	7.47	63.91	6162.67	96.43	20.18	50.90	0.962
645B	32X 7	19	302.69	8.92	92.95	1971.46	21.21	28.17	203.45	0.871
645E	2R 1	49	311.29	7.59	86.07	2307.65	26.81	12.60	10.40	0.987
645D	6R 1	28	311.68	8.70	67.87	4106.45	60.51	24.04	46.56	0.966
645D	8R 1	37	340.77	7.82	41.77	1345.92	32.22	7.35	25.65	0.945

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645D	8R 2	87	342.77	6.74	26.09	1427.76	54.71	7.74	24.69	0.957
645D	8R 3	69	344.09	7.28	13.81	942.56	68.27	5.62	10.34	0.973
645D	9R 4	58	355.08	8.72	18.73	1482.18	79.14	13.08	12.16	0.984
645D	9R 5	27	356.27	8.71	17.31	1350.90	78.05	9.90	12.95	0.977
645D	9R 6	15	357.65	6.98	12.60	547.87	43.49	2.26	3.13	0.981
645D	10R 1	46	360.16	7.27	20.74	1425.28	68.73	8.01	12.25	0.978
645D	10R 2	80	362.00	7.15	7.03	552.76	78.65	1.01	6.87	0.903
645D	10R 3	49	363.19	6.74	11.18	450.32	40.27	0.58	1.90	0.956
645D	10R 4	76	364.96	6.88	7.30	470.56	64.43	0.98	2.16	0.970
645D	11R 1	81	370.21	7.19	8.74	468.09	53.58	0.77	2.29	0.957
645D	11R 2	97	371.87	8.07	9.34	495.04	53.00	1.25	2.33	0.970
645D	11R 3	75	373.15	7.53	8.34	590.77	70.82	1.00	3.96	0.941
645D	11R 4	100	374.90	6.43	11.72	476.92	40.68	1.14	20.92	0.765
645D	11R 5	83	376.23	8.20	12.26	578.66	47.21	1.39	7.89	0.907
645D	11R 6	73	377.63	5.10	9.85	311.36	31.60	0.50	3.79	0.922
645D	11R 7	36	378.76	6.60	15.23	391.35	25.70	0.85	5.46	0.916
645D	12R 1	100	380.00	7.21	8.71	297.60	34.16	0.69	3.42	0.929
645D	13R 1	139	389.99	9.10	17.95	1065.22	59.35	7.31	11.82	0.971
645D	13R 2	55	390.65	8.78	14.31	519.11	36.28	1.71	16.57	0.830
645D	13R 3	104	392.64	8.47	8.90	473.59	53.22	1.29	5.79	0.924
645D	13R 4	54	393.64	8.47	13.35	762.67	57.13	4.52	7.40	0.972
645D	13R 5	43	395.03	9.47	13.27	702.43	52.95	5.95	0.25	0.999
645D	13R 6	69	396.79	9.60	10.47	405.54	38.74	1.51	8.67	0.890
645D	14R 1	66	398.96	8.43	25.33	3141.30	123.99	36.87	52.00	0.976
645D	14R 2	46	400.26	9.02	20.89	2051.14	98.18	29.15	37.40	0.977
645D	14R 3	127	402.57	8.45	11.89	769.38	64.69	4.34	6.72	0.974
645D	14R 4	28	403.08	8.02	26.63	2811.60	105.58	30.39	70.17	0.963
645D	14R 5	41	404.71	8.43	37.26	5554.61	149.09	101.51	520.02	0.914
645D	14R 5	41	404.71	7.73	40.63	5058.28	124.50	76.74	239.28	0.952
645D	15R 1	140	409.30	8.55	27.92	4232.57	151.61	61.02	275.80	0.923
645D	15R 2	112	410.52	7.79	20.96	1104.04	52.66	3.67	11.79	0.950
645D	15R 3	34	411.24	8.82	21.37	1687.01	78.96	14.69	23.63	0.972
645D	15R 4	139	413.79	7.97	20.49	1787.48	87.23	17.44	21.25	0.981
645D	15R 5	132	415.22	8.08	18.66	1968.07	105.48	25.95	102.66	0.936
645D	15R 6	139	416.79	8.58	33.68	1780.90	52.88	16.08	25.06	0.973
645D	16R 1	59	418.19	8.60	17.53	861.87	49.17	3.75	19.94	0.909
645D	16R 2	29	419.39	6.72	11.22	792.09	70.62	4.34	5.86	0.982
645D	16R 3	107	421.67	7.86	108.69	11299.02	103.96	109.14	248.37	0.964
645D	17R 2	142	430.12	6.28	18.00	971.82	53.98	3.10	17.45	0.929
645D	17R 3	88	431.08	6.89	29.17	4028.31	138.08	40.76	497.71	0.832
645D	17R 4	25	431.95	7.42	23.70	2616.18	110.37	35.03	190.82	0.919
645D	17R 5	134	434.54	6.48	31.02	3173.66	102.31	20.74	1.23	0.999
645D	17R 7	102	437.22	8.70	88.08	21938.43	249.06	345.93	642.14	0.968
645D	18R 1	65	437.55	8.87	123.22	9612.61	78.01	44.53	21.51	0.991
645D	18R 3	24	440.14	7.47	20.18	1701.45	84.31	12.07	13.05	0.984
645D	19R 1	21	446.71	6.54	86.44	18270.25	211.36	238.51	2148.39	0.882
645D	19R 2	18	448.18	10.02	21.31	1577.62	74.02	17.85	6.16	0.993
645D	19R 3	106	450.56	8.48	117.04	8461.38	72.30	26.02	44.04	0.971
645D	19R 4	104	452.04	8.21	18.36	1124.07	61.22	2.81	19.76	0.884
645D	19R 5	111	453.61	8.78	20.03	1353.01	67.54	13.53	30.41	0.961
645E	4R 1	130	456.50	7.30	25.81	1073.00	41.57	6.08	16.36	0.961
645D	20R 1	65	456.85	8.18	38.39	3614.65	94.14	34.83	39.70	0.981
645E	4R 2	137	458.07	7.85	24.01	655.99	27.33	2.21	17.67	0.875
645D	20R 2	85	458.55	8.67	14.49	686.83	47.40	4.61	9.22	0.965
645E	4R 3	106	459.26	6.76	29.73	1775.52	59.71	18.84	5.30	0.996
645D	20R 5	116	463.36	8.62	5.83	255.05	43.75	0.39	1.06	0.954
645E	6R 1	112	475.62	7.32	17.16	523.11	30.48	0.57	1.44	0.963

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645E	6R 5	105	481.55	8.26	19.77	1152.25	58.28	7.96	1.31	0.997
645E	7R 3	90	488.00	7.14	8.80	450.43	51.20	0.89	1.56	0.975
645E	7R 4	95	489.55	7.42	8.47	379.59	44.84	0.58	1.38	0.965
645E	7R 5	98	491.08	7.05	8.91	406.82	45.66	0.51	1.61	0.956
645E	8R 1	13	493.83	6.82	11.05	551.14	49.87	1.56	0.07	0.999
645E	8R 2	38	495.58	7.15	12.30	381.63	31.03	1.04	1.06	0.985
645E	8R 3	60	497.30	7.77	12.93	357.97	27.68	0.54	1.51	0.956
645E	8R 5	70	500.40	7.16	10.53	433.03	41.13	0.54	1.35	0.964
645E	9R 1	21	503.61	5.95	10.56	343.52	32.54	0.33	1.19	0.958
645E	9R 2	48	505.38	5.87	6.42	368.54	57.40	0.38	0.85	0.974
645E	9R 3	83	507.23	6.37	7.89	431.12	54.65	0.48	1.98	0.948
645E	9R 5	102	510.42	6.23	10.08	437.98	43.44	0.89	0.85	0.988
645E	9R 6	97	511.87	5.49	6.86	363.61	52.97	0.35	1.59	0.950
645E	10R 2	5	514.55	18.67	10.16	399.63	39.33	5.03	1.01	0.992
645E	11R 1	130	523.90	18.68	16.68	409.57	24.56	4.55	25.03	0.794
645E	11R 2	81	524.91	20.95	18.89	1276.07	67.56	35.54	13.31	0.984
645E	11R 3	143	527.03	14.47	13.46	576.05	42.81	5.70	13.82	0.930
645E	13R 2	130	544.60	9.08	9.68	295.25	30.49	0.45	0.85	0.966
645E	13R 4	36	546.66	13.94	19.20	1705.89	88.87	33.18	27.12	0.977
645E	13R 6	67	549.97	18.36	51.25	6320.48	123.33	334.58	1153.04	0.873
645E	14R 4	76	556.76	7.59	26.65	983.01	36.89	4.80	8.40	0.973
645E	14R 7	17	560.67	7.48	11.76	296.44	25.21	0.42	1.09	0.961
645E	15R 2	91	563.51	8.63	64.05	5005.04	78.14	69.34	47.86	0.988
645E	16R 1	9	570.99	7.69	8.17	375.25	45.94	0.50	1.73	0.947
645E	16R 2	65	573.05	7.75	14.59	466.69	31.99	0.60	1.24	0.968
645E	16R 3	24	574.14	7.42	13.54	398.73	29.44	0.60	0.77	0.981
645E	16R 5	131	578.21	7.78	12.92	424.52	32.86	0.53	1.42	0.959
645E	17R 1	38	580.88	7.94	17.40	224.04	12.87	0.35	0.91	0.958
645E	17R 3	93	584.43	7.49	26.84	443.47	16.53	0.93	7.20	0.884
645E	17R 5	49	586.99	7.63	9.88	282.87	28.63	0.43	1.15	0.960
645E	17R 6	59	588.59	7.24	10.41	324.48	31.17	0.48	1.74	0.948
645E	18R 1	118	591.28	6.63	24.63	313.60	12.73	0.44	1.37	0.958
645E	18R 2	37	591.97	6.69	20.66	274.17	13.27	0.36	2.03	0.925
645E	19R 1	103	600.83	9.49	22.50	419.11	18.62	0.94	2.76	0.944
645E	19R 2	138	602.68	8.06	21.82	267.00	12.24	0.65	8.24	0.795
645E	20R 1	112	610.42	8.42	17.90	1220.32	68.16	8.59	1.82	0.996
645E	20R 2	101	611.81	7.89	11.15	307.62	27.60	0.71	5.58	0.876
645E	20R 3	56	612.86	8.69	14.46	651.85	45.09	1.51	2.43	0.972
645E	23R 1	22	628.62	7.55	24.96	1359.61	54.47	9.50	0.78	0.999
645E	23R 3	117	632.57	7.91	31.76	378.79	11.93	0.70	3.30	0.926
645E	24R 1	18	638.18	7.75	32.42	1212.51	37.40	3.91	9.81	0.961
645E	24R 2	17	639.67	18.53	15.12	431.05	28.51	2.19	2.00	0.966
645E	25R 1	70	648.40	18.64	12.40	309.02	24.92	1.39	1.69	0.955
645E	25R 2	121	650.41	8.08	10.88	539.21	49.54	0.91	0.46	0.992
645E	26R 1	144	658.54	19.12	12.35	359.74	29.12	1.67	1.46	0.967
645E	26R 2	120	659.80	21.05	12.83	349.07	27.20	1.79	1.51	0.964
645E	26R 3	127	661.37	17.94	13.80	451.18	32.71	1.79	1.88	0.962
645E	27R 2	145	669.65	18.95	11.87	388.62	32.75	1.53	2.19	0.946
645E	27R 3	145	671.15	18.96	12.26	465.94	38.01	3.23	5.41	0.936
645E	27R 4	2	671.22	18.68	12.58	394.24	31.35	1.77	2.28	0.952
645E	27R 6	2	674.22	20.81	13.28	262.48	19.76	1.78	0.87	0.980
645E	28R 1	134	677.74	20.81	12.98	648.91	50.00	7.51	1.22	0.993
645E	29R 2	136	688.86	8.44	14.88	377.18	25.34	1.08	7.37	0.885
645E	29R 4	67	691.17	6.12	24.63	407.06	16.53	0.91	10.03	0.865
645E	29R 6	75	694.25	8.11	13.94	491.67	35.27	1.54	3.81	0.960
645E	30R 1	116	696.76	10.01	13.81	375.75	27.22	1.08	4.30	0.920
645E	32R 3	119	713.89	8.94	18.27	368.03	20.15	1.81	7.48	0.926

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645E	32R 4	119	715.39	8.82	21.37	373.04	17.46	1.11	5.64	0.910
645E	33R 1	121	715.91	9.17	15.07	396.20	26.29	1.17	4.46	0.930
645E	33R 4	77	719.97	6.94	43.44	3338.56	76.85	23.10	38.43	0.977
645E	33R 5	92	721.62	9.05	12.49	369.39	29.57	0.87	3.60	0.925
645E	34R 1	130	725.70	8.52	14.75	401.66	27.24	0.72	1.69	0.960
645E	34R 2	130	727.20	8.71	11.54	354.24	30.70	0.61	1.28	0.964
645E	34R 3	130	728.70	7.93	15.84	339.34	21.42	0.55	1.69	0.951
645E	34R 4	40	729.30	9.51	9.25	310.83	33.61	0.62	1.12	0.966
645E	35R 2	51	736.01	9.06	11.09	362.46	32.68	0.82	2.05	0.954
645E	35R 3	110	738.10	7.27	12.10	352.86	29.17	0.49	1.21	0.964
645E	35R 4	2	738.52	7.53	11.68	402.74	34.49	0.55	1.29	0.965
645E	36R 1	111	744.81	11.97	10.50	320.63	30.55	0.79	1.30	0.960
645E	36R 2	123	746.43	13.94	11.36	306.95	27.03	0.97	1.89	0.946
645E	38R 1	28	763.28	19.64	16.89	4895.60	289.91	159.90	60.03	0.985
645E	38R 2	81	765.31	20.20	13.18	358.23	27.17	2.54	0.71	0.989
645E	38R 4	129	768.79	20.97	15.04	790.73	52.59	9.84	13.16	0.944
645E	39R 5	74	779.44	20.70	40.54	808.57	19.94	11.73	3.91	0.986
645E	40R 1	28	782.58	20.39	11.83	340.41	28.78	1.90	2.43	0.948
645E	40R 3	53	785.83	21.52	10.92	285.76	26.18	1.67	0.59	0.985
645E	41R 1	14	792.14	18.15	10.04	246.34	24.54	1.20	1.28	0.961
645E	41R 1	138	793.38	9.72	18.09	333.33	18.42	0.69	1.78	0.950
645E	41R 2	37	793.87	21.67	10.96	291.78	26.63	1.94	1.37	0.970
645E	41R 5	113	799.13	21.36	10.12	263.84	26.08	1.55	1.15	0.968
645E	42R 2	54	803.64	9.34	16.14	323.35	20.03	0.69	0.89	0.976
645E	42R 3	35	804.95	8.06	12.47	273.70	21.95	0.54	1.09	0.968
645E	42R 5	131	808.91	7.86	148.64	9690.79	65.19	136.05	71.88	0.992
645E	43R 1	114	812.34	20.85	9.28	251.08	27.06	1.43	2.07	0.940
645E	43R 2	79	813.49	21.29	10.03	278.34	27.75	1.66	2.57	0.934
645E	43R 3	97	815.17	18.19	12.43	554.17	44.58	5.64	1.63	0.989
645E	43R 4	140	817.10	20.89	9.98	293.59	29.41	1.57	1.64	0.957
645E	43R 5	109	818.29	20.15	11.04	307.06	27.82	1.87	3.10	0.933
645E	43R 6	40	819.10	21.51	15.65	1264.22	80.77	21.63	1.04	0.998
645E	44R 1	145	822.25	7.94	11.08	381.00	34.40	0.71	1.48	0.967
645E	44R 2	147	823.77	7.38	11.92	336.37	28.23	0.60	1.16	0.971
645E	44R 3	135	825.15	8.71	14.42	467.61	32.42	1.30	1.10	0.985
645E	44R 5	113	827.93	9.38	10.71	304.70	28.44	0.69	1.39	0.962
645E	44R 6	110	829.40	9.30	9.46	280.43	29.66	0.61	1.20	0.963
645E	45R 1	131	831.81	9.33	13.46	302.69	22.48	0.63	1.20	0.965
645E	45R 2	131	833.31	7.84	9.61	274.17	28.52	0.51	1.06	0.967
645E	45R 3	131	834.81	8.72	10.08	324.59	32.19	0.61	1.46	0.959
645E	45R 5	75	837.25	7.64	9.87	274.77	27.85	0.44	1.18	0.959
645E	46R 1	127	841.37	7.89	11.15	360.01	32.30	0.66	1.03	0.975
645E	46R 2	127	842.87	8.65	14.52	282.77	19.47	0.56	1.29	0.960
645E	46R 3	129	844.39	7.18	21.00	463.14	22.06	0.98	0.29	0.996
645E	48R 1	134	860.74	9.00	8.38	196.26	23.43	0.39	0.94	0.957
645E	48R 2	134	862.24	9.99	12.58	263.96	20.99	0.69	0.40	0.989
645E	49R 2	144	871.54	22.74	11.21	266.45	23.76	1.62	1.36	0.962
645E	49R 5	135	875.95	7.15	1.76	4595.00	2615.20	39.59	43.15	0.984
645E	50R 2	145	881.15	21.19	30.83	259.38	8.41	1.31	1.75	0.943
645E	50R 5	5	884.25	20.21	48.36	5029.66	104.00	162.50	42.92	0.989
645E	51R 1	13	885.03	21.54	29.39	2041.66	69.46	84.28	159.78	0.918
645E	51R 2	146	887.86	4.76	10.56	439.17	41.60	0.66	1.64	0.976
645E	52R 1	94	888.84	20.45	105.66	11683.79	110.58	444.03	45.60	0.996
645E	52R 4	112	893.52	21.68	9.79	265.11	27.07	1.54	1.65	0.953
645E	52R 5	57	894.47	21.43	9.97	237.48	23.83	1.21	0.70	0.975
645E	53R 1	30	897.90	24.27	8.85	243.75	27.54	1.43	1.65	0.944
645E	53R 3	130	901.90	14.61	9.80	267.16	27.25	0.83	0.95	0.966
645E	53R 5	135	904.95	23.92	11.40	267.27	23.45	1.37	1.68	0.941

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645E	54R 1	133	908.53	14.75	86.36	10201.43	118.12	211.24	120.01	0.983
645E	54R 2	141	910.11	20.80	48.56	5274.45	108.62	174.54	34.98	0.992
645E	54R 3	147	911.67	18.53	10.71	275.39	25.71	1.16	2.23	0.929
645E	54R 4	145	913.15	19.71	8.41	177.00	21.04	0.78	1.10	0.944
645E	55R 2	83	919.13	18.45	10.62	359.11	33.81	3.92	0.65	0.994
645E	55R 3	103	920.83	17.25	17.70	804.38	45.45	21.83	127.94	0.798
645E	55R 6	89	925.19	25.01	11.25	170.84	15.18	0.97	0.62	0.968
645E	56R 1	121	927.81	15.20	9.92	164.23	16.56	0.63	0.72	0.965
645E	56R 3	109	930.69	7.10	115.01	6275.04	54.56	62.63	38.51	0.991
645E	56R 5	140	934.00	19.32	10.73	201.97	18.82	0.86	0.83	0.963
645E	56R 6	8	934.18	23.92	9.72	192.54	19.82	0.99	0.54	0.974
645E	57R 1	49	936.69	23.39	10.90	254.80	23.37	1.41	1.56	0.949
645E	57R 2	78	938.48	20.21	11.44	252.06	22.04	1.30	1.71	0.947
645E	57R 3	93	940.13	17.99	9.57	233.45	24.40	1.06	1.73	0.941
645E	57R 4	12	940.82	19.78	9.97	266.25	26.70	1.25	2.34	0.926
645E	57R 5	122	943.42	16.21	9.61	208.09	21.65	0.84	0.71	0.973
645E	57R 6	87	944.57	21.99	9.37	219.55	23.43	1.14	0.33	0.987
645E	58R 1	16	946.06	13.45	33.35	3301.64	99.01	53.35	77.89	0.961
645E	58R 3	146	950.36	12.32	10.81	253.50	23.45	0.65	1.45	0.945
645E	58R 4	116	951.56	20.59	10.56	230.51	21.84	1.06	0.30	0.988
645E	58R 5	134	953.24	21.25	9.70	238.60	24.61	1.16	0.85	0.969
645E	59R 1	124	956.84	17.43	10.88	205.63	18.89	0.77	0.11	0.995
645E	59R 2	115	958.25	19.33	9.16	237.80	25.95	1.03	1.41	0.947
645E	59R 3	130	959.90	18.84	9.60	217.72	22.67	0.97	1.33	0.948
645E	59R 4	88	960.98	17.87	9.77	228.48	23.38	0.96	1.97	0.927
645E	59R 5	93	962.53	19.08	9.74	184.03	18.89	0.69	0.23	0.987
645E	59R 6	97	964.07	19.12	9.72	174.97	17.99	0.73	0.86	0.955
645E	60R 1	54	965.84	16.40	10.42	205.83	19.76	0.73	1.10	0.950
645E	60R 4	36	970.16	18.35	10.41	226.68	21.78	0.90	1.12	0.954
645E	60R 5	34	971.64	18.35	9.58	166.84	17.41	0.65	0.19	0.989
645E	61R 1	108	975.98	17.89	20.43	1676.00	82.02	34.93	16.32	0.983
645E	61R 3	104	978.94	19.12	12.29	197.64	16.09	0.77	0.68	0.966
645E	61R 5	25	981.15	21.14	9.15	214.29	23.42	0.85	0.81	0.960
645E	61R 6	2	982.42	20.62	18.64	200.63	10.76	0.75	0.95	0.948
645E	62R 1	125	985.75	13.67	8.45	208.15	24.62	0.71	1.00	0.962
645E	62R 2	83	986.83	12.63	10.64	227.38	21.36	0.54	1.42	0.934
645E	62R 3	122	988.72	18.90	10.83	199.14	18.38	0.73	1.02	0.947
645E	62R 4	112	990.12	17.77	10.68	230.19	21.56	0.98	0.77	0.972
645E	62R 5	112	991.62	20.50	11.70	253.09	21.62	1.29	1.05	0.967
645E	62R 6	51	992.51	15.69	10.65	206.82	19.42	0.68	0.66	0.969
645E	63R 1	142	995.62	16.37	10.67	236.98	22.22	0.88	0.81	0.970
645E	63R 2	142	997.12	19.37	9.86	211.76	21.48	0.67	0.27	0.984
645E	63R 3	142	998.62	19.62	9.35	201.25	21.53	0.59	0.84	0.944
645E	63R 4	142	1000.12	22.81	8.48	192.77	22.73	0.85	0.97	0.948
645E	63R 5	2	1000.22	17.25	9.10	200.28	22.00	0.63	1.32	0.927
645E	63R 6	131	1003.01	18.62	9.24	172.25	18.64	0.57	0.19	0.987
645E	64R 1	140	1005.30	17.02	10.26	204.90	19.97	0.56	0.54	0.967
645E	65R 2	140	1016.50	17.96	10.56	215.86	20.44	0.82	4.59	0.800
645E	65R 3	141	1018.01	12.94	11.07	186.11	16.82	0.51	0.15	0.992
645E	65R 4	140	1019.50	18.34	9.45	158.37	16.75	0.67	0.21	0.989
645E	65R 5	40	1020.00	19.16	9.90	162.41	16.40	0.60	0.46	0.970
645E	65R 7	40	1023.00	17.54	11.67	250.75	21.48	1.16	3.32	0.900
645E	66R 4	117	1028.97	18.11	8.74	231.49	26.48	0.63	0.77	0.956
645E	67R 3	141	1037.31	15.48	10.06	198.91	19.77	0.52	0.92	0.945
645E	68R 5	23	1048.83	14.60	9.29	188.27	20.26	0.36	0.52	0.958
645E	69R 2	125	1054.95	20.33	10.20	230.00	22.56	0.60	0.14	0.991
645E	69R 6	108	1060.78	20.82	21.54	227.18	10.55	0.51	2.06	0.833
645E	71R 2	126	1073.86	17.81	7.69	243.92	31.72	0.51	0.71	0.951

Appendix (continued)

Hole	Core S	Depth (cm)	SBD (mbsf)	MASS (g)	χ $10^{-6}m^3/kg$	χ_{ARM} $10^{-6}m^3/kg$	χ_{ARM}/χ	SIRM (mA/m kg)	HIRM (mA/m kg)	S
645E	72R 2	57	1082.77	19.60	8.72	314.78	36.11	0.71	1.26	0.931
645E	73R 2	131	1093.21	21.89	10.22	313.12	30.65	0.73	0.67	0.960
645E	73R 5	77	1097.17	22.88	9.88	273.16	27.64	1.04	0.63	0.972
645E	74R 6	94	1108.24	24.07	10.28	284.82	27.70	1.00	0.31	0.985
645E	75R 1	136	1110.66	16.23	10.76	306.06	28.45	0.73	0.64	0.971
645E	76R 2	143	1121.73	16.23	8.67	252.57	29.13	1.20	2.04	0.945
645E	78R 3	136	1142.06	19.16	11.67	256.96	22.02	0.94	0.87	0.965