23. PALEOMAGNETIC STRATIGRAPHY OF SITES 1-7 (LEG 1) PRELIMINARY REPORT[1]

N. D. Opdyke, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York
and
J. D. Phillips, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts

INTRODUCTION

Recent studies of deep-sea piston cores have shown that the history of the geomagnetic field may be recorded in the remanent magnetization of sea floor sediments (Harrison and Funnell, 1964; Opdyke *et al.*, 1966; Phillips *et al.*, 1968; Hays *et al.*, 1969). The utilization of long drill cores obtained during the Deep Sea Drilling Project allows an obvious extension of these studies, provided adequate paleomagnetic sampling of the stratigraphic section is available. The purpose of this report is to assess the potential usefulness of core samples recovered during Leg 1 of the Deep Sea Drilling Project drilling in the Gulf of Mexico and western North Atlantic.

RESULTS

The shipboard sampling program provided approximately 130 vertically oriented cylindrical specimens (2.5 cm long × 2.5 cm diameter) for drill sites 1 through 7. Although absolute azimuthal orientation was not possible, the relative azimuth of specimens from the same core barrel was recorded with a fiducial mark on each specimen holder. The natural remanent magnetization (NRM) of about 100 specimens distributed throughout approximately 2000 meters of stratigraphic section was measured using a spinner magnetometer (Foster, 1966). Selected specimens were then partially demagnetized (cleaned) in an alternating magnetic field device similar to a unit described by McElhinney (1966). Progressively higher fields were applied in steps of 25 or 50 oersteds. A value of 50 oersteds was the minimum demagnetizing field which appeared to remove a significant fraction of the "soft" spurious magnetization acquired. The results of these investigations are summarized in Table 1. Figures 1 through 7 show demagnetization curves of magnetic intensity for selected specimens at each site. In Figures 8 through 14 the magnetic polarity of the specimens after 50 oersteds demagnetization and, also, the paleontologically determined geologic time scale for the respective sites are shown.

Inspection of Table 1 reveals that the NRM vector directions and intensities vary widely; somewhat less than fifty per cent of the vector inclinations lie between 30 to 65 degrees, the range which might be considered reasonable for sediments magnetized in the ambient dipole field. The specimen declinations are also greatly dispersed. The intensities range from 10^{-4} to 10^{-8} emu/gm. The general demagnetization treatment at 50 oersteds did not seem to alter significantly the intensities or inclinations. It should be noted, however, that declinations of certain specimens from the same core barrel become more uniform (Hole 3, Cores 5, 7, and 8). The vector directions appear to migrate toward a closer grouping (Figure 15).

DISCUSSION

Several criteria can be used to evaluate the reliability of the paleomagnetic measurements; the magnetic stability can be inferred by: (1) the effects of alternating field demagnetization treatment, (2) comparison of the measured vector inclinations with the inclination expected from magnetization in the ancient geomagnetic field, (3) comparing declination changes with inclination reversals within single core barrels.

Examination of the demagnetization curves (Figures 1 through 7) reveals that after a sharp initial intensity decrease, most specimens appeared to be magnetically stable as reflected by the flatness of the curves above 50 to 150 oersteds. After treatment at 200 oersteds the intensities are generally 10 to 30 per cent of the NRM values. Two specimens (Figures 1a and 2) showed uniform decrease suggesting that treatment at 200 oersteds a.c. demagnetization was insufficient to remove spurious magnetic components. Only two specimens appear to be unstable, (Figures 7a and 7c), as indicated by their erratic behavior. Whether this instability reflects intrinsic magnetic properties or results from mechanical and/or chemical disturbances associated with the drilling process is unknown.

The latitudes of Sites 1 through 7 are between 23 degrees and 30 degrees North; the magnetic inclination of sediments magnetized in an axial dipole field would be about 45 degrees. Comparison of the measured vector inclination (after 50 oersteds demagnetization) with this expected value suggests that a major portion of the

[1]L-D.G.O. Contribution No. 1332;
[1]W.H.O.I. Contribution No. 2293

TABLE 1
Summary of Magnetic Data

Hole	Core	Section	Sampled at (cm)	Depth Below Sea Floor (m)	NRM Decl.	NRM Incl.	NRM Intensity emu/gm	50 oersted Decl.	50 oersted Incl.	50 oersted Intensity emu/gm
1P	1	4	135-7	5.85	346.6	56.8	6.913×10^{-6}	355.1	48.9	6.970×10^{-6}
1P	1	5	135-7	7.35	354.7	22.1	8.937×10^{-6}	355.3	21.6	7.808×10^{-6}
1P	1	6[a]	132-4	8.8	149.2	-8.1	9.420×10^{-6}	159.7	-11.1	7.874×10^{-6}
1	1	1	6-8	151.5	165.4	41.8	1.358×10^{-5}	197.7	43.0	9.450×10^{-6}
1	1	2	6-8	153.1	267.8	33.7	2.595×10^{-5}	273.8	29.3	2.019×10^{-5}
1	1	3	6-8	154.6	17.1	14.4	3.393×10^{-5}	22.5	11.9	2.807×10^{-5}
1	1	4	7-9	156.1	240.8	-7.2	3.751×10^{-5}	241.2	-8.2	3.731×10^{-5}
1	1	5	8-10	157.6	5.6	-12.2	2.552×10^{-5}	4.4	-8.3	2.504×10^{-5}
1	1	6	5-7	159.1	352.8	-35.1	2.744×10^{-5}	354.0	-34.5	2.315×10^{-5}
1	1	7	6-8	160.5	213.6	63.2	1.761×10^{-5}	199.6	62.8	1.433×10^{-5}
1	2	1[a]	52-4	300.0	11.7	71.3		15.5	52.4	
1	2	2	3-5	301.0	97.1	-58.3	1.605×10^{-5}	95.5	-28.6	1.164×10^{-5}
1	2	3	9-11	302.6	32.5	-29.3	2.010×10^{-5}	28.0	-24.0	1.503×10^{-5}
1	3	1	8-10	455.1	281.6	-60.6	2.296×10^{-5}	279.5	-52.8	1.773×10^{-5}
1	5	1	42-4	484.4	113.3	15.5	3.038×10^{-5}	112.4	10.0	2.476×10^{-5}
1	5	2	22-4	485.7	258.0	24.4	4.377×10^{-5}	261.0	22.6	3.720×10^{-5}
1	6	1	11-13	691.1	164.8	72.1		154.1	75.8	
1	6	3	4-6	694.1	297.5	69.8	3.282×10^{-5}	310.7	61.1	2.031×10^{-5}
1	7	2	10-12	696.6	88.1	57.7	1.706×10^{-5}	86.7	49.7	1.093×10^{-5}
1	7	3	5-7	698.1	169.3	66.4	1.097×10^{-5}	199.8	66.5	4.962×10^{-6}
1	7	4	3-5	700.5	337.1	66.0	1.038×10^{-5}	334.5	57.6	4.468×10^{-6}
1	7	5	8-10	701.1	300.5	55.5	2.175×10^{-5}	302.5	53.2	1.562×10^{-5}
1	7	6	8-10	702.6	130.1	75.6	2.805×10^{-5}	163.3	85.3	1.959×10^{-5}
1	7	7	8-10	704.1	290.3	65.5	1.699×10^{-5}	295.2	60.0	1.068×10^{-5}

[a] a-c Demagnetization Cur

TABLE 1 - *Continued*

Hole	Core	Section	Sampled at (cm)	Depth Below Sea Floor (m)	NRM			50 oersted		
					Decl.	Incl.	Intensity emu/gm	Decl.	Incl.	Intensity emu/gm
2	1	3	9-11[a]	22.6	122.1	65.5	1.652×10^{-5}	89.7	68.1	1.246×10^{-5}
2	2	1	41-3	58.0	194.0	-9.1	4.427×10^{-7}	225.0	67.4	3.252×10^{-7}
2	3	2	5-7	68.2	333.4	38.0	7.540×10^{-8}	1.4	58.3	1.013×10^{-7}
2	3	3	11-13	69.8	307.3	33.9	2.384×10^{-7}	15.2	46.4	2.205×10^{-7}
2	4	1	47-9	102.0	180.4	-5.7	1.632×10^{-6}	182.4	-5.5	1.156×10^{-6}
2	4	2	14-6	103.1	143.1	-38.6	7.001×10^{-8}	221.1	-5.3	5.837×10^{-8}
3	1	1	28-30	25.3	80.5	27.0	9.621×10^{-6}	85.8	22.0	7.024×10^{-6}
3	1	2	23-5	26.7	134.0	5.7	1.483×10^{-5}	132.9	0.2	1.021×10^{-5}
3	2	1	57-9	36.3	212.2	27.1	2.012×10^{-5}	215.4	30.9	1.654×10^{-5}
3	2	2	40-2	37.6	296.3	73.6	5.431×10^{-6}	339.9	10.2	4.248×10^{-6}
3	2	3	14-6	38.8	122.1	59.4	7.834×10^{-6}	115.7	63.5	6.840×10^{-6}
3	3	2	14-6	201.9	215.6	59.1	2.819×10^{-5}	224.5	64.7	2.276×10^{-5}
3	4	1	6-8	209.8	280.6	34.3	2.020×10^{-5}	270.9	37.2	2.683×10^{-5}
3	5	1	37-9	320.4	155.4	28.9	7.084×10^{-7}	141.9	23.9	3.918×10^{-7}
3	5	2	24-6	321.7	205.1	41.2	5.995×10^{-7}	218.1	21.4	2.439×10^{-7}
3	5	3	15-7	323.2	211.6	42.5	5.138×10^{-7}	258.6	41.4	1.686×10^{-7}
3	5	4	18-20	324.7	272.4	-19.1	3.381×10^{-7}	45.0	-39.8	2.812×10^{-7}
3	5	5	26-8	326.3	288.4	76.5	6.105×10^{-7}	330.1	33.6	5.338×10^{-7}
3	6	1	61-3	330.6	182.1	33.6	3.608×10^{-7}	153.4	43.7	2.410×10^{-7}
3	6	2	11-13	331.6	220.9	52.6	4.038×10^{-7}	279.4	67.9	1.998×10^{-7}
3	7	1	32-4	381.3	231.6	-29.0	4.446×10^{-7}	227.4	-10.4	2.101×10^{-7}
3	7	2	1-3	382.5	147.2	-27.0	3.624×10^{-7}	77.4	54.6	3.091×10^{-7}
3	7	3	66-8	384.7	117.6	25.8	7.644×10^{-7}	113.3	22.8	6.346×10^{-7}
3	7	4	131-3	386.8	210.9	36.3	1.281×10^{-7}	247.7	-39.7	1.779×10^{-7}
3	8	1	101-3	430.5	317.2	-24.3	2.561×10^{-7}	353.3	-3.1	2.394×10^{-7}

[a] a-c Demagnetization Curve.

TABLE 1 - *Continued*

Hole	Core	Section	Sampled at (cm)	Depth Below Sea Floor (m)	NRM Decl.	NRM Incl.	NRM Intensity emu/gm	50 oersted Decl.	50 oersted Incl.	50 oersted Intensity emu/gm
3	8	2	14-6	431.1	282.0	1.6	5.806×10^{-7}	336.0	16.9	1.390×10^{-7}
3	8	3	11-3	432.6	224.8	-10.0	3.642×10^{-7}	237.5	-20.9	1.766×10^{-7}
3	8	4	15-7	434.2	104.7	44.0	3.742×10^{-7}	100.3	26.1	3.412×10^{-7}
3	8	5	13-5	435.6	54.7	-39.9	9.208×10^{-7}	45.9	-34.8	7.147×10^{-7}
3	8	6	44-6[a]	437.4	138.9	66.4	9.586×10^{-7}	319.3	50.8	5.504×10^{-7}
3	9	2	15-17	535.7	47.2	42.1	3.294×10^{-7}	26.5	46.2	2.677×10^{-7}
3	9	3	10-12	537.1	79.1	56.4	6.282×10^{-7}	81.2	42.3	2.331×10^{-7}
3	9	4	8-10	538.6	164.6	54.8	1.149×10^{-6}	191.3	4.8	4.487×10^{-7}
3	9	6	18-20	541.7	197.4	36.3	6.137×10^{-7}	109.6	36.4	2.491×10^{-7}
3	9	7	14-16	543.1	207.7	23.1	1.630×10^{-7}	153.4	36.6	1.167×10^{-7}
3	10	2	9-11	611.2	1.7	56.4	1.706×10^{-6}	12.2	52.8	9.100×10^{-7}
4	1	2	100-2	2.5	196.6	2.3	1.985×10^{-5}	200.2	82.1	7.739×10^{-5}
4	1	5	50-1	6.5	133.4	71.4	3.551×10^{-5}	102.3	72.8	2.741×10^{-5}
4	2	1	107-9[a]	105.3	183.2	18.0	2.124×10^{-5}	181.1	28.8	7.252×10^{-6}
4	3	1	6-8	133.9	201.4	36.1	4.228×10^{-7}	235.8	52.1	2.011×10^{-7}
4	4	1	74-6	191.5	40.2	13.2	3.394×10^{-7}	57.2	10.2	3.281×10^{-7}
4A	1	3	2-4[a]	75.8	191.5	25.1	6.274×10^{-6}	224.5	55.1	1.812×10^{-6}
5	1	2	60-2	2.1	322.0	-68.3	2.594×10^{-7}	253.1	-63.7	1.176×10^{-7}
5	1	3	16-8	3.2	116.5	30.8	1.579×10^{-7}	78.1	-22.3	2.123×10^{-7}
5	2	1	85-7[a]	32.0	200.3	21.7	8.119×10^{-6}	12.8	-24.3	3.686×10^{-6}
5	3	1	60-2[a]	71.6	270.5	46.9	1.674×10^{-5}	272.6	41.0	1.235×10^{-5}
6	1	1	24-6	41.1	149.0	37.8	2.202×10^{-5}	111.1	44.2	9.363×10^{-6}
6	1	2	24-6[a]	42.5	330.4	62.8	1.118×10^{-5}	342.6	74.6	6.053×10^{-6}
6	1	4	7-9	45.4	216.8	22.2	2.063×10^{-5}	15.3	61.9	6.964×10^{-6}

[a]a-c Demagnetization Curves.

TABLE 1 - *Continued*

					NRM			50 oersted		
Hole	Core	Section	Sampled at (cm)	Depth Below Sea Floor (m)	Decl.	Incl.	Intensity emu/gm	Decl.	Incl.	Intensity emu/gm
6	2	1	44-6	152.5	55.9	-0.9	3.994×10^{-5}	43.3	8.7	2.803×10^{-5}
6	2	2	20-2	153.8	308.4	77.1	1.414×10^{-5}	332.2	59.8	1.275×10^{-5}
6	2	3	11-13	155.2	56.0	23.7	3.472×10^{-5}	44.1	20.9	3.068×10^{-5}
6	2	4	16-18	156.8	296.9	20.7	2.801×10^{-5}	307.6	18.9	1.585×10^{-5}
6	2	5	25-7	158.4	294.7	74.9	1.878×10^{-5}	293.0	79.3	1.337×10^{-5}
6	2	6	14-6	159.7	226.7	55.3	3.567×10^{-5}	238.4	65.6	2.053×10^{-5}
6	3	3	51-3	194.0	26.5	60.7	6.224×10^{-8}	349.7	11.1	1.405×10^{-7}
6	3	4	8-10	195.1	15.9	-0.8	9.963×10^{-8}	339.8	-3.4	1.281×10^{-7}
6	4	1	29-30	229.5	68.3	15.9	1.430×10^{-7}	348.6	-68.5	1.768×10^{-7}
6	4	2	10-12	230.8	169.6	60.7	1.627×10^{-7}	344.6	76.2	2.486×10^{-7}
6	4	3	94-6	233.1	167.5	47.1	2.772×10^{-7}	133.3	38.9	3.082×10^{-7}
6	5	1	13-15	246.7	154.4	49.8	5.381×10^{-7}	171.3	52.3	5.401×10^{-7}
6	5	2	20-2	248.3	173.1	11.2	3.453×10^{-7}	138.0	77.3	8.266×10^{-8}
6	6	2	3-5	250.5	242.8	71.3	2.094×10^{-7}	345.9	63.0	1.387×10^{-7}
6A	1	1	33-35[a]	15.5	216.4	61.1	1.539×10^{-5}	317.6	62.5	8.761×10^{-6}
6A	1	4	29-31	20.0	276.0	54.5	4.322×10^{-5}	305.3	54.1	3.266×10^{-5}
6A	1	6	18-20	22.9	177.6	45.5	1.952×10^{-5}	165.0	50.2	1.140×10^{-5}
7	1	3	12-14	3.1	241.6	71.4	1.518×10^{-5}	146.3	89.3	1.455×10^{-5}
7	1	4	14-16[a]	4.6	221.6	74.0	4.774×10^{-5}	298.0	74.7	3.092×10^{-5}
7	1	6	19-21	7.7	122.2	69.6	2.026×10^{-5}	56.3	75.8	1.603×10^{-5}
7A	2	2	21-3[a]	279.7	31.4	59.7	4.156×10^{-5}	17.5	9.3	8.685×10^{-6}
7A	3	1	30-2[a]	287.4	153.1	72.7	3.061×10^{-5}	151.8	-14.3	2.058×10^{-5}
7A	3	2	12-14[a]	288.7	95.9	72.9	2.617×10^{-4}	82.7	51.4	5.832×10^{-5}

[a] a-c Demagnetization Curves.

specimens possess magnetization which reflects the ancient geomagnetic field. At Holes 1, 3, 5 and 6 fifty per cent or more of the demagnetized specimens had normal and reversed vector inclinations in the range 30 degrees to 65 degrees. Undoubtedly many specimens still possess a strong spurious component which contributes to the scattered vector directions. Demagnetization treatment at higher field strength may further reduce the dispersion. In spite of the high vector dispersion, reversals of inclination in certain specimens of Holes 1 and 3 appear to be accompanied by expected declination changes. That is, several specimens taken from the same cores (Hole 1, Core 1; Hole 3, Section 5; and Hole 3, Section 7) show inclination reversals matched by 120 degrees to 180 degrees declination reversal.

Although the changes measured in Site 3 probably reflect geomagnetic field polarity reversals, it is extremely doubtful that the magnetic stratigraphy of this site or any of the sites can be used independently to date the sediments due to the paucity of data. For example, Figure 16 shows a comparison of the polarity intervals of Site 3 with the known paleomagnetic stratigraphy for the geologic time period believed represented by the sediments. The modified geomagnetic time scale of Cox *et al.* (1968) has been calibrated with the geologic time scale by utilizing the glacial turbidite calcilutite datum (0.7 million years ago) and the *Globoquadrina altispira* extinction datum (2.8 million years ago) proposed by Berggren for Site 3. Clearly, there is not a sufficient number of specimens to establish a recognizable polarity sequence which can be correlated directly with the geomagnetic polarity time scale. This results primarily from inadequate core recovery and from the fact that the sampling interval within each core is too large to insure detection of significant polarity changes. For example, the Jaramillo and Olduvai events probably occupy only 1.2 to 3.6 meters of core length based on the 6 cm/1000 years sedimentation rate proposed by Berggren for the period 0.7 to 2.8 million years ago at Site 3. It is likely that the 1-2 meter sampling interval currently employed is inadequate to delineate these events even in a core which spanned the entire event. However, it should be noted that, in another part of this volume, Berggren has speculated on the age of certain polarity intervals in Hole 3 by analyzing the paleomagnetic data with the faunal information. He finds reasonable agreement between the observed polarity sequence and geomagnetic time scale and that which he has inferred from "absolute" dating of faunal zones.

Another important observation which can be interpreted to indicate magnetic stability of the core material is that many reversals of inclination are found. Of course, it is also possible that these apparent reversals and wide vector dispersions result from partial remagnetization of the specimens during shipboard and laboratory processing. It should be noted that reversed inclinations were not observed in any specimens recovered from depths greater than 500 meters below the sea floor. The magnetic vectors appear to be inclined steeply downward even after 50 oersted demagnetization. This suggests that the deeper and older core material has acquired a relatively large component of stable secondary magnetization in the present earth's field. Subsequent processing does not appear to change these vector directions. The magnetization of the upper part of the cores may not be nearly so stable. Significant secondary magnetization acquired either in the laboratory or on the sea floor probably contributes to the wide NRM vector dispersion. This secondary magnetization may not be completely removed by the relatively weak 50 oersted demagnetization field.

The usefulness of this core material for studies of secular variation and paleo-intensity changes cannot be presently evaluated. The density of sampling within each core has not been sufficient to allow detection of smooth intensity variations which might be expected from such long-term effects. However, further laboratory sampling and analyses could prove effective.

It should be noted that in some cases, in particular at Site 1, the sediments have been folded and contorted. It is likely that paleomagnetic results from these holes are badly disturbed and the paleomagnetic results should be used with caution.

CONCLUSIONS

Preliminary analyses of specimens provided by the shipboard sampling program show that: (1) Much of the core material is potentially useful for paleomagnetic purposes. The drill coring and specimen preparation techniques proposed by Opdyke and Phillips appear to be satisfactory. (2) Wide dispersion of the remanent magnetic vector directions accompanied by inadequate density of sampling at all sites does not allow direct application of the paleomagnetic reversal dating techniques or studies of ancient geomagnetic field behavior. More detailed laboratory sampling and demagnetization analysis will be required.

REFERENCES

Cox, A., Doell, R. and Dalrymple, G.B., 1968. Radiometric time-scale for geomagnetic reversals. *Quart. J. Geol. Soc. London.* **124**, 53.

Foster, J.H., 1966. Paleomagnetic Spinner magnetometer using a fluxgate gradiometer. *Earth and Planetary Science Letters.* **1**, 463.

Harrison, C.G.A. and Funnell, B.M., 1964. Relationship of paleomagnetic reversals and micropaleontology on two late Cenozoic cores from the Pacific Ocean. *Nature.* **204**, 566.

Hays, J.D., Saito, T., Opdyke, N.D., and Burckle, L.H., 1969. Pleiocene-Pleistocene sediments of the equatorial Pacific—their paleomagnetic, biostratigraphic and climatic record. *Geol. Soc. Am. Spec. Papers,* (in press).

McElhinney, M.W., 1966. An improved method for demagnetizing rocks in alternating magnetic fields. *Geophys. J.* **10**, 369.

Opdyke, N.D., Glass, B., Hays, J.D., and Foster, J. H., 1966. Paleomagnetic study of Antarctic deep-sea cores. *Science.* **154**, 349.

Phillips, J.D., Berggren, W.A., Bertels, A., and Wall, D., 1967. Paleomagnetic stratigraphy and micropaleontology of three deep sea cores from the central North Atlantic Ocean. *Earth and Planetary Science Letters.* **4**, 118.

Figures 1 through 7: Demagnetization curves for samples from Holes 1 through 7.

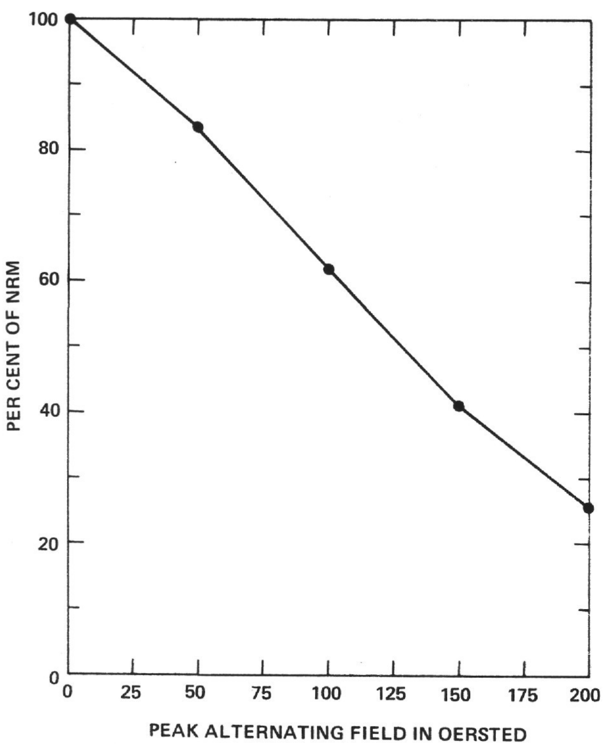

Figure 1a. *1-1P-1-6, depth 132-134 cm.*

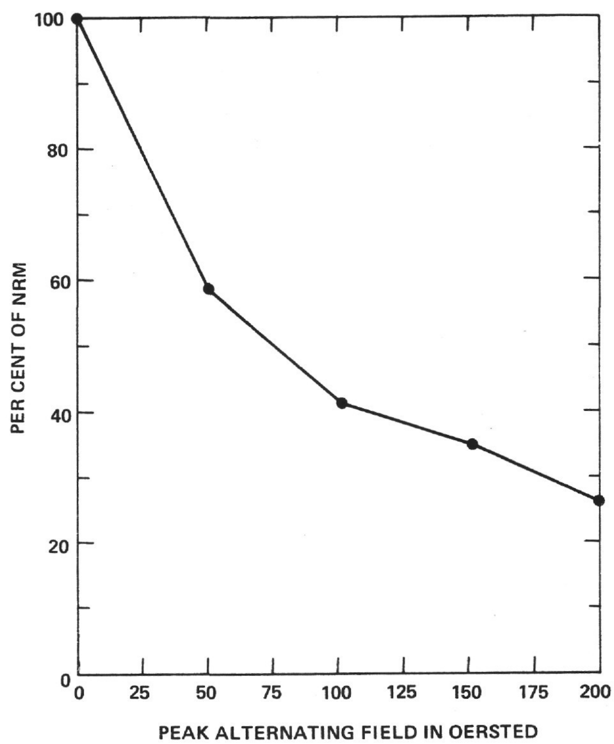

Figure 1b. *1-1-2-1, depth 52-54 cm.*

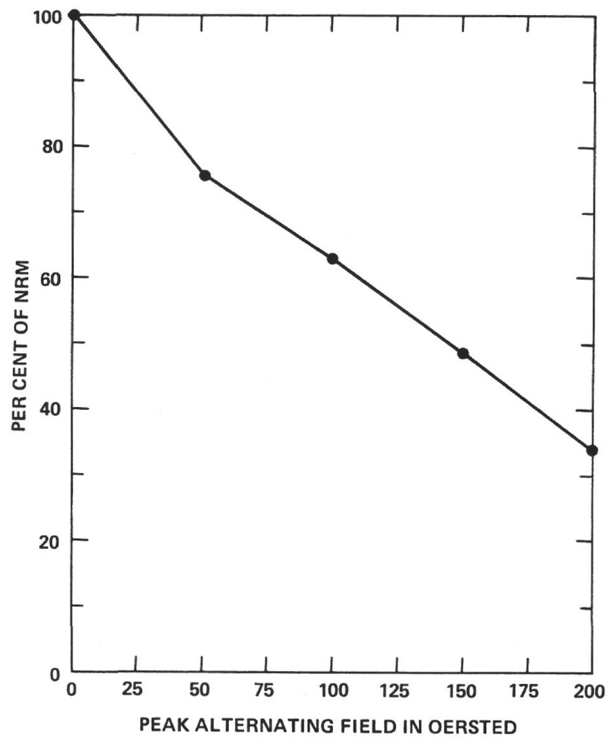

Figure 2. *1-2-1-3, depth 9-11 cm.*

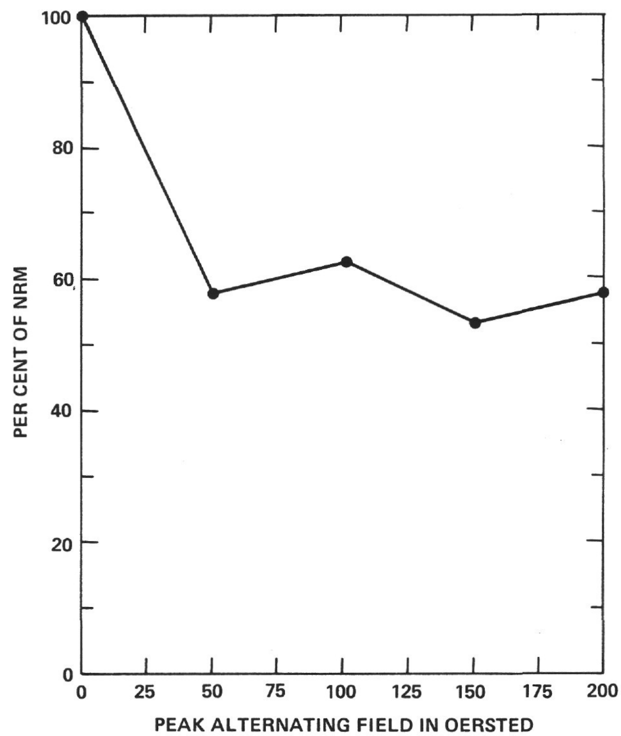

Figure 3. *1-3-8-6, depth 44-46 cm.*

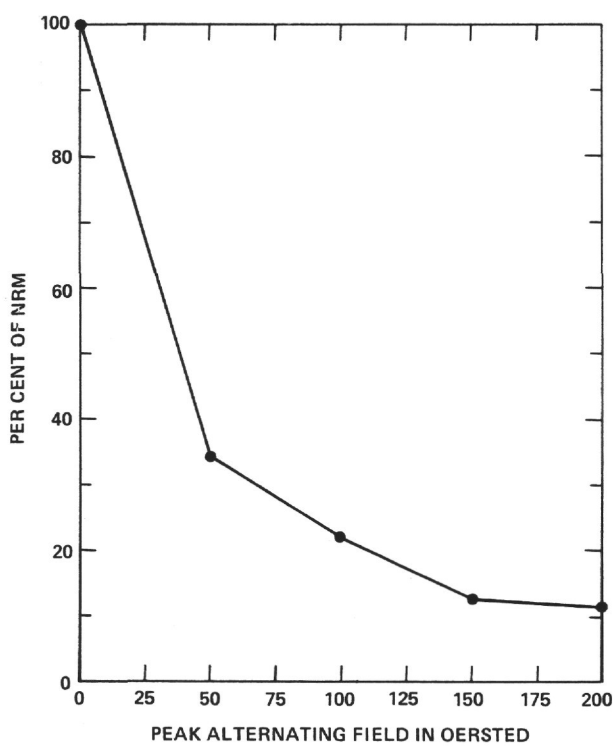

Figure 4a. *1-4-2-1, depth 107-109 cm.*

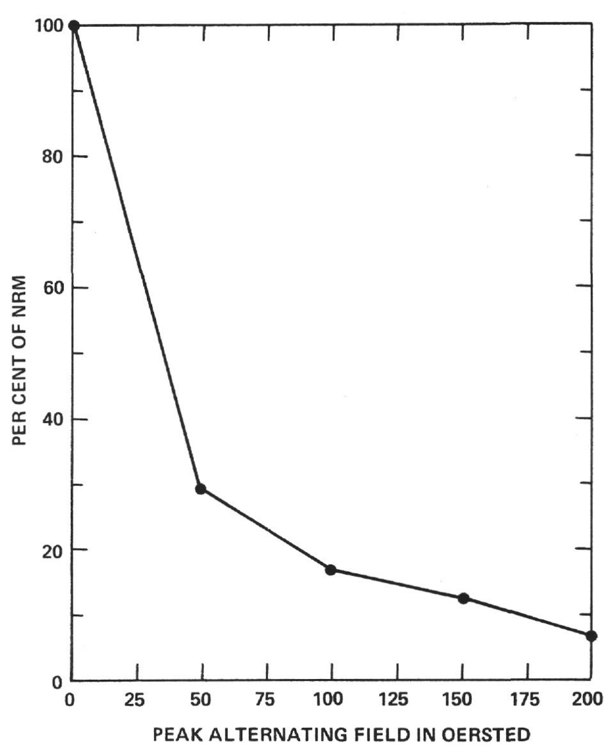

Figure 4b. *1-4A-1-3, depth 2-4 cm.*

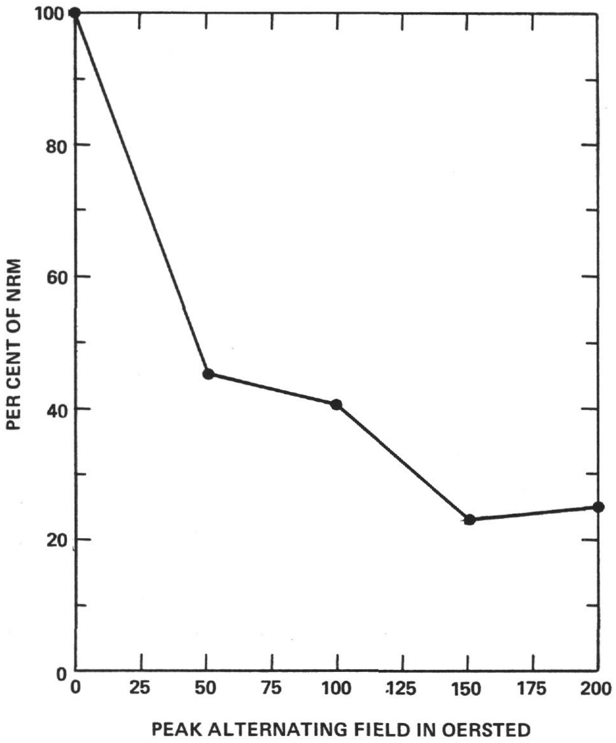

Figure 5a. *1-5-2-01, depth 85-87 cm.*

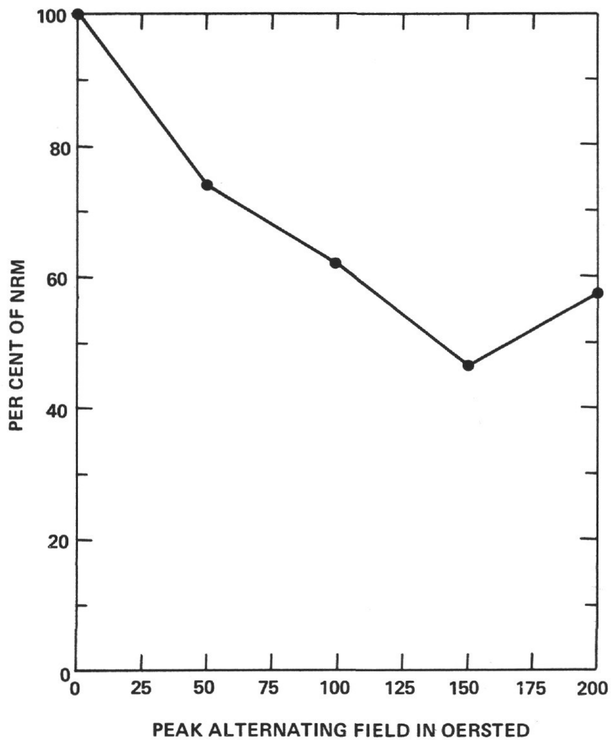

Figure 5b. *1-5-3-01, depth 60-62 cm.*

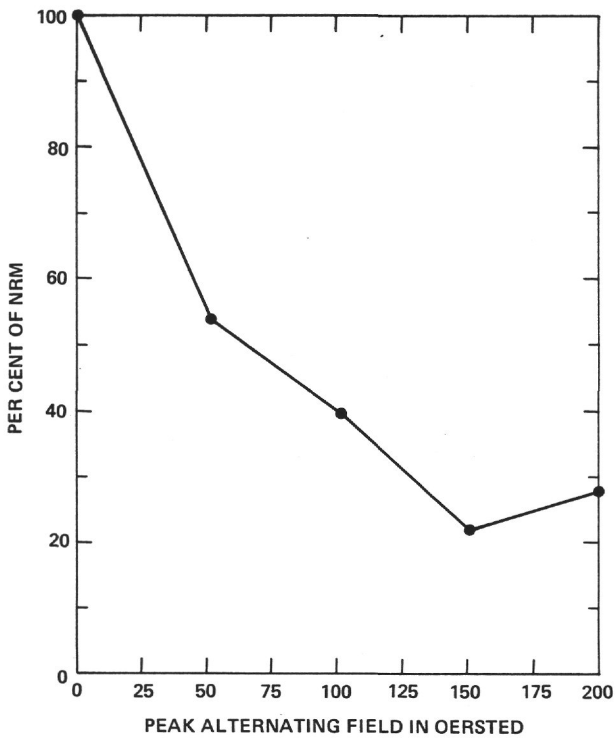

Figure 6a. *1-6-1-02, depth 24-26 cm.*

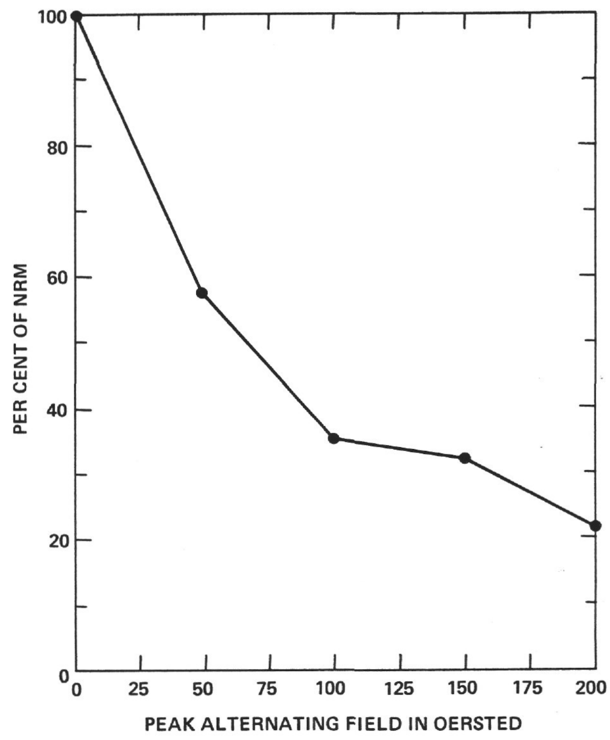

Figure 6b. *1-6A-1-1, depth 33-35 cm.*

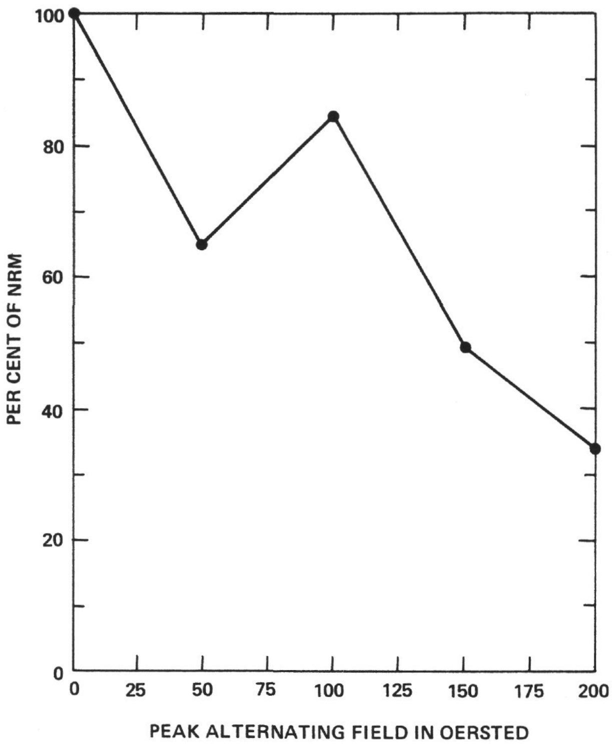

Figure 7a. *1-7-1-4, depth 14-16 cm.*

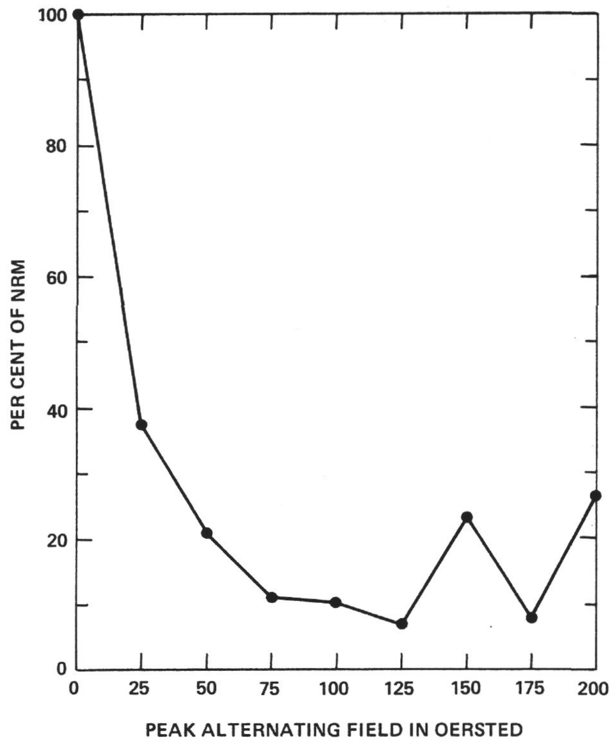

Figure 7b. *1-7A-2-2, depth 21-23 cm.*

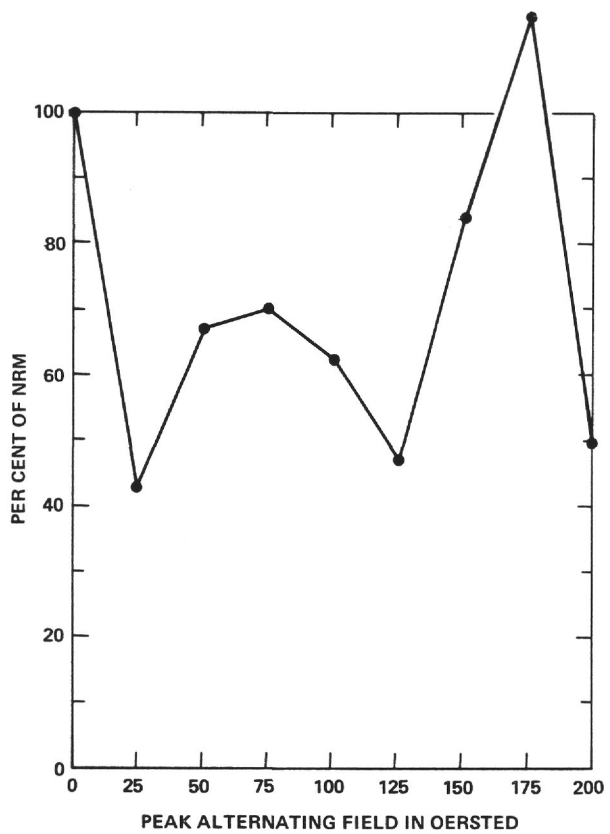

Figure 7c. *1-7A-3-1, depth 30 cm.*

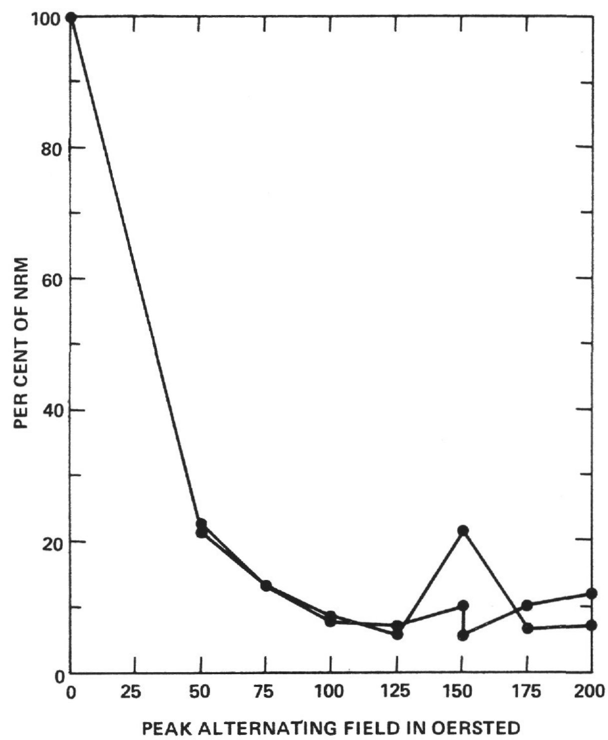

Figure 7d. *1-7A-3-2, depth 12-14 cm.*

Figures 8 through 14: Paleomagnetic reversal stratigraphy for Holes 1 through 7.

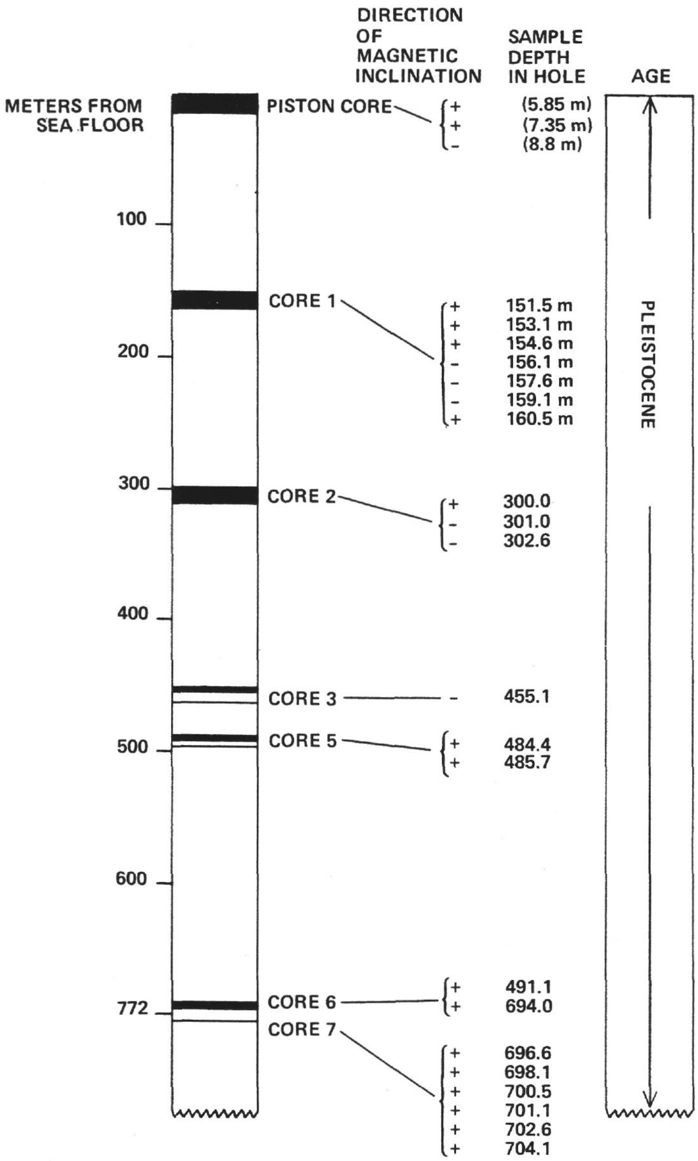

Figure 8. *Hole 1.*

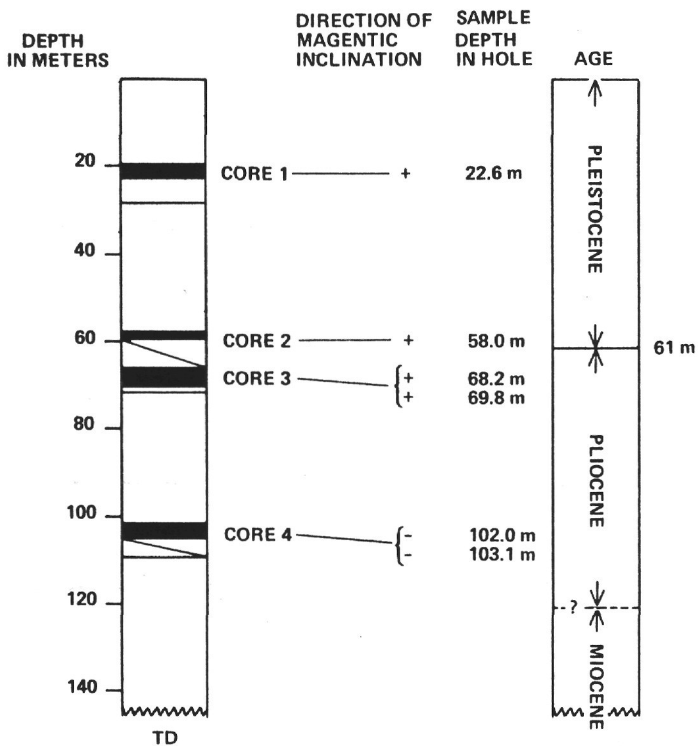

Figure 9. *Hole 2.*

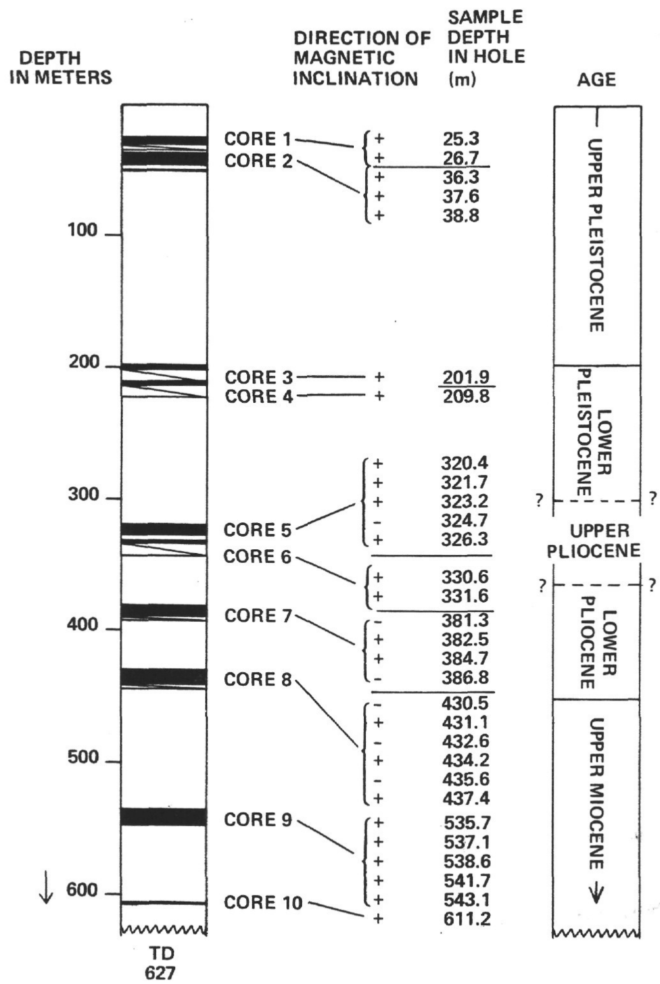

Figure 10. *Hole 3.*

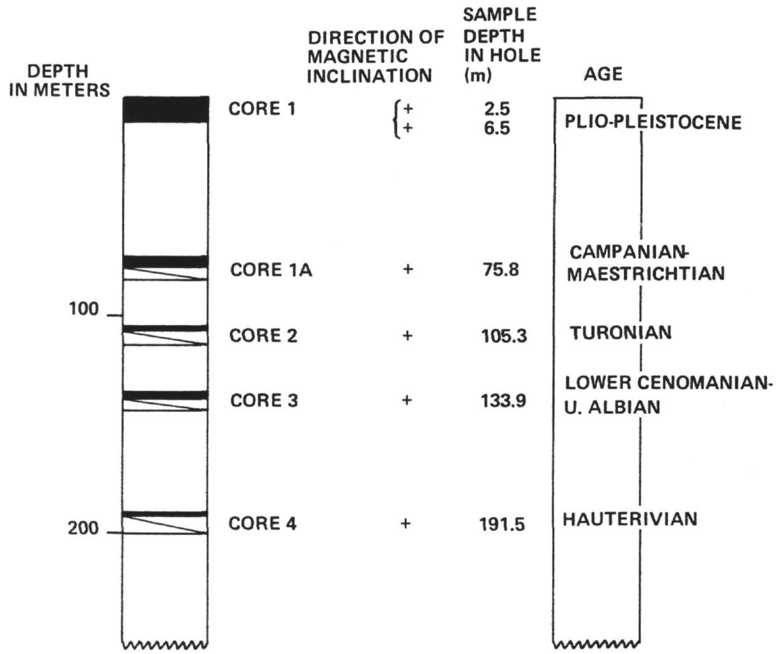

Figure 11. *Holes 4 and 4A.*

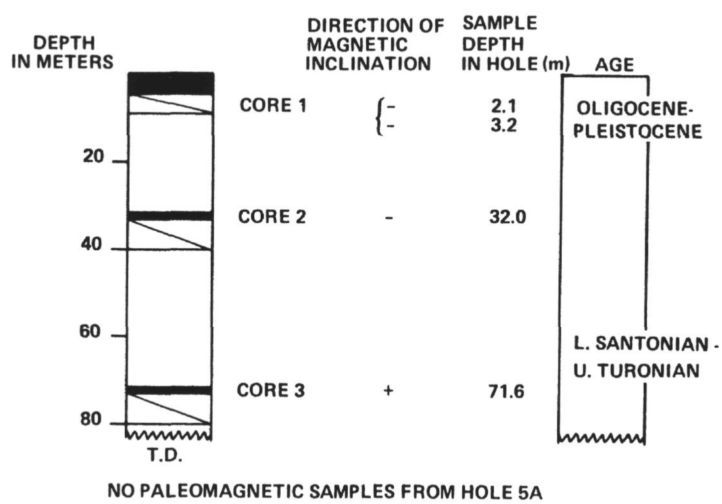

Figure 12. *Hole 5.*

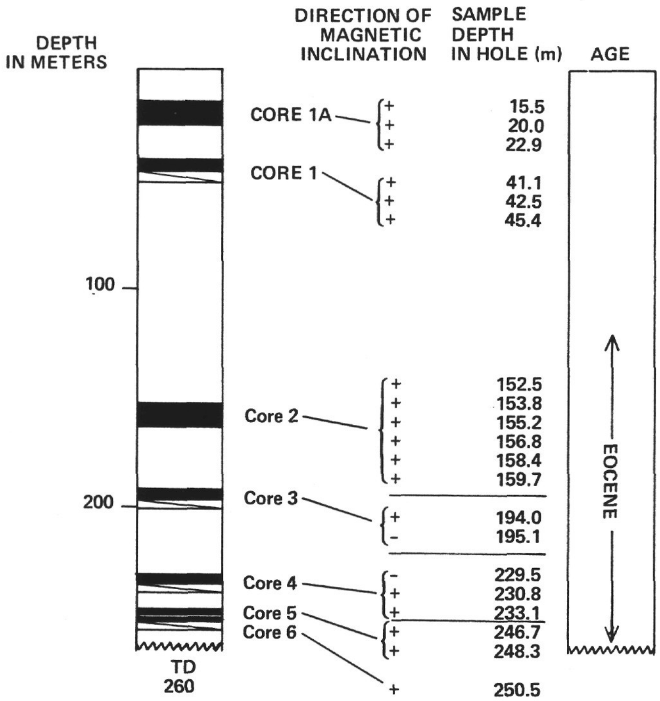

Figure 13. *Holes 6 and 6A.*

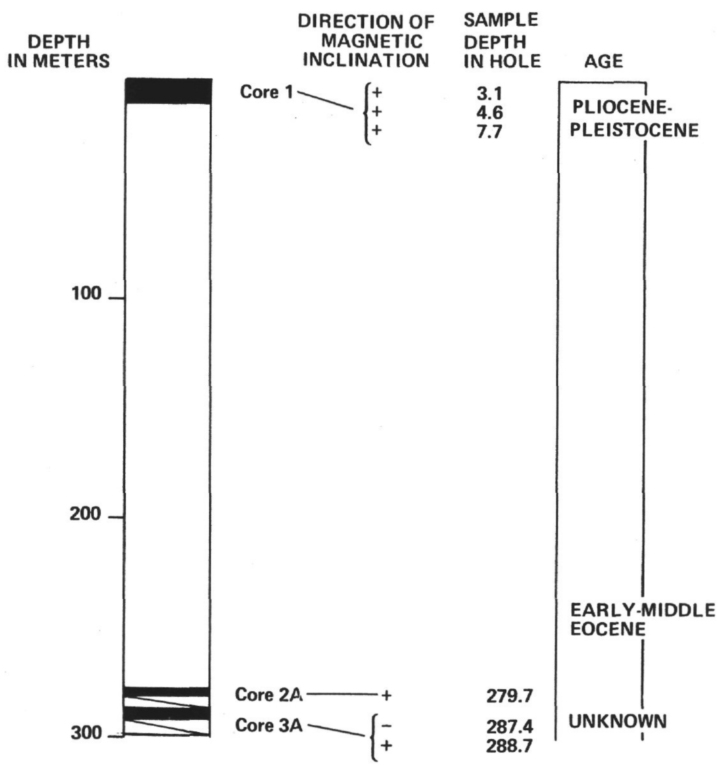

Figure 14. *Holes 7 and 7A.*

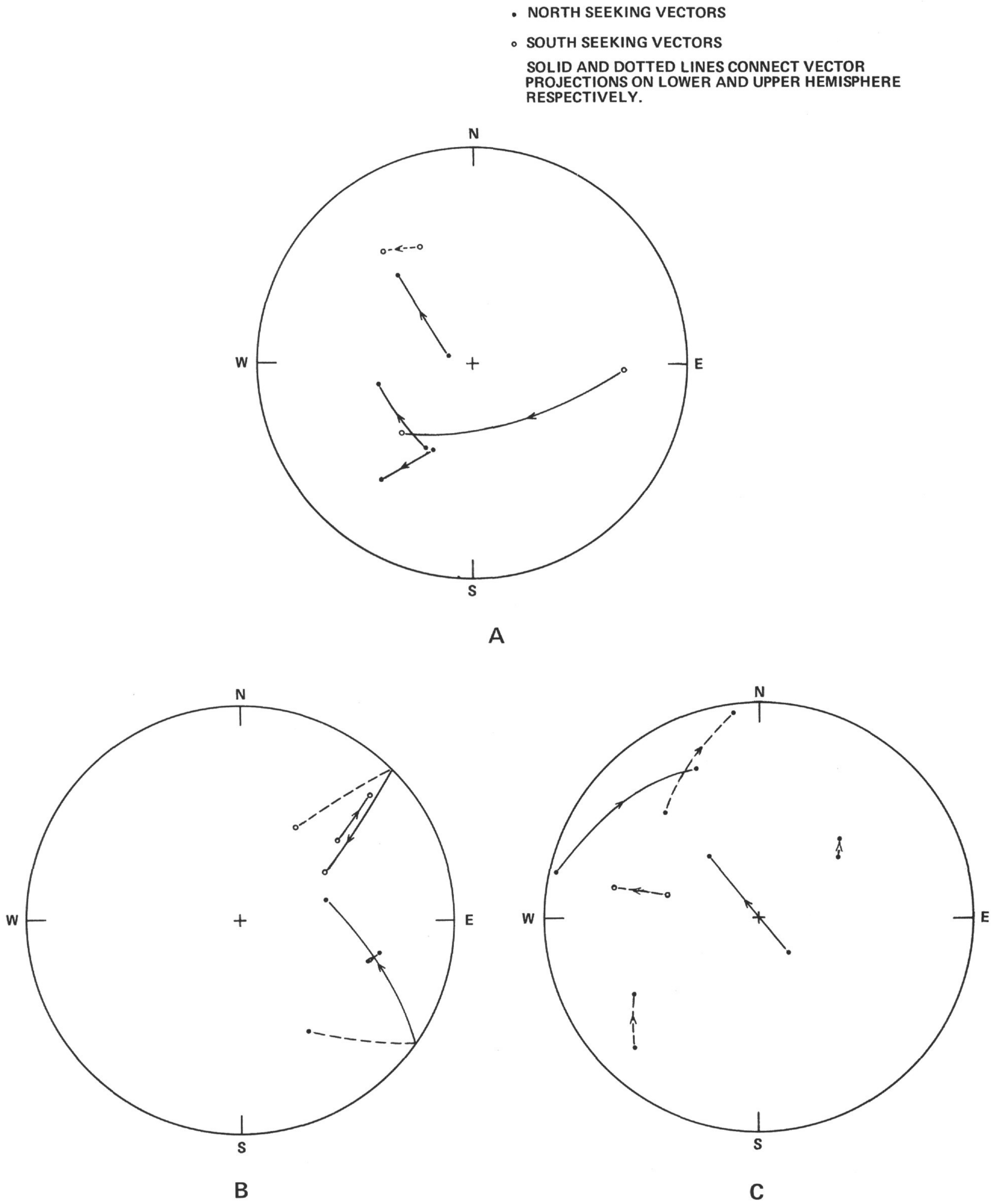

Figure 15. *Stereographic projections showing change of magnetic vectors after 50 oersted demagnetization treatment. The arrow directions indicate vector change after treatment.*

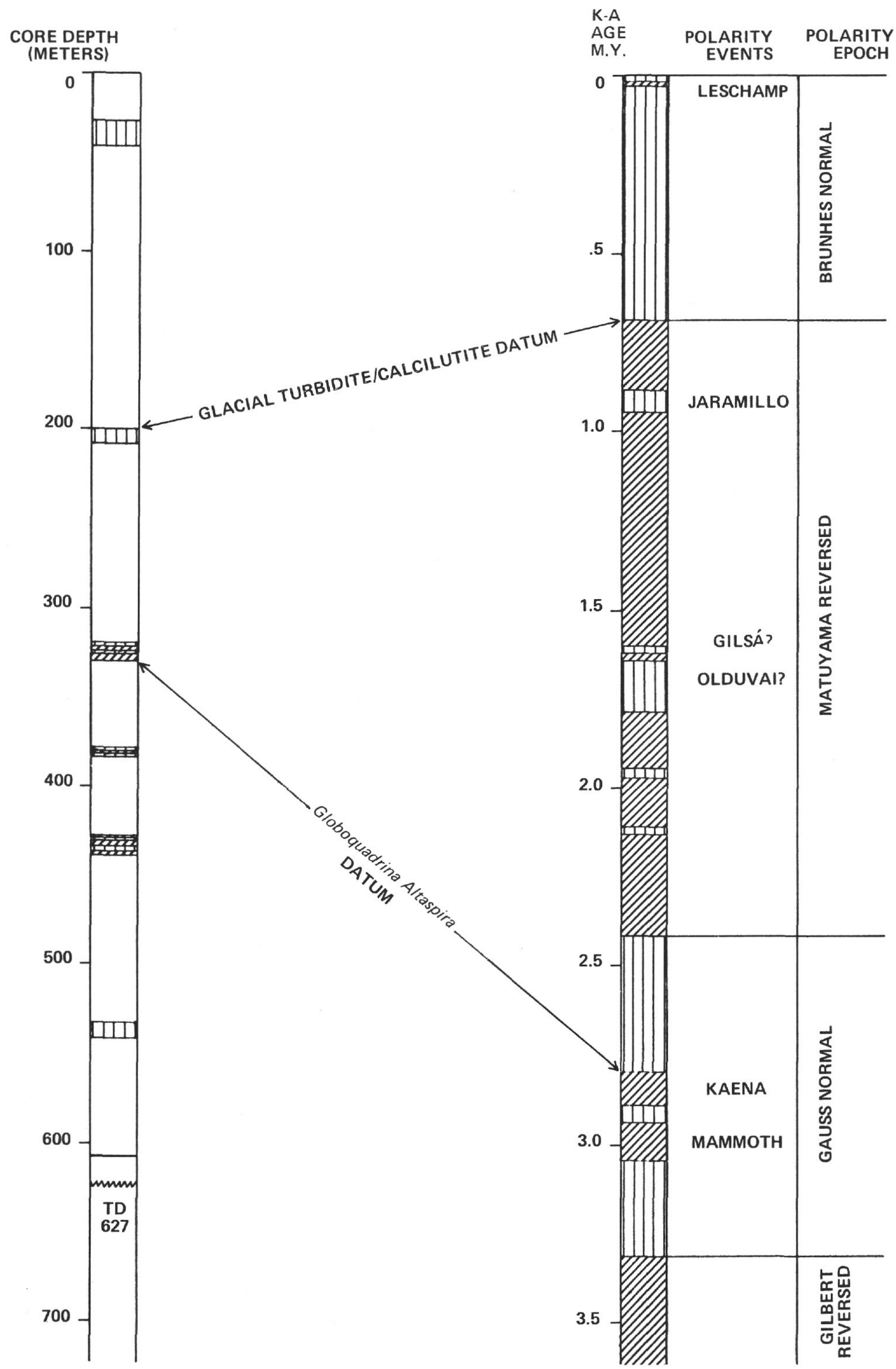

Figure 16. *Comparison of magnetic stratigraphy at Hole 3 (left) with the geomagnetic reversal time-scale of Cox (1969). The diagonal and vertical shading indicates normal and reversal magnetic polarity respectively. The open bars down the core length show sections where there are no specimens.*