Wilkens, R.H., Firth, J., Bender, J., et al., 1993
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3. PALEOMAGNETIC RESULTS FROM LEG 136[1]

Charles E. Helsley[2]

ABSTRACT

Paleomagnetic studies on sediments recovered during Leg 136 have yielded a polarity reversal sequence that can be compared with the global magnetic reversal time scale to establish a sedimentation rate for Hole 842B. This sedimentation rate is substantially higher than that normally observed in the central Pacific basin probably as a result of the contribution of volcanic ash to the normal pelagic sources of sediment. The basalt samples from the oceanic crust at Site 843 have been used to determine a paleolatitude of 10.2°S for the 110±2 m.y.-old crust from this site. Detailed studies of the polarity transitions yielded few intermediate directions, but these few records provide support for the "Americas" transitional path observed at other continental and marine sites in Europe and North America.

INTRODUCTION

Although the primary goal of Ocean Drilling Program (ODP) Leg 136 was to drill a hole into which an ocean sub-bottom seismographic station could be emplaced at a future date as part of the global Ocean Seismic Network (OSN) program (see Dziewonski, Wilkens, Firth, et al. [1992] for additional detail), the sediment and basement cores collected at Sites 842 and 843 provide an exceptional opportunity for the study of the paleomagnetism of the central portion of the Pacific plate. Moreover, the general drilling location, downwind of the Hawaiian Islands, raised possibilities that we might find a high sedimentation rate environment from which a record of the behavior of the Earth's magnetic field during the last five transitions of polarity could be determined. Previous conventional piston core material from a nearby location (Herrero-Bervera and Theyer, 1986) gave encouragement in this regard. This is the first ODP site to be drilled on Cretaceous crust in the central Pacific Ocean. The extensive coring of the basaltic crust that was to be part of the OSN objective for this leg provided an opportunity to recover a paleolatitude record for the Cretaceous long normal interval that would help to constrain the older portion of the polar wander curve for the Pacific plate (Cox and Gordon, 1984; Sager, 1983; Sager and Pringle, 1988; Sager, 1992). Finally, due to the large drilling-induced magnetism acquired by most of the sediment samples (see "Site 842" chapter in Dziewonski, Wilkens, Firth, et al. [1992] for details), it was necessary to conduct laboratory demagnetization experiments to confirm and further refine the magnetostratigraphy of the portion of the sedimentary section cored with an advanced piston corer (APC). Each of these objectives was addressed but only the last two contributed substantial new information.

The location of the two sites, about 140 miles southwest of Honolulu, Hawaii, was chosen primarily for logistical reasons constrained primarily by the need to be on normal oceanic crust at a site that was convenient to a logistics base. To minimize drilling time to reach the basement objectives, a site was chosen on the Hawaiian swell rather than in the more thickly sedimented moat that surrounds the Hawaiian Islands. The preliminary results from these cores are reported in Dziewonski, Wilkens, Firth, et al. (1992), and the initial shipboard paleomagnetic results made by C. Helsley and J. Briden are reported in the "Site 842" and "Site 843" chapters of that volume.

SAMPLING AND METHODOLOGY

Samples of three types were taken aboard the *JOIDES Resolution* for subsequent shore-based laboratory work. These consisted of: (1) normal 6-cm^3 ODP cubical samples taken at approximately 20-cm intervals throughout the APC-cored portion of the hole, (2) cubical and cylindrical samples cut from pieces of the basement samples, and (3) minicubes—1-cm^3 cubical samples—taken from the portions of the core where the continuous record from the ODP shipboard magnetometer indicated that transitional records might be obtained. The minicube samples generally extended 25 to 40 cm on either side of the polarity boundary with an overlapping second set, offset by 0.5 cm, taken in the 10-cm interval on either side of the presumed polarity boundary. All samples were labeled with an "up" arrow, and care was taken to minimize disturbance of the sediment during the sampling of the core.

Basement samples were initially taken by cutting 2.54-cm diameter cores from the larger pieces of basalt recovered during the coring of basement material. These core samples were augmented by collecting the 2-cm cubical samples originally cut for physical property studies. Upon return to the laboratory in Honolulu, all samples were stored in a magnetic field-free (less than 0.5 nT) room for several months and then measured for remanence on a SCT cryogenic magnetometer. The samples were then progressively demagnetized using a Schoenstedt AC demagnetization unit modified to incorporate a three-axis tumbler to maximum fields of 40 to 50 mT.

Upon completion of the demagnetization experiments, all the sediment samples were given an anhysteretic remanent magnetization (ARM) in a 0.5 mT DC field using an applied alternating field of 50 mT. After the ARM measurement, all sediment samples were given a saturation isothermal remanent magnetization (SIRM) with peak applied fields of 1.38 T generated by an impulse magnetization unit. Selected samples were also given a progressive SIRM in the same unit, as discussed later.

LITHOLOGY

The sediments sampled for this work are described in the *Initial Reports* volume (Dziewonski, Wilkens, Firth, et al., 1992). At the top of the cores the samples are dark brown clayey silts and silty clays with variable amounts of volcanic ash. The sediments become progressively darker with depth and below about 20 mbsf become dark reddish brown in color. Authigenic phillipsite is present throughout the section. The degree of alteration of the volcanic ash component increases with depth, and below 25 m the cores consist of dark reddish clays with rare faint wavy laminations of light brown clay.

The basement samples are aphyric basalts with rare phenocrysts of plagioclase or xenocrysts of gabbroic composition. All samples show

[1] Wilkens, R.H., Firth, J., Bender, J., et al., 1993. *Proc. ODP, Sci. Results,* 136: College Station, TX (Ocean Drilling Program).

[2] Hawaii Institute of Geophysics, School of Ocean and Earth Sciences and Technology, University of Hawaii, 2525 Correa Road, Honolulu, HI 96822 U.S.A. SOEST contribution no. 3288.

evidence of deuteric alteration, particularly along fractures. The alteration has characteristics of low-temperature alteration and was probably caused by interaction of the basalts with seawater during cooling.

MAGNETIC PROPERTY STUDIES

Alternating field demagnetization readily isolated a stable remanence direction in all the samples collected from Cores 136-842B-1H and -2H. At fields in excess of 5 mT the polarity of the sample was clearly recognizable, and at fields greater than 10 mT little additional change in direction occurred even in the small minicube samples. The behavior of three individual samples (minicubes) is shown in the orthogonal vector diagrams shown in Figure 1. Each of these specimens shows an initial rapid intensity loss at low applied fields that can be attributed to the removal of an uphole drilling-related magnetization. After the removal of this magnetization at fields of about 5 mT, the remainder of the demagnetization run is uneventful and is represented by a simple decay to the origin. Thus a characteristic magnetization appears to have been isolated by 20 mT.

The alternating field demagnetization results from four standard ODP 6-cm^3 samples from Cores 136-842B-3H and -4H are shown in Figure 2. These samples continue to show the same systematic behavior as the minicubes from higher in the hole. There is a tendency for the normal samples to show a small amount of continued movement upon demagnetization because a small amount of the drilling overprint appears to remain even after demagnetization to 10 mT. This overprint does not seem to change character deeper down the hole where the samples take on a dark red hue, thus indicating the possible presence of a secondary chemical magnetization. However, the data become much more scattered as the color changes, and samples such as Sample 136-842B-4H-6, 79–81 cm, appear to reach a stable endpoint direction with an inclination much too steep for any expected field from this site latitude. Thus, although the samples appear to reach a stable endpoint direction, the stability and significance of the deeper portion of the polarity reversal record may be problematic.

After application of an alternating field of 40 mT, the intensity of all samples was reduced to a few percent of the original natural remanent magnetization (NRM) value, and most samples began to show irregular jumps in remanent direction probably as a result of acquisition of a small ARM component during demagnetization. Nevertheless, a discernible and internally consistent polarity stratigraphy appears to be present at 20 mT for Cores 136-842B-3H and -4H even though this portion of the hole yielded no recognizable polarity stratigraphy during shipboard measurements. Thus, the 20-mT laboratory measurements from Cores 136-842B-3H and -4H have been combined with the shipboard data from Cores 136-842B-1H and -2H and used to determine the polarity stratigraphy discussed below. One must bear in mind, however, that the presence of very steep inclination records for the intervals 25–26 mbsf and 33–34 mbsf raises questions about the usefulness of this polarity record.

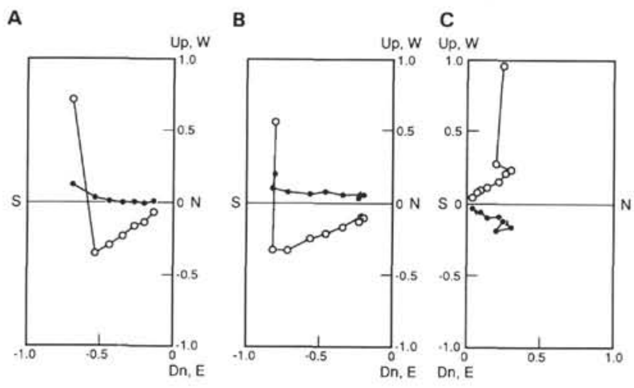

Figure 1. Normalized orthogonal demagnetization diagrams showing results of progressive stepwise alternating field demagnetization of samples. **A.** Sample 136-842B-1H-2, 10–11 cm. **B.** Sample 136-842B-1H-2, 21–22 cm. **C.** Sample 136-842B-1H-2, 30.5–31.5 cm. Demagnetization steps shown are NRM (0), 5, 10, 15, 20, 30, and 40 mT. The 40-mT step is repeated for the second and third samples. Open circles are in the vertical plane, and filled circles are in the horizontal plane. Note the large uphole component of magnetization that is removed during the first two demagnetization steps.

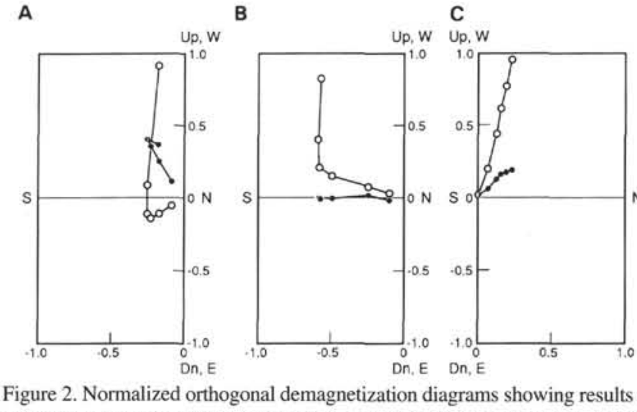

Figure 2. Normalized orthogonal demagnetization diagrams showing results of progressive stepwise alternating field demagnetization of samples. **A.** Sample 136-842B-3H-2, 68–70 cm. **B.** Sample 136-842B-4H-4, 24–26 cm. **C.** Sample 136-842B-4H-6, 79–81 cm. Demagnetization steps shown are NRM (0), 2.5, 5, 10, 20, and 40 mT. Open circles are in the vertical plane, and filled circles are in the horizontal plane. Note the large uphole component of magnetization that is removed during the first two demagnetization steps on the first two samples.

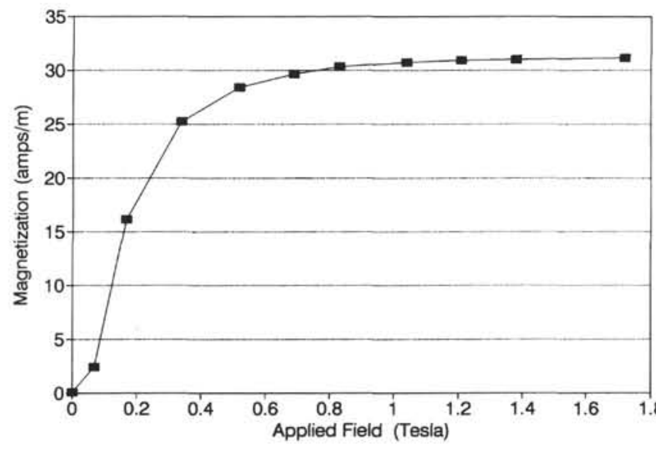

Figure 3. Progressive IRM acquisition for Sample 136-842B-1H-2, 10–12 cm.

ARM and SIRM experiments were made on all the sediment samples using the previously outlined procedures. The isothermal remanent magnetization (IRM) acquisition data for Sample 136-842B-1H-2, 10–12 cm, typical of all the samples, is shown in Figure 3. The rapid acquisition of magnetic moment at fields of less than 0.4 T and the apparent plateau above 1 T appear to be characteristic of all the sediment samples (Fig. 4) and strongly suggest a carrier such as magnetite. Even the brown and red colors indicating the presence of goethite and hematite in the deeper part of the section do not seem to alter the shape of the IRM acquisition curves. Thus, one must conclude that goethite and hematite are not contributing to the remanence in a substantial way. The rapid loss of moment on demagnetization suggests that a low coercivity carrier is present. This carrier may be goethite based upon the color of the samples. Nevertheless, the primary NRM carrier is probably magnetite.

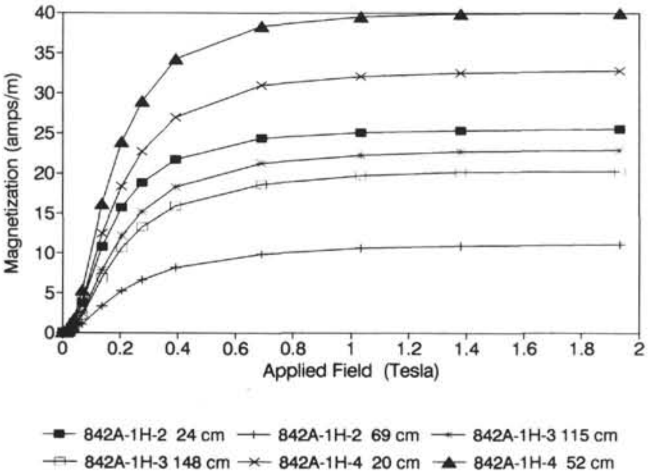

Figure 4. Progressive IRM acquisition for samples from Hole 842A.

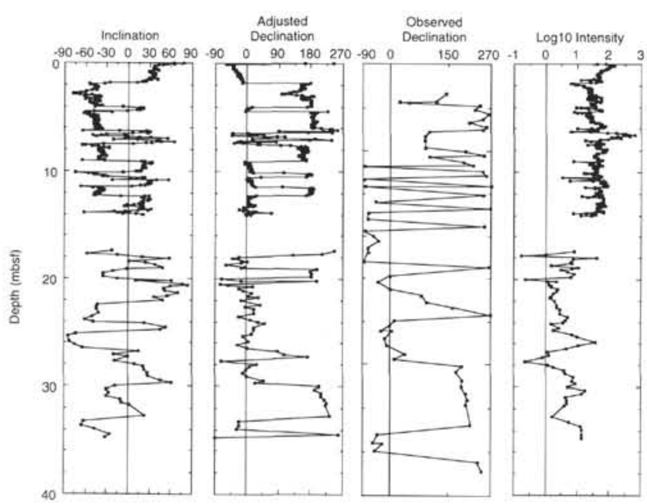

Figure 5. Stratigraphic plot of demagnetized paleomagnetic data from Hole 842B. Data for the upper part of the plot are from the shipboard continuous data from Cores 136-842B-1H and -2H demagnetized to 10 mT. The lower part of the plot is from Cores 136-842B-3H and -4H demagnetized to 30 mT. Declination for cores -3H and -4H is presented in observed coordinates and in adjusted coordinates to aid in visualization.

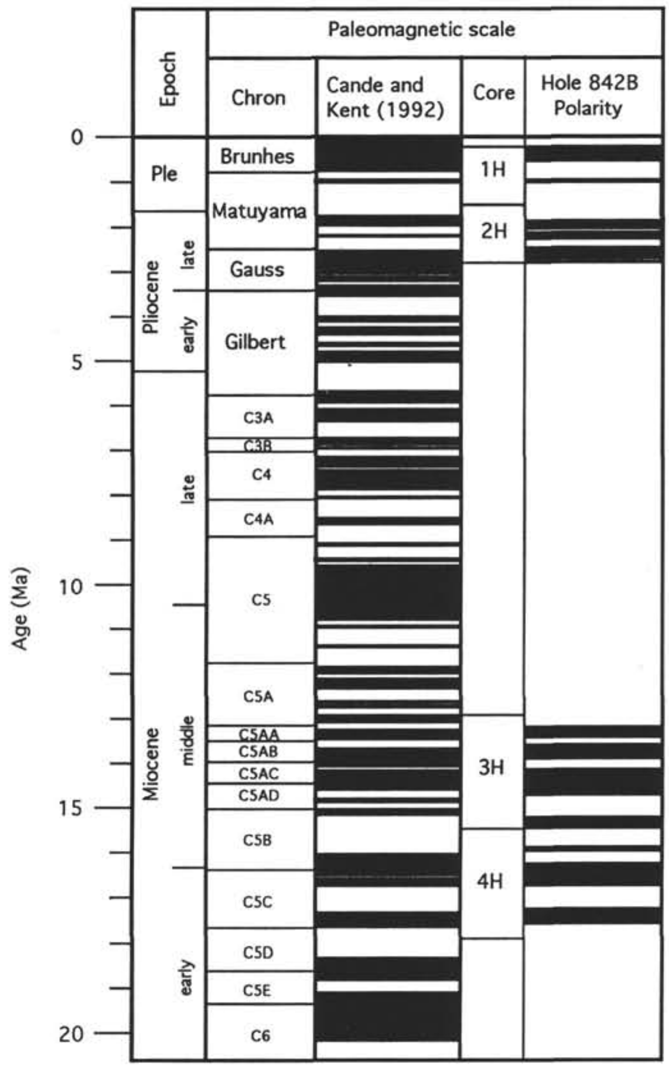

Figure 6. Comparison of observed magnetic polarity (right-hand column) with the geomagnetic polarity time scale of Cande and Kent (1992). Vertical scale of the observed data has been adjusted to bring the reversal pattern into approximate agreement with the standard scale.

MAGNETOSTRATIGRAPHY

Shipboard work presented in the "Site 842" and "Site 843" chapters of the *Initial Reports* (Dziewonski, Wilkens, Firth, et al., 1992) established a tentative magnetostratigraphy for the upper two cores of Hole 842B. In Cores 136-842A-1H, 136-842B-1H, and 136-843C-1H, the Brunhes/Matuyama boundary and the Jaramillo subchron are present at about 2 mbsf and between 4 and 4.75 mbsf, respectively. A disturbed interval at the top of Core 136-842B-2H and a probable unsampled interval at its base disrupt the polarity sequence that continues downcore and raise uncertainty about the location of the base of the Matuyama Chron. The shipboard consensus was that the Olduvai subchron was unsampled and that the normal intervals in Core 136-842B-2H represented those characteristic of the Gauss Chron. The shipboard measurements of the cored interval below Core 136-842B-2H showed the possibility that additional polarity intervals were present. However, due to the drilling-induced overprinting acquired during coring and possible secondary magnetizations due to chemical causes, this interval was not interpreted at sea. The shipboard data for Cores 136-842B-1H and -2H have been combined with the demagnetized data from the discrete sample measurements made on shore on samples from Cores 136-842B-3H and -4H (Fig. 5). The inclination data for the discrete samples from 16.4 mbsf to about 33 mbsf shows a distinct polarity pattern but it does not readily correlate with the known worldwide polarity reversal pattern. Moreover, the reversed inclination interval generally records an inclination that is significantly steeper than the normal intervals. This is most pronounced in the data from Core 136-842B-4H.

Figure 6 shows the standard polarity pattern and a possible correlation of the observed polarity sequence. The observed sequence compares favorably with the standard polarity time scale for the last 2 m.y. For the portion of the core older than the Olduvai subchron there is a less obvious correspondence. The Reunion events may be present or the reversed interval between the two normal Reunion events may have been missed and thus the lowest normal interval in Core 136-842B-2H may represent the upper normal of the Gauss Chron. The lack of continuity in sampling between -2H and -3H permits substantial ambiguity to exist in this interval.

The inferred sedimentation rate for Cores 136-842B-1H and -2H is shown in Figure 7. It is substantially greater than that given in the

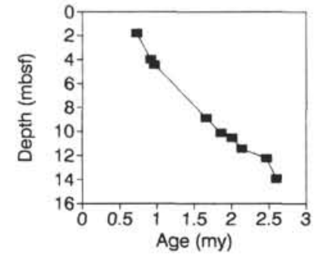

Figure 7. Depth vs. age diagram showing increasing sedimentation rate for the younger parts of the stratigraphic section in Hole 842B. Note the implied hiatus at or near the surface.

Initial Reports and is fairly uniform at about 7.3 mm/k.y. with two noteworthy exceptions. At the top of the cores, above the Brunhes/Matuyama boundary, the sedimentation rate must greatly decrease (unlikely), or there must be a substantial hiatus at, or very near, the surface. Because the bulk density of these cores is uniformly high except for the top 20 cm of Holes 842A and 843C (Dziewonski, Wilkens, Firth, et al., 1992), the most likely place for a hiatus is at the very surface of the cores. Projecting the sedimentation rate in Figure 7 to the surface suggests that a hiatus of more than 0.5 m.y. may be present.

The second anomaly is present at a depth of about 11 mbsf, where one can infer either an anomalously high or an anomalously low sedimentation rate, depending upon the magnetic correlation used. If one assumes that the two Reunion events have been recorded as one in this record (implying a small hiatus is present in this interval), then a progressively decreasing rate with increasing depth results. If one assumes that both Reunion events are present, then an exceptionally high sedimentation rate must have been present between 2.0 and 2.2 m.y. ago. Without a source of data for the missing interval at the base of Core 136-842B-2H, one cannot totally resolve this problem. The least troublesome solution is the first one, and thus it has been shown in Figure 7.

Paleontologic data from Cores 136-842B-3H and -4H suggest ages of early to middle Miocene (Firth and Hull, this volume). The polarity sequence observed in these cores is generally compatible with this age assignment as is illustrated in Figure 6. The discrete sample data from Cores 136-842B-3H and -4H provide a record that is primarily normal at the top and primarily reversed at the bottom. Due to the slow sedimentation rate that the biostratigraphy implies, these cores were probably undersampled at the 20-cm interval that was used for these cores. If one assumes that some polarity intervals have been overlooked as a result of undersampling the cores and that the biostratigraphic information presented by Firth and Hull (this volume) provides an overall time control, a correlation with chron Intervals C5A to C5AC or C5C to C6 seems most likely. Correlation with either of these intervals implies a major hiatus, or a very slow sedimentation rate, for the unsampled interval between Cores 136-842B-2H and -3H. This correlation is by no means unique, and thus the polarity stratigraphy older than 2 m.y. is considered unreliable.

TRANSITIONS AT POLARITY BOUNDARIES

Considerable effort was spent on the search for data that would provide information on the behavior of the Earth's magnetic field during polarity transitions. Unfortunately, few transitional data points were found, and thus little new information was contributed. Those transitional points that were observed are presented in Figure 8 and in Table 1. In spite of the paucity of data, the virtual geomagnetic poles (VGPs) calculated from these data support the current models of transitional field behavior, as they are confined to narrow regions of the Earth encompassing the "Americas path" and its antipodal path near Australia. The VGPs along these paths are similar to those described for the Blake Event by Herrero-Bervera, et al. (1989) and more globally by Laj et al. (1991).

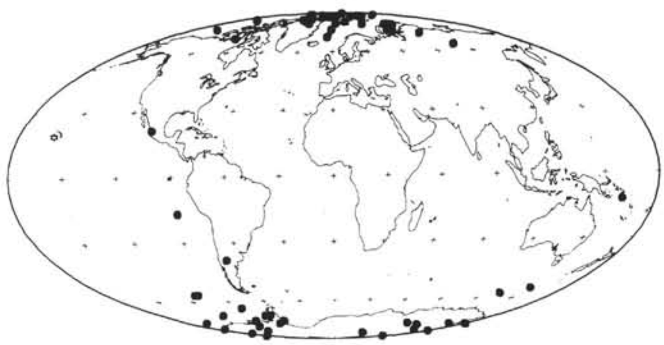

Figure 8. Plot of observed VGPs in and adjacent to the five transitions sampled in this study. Although the data are sparse, all transitional VGP points lie on the "Americas" or "Australian" path.

PALEOLATITUDE OF BASEMENT ROCKS

Because of the limited material recovered during Leg 136, two sets of basement samples were investigated during this study: (1) samples taken specifically for magnetic studies and (2) samples originally studied for physical properties. Care was taken to preserve the "up" direction during the sampling of the paleomagnetic samples. The original "up" direction for many of the physical property samples had been preserved during preparation, and in several other cases it could be determined by reassembling the fragments using saw marks, dimensions, and various marks and cracks to establish the proper "up" direction. In two cases an alternate "up" direction was also noted where the sample could not be reoriented with adequate certainty.

For the most part, these indirect determinations of the "up" direction seem to have been correct. For all but three cases, the inclination data is very consistent. All samples, except for one of these uncertain samples, have a negative inclination, as one would expect for a site located in the Southern Hemisphere during the Cretaceous long normal interval. Thus the polarity of this particular sample is suspect and its polarity was inverted for subsequent analysis. Inversion is the only option available because the original core surface is visible on one of the edges of this sample and rotation by 90° is thus precluded. For the other two cases, the use of the alternate "up" direction, marked on the sample at the time of collection, brings the data into accord with the rest of the data set.

In addition to the basement samples, one sediment sample was collected from the sediments immediately overlying the basement in Hole 843A. This sample, dated as upper Albian–lower Cenomanian (approximately 100 m.y.), may be about 10 m.y. younger than the underlying basalt (dated as 110 ±2 Ma by Waggoner, this volume). The inclination of this sediment sample is comparable to that from the basalt samples, and therefore it is included as the uppermost sample in the figures.

Figure 9 presents the NRM of all the basement samples and the sediment sample immediately overlying the basement (the uppermost sample in the figure). Upon stepwise alternating field demagnetization, each of the samples showed a trend of moving to a shallower inclination. This is consistent with the progressive removal of a steep upward-directed drilling overprint, as had been observed in the sediments discussed above. This is expressed in the curved portion of the progressive demagnetization diagrams shown in Figure 10. For most samples this overprint had been removed by 7.5 mT, but in a few cases some evidence of the overprint magnetization remains, even after applying 15 mT. Application of 25 to 40 mT tended to produce more scattered data, perhaps as a result of small ARM components being

Table 1. Declination and inclination data and computed VGP directions for samples near the polarity transitions sampled with minicubes.

Core, section, interval (cm)	Inclination (°)	Unrotated declination (°)	Rotated declination (°)	Latitude (°)	Longitude (°)
136-842A-					
1H-2, 42.5	28.3	241.6	0.7	85.8	11
1H-2, 43	27	221.8	340.9	71.1	98.2
1H-2, 43.5	8.3	246.7	5.8	73.9	359
1H-2, 45	28.8	247.7	6.8	82.5	319.8
1H-2, 45.5	35.4	236.8	355.9	86.1	116.3
1H-2, 46	36.4	252.3	11.4	79.2	282.9
1H-2, 46.5	−34.1	38.7	157.8	−69	292.6
1H-2, 47	−27.8	62.4	181.5	−85.3	182.2
1H-2, 47.5	−38	42.4	161.5	−72.5	300.5
1H-2, 48	−6.6	46.1	165.2	−68.5	244.5
1H-2, 48.5	−31.1	39	158.1	−69	287.2
1H-2, 50	−21.8	49.5	168.6	−76.5	256.3
136-842B-					
1H-2,22	26.3	186.3	357.9	84.4	42.1
1H-2, 23	27.2	191	2.6	84.7	352.3
1H-2, 25	31.4	196.5	8.1	82	304.8
1H-2, 26	32.1	160.7	332.3	63.7	111.5
1H-2, 28	6.5	342.6	154.2	−56.2	252
1H-2, 28.5	26.3	183.8	355.4	83.2	61.6
1H-2, 29	−19.7	343.2	154.8	−64.1	274.1
1H-2, 29.5	22.7	300.8	112.4	−16.6	271.4
1H-2, 30	−22.3	351.7	163.3	−72.3	268.1
1H-2, 30.5	−33.2	22.7	194.3	−76.4	112.5
2H-2, 114	−31.3	306	182.6	−86.7	151.7
2H-2, 116	−33.5	344.1	163.7	−74.5	290.4
2H-2, 117	−43.3	0.3	184.5	−82.6	54
2H-2, 118	−23.5	144.6	126.6	−38.3	291.4
2R-2, 119	33.8	85.7	3.8	86.4	299.3
2H-2, 121	25.3	102.6	348	77.1	85.7
2H-2, 121.5	31.5	91.8	2.8	86.6	327.9
2H-2, 122	15.1	114.8	348.2	73.8	67.4
2H-2, 122.5	30.3	116.7	356.7	85.8	69.5
2H-2, 123	14.9	119.2	346.4	72.5	71.4
2H-3, 115	−23.3	323	173.2	−80.5	245
2H-3, 117	−22.7	341.9	180.9	−82.7	193.7
2H-3, 118	−40.2	0.4	195.7	−74.9	93.3
2H-3, 119	−27.8	12.2	188.7	−80.6	136.8
2H-3, 120	−15.1	339.7	181.8	−78.5	191.7
2H-3, 122	−12.8	320.8	185.1	−76.4	178.5
2H-3, 122.5	47.5	52.4	21.4	68.3	260.6
2H-3, 123	58.1	14.1	77.9	21.1	255.4
2H-3, 123.5	8.7	313.1	155.2	−56.1	249.3
2H-3, 124	45.2	78.5	2.6	82	217.6
2H-3, 124.5	32.9	119.9	359.3	88.7	50.4
2H-3, 125	15.1	84	355.2	77.7	43.5
2H-3, 125.5	23.1	123.7	349.7	77.8	76.7
2H-4, 50	31	138	356	85.5	79.4
2H-4, 51	17.8	138.5	359.9	80	21.2
2H-4, 53	15.8	145.2	3	78.6	5.5
2H-4, 54	35	149.9	3.1	87.1	286.1
2H-4, 55	27.3	143.1	359.4	85.3	27.8
2H-4, 56	28.4	155.2	9	80.5	314
2H-4, 57	23.9	154.7	9.8	78.5	324.2
2H-4, 59	−5.2	329.7	179.1	−73.5	203.8
2H-4, 60	−0.4	7.8	9.2	68.7	354.5
2H-4, 60.5	53.4	147.5	3.7	74.8	212.4
2H-4, 61	10.2	315.6	206.3	−54.5	151.1
2H-4, 61.5	59.4	53.1	235	−11.7	161
2H-4, 62	−8.9	353.1	210.1	−57.2	133.3
2H-4, 62.5	−22.5	332.5	183.6	−81.8	175
2H-4, 63	−18	336.2	190.1	−76.1	154.5

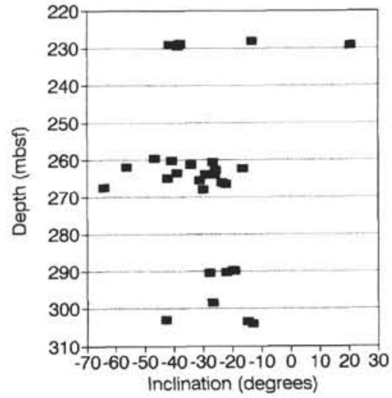

Figure 9. NRM of basalt and basement contact sediment from Holes 843A and 843B.

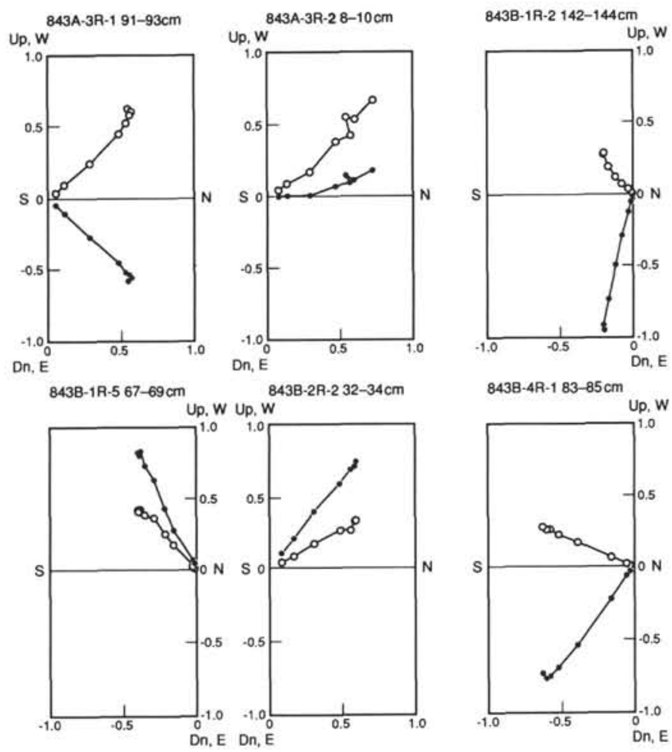

Figure 10. Normalized orthogonal demagnetization diagrams showing results of progressive stepwise alternating field demagnetization of basalt samples from Holes 843A and 843B. Demagnetization steps shown are NRM (0), 2.5, 5, 7.5, 10, 20, and 25 mT. Open circles are in the vertical plane, and filled circles are in the horizontal plane.

introduced during demagnetization. Because the remaining intensity of the samples at these high field values was very small and the results were more scattered, the best overall estimate of paleoinclination probably is given by the 20-mT data set shown in Figure 11.

Mean inclinations and paleolatitudes were determined from the data shown in Figure 11 using the statistical procedures proposed by McFadden and Reid (1982) for the analysis of inclination-only data sets. The data in Table 2 show that inclusion or omission of the sediment sample and the adjusted basalt samples makes no material difference in the overall mean direction. Correction, or deletion, of the three anomalous basalt samples also makes an insignificant change other than a marked decrease in the α_{95}, as would be expected when samples of the opposite polarity and scattered direction were removed from the data set. Of the seven analyses shown in Table 2, the last entry is probably the most conservative, for the sediment data point and the data points represented by the three samples of uncertain orientation have simply been deleted. It is interesting that this result also has the lowest α_{95}, for one would expect the α_{95} to increase slightly as the number of samples decreased.

The above analysis gives all observations equal weight. As discussed by Cox and Gordon (1984), this does not necessarily yield an unbiased estimate of the true mean direction because groups of samples—such as those from Core 136-843B-1R in which 16 samples were collected from 6.9 m of basalt—apparently from one cooling unit, may dominate the statistical analysis. This problem can be overcome by using the mean inclination from each cooling unit rather than the individual inclination measurements. Unfortunately, the ex-

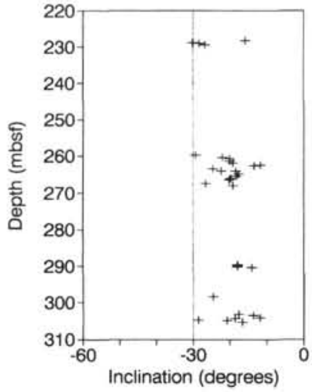

Figure 11. Stratigraphic presentation of the 20-mT demagnetization inclination data for basaltic samples and a sediment sample in contact with basement from Holes 843A and 843B.

Table 2. Mean inclinations and paleolatitudes for Site 843 basement samples.

Inclination (°)	α_{95}	Latitude (°)	No. of samples and comments
−29.56	13.94	−14.78	33 NRM—using all samples
−21.28	5.40	−10.64	33 15 mT—using all samples
−20.92	5.25	−10.46	33 20 mT—using all samples
−20.56	2.60	−10.28	33 15 mT—adjusting 3 samples
−18.60	3.30	−9.30	33 20 mT—adjusting 3 samples
−20.31	2.53	−10.15	29 15 mT—deleting 4 samples
−19.82	1.96	−9.91	29 20 mT—deleting 4 samples

Note: α_{95} is the half angle of the cone of confidence at the 95% level.

Table 3. Mean inclinations and paleolatitudes of basement cooling units from Site 843.

Inclination (°)	α_{95}	Latitude (°)	No. of samples and comments
−20.41	5.29	−10.21	6 20 mT—sediment plus 5 units
−21.39	6.14	−10.70	5 20 mT—5 cooling units only

Note: α_{95} is the half angle of confidence at the 95% confidence level.

act number of cooling units is unknown. Shipboard core descriptions identified four units in cores from Hole 843B, three of which were sampled for paleomagnetic studies (Unit 2 was represented by a group of small unoriented fragments not useful for magnetic inclination studies). At least one additional unit, represented by a sample from Core 136-843B-3R, is also present, and the sediment overlying the basalt and the basalt from Core 136-843A-1R can be used as additional units. Thus a minimum of six distinct units has been sampled at Site 843. The statistics for these samples are shown in Table 3.

From the perspective of determining the latitude of origin of the crust at Site 843, the first entry of Table 3 probably gives the most meaningful result. The resultant paleolatitude of 10.2°S for these 110-m.y.-old basalts is entirely consistent with the polar wander path for the Pacific Ocean given in a recent summary article by Sager (1992), and is in reasonable agreement with the other core latitude data acquired from Cretaceous-age DSDP cores.

CONCLUSIONS

The paleomagnetic results from Leg 136 permit estimation of a sedimentation rate of about 7 mm/k.y. for most of the last 2 m.y., a rate that is substantially higher than that normally found in red clays of the central Pacific Ocean. This high sedimentation rate is probably due to the proximity of the Hawaiian hotspot volcanism during the time interval for which a magnetostratigraphy has been recovered, as has been discussed in more detail by Garcia (this volume). The magnetic record also lends strong support to the presence of a significant hiatus at or near the current seafloor. Projecting the magnetic time scale to the seafloor results in about 500,000 years of missing record. This major hiatus at or near the current seafloor may be due to erosion of the seafloor by uplift during the passage of the site over the Hawaiian swell during the last million years, or it may be the result of erosion by bottom currents set up during major mass wasting events on the flanks of the Hawaiian Islands. Even though the sedimentation rate is more than five times that in the normal deep ocean environments, incomplete evidence of transitional directions was found at the boundaries of the last five magnetic polarity transitions. Nevertheless, the few points that were observed support the "Americas" transitional path that was documented by Herrero-Bervera et al. (1989) for the Blake Event. Finally, a Cretaceous paleolatitude of 10.2°S has been determined for the 110-m.y. basalts from Site 843.

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* Abbreviations for names of organizations and publications in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

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