1. INTRODUCTION

The Shipboard Scientific Party[1]

OBJECTIVES

Leg 5 of the Deep Sea Drilling Project left San Diego, California, on April 12, 1969, and arrived in Honolulu, Hawaii, on June 5, 1969. During the cruise, twelve sites were drilled (Figure 1) to obtain information on the geologic history of the ocean basin. Of the several overall objectives recommended in the JOIDES Pacific Advisory Panel Report (JOIDES, 1967), the Leg 5 drilling program was designed to sample "near fracture zones to investigate the origin of the magnetic anomaly patterns and possible relative movement along the zones," and to recover ". . .continuous sedimentary sections along a longitudinal (N-S) profile for paleontologic and stratigraphic studies".

This was the only leg which could examine the association of linear magnetic anomaly patterns and the major east-west fracture zones of the northeast Pacific. Since the original detailed mapping of the north-south magnetic anomaly patterns (Mason and Raff, 1961; Raff and Mason, 1961), they have been a subject of intensive study; and, various models have been proposed concerning their origin and their relationship to the fracture zones. Sites 32 through 37 were located on identified anomalies with the objective of drilling through the sediment column and into the basement. In addition to providing information for testing models explaining the anomaly pattern, these sites were also selected with regard to the Pioneer and Mendocino Fracture Zones. Sampling of the basal sediment and basement would provide an opportunity to examine the correlation with the time scale of magnetic reversals that has been developed (Heirtzler *et al.,* 1968).

The principal objective of the meridional series of sites along 140°W longitude was to determine the history of the Equatorial Current System and the North Pacific Central Water masses, insofar as this could be deduced from their effects on the sediments. Along the profile (Sites 37 through 42), there is a transition from thin, slowly accumulating, sparsely fossiliferous "red clays" in the north to a thick sequence of biogenous sediment which is associated with the Equatorial Current System. This transition is presently at about 8° North, but appears to have varied between 7°N and 15°N in late Eocene and post-Eocene time (Riedel and Funnell, 1964).

In addition to these principal objectives, down-hole logging was to be conducted at as many sites as possible, and measurement of *in situ* temperatures was planned at several sites. As part of the development of re-entry capability, the initial attempt was to be made to set casing in the upper part of one hole, and accelerometer measurements were planned to be made in the unsupported drill string.

OPERATIONAL RESULTS

The twelve drilling sites on Leg 5 were located in water depths ranging from 3273 meters to 5405 meters (Table 1). A total of 869 meters of core were recovered. At Sites 32 through 35, cored intervals were selected at certain depths below the bottom, and the intervening intervals were drilled. At Sites 36 through 43, the sediment section was continuously cored either to the base of the section, where basalt was encountered, or until coring operations were prematurely terminated. Such terminations at Sites 33, 40 and 42 were due to the presence of chert in the section. At Site 35, the termination at 390 meters penetration was caused by decreased drilling rate and time limitations.

Included in the Site Report for each site are more specific operational results.

COMMENTS ON THE CORES

Identification System: Sites, Holes, Cores, Sections

Drilling sites are the locations at which coring operations could be conducted without moving the ship sufficiently to necessitate repositioning it over additional bottom-mounted transponders. One exception to this designation was at Site 35, where the ship was subsequently repositioned, but a new site was not designated because no cores were attempted at the

[1]D. A. McManus, University of Washington, Seattle, Washington; R. E. Burns, ESSA–University of Washington, Seattle, Washington; C. von der Borch, Scripps Institution of Oceanography, La Jolla, California; R. Goll, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York; E. D. Milow, Scripps Institution of Oceanography, La Jolla, California; R. K. Olsson, Rutgers University, New Brunswick, New Jersey; T. Vallier, Indiana State University, Terre Haute, Indiana; O. Weser, Chevron Oil Field Research Company, La Habra, California.

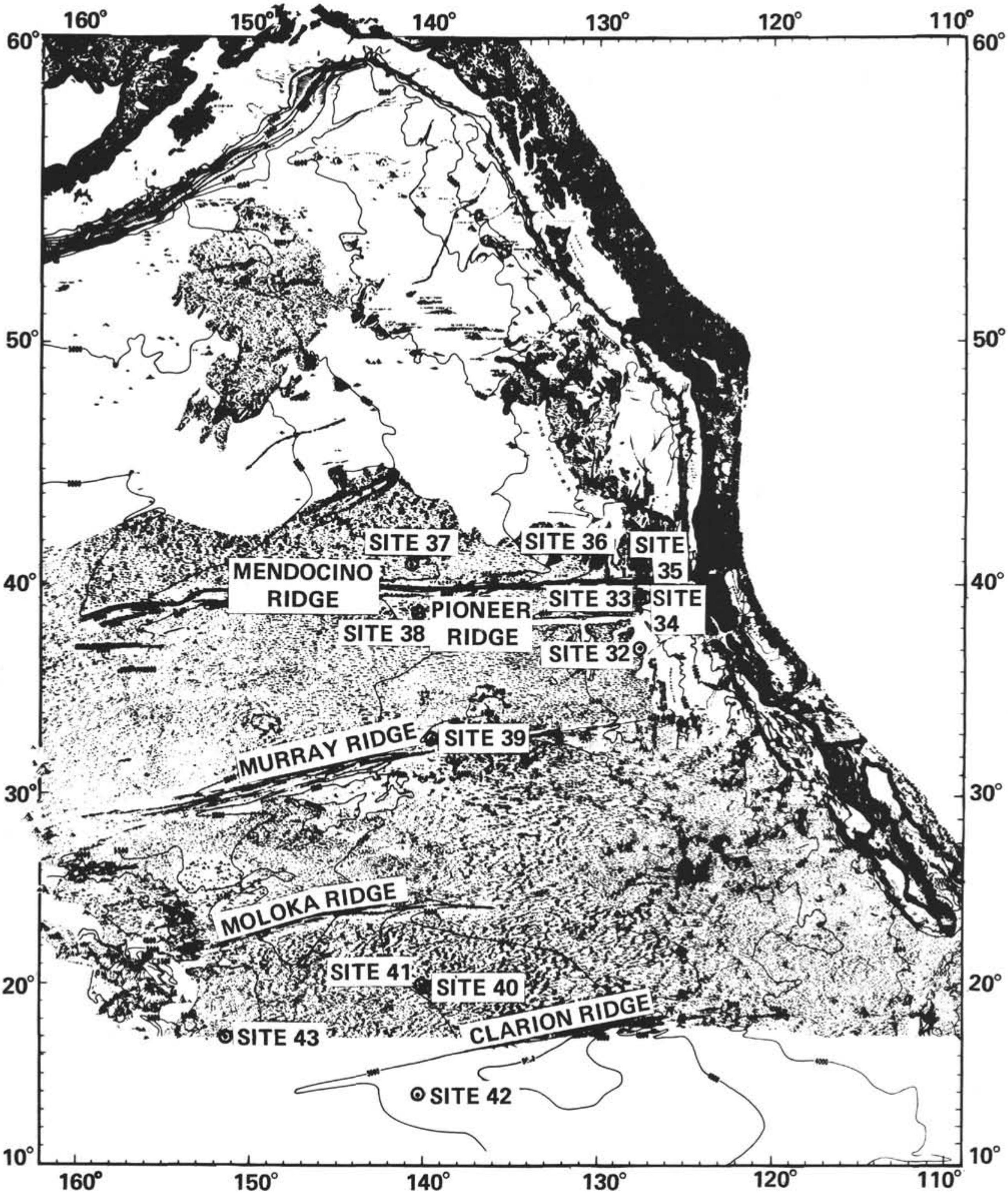


Figure 1. *Physiographic diagram of northeast Pacific Ocean showing location of drilling sites on Leg 5. (Based on "Marine Geology of the Pacific" by H. W. Menard. Copyright 1964 by McGraw-Hill, Inc.).*

TABLE 1
Operational Statistics for Leg 5, Deep Sea Drilling Project

Site Number	Latitude (N)	Longitude (W)	Water Depth		Penetration		Number of Cores	Cored		Recovery		Per Cent Recovery
			Feet	Meters	Feet	Meters		Feet	Meters	Feet	Meters	
32	37° 07.63′	127° 33.38′	15,605	4758	706	215	14	368	112	284	87	77
33	39° 28.48′	127° 29.81′	14,051	4284	968	295	15	398	121	367	112	92
34	39° 28.21′	127° 16.54′	14,175	4322	1260	384	18	445	136	347	106	78
35	40° 40.42′	127° 28.48′	10,735	3273	1279	390	17	460	140	313	95	68
36	40° 59.08′	130° 06.58′	10,735	3273	379	116	14	372	113	369	112	99
37	40° 58.74′	140° 43.11′	15,356	4682	102	31	5	102	31	100	30	98
38	38° 42.12′	140° 21.27′	16,849	5137	157	48	6	156	48	156	48	100
39	32° 48.28′	139° 34.29′	16,165	4929	56	17	2	55	17	55	17	100
40	19° 47.57′	139° 54.08′	16,999	5183	512	156	19	505	154	423	129	84
41	19° 51.25′	140° 02.88′	17,515	5339	112	34	5	110	34	85	26	77
42.0	13° 50.56′	140° 11.31′	15,901	4848	328	100	11	329	100	303	92	92
42.1	13° 50.56′	140° 11.31′	15,901	4848	371	113	3	27	8	24	7	87
43	17° 06.59′	151° 22.51′	17,728	5405	30	9	2	28	8	28	8	100
		Totals			6260	1908	131	3355	1022	2854	869	85

second location. The sites are numbered as a continuation of site numbers from previous legs of the Deep Sea Drilling Project.

When more than one hole was drilled at a site, the holes were designated by the site number and a decimal, for example, 42.0, 42.1.

Coring within the hole was done with a core barrel 9 meters in length. Each of the cores was numbered, with Number 1 usually being an attempted surface core. The 150-centimeter sections into which the core was cut were also numbered from the top down. A complete designation for an individual core section, therefore, would be 5-35.0-12-5, representing Leg 5, Site 35 (the first hole at the site), Core 12, and Section 5 of that core.

Routine and Special Handling

Explanatory notes for routine handling and sampling of cores in the Deep Sea Drilling Project are contained in Appendix II of Volume II of this series of Initial Reports. Points which have a direct bearing on Leg 5 are summarized below.

Fluid Cores

In many instances, it was found that core sections were too fluid to be split. In such cases, except where important boundaries were expected, such sections were not opened, rather they were described on the basis of smear slides and paleontological samples taken from their top or bottom ends.

Zero Sections

Although the standard core barrel was 30 feet (9 meters) long, the configuration of the barrel was such that the core liners were approximately 30.5 feet long. When the coring operations resulted in complete penetration of the core barrel, the subsequent removal of the core liner commonly disclosed sediment completely filling the 30.5-foot liner. After such cores were cut into the standard 5-foot (150-centimeter) sections, the excess few inches at the top of the core would be retained in its short length of liner and be labeled as the "zero section".

SEDIMENT DISTURBANCE FROM CORING

Cores from all of the sites showed that coring operations displaced the sediments, either upward or downward. In most cases, however, the displacement either was minor or was recognized and taken into account by the paleontologists and geologists. Therefore, serious errors in compiling the stratigraphic sequence are not believed to have occurred. A more serious consequence of sediment disturbance was the destruction of primary sedimentary structures. The different types of disturbance and their effect on the sediments are discussed below.

Sediment Injection

Some sediments were squeezed into the core liner, rather than having been cut and filling the liner in the normal way. This disturbance occurred only in water-filled, unconsolidated sediments, particularly in the finer-grained plastic muds and the biogenous oozes. Granular sediments, such as sands, were but slightly affected, if at all. This sediment injection manifested itself in two ways. Where the sediments were homogeneous and of uniform competency, marbling or diapirism resulted. The amount of distortion and stretching of the sediments varied. Commonly, in the 9-meter cores, a bedding plane was stretched 10 to 50 centimeters. This type of deformation affected over 90 per cent of the unconsolidated sediments.

Where the sediments had differing competencies, the distortion occurred by the more plastic material being injected upward in a thin layer along the walls of the core liner. Where there were lithologic, or bedding breaks, the material was injected into the core at a low angle or horizontally, thereby creating false bedding. This manner of injection, difficult to distinguish from the true bedding, is probably related to the pitching motion of the ship that creates periodic increases and decreases in bit pressure—an effect similar to that which prevailed in the old cable tool drilling technique. On the *Glomar Challenger,* the varying bit pressure is transferred to the sediments being cored and results in the observed intrusion. This feature was not as prevalent as the diapirism previously mentioned.

Sediment injection obviously cannot displace sediments a great distance. It is, however, the most important factor in destroying primary sediment structures and renders the detection of penecontemporaneous sedimentary deformation difficult.

Drill-Bit Wandering

Drill-bit wandering may occur whenever a hard layer is encountered in a shallow hole. When a harder bed is drilled in consolidated sediments, the drill string is constrained to remain in place by the hole wall or the casing string. In unconsolidated, water-filled sediments at great water depths, the long drill string is not firmly held in place. Consequently, when a chert bed or basalt is encountered, even with several hundred feet of overburden, the bit tends to wander along the interface. Increasing the bit pressure may only result in bowing or twisting off the drill string. A graphic example of drill-bit wandering may have been provided at Site 33, at a depth of 293 meters below the sea floor, where the driller's log recorded 0.33 meter of penetration, yet 5 meters of sediment were recovered.

In this type of disturbance, it would appear likely that a greater recovery than warranted for the depth penetrated would be characteristic.

Continuous-Coring Gaps or Duplications

With the wireline coring technique, at least one hour is required to retrieve one core barrel and then lower the next one. During this period, the thrusters of the ship attempt to keep the ship and the drill bit in a fixed position. This is impossible, of course, and the lateral movement plus the pitching of the ship result in the drill bit being slightly deeper or shallower when coring is resumed.

Such discrepancies in depth were evident at Site 36. Here, the hole was indicated as being 5 meters deeper when Core 6 was begun than at the completion of Core 5. Conversely, upon commencing coring for Core 9, the bottom of the hole was indicated as being 2 meters shallower than when Core 8 was pulled up.

These changes in the position of the drill bit between successive cores were also, no doubt, partially responsible for the inordinate number of lithology changes which occurred between cores. (Another possible explanation for such changes is described under Sediment Slumping.) Very commonly, a pronounced change in lithology was observed by comparing the bottom of one core with the top of the subsequent, lower core. Far less often such a contact occurred within a core. In both examples the sediment section was being continuously cored.

Washing Action by Drill Jets

The washing action of the drilling fluid leaving the drill jets tends to rework the softer bottom-hole sediments. At Site 32, when the pumping rate was increased while drilling harder beds, most of the softer sediment was washed out of the cores.

Jammed Core Barrel

Jamming of the core barrel occurred at various sites when the core liner in the barrel collapsed or broke. Usually, this occurrence could be associated with attempts to core resistant material, although coring resistant material did not always produce collapsed liners. Jamming of the barrel resulted in incomplete or no core recovery.

Sediment Slumping

Induced partly by the motion of the drill string, sediment slumping was quite common. This could take place from the top or sides of the hole. Slumping at the top of the hole is believed to form a sizable funnel-shaped cavity. How serious this is has been difficult to determine, but it must be more completely understood before some geologic problems can be solved. For instance, the in-hole occurrences of manganese nodules is suspect. It may be assumed that they have slumped into the hole between cores, but if this should prove to be untrue the economics of nodule mining would be drastically changed. In-hole slumping manifests itself in several ways. It may explain the changes in lithology so often found at the tops of the cores when consecutive cores are run. One indication of the degree of slumping was the large-sized hole indicated by the caliper log run at Site 35. This downward displacement of sediments was also evidenced by the repetition of younger material occurring within or below older material in the upper portion of cores taken at Sites 33, 36 and 42.

Slurry Injection or Filtration by Core Material

This type of drilling contamination was most apparent in Hole 42.0, especially in Core 7, where more porous and permeable radiolarian oozes occur which lack common or abundant interstitial clay and silt-sized material. Fluids, rich in slurried material from higher in the hole, back flow into the drill string under the normal procedures used when retrieving a core or center bit. The next core barrel that is dropped becomes filled with this up-hole slurry, which often contaminates the top and sides of the core. When portions of the cored material are more permeable, this slurry is easily injected or it passes through the sediment where the finer materials, especially nannofossils, concentrate in the interstices. This type of drilling contamination mainly affects the finer materials; for example, most of the Radiolaria occurring in the Eocene portion of Hole 42.0 indicate an Eocene age, whereas the calcareous nannoplanktons are mostly Oligocene types within the contaminated portions of these cores.

BASIS FOR AGE DETERMINATION

Nannofossils

A sequence of tentative zones and subzones is proposed for the nannofossil sequence recovered from the northeast Pacific on this leg (Table 2). This is to form a frame of reference for these somewhat different and more variable microfossil assemblages from the mid-to-high latitude sites occupied by Leg 5 as compared to the lower latitude zonations available.

The differences are most evident in the Neogene sequence where alterations of siliceous- and calcareous-rich materials are encountered or where parts of the sequence are highly diluted by clastic or volcanic detritus. Because of these variable local conditions encountered in this part of the section, all of the distinctive characteristics of both the calcareous and siliceous nannofossils are used in the establishment and recognition of these biostratigraphic units. Subzones are used because of the experience of not always being able to recognize the smaller subdivisions

TABLE 2
Tentative Nannofossil Zones and Subzones and Their Radiometric Age, Northeast Pacific

Series or Subseries	Radiometric Time Scale in m.y.	Tentative Zone or Subzone
Holocene		Not recognized on Leg 5 (*Emiliania huxleyi* Zone)
	± 0.24	
Pleistocene		*Coccolithus carteri* Zone
	± 2.00	
Upper Pliocene		*Discoaster brouweri* Zone
	± 3.25	
Lower Pliocene		*Ceratolithus rugosus* Zone *Ceratolithus rugosus-Cyclococcolithus leptoporus* Subzone
	± 3.50	
		Ceratolithus rugosus-Reticulofenestra pseudoumbilica Subzone
	± 5.50	
		Ceratolithus tricorniculatus Zone
	± 9.00	
Upper Miocene		*Discoaster variabilis* Zone *Discoaster variabilis-Discoaster challengeri* Subzone
	±10.00	
		Discoaster variabilis-Discoaster exilis Subzone
	±11.50	
Middle Miocene		*Discoaster exilis* Zone *Discoaster exilis-Reticulofenestra pseudoumbilica* Subzone
	±12.70	
		Discoaster exilis-Cyclococcolithus neogammation Subzone
	±14.00	
upper Lower Miocene		Nonfossiliferous on Leg 5
	±17.50	

TABLE 2 – *Continued*

Series or Subseries	Radiometric Time Scale in m.y.	Tentative Zone or Subzone
Lower Miocene		***Triquetrorhabdulus*** *carinatus* Zone
	±23.50	
		Coccolithus bisectus Zone *Coccolithus bisectus* - ***Triquetrorhabdulus carinatus*** Subzone
	±27.00	
Upper Oligocene		*Coccolithus bisectus* - *Sphenolithus distentus* Subzone
	±30.50	
		Coccolithus bisectus - *Sphenolithus predistentus* Subzone
	±31.70	
Lower Oligocene		*Coccolithus bisectus* - *Reticulofenestra umbilica* Subzone
	±36.00	
Upper Eocene		*Discoaster barbadiensis* Zone
	±45.00	
		Chiasmolithus grandis Zone
	±47.00	
Middle Eocene		*Chiphragmalithus quadratus* Zone *Chiphragmalithus quadratus* - *Chiasmolithus solitus* Subzone *Chiphragmalithus quadratus* - *Chiasmolithus gigas* Subzone
	±48.50	
		(*Discoaster sublodoensis* Zone) Not encountered on Leg 5
	±49.00	
Lower Eocene		*Discoaster lodoensis* Zone *Discoaster lodoensis* - *Triquetrorhabdulus inversus* Subzone *Discoaster lodoensis* - *Coccolithus crassus* Subzone
	±50.50	

TABLE 2 – *Continued*

Series or Subseries	Radiometric Time Scale in m.y.	Tentative Zone or Subzone
		Not encountered on Leg 5 (*Marthasterites tribrachiatus* Zone)
	±51.50	
Lower Eocene		*Discoaster diastypus* Zone *Discoaster diastypus-Marthasterites tribrachiatus* Subzone
	±52.50	
		Discoaster diastypus-Marthasterites contortus Subzone
	±53.50	
Paleocene		Not encountered on Leg 5

from individual samples, due to the variable local conditions. However, these biostratigraphic units are usually evident when examining more highly fossiliferous samples or sequences of material.

As a basis for reference and use, the boundaries of most of the zones and subzones have been related to the radiometric time scale, using Berggren's latest collation (Berggren, 1969). Additional information on the Pliocene to Holocene part is provided in Hays *et al.* (1969), and updating or refinement on the ranges and ages of various calcareous nannoplankton has been incorporated from the results of earlier legs of the Deep Sea Drilling Project, especially from Leg 3.

The definitions, correlations, basic data and evaluation of this synthesis are given in the later Biostratigraphy section of this volume.

Since relatively few paleontological samples were taken–generally two per section for each type of fossil group–age boundaries are interpolated midway between samples of different age or they are placed in accord with the lithologic samples and data where lithologic changes coincide with noticeable changes in the biogenous content of the cores.

Extreme care was used in the collecting of nannofossil samples for this study. The anticipation of rarity of some of the diagnostic calcareous nannoplankton at these higher latitudes and the core contamination problems encountered on earlier legs of this project were the main reasons for this caution. The middle surface of the cut cores was scraped clean at a sampling spot of least disturbed material and a centrally located 12-millimeter diameter plug of sediment was extracted no deeper than one to two centimeters. This procedure, for the most part, provides reliable assemblages that are free from the possible contamination which is most commonly found in the peripheral parts of the core or on the exposed half surface due to the cutting of the core. Techniques to minimize possible contamination were used in subsequent preparation procedures.

Therefore, the occurrences and distribution given are as indicative as can be obtained with the present drilling and coring procedures. Certain parts or entire sections of some cores still exhibited drilling contamination, and these are indicated in the description of the characteristics of the cores collected at the various sites. The different kinds or sources of contamination encountered are more fully discussed in the previous section on Drilling Disturbances.

Planktonic Foraminifera

Age determination for the Neogene by use of planktonic foraminifera was accomplished by correlation for the most part with the low latitude biostratigraphy outlined by Blow (1969). Correlation based on planktonic foraminifera in the Upper Miocene to Pleistocene sections drilled during Leg 5 was somewhat difficult because many of the low latitude zonal species did not inhabit the cooler, higher latitude water masses. The use of extinction and evolutionary datums enabled approximate correlations with the low latitude zonation. In this instance, the work of Hays *et al.* (1969)

TABLE 3
Sediment Classification Chart

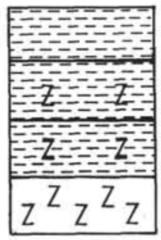
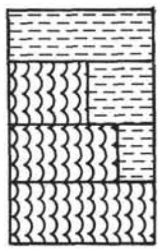
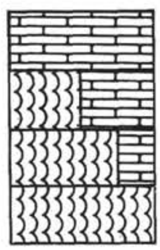
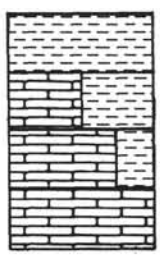
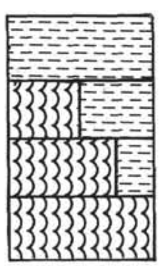
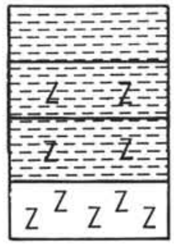
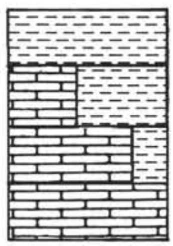
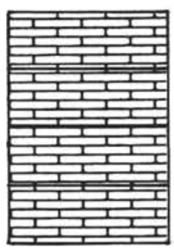
Composition		Symbols	Terminology
Zeolite	Red Clay		
0-25	75-100		"Red" clay
25-50	50-75		Zeolitic "red" clay
50-75	25-50		"Red" clay zeolitite
75-100	0-25		Zeolite
Silica Fossils	"Red" Clay		
0-25	75-100		"Red" clay
25-50	50-75		Sil fos "red" clay
50-75	25-50		"Red" clay sil fos ooze
75-100	0-25		Sil fos ooze
Silica Fossils	Nannoplankton		
0-25	75-100		Nanno ooze
25-50	50-75		Sil fos nanno ooze
50-75	25-50		Nanno sil fos ooze
75-100	0-25		Sil fos ooze
Nannoplankton	Mud		
0-25	75-100		Mud
25-50	50-75		Nanno mud
50-75	25-50		Mud nanno ooze
75-100	0-25		Nanno ooze
Silica Fossils	Mud		
0-25	75-100		Mud
25-50	50-75		Sil fos mud
50-75	25-50		Mud sil fos ooze
75-100	0-25		Sil fos ooze

TABLE 3 – *Continued*

Composition		Symbols	Terminology
Zeolite	Mud		
0-25	75-100		Mud
25-50	50-75		Zeolitic mud
50-75	25-50		Mud zeolitite
75-100	0-25		Zeolitite
Nannoplankton	Red Clay		
0-25	75-100		"Red" clay
25-50	50-75		Nanno "red" clay
50-75	25-50		"Red" clay nanno ooze
75-100	0-25		Nanno ooze
Foraminifera	Nannoplankton		
0-25	75-100		Nanno ooze
25-50	50-75		Foram nanno ooze
50-75	25-50		Nanno foram ooze
75-100	0-25		Foram ooze

provided a useful framework (see later discussions under the Biostratigraphy section). The discoaster extinction datum is used in this report as approximating the Pleistocene-Pliocene boundary. The boundary is placed somewhat higher in the low latitude sections studied by Hays *et al.* (1969), but the foraminiferal criteria used by them cannot be recognized in the northeast Pacific sections. The discoaster extinction datum is followed here to provide consistency in site correlations (in the Biostratigraphy section a Pleistocene-Pliocene boundary is approximated on foraminiferal evidence).

Radiolaria

Age determinations based on Radiolaria were made by the use of the biostratigraphic ranges of species presented in the JOIDES Biostratigraphic Manual. This information has been brought up to date and summarized in the Initial Report of Leg 4 (Riedel and Sanfilippo, in press).

STRATIGRAPHIC UNITS

The stratigraphic intervals encountered vary greatly in extent. Thin intervals encountered only in individual holes are of minor stratigraphic significance. Other, thick stratigraphic intervals can be recognized over a wide area and, so, are of importance in any discussion of regional stratigraphy. They necessitated the development of some type of stratigraphic nomenclature.

Although consideration was given to these major stratigraphic intervals being formally designated as rock-stratigraphic units, it was decided that their presence in, at most, only three or four holes provided too weak a control for determining their geographic limits or a contiguous relationship between them from hole to hole. Furthermore, many of these intervals are not pure compositional end-members, but rather are mixtures of many constituents; and, it becomes an arbitrary matter to define the end of one stratigraphic interval and the beginning of another. This confusion is compounded by present systems of terminology applied to deep-sea sediments.

Consequently, at the present stage of knowledge it was not felt that under the rules of stratigraphic nomenclature these intervals could be given formal designations. They are referred to as "units" in the Lithologic Summaries of each hole, and are similarly designated in other portions of this report.

SEDIMENT NOMENCLATURE

The Problems

Many difficulties were encountered in naming sediments recovered during Leg 5. There were such obvious problems as those of operator differences in evaluating the percentages of the various constituents, and of there being more than one name acceptable for a given sediment composition. However, even more fundamental terminology problems were encountered. First, there was the choice of a descriptive or a genetic classification. The latter was selected as best suiting the more generalized preliminary study being conducted aboard ship. Next came the problem of devising names for sediments which commonly had many different constituents. Seven constituents occurred in major amounts (>25 per cent), and five others occurred in minor amounts (10 to 25 per cent). Although no sediment contained all these constituents, some had four or five constituents present in significant amounts. When all the constituent names were used in the sediment name, the result was an unwieldy terminology, especially when adjectival terms were added to distinguish the minor from the major constituents.

Another problem was the lack of a single sediment classification system providing names for all the constituents encountered. Some constituents might comprise over 50 per cent of a sample and yet be considered unimportant in the classification system. Even by combining, say, the Shepard (1954) and Olausson (1960) classifications, lithologic terms were not available for some sediments. Furthermore, by employing several classifications the problem of dissimilar class limits was introduced. Thus, the Shepard classification uses 25, 50 and 75 per cent as class limits, whereas the Olausson classification uses 30 and 60 per cent. Also, the Olausson classification makes no provision for distinguishing, for instance, between a sediment which contains 30 per cent skeletal remains and one which contains 90 per cent; and, such distinctions are necessary to permit quantitative determinations for evaluating the genetic implications of the sediments and for constructing facies maps.

Many of these shortcomings have been outlined by Krasheninnikov (1968). He also points out the problem of comparing modern marine and ancient sediments by means of present-day classification systems.

It was decided, therefore, to devise a sediment classification which would be descriptive, simple, consistent and amenable for preliminary studies. The system finally adopted was suited to the shipboard practice of tabulating the occurrence of each constituent in per cent of the sample.

Classification Adopted

The classification which has been adopted is shown in Table 3. Its class limits are similar to those used by Shepard (1954) in his classification of terrigenous sediments, which facilitates the statistical comparison of constituents. Although each component is shown only in a 2 end-member system, the classification can accommodate three constituents present in amounts greater than 25 per cent (or even the unlikely situation of four constituents, each present as 25 per cent of the sediment). In this classification, the name of the dominant constituent always appears on the right. Successively less numerous constituents are progressively farther to the left in the sediment name.

This classification includes only those components encountered during Leg 5 in amounts > 25 per cent. (If a component was deemed worthy of mention but occurred in amounts < 25 per cent, it was appropriately identified, but was not made part of the sediment name.) This classification system can easily be expanded to include other constituents.

For ease of writing, many of the terms are abbreviated. The term "mud" is substituted for that of clay. Otherwise, terrigenous sediment terminology follows the Shepard (1954) classification. The distinction made between "red clay" and "mud" is strictly on the basis of color. "Red clay" is applied to shades of red, brown and yellow. "Mud" is used in conjunction with blue, green, gray and black sediments. This distinction is the one genetic aspect to an otherwise descriptive classification. The terms "marl" and "chalk" as used by Olausson (1960) are not used here because the nonbiogenous carbonate did not exceed 25 per cent in any sediment. The term "zeolitite" (Arrhenius, 1963) is used in this classification for any sediment containing > 50 per cent zeolites.

For biogenous sediments, if one fossil type clearly predominates, it becomes part of the sediment name. Thus, where radiolarians constitute practically all the siliceous fossils in an ooze, the sediment is termed "radiolarian ooze"; where radiolarians, diatoms, and/or sponge spicules appear in varying amounts, the more general term "siliceous fossil ooze" is applied.

As used in this report, "nannofossils" refer only to calcareous planktonic forms smaller than 50 microns. Specifically, the term refers mainly to coccoliths. However, it also includes discoasters, *Sphenolithus, Rhabdosphaera,* and other less important forms. Again, clear predominance of any form is sufficient reason to apply the specific name rather than the more encompassing term "nannofossils".

For indurated sediments the suffix "stone" is added. Thus, an indurated mud becomes a "mudstone". If an indurated sediment does not show extensive chert replacement, the term "chert" is not applied. The adjectives "siliceous" or "calcareous" are used for indurated sediments having silica or calcium-carbonate cement. An indurated terrigenous mud have a calcium-carbonate cement plus undissolved fossils is a "calcareous biogenous mudstone". For those indurated samples shown by thin-section examination to have a specific composition for which an accepted name already exists, that name is used: for example, "micritic argillaceous mudstone". No restrictions were placed on terminology for the igneous rocks.

As discussed in the lithologic summary of Part III of this report, the colors of pelagic sediments range through various shades of red, brown or yellow. For those pelagic sediments consisting mostly of clay minerals, the term "red clay" is applied, irrespective of the true color. In some cores the color variations in the "red clays" were significant and, therefore, the appropriate color distinctions were made.

BASEMENT

In this report the term "basement" is used in the sense of "acoustic basement", the deepest, positively identified reflector on the seismic reflection profile. No lithologic connotation is intended in this use of the term. At some sites the acoustic basement is basalt; at other sites it is chert.

REFERENCES

Arrhenius, G., 1963. Pelagic sediments. In *The Sea.* M. N. Hill (Ed.). New York (Interscience) **3**, 655.

Berggren, W. A., 1969. Cenozoic chronostratigraphy, planktonic foraminiferal zonation and the radiometric time scale. *Nature.* **224**, 1072.

Blow, W. H., 1969. Late Middle Eocene to Recent planktonic foraminiferal biostratigraphy. In *Proceedings of the First International Conference on Planktonic Microfossils.* P. Bronnimann and H. H. Renz (Eds.). Leiden (E. J. Brill) **1**, 199.

Hays, J. D., Saito, T., Opdyke, N. D. and Burckle, L. H., 1969. Pliocene-Pleistocene sediments of the Equatorial Pacific: their paleomagnetic, biostratigraphic and climatic record. *Bull. Geol. Soc. Amer.* **80**, 1481.

Heirtzler, J. R., Dickson, G. O., Herron, E. M., Pitman III, W. C. and Le Pichon, X., 1968. Marine magnetic anomalies, geomagnetic field reversals, and motions of the ocean floor and continents. *J. Geophys. Res.* **73**, 2119.

JOIDES, 1967. The Deep Sea Drilling Project. *Bull. Am. Assoc. Petrol. Geologists.* **51**, 1787.

Krasheninnikov, G. F., 1968. Basic principles of classification of sedimentary rocks and recent sediments. *XXIII Intern. Geol. Cong.* **8**, 147.

Mason, R. G. and Raff, A. D., 1961. Magnetic survey off the west coast of North America, 32°N. latitude to 42°N. latitude. *Bull. Geol. Soc. Amer.* **72**, 1259.

Olausson, E., 1960. Description of sediment cores from central and western Pacific with the adjacent Indonesian region. In *Rept. Swedish Deep-Sea Exped. 1947-1948.* H. Pettersson (Ed.). Goteborg (Elanders Boktryckeri Aktiebolag) **6** (5), 161.

Raff, A. D. and Mason, R. G., 1961. Magnetic survey off the west coast of North America, 40°N. latitude to 52°N. latitude. *Bull. Geol. Soc. Amer.* **72**, 1267.

Riedel, W. R. and Funnell, B. M., 1964. Tertiary sediment cores and microfossils from the Pacific Ocean floor. *Quart. J. Geol. Soc. London.* **120**, 305.

Riedel, W. R. and Sanfilippo, A. (in press). Radiolaria. In Bader, R. G. *et al.* Initial Reports of the Deep Sea Drilling Project, Volume IV. Washington (U. S. Government Printing Office).

Shepard, F. P., 1954. Nomenclature based on sand, silt, and clay ratios. *J. Sediment. Petrol.* **24**, 151.