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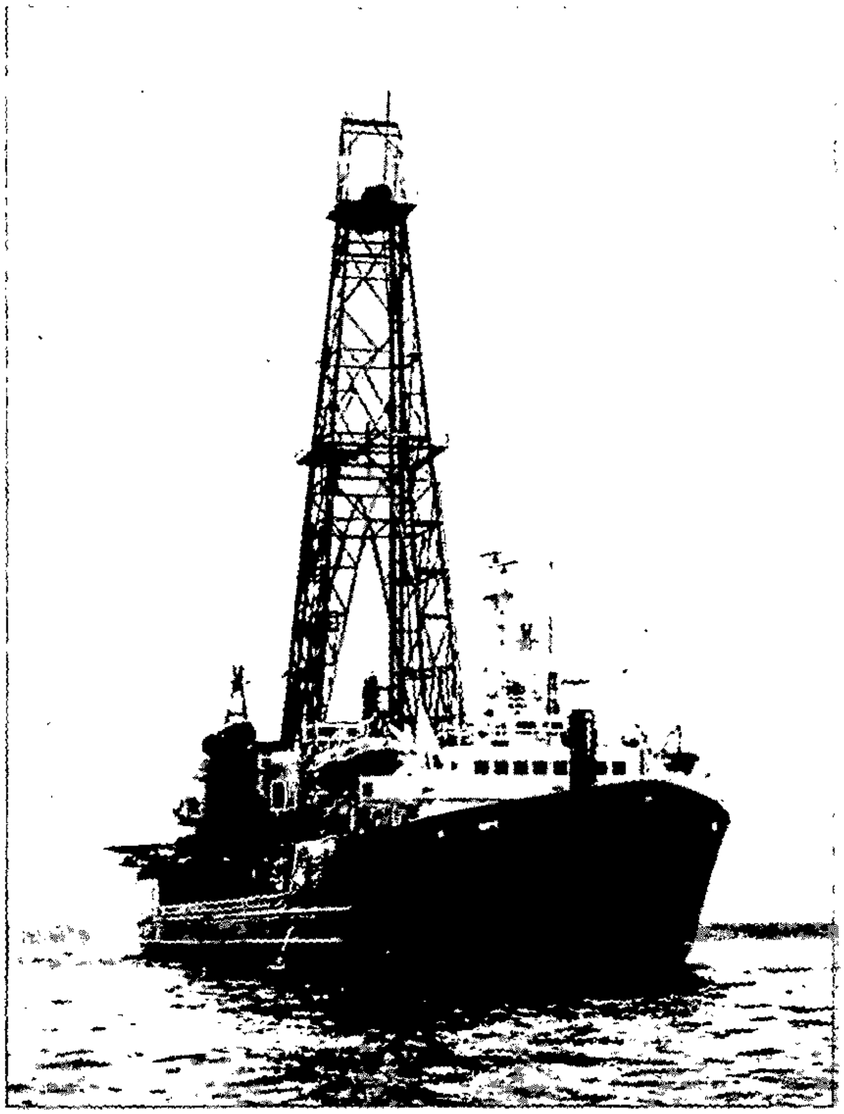

SEDCO/BP 471

SEDCO/BP 471

The SEDCO/BP 471 is a 470-foot ship, 70 feet in width, and has a displacement of 16,596 long tons. The derrick towers 200 feet above the water line. A computer controlled dynamic positioning system can be used in water depths as great as 27,000 feet. The ship, which was built in Halifax, Nova Scotia in 1978, is among the top worldwide dynamically positioned drillships due to its rating of drilling depth capabilities.

The rig will be converted to hold up to 30,000 feet of drillstring and will be able to use a riser system for drilling in 6,000 feet of water.

It has a crew of 52 members and can accommodate a scientific party of up to 50 members. Approximately 12,000 sq. ft. of shipboard space will be equipped for science laboratories.

SEDCO/BP 471 is jointly owned by SEDCO (Southeastern Drilling Company) and British Petroleum.

(Cover photo courtesy of ODP, Texas A & M University)

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GLOMAR CHALLENGER OPERATIONS

CRUISE SUMMARIES

Leg 94 - Northeast Atlantic Ocean

Leg 94 began 17 June 1983 in Norfolk, Virginia, and ended 17 August 1983 at St. Johns, Newfoundland.

Background and Objectives

The high-latitude North Atlantic Ocean is one of the most critical components of the global climatic system, both as an interactive component and as a long-term climatic sensor. It is flanked on three sides by continents, and is particularly influenced by air masses generated over the Canadian Arctic. The North Atlantic is one of two sites of formation of the deep waters that fill most of the world ocean, and waters sinking to intermediate depths are created here as well. During the winter-time, when cooling of the ocean surface accompanies the formation of deep and intermediate waters, the release of sensible and latent heat to cold air masses from the continents reaches values an order of magnitude larger than the global average. This extracted heat then moderates the climate over adjacent land masses.

The modern linkages of air, land, and sea changed during the ice-age climatic cycles of the Pleistocene and late Pliocene. Periodically, as ice sheets covered North America and Europe, the ocean surface north of 40° latitude chilled by as much as 10-12°C, and the temperate waters of the North Atlantic Drift were replaced by a cold, iceberg-filled subpolar gyre separated from the warmer subtropical gyre by a sharply defined polar front along 42-46°N. Formation rates of deep water periodically slowed and may at times have stopped altogether.

These responses to the ice-age cycles left several strong imprints in the deep marine sediments of the high-latitude North Atlantic Ocean: lithologic changes from interglacial carbonate oozes to glacial muds and marls; wholesale replacement of warm planktonic faunas and floras by cold communities; oxygen isotopic evidence of changes in volume of ice stored on land; and variations in the amount of material dropped by melting icebergs. It is now known that the major late Pleistocene advances and retreats of the polar front north of 45° occurred with a 100,000- and 40,000-yr. periodicity, in phase with ice-volume growth and decay. It is also known that a very different tempo of sea-surface temperature change occurred south of 45°N in the northern subtropical gyre. Here, 23,000-yr. oscillations were dominant, and the ocean responded out of phase with (later than) ice volume.

Studies of conventional piston cores have delimited these changes in detail over the time span of the last several hundred thousand years. However, the high rates of deposition that make North Atlantic sediments ideal recorders of long-term climatic change precluded obtaining long climatic sequences from conventional piston cores. With the development of the hydraulic piston corer for use on the Glomar Challenger, these deeper sections have become accessible.

Beyond the late Pleistocene lies a long span of Neogene time during which the oceanographic response if the North Atlantic was also a critical component of the larger picture of global climatic change. Several intervals within this span stand out as particularly interesting, either in their own right or because of their possible connections to important climatic changes nearby or elsewhere on the globe.

At the time scale of the glacial cycles:

1. When did major southward swings of the polar front begin and with what relation to the first major glaciations?

2. Did development of strong 100,000-yr. cycles in ice volume roughly 800,000 yr. ago coincide with similar changes in rhythm of polar-front movements?

3. What was the rhythm of oceanic response in the northern subtropical gyre south of the polar front as the ice-volume rhythms changed?

Before the major Pliocene-Pleistocene glaciations that began at 2.4 Ma, what were the responses of the North Atlantic to the following events?

1. Closing of the Panamanian Isthmus (4-3 Ma), which must have strengthened Gulf stream flow?

2. Closing and re-opening of connections with the Mediterranean around 6.3 to 5.5 Ma, during the Messinian?

3. Climatic coolings know from scattered glacial evidence on Northern Hemisphere land masses at 3.4 to 3.2 Ma (Iceland, Sierra Nevada Mountains) and 10 Ma (Alaska)?

4. Major increases in Antarctic glaciation around 15 and 6.5 Ma?

In short, what is the Neogene history of paleoceanographic change in the mid-latitude North Atlantic?

Related objectives dependent on a sequence of high-quality pelagic cores from the North Atlantic include the following:

1) high-quality paleomagnetic stratigraphy stratigraphy, including definition of very short events because of unusually high sedimentation rates;

2) long, detailed records of the "global" oxygen isotope signal and of regional variations in the carbon isotopic signal;

3) major refinement and extension of high-latitude biostratigraphic datum levels for all planktonic organisms;

4) investigation of the detailed history of $CaCO_3$ and silica preservation and dissolution;

5) studies of the terrigenous fraction, both that delivered by glacial ice-rafting and the smaller background component of windblown origin;

6) information on Icelandic and Azores volcanism; and

7) the history of deep-water circulation, using both stable isotopes and benthic foraminifers.

Coring during the summer of 1981 on previous DSDP legs obtained two long HPC sequences with which to study North Atlantic paleoclimate: Site 552 on Leg 81 and Site 558 on Leg 82. Both retrieved valuable sedimentary sections, their usefulness limited only by the relatively low sedimentation rates (10-20 m/m.y.) and the lack of double-HPC coring to fill breaks between cores and disturbances within cores. Results from Site 552 on the western flank of Rockall Plateau suggested that the fundamental initiation of glacial carbonate cycles occurred at 2.4 Ma, coincident with the first large positive shift in oxygen-isotope values. Site 558, southwest of the Azores, lies south of the region most heavily impacted by surface-water changes in the North Atlantic. Basically, these two sites are end points that pin the northern and southern limits of the transect of cores obtained on Leg 94 in the summer of 1983.

The Leg 94 objectives called for a transect beginning in the warm waters of the subtropical gyre near the Azores (Site 606) and proceeding to the north and northeast through the northern subtropical gyre (Site 607), and the transitional waters (Sites 608 and 609), to Site 610 located off the coast of Ireland. The final site (611) was chosen to the west of Site 610, but in still colder waters. Thus the numerical sequence of sites is from the warmest to the coldest (Fig. 94-1).

Because the paleoceanographic objectives require pelagic sediments and good preservation of the calcareous components, most of the sites were situated along the Mid-Atlantic Ridge and all at relatively shallow depths (2417 to 3883 m). In regions of locally variable sediment thickness (Sites 606, 607, and 609), we used seismic profiler records during the approach to pinpoint final site placement within the thickest parts of local sediment ponds. On the sediment drifts at Sites 610 and 611, sedimentation rates were uniformly rather high, so that final adjustments were not needed. Placement of Site 608 was determined largely by the tectonic objectives at King's Trough.

Two other major objectives for Leg 94 were to study the history and nature of North Atlantic Drift sedimentation on Feni and Gardar Drifts, and the tectonic history of the King's Trough region.

Seismic reflection profiles run in many areas of the North Atlantic are replete with examples of anomalously thick sediment piles considered to have been built up by the long-term circulation of bottom waters. Where the major bottom water masses have been most active piles of sediments several hundreds of meters thick, known as sediment drifts, have accumulated. Drilling in such sequences has been sparse, although it has become clear that the drifts hold an important record of the history of bottom water circulation in the ocean. Attempts to relate available drilling results to seismic stratigraphy suggested that the major North Atlantic drifts were initiated in the Paleogene, but the ages of many drifts are poorly constrained.

Sediment drifts have a characteristic ornamentation of largescale sediment waves, which generally are tens of meters in amplitude and kilometers apart. These wave features have not been sampled to a great extent by piston cores, but they have frequently been characterized as sites of so-called "contourite" deposition.

The proposal to locate some of the sites (in the paleoclimate transect) on two of the major North Atlantic sediment drifts (because of their anticipated high sediment accumulation rates) provided an opportunity to examine the sedimentation of drift sequences in some detail. At Feni Drift on the western side of Rockall Trough and Gardar Drift on the eastern flank of the Reykjanes Ridge three main aspects were tackled:

1. General characterization of drift lithologies, with documentation of systematic structural features, sedimentation rate changes or hiatuses.

2. The structure and composition of the sediment waves (by drilling a number of closely-spaced offset HPC holes).

3. The overall sedimentation history of the drifts (by drilling some deep holes to date significant seismic reflectors and biostratigraphic horizons within them).

The third site in the original series of sites planned for the paleoclimate transect was chosen to examine the fluctuations of the polar front and Neogene sea surface temperature history at about 44 N. A later proposal, aimed at determining the tectonic history of the intraplate King's Trough complex at a location slightly further to the south and east, was combined with the initial objectives. A continuous stratigraphic record was sought through the Paleogene to basement on the southern flank of King's Trough. The results were to be compared with rock-core and dredge haul data from within the complex.

The origin of King's Trough has been a matter of dispute for over 15 yr., despite the relatively abundant geophysical data available from the area. Hypotheses for its formation included: a compressional origin; a short-lived bend in the Mid-Atlantic Ridge; a transform fault; and a rifted aseismic ridge that had originally been built from a hot spot. The latest hypothesis, based on dredge haul and rock-core data, involves uplift of a aseismic ridge during the early Oligocene, followed by Miocene intraplate rifting. This hypothesis could be tested by drilling a deep hole in a flank of the complex. In addition, a number of biostratigraphic objectives could be met if Paleogene sediments were continuously drilled.

Summary of Main Observations

Leg 94 obtained cores in 21 holes at six sites in the North Atlantic (Fig. 94-1, Table 94-1). Ages ranged back to the late middle Eocene at one site (608), but were otherwise all Neogene (mid-Miocene or younger) in age (Fig. 94-2). At least the upper 3 Ma was doubled-cored at all sites; in some sites, the double coring extended into the Miocene.

Test of New Coring Apparatus

At site 606 we tested the newly developed Advanced Piston Corer (APC). This tool represents a potential improvement over the VLHPC in two major respects: (1) scoped out, the unit is much shorter than the VLHPC, thus improving ease of handling on deck with no sacrifice in length of retrieved cores; (2) it was built to withstand roughly double the pull-out pressure limit of the VLHPC (100,000 vs 40,000 lb.), thus potentially extending its coring range beyond that of the VLHPC. The APC functioned successfully to a depth of 178.4 m at Site 606, but was lost at the bottom of Hole 606A after having withstood a 100,000 lb pull-out on a previous core. This was regarded as a successful test of the new tool.

Core Recovey

Leg 94 cores were taken using the APC and VLHPC to refusal, which invariably occurred within a depth range of 125-175 m sub-bottom. We then used the XCB (Extended Core-Barrel) system to extend continuous coring below. For some of the deeper objectives, we washed down and spot-cored selectively within the sediment column. In general recovery was good, averaging 85% of the total thickness cored. Distortions of the cores were non-existent at Site 606, infrequent at Site 607, but more frequent at the four northern sites. This seemed to be caused by the increasing incidence of moderately large swell in the rougher seas to the north. At no time, however, was the weather on site really bad. The sediments most vulnerable to these disturbances were invariably those in the upper 50 m, where high water contents probably contributed to the poor recovery.

Sediment Lithology

Two kinds of sediments were prevalent: interlayered nannofossil oozes, marls, and muds in the upper 2.4 Ma of Sites 608 through 611, and nannofossil chalks in early Pliocene and older levels at all sites (Fig. 94-2). Site 606 consisted of nannofossil oozes even in the

Pliocene-Pleistocene, because it lay south of the region of ice-rafting. Similarly, at Site 607 we recovered largely nannofossil ooze, but with some glacial strata of marly oozes.

The variations on this basic pattern were minor: a high siliceous content in the upper Pliocene of Sites 610 and 611 and the middle Miocene of Site 610; increased volcanic influx in the lower Miocene and upper Oligocene of Site 608 and the upper Pliocene and Pleistocene of Site 610; and slightly higher mud content in the upper Pliocene of Site 609 and various Pliocene-Miocene levels of Sites 610-611.

Stratigraphic Continuity

Because of the striking visual correlations provided by the glacial carbonate layering of the upper Pliocene and Pleistocene, it proved possible to correlate photographs of equivalent layers at offset holes and thus verify onboard whether or not we had obtained a completely continuous record (that is, with core breaks in one hole at a site spanned by a continuous section of core inthe complementary offset hole at that site). Because this correlation was based on photographs, it could not quite be done in real time, but necessarily after a delay of several days. In some cases, gaps in continuity were detected while we were still on station and filled by additional spot coring. More often , we did not know until in transit whether or not we had obtained a complete record.

In general, there were far more complications evident in these cores than might be imagined from an unbroken sequence of homogeneous calcareous oozes or clays. Even in cases where the two holes were placed next to the same beacon with no measurable offset, lithologic and other tie lines were often

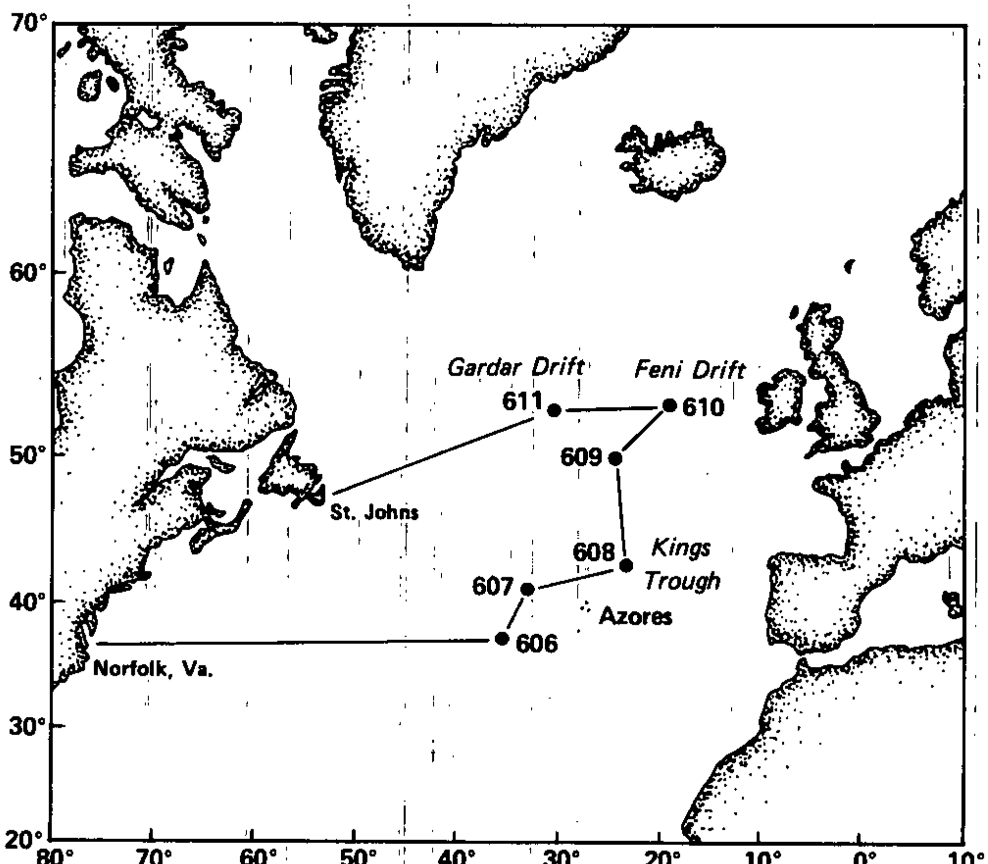


Figure 94-1. Location of the sites drilled on Leg 94.

shifted by 1 to 10 m between holes. This meant that it was not sufficient simply to use pipe-line depths to align core breaks in one hole midway between core breaks in the other; the offset in correlations also had to be considered. We found several instances in which sections were repeated, with the layers retrieved in the top of one core repeating those just obtained in the bottom of the previous core. This implied lateral movement at the bottom of the drill string during raising between cores. In some instances a given core was taken as much as 5 m below the level anticipated from pipe-line lengths, apparently because of downward heaving of the ship at the instant of coring. In such cases, the next core would come up shortened by roughly the amount over-cored on the previous attempt. Other problems included obvious compression and extension of sequences, and various kinds of coring deformation caused by heaving of the ship and armoring of sediment surface caused by coarse glacial debris. All of these complications will be discussed in detail in Volume 94 of the Initial Reports.

Below the glacial cycles, it was not possible to check for continuity in such detail. Generally, within the resolution available from paleomagnetic and biostratigraphic datum levels, hiatuses were not detected, except for one large 1.6 Ma gap at 462 m in Site 608, with upper Oligocene sediments directly overlying upper Eocene. Even the sites on sediment drifts appeared to be entirely hiatus-free.

Paleomagnetic Stratigraphy

Although results were variable from core to core, in general we obtained very good paleomagnetic stratigraphies. Typically, the detrital minerals in the glacial marls and muds gave the strongest intensties and best signals, with the carbonate-rich oozes below and south of the glacial cycles more weakly magnetized, but still useful. Invariably, it was difficult or impossible to obtain magnetic stratigraphies in the semi-indurated chalks (250-350 m sub-bottom), that were broken up into small "drilling biscuits", but the deeper and more lithified chalks gave useable results, except in tectonically disturbed sections. In most sites, the basic magnetic epochs were clearly defined, and even short events like the Reunion and Cobb Mountain were detected in several holes at one site.

Biostratigraphy and Microfossil Preservation

The North Atlantic is recognized as the least corrosive ocean to calcareous sediments, and in general, preservation of the abundant calcareous microfossils and nannofossils was very good to excellent, except for the Eocene, Oligocene and Miocene at Site 608, and parts of the early Miocene at Site 610, where preservation was moderate to poor. Silica was much rarer, generally constituting only a few percent of the sediment at most. Although silica preservation is generally noted as good to moderate, it is likely that only a very small fraction of the silica originally produced in the surface water survives in the sediments, due to light silification of the tests in silica-deficient surface waters.

Generally, biostratigraphy was secondary to paleomagnetic stratigraphy on Leg 94. This was due in part to the extraordinarily good quality of the paleomagnetic records and in part to the progressive northward loss of the low-latitude species that form the basis of the calcareous microfossil zonation schemes. Usually, the nannofossils (and less frequently the planktonic foraminifers or diatoms) were used to put broad time constraints on intervals of sporadic coring or poor core-recovery, so that the magnetic record could then be used for finer resolution.

Major inconsistencies in age assignments at high latitudes using previously published tropical-subtropical biostratigraphic zonation schemes for both nannofossils and planktonic foraminifers became evident in Site 607 and recurred on every site through Site 611.

In general, the combination of biostratigraphy and paleomagnetic stratigraphy provided numerous very tightly age-constrained datum levels at all sites.

Sediment Accumulation Rates

Relative to the global average, almost every site cored on Leg 94 had a very high sedimentation rate. Only Site 608, with rates of 10-30 m/m.y., had rates near the global mean.

The reasons for the high sedimentation rates vary. Sites 606, 607, and 609 on the Mid-Atlantic Ridge were specifically chosen in regions of locally thickened sedimentary fill, evident on seismic records. The rates of deposition at these sites range from 45 to 75 m/m.y., unusually high for the deep sea. We envisage that sediment initially deposited on locally higher topography related to basement structure is subsequently removed and transported by some kind of gentle, relatively steady form of near-bottom energy into the closed basins and lower topography that we cored. The lack of significant contamination by older nannofossils at these sites argues

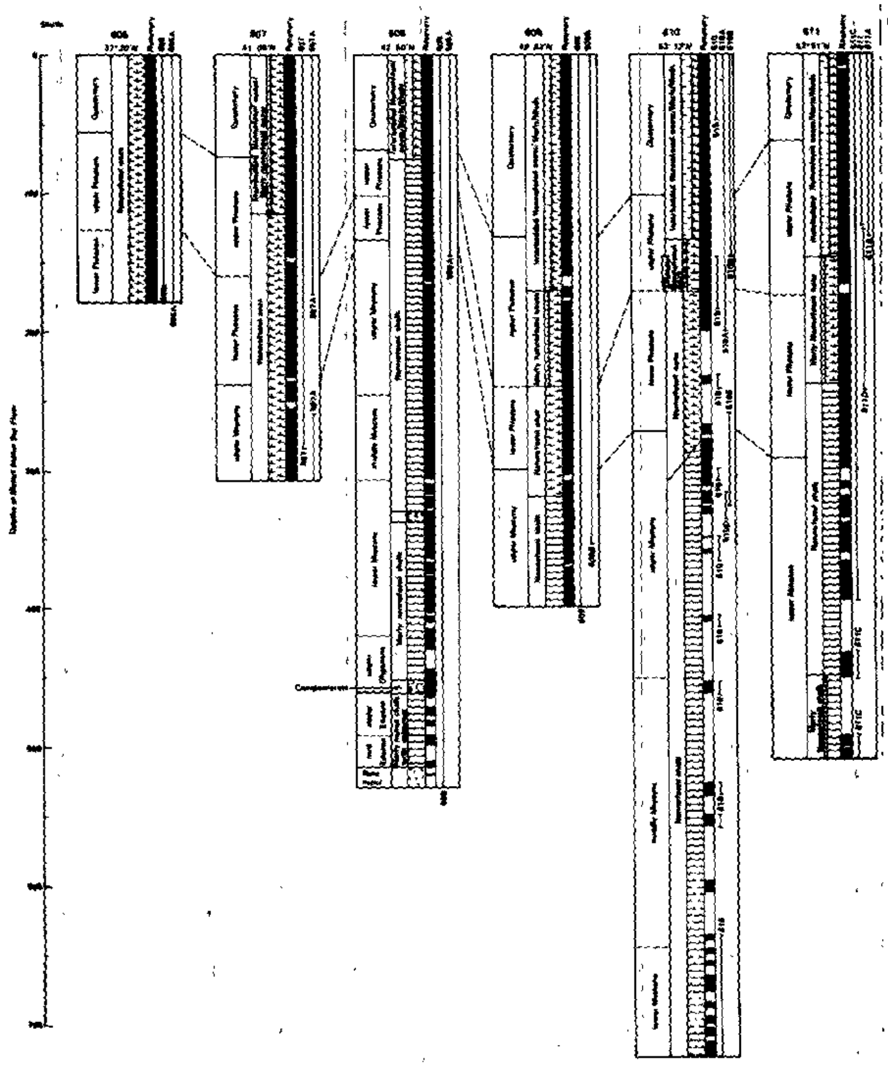


Figure 94-2. Lithostratigraphic columns of sediments recovered on Leg 94. The stratigraphic boundaries were drawn according to a time scale made up by the shipboard party and defined by calcareous nannofossil, foraminiferal and diatom datum levels and paleomagnetic stratigraphy.

against strong erosion by bottom currents; for the most parts, the sediments moving about are contemporaneous with the pelagic "rain". Whatever the exact mechanism of sediment redistribution, it results in accumulation rates two to four times greater than the local mean and far higher than the global average.

The rates of deposition observed at the two drift sites (Sites 610 and 611) were, if anything, somewhat lower than expected, although still above the regional norm, and were also surprisingly steady through time at Feni Drift. Basically, these rates are no more obviously a product of bottom-current deposition than those at the three "pelagic" sites on the Mid-Atlantic Ridge; the drift-sediments did not show major differences from the pelagic sediments (see below).

The only obvious difference between the drift sites and the Mid-Atlantic Ridge sites is one of scale. On the ridge, redeposition is local in scale; sediment-deficient sources are closely juxtaposed with sites of excess deposition. For the drifts, the sediment sources are larger and far more remote, and the transport distances far larger, as are the regions of positive accumulation (the scale of the entire drift). The sources of Feni Drift sediments (Site 610) are probably the European margin and eastern Rockall Plateau. Those for Gardar Drift (Site 611) are the western Rockall Plateau and the Iceland-Faeroes Ridge. During long-range transport, considerable amounts of older nannofossils and other contaminants from a variety of sources are entrained in the flow and deposited on the drift, but in a sedimentary sequence still dominated by contemporaneous pelagic material.

Site 608 has a mean rate of sediment accumulation much nearer to the regional mean. The site is situated in a region of relatively smooth, unvarying topography and sedimentary fill, and this appears to offer less chance for local-scale redistribution and local thickening of sedimentary sequences.

Drift Sedimentology

Our sedimentological studies aimed at characterizing the deposits accumulating on major drifts resulted in additional surprising findings. The lithologies were fundamentally pelagic in type at both the Feni Drift and the Gardar Drift. As at the other Leg 94 sites, the glacial carbonate cycles dominated the upper parts of the holes and gave way downwards to nannofossil oozes, marls, and chalks. No primary structures that might be interpreted as due to bottom-current activity were identified at either site. Gardar Drift sediments were generally more terrigenous than those at Feni Drift, but this is clearly due to a greater input of ice-rafted sediment and rock debris from Iceland. Feni Drift sediments contain evidence of local turbitdite activity, but sharp-based, coarse-grained beds are entirely absent at Gardar Drift. We await shore-based X-radiography of the cores to confirm the lack of current evidence. Reworking of nannofossil material was recognized throughout the sections drilled, and thus we have no doubt that sediment redistribution occurred. No hiatuses were detected in the records.

Sediment Waves

The site chosen for drilling were located within sediment wave fields at both drifts, but these fields were situated at different relative levels on the flanks of the drifts. The waves drilled on Feni Ridge were at around 2400 m water depth close to the drift crest (Fig. 94-3); those drilled on Gardar Drift were at 3200 m on its lower southeastern flank, where the core of Norwegian Sea overflow water turns westward before spilling into the Charlie Gibbs Fracture Zone.

Detailed PDR and 3.5 kHz profiling in the vicinity of both sites showed that the sediment waves are characteristically irregular in shape and amplitude. The wave crests around Site 611 could be traced laterally with ease, whereas only some of those at Site 610 could be traced track-to-track.

Holes were drilled on a selected wave crest on both drifts and in each case were compared with offset holes drilled in adjacent troughs (Fig. 94-3). Crest-to-trough lithologic variations were slight, although bed-to-bed correlations were easily definable. Some thickening and thinning of individual beds occurred, and we plan detailed shore-based grain size analyses to discern any differences in local sedimentation conditions.

Although there is little evidence of migration of the sediment waves on seismic profiles, systematic differences in accumulation-rate curves for trough versus crest holes at Gardar Drift can at this stage best be explained by Pliocene wave migration.

History of Sediment Drifts

Our prime objective at Feni Drift was to penetrate a regional seismic reflector at 0.75 s sub-bottom (two-way travel time). The reflector had been characterized by some workers as the base of the drift sequence, but others considered it a mid-drift reflector representing the onset of modern circulation in Rockall Trough. We identified the reflector as a siliceous nannofossil chalk, dated as latest early Miocene (NN4). At the level of the reflector, we recognized selective dissolution of diatoms, possibly indicative of a regional oceanographic event. No hiatus was observed; neither was there apparently a change in accumulation rate.

Another reflector at Feni Drift at 0.37 s sub-bottom (two-way travel time) represents a period of decreased sedimentation rate in the late Miocene, which correlates in time with the Messinian isolation of the Mediterranean.

On Gardar Drift a good correlation of seismic stratigraphy with downhole lithologic unit boundaries was obtained, but our plans to penetrate deep reflectors were frustrated by extremely low drilling rates in the upper Miocene sequence.

Overall, the upper parts of the two major drifts are comprised of sediments younger in age than had been estimated previously. We suspect other drift sequences examined in the light of our seismic and stratigraphic results may present a similar picture.

King's Trough

At King's Trough we sampled an almost complete sequence on its southern flank through to basement. In age the sediments range from late Quaternary to late middle Eocene (NP16). They lie on relatively fresh pillow lava basalt, dated at about 42 Ma from sediments at the contact. This matches well with a predicted age from magnetic anomaly identification. A major hiatus occurs at a depth of 462 m sub-bottom, separating green nannofossil chalks with ash layers and volcaniclastic turbidites of late Eocene age (NP17), from upper Oligocene (NP24) chalk conglomerates and pinkish nannofossil chalks: a time span of about 11.6 m.y. The Oligocene chalks display a range of soft-sediment deformation structures that suggest debris-flow processes on unstable slopes. A futher interval with soft-sedimtent deformation structures and with conspicuous microfaulting occurs higher in the sequence within the lower Miocene. The remaining parts of the section are nannofossil oozes and chalks, except for the glacial-interglacial cycles of marl and ooze in the upper 76 m.

The interpretation of tectonic events at King's Trough from the sedimentary evidence of slope instability and volcanic activity, along with the presence of the major hiatus, agrees well with the sequence of events predicted from dredge haul, rock core and geophysical data. Following a period in the Miocene to form the present-day King's Trough.

Leg 94 was extraordinary lucky with respect to weather; no storm of any force affected the ship on any station, and no time was lost as a result of bad weather. The only gale-force wind encountered during the entire 55 days came three days from port and pushed the ship into port embarrassingly early.

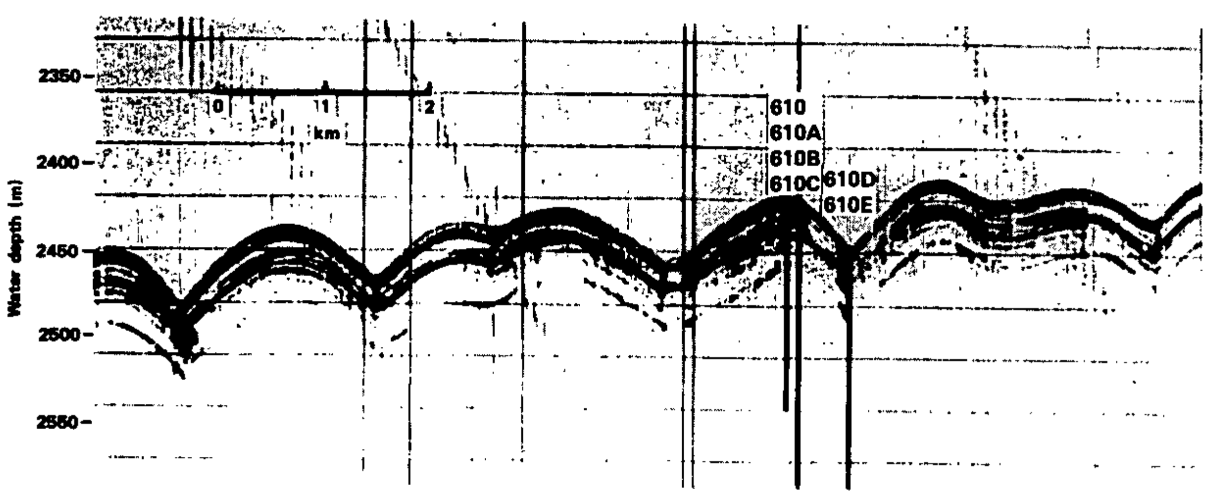


Figure 94-3. High resolution seismic profile (3.5 kHz) of the sediment waves on Feni Drift, illustrating location of crest and trough drilling at site 610.

Leg 95

New Jersey Transect - ENA 3

Leg 95 began 21 August 1983 at St. Johns, Newfoundland, and ended 26 September 1983 at Ft. Lauderdale, Florida.

Introduction

Baltimore Canyon trough, the most intensely studied sedimentary basin of the United States Atlantic margin, encompasses the coastal plain, continental shelf and continental slope of New Jersey (Fig. 95-1). Outcrop and subsurface investigations of the coastal plain have been carried out since the early 1900's. Offshore studies began in the 1950's (e.g. Drake, et al., 1959) and have intensified since 1973 as a result of renewed interest in offshore petroleum leasing. Forty-one boreholes and numerous seafloor samples now provide a geologic basis for interpreting thousands of kilometers of seismic reflection profiles. Summaries of the structural and stratigraphic framework and depositional history have been published by Klitgord and Grow (1980), Schlee (1981) and Poag (1980; in press). On the basis of the extensive published record of these geological and geophysical investigations, the New Jersey margin was chosen as the most suitable location for constructing the first marginwide stratigraphic transect. As envisioned, the transect would extend from the outcrop belt in central New Jersey to a location 700 km distant on the lower continental rise. Initial DSDP core holes on the slope and upper rise would emphasize the Cenozoic and Upper Cretaceous sections, as dictated by the limitations of open-hole drilling. However, future coring could be expected to provide comparable data from more deeply buried Mesozoic deposits and basement rocks.

Leg 93 began the current phase of drilling on the New Jersey Transect by placing two shallow core sites (maximum penetration 816.7 m) on the upper continental rise (Sites 604, 605; Figs. 95-1 through 95-3). In addition, they established the extreme oceanward end of the transect at Site 603 (Fig. 95-1) on the lower rise, where a penetration of 1585.2 m nearly reached basement and recovered rocks as old as Valanginian (Early Cretaceous). Leg 95 is principally intended to provide a crucial link between shelf and rise sites.

The U.S. Geological Survey (USGS) and the Bundesanstalt fur Geowissenschaften und Rohstoffe (BGR) have collected more than 6000 km of multichannel and 15,000 km of single-channel, high-resolution seismic reflection profiles in the Baltimore Canyon trough region (Figs. 95-2 and 95-3; Robb and Kirby, 1980; Schlee 1981). A large number of lines have also been collected by Lamont-Doherty Geological Observatory, Woods Hole Oceanographic Institution and other institutions. These lines provide a dense network of seismostratigraphic sections along the New Jersey slope and rise.

Calibration of these profiles is provided by a series of boreholes. Sixteen wells in New Jersey (Olsson, et al., 1980), four wells on the shelf and slope (Poag, 1980; in press) and eight shallow holes on the slope and shelf (Poag, in press), provide the principal geologic control (Fig. 95-1). Approximately 26 additional commercial wells on the outer shelf have been released to the public domain, but have not yet been analyzed.

The standard reference section for the Baltimore Canyon trough is USGS seismic reflection profile Line 25, which crosses the depocenter in a southeastward direction, beginning 20 km off Atlantic City, New Jersey, and passing 10 km south of the COST B-3 well (Fig. 95-2). Poag (in press) has integrated seismic and borehole data in a detailed description and analysis of this section. The principal DSDP sites proposed for the New Jersey margin have been located on or near Line 25 in order to maximize the accuracy of seismic correlations in all present and future core sites along the transect.

Unconformities, paleobathymetric cycles, sea level change

Poag (1980; 1982a,b; in press) and Poag and Schlee (in press) have discussed the widespread and frequent occurrence of stratigraphic gaps in the sedimentary basins of the Atlantic offshore region, including the Baltimore Canyon trough (Fig. 95-4). In the boreholes, the presence and duration of hiatuses has been documented by the absence of biostratigraphic zones. Seismic sequence analysis also reveals the presence of these unconformities crossing the boreholes and in undrilled sections as well. Within the shelf sequences of the trough, major stage boundaries are often distinguished as distinct reflections and can be seen to truncate the underlying reflections at scattered locations along their lengths, indicating erosion. Above them, the reflections often onlap or downlap, indicating intervals of nondeposition. However, the vertical resolution of the seismic systems used is limited to around 5 m at depths of less than 2 km, so that

Table 95-1. Coring summary Leg 95, Site 603, Hole 603 D.

Core No.	Date 1983	Time	Depth From Drill Floor (m) Top Bottom	Depth Below Sea Floor (m) Top Bottom	Length Cored (m)	Length Recovered (m)	Per Cent Recovered
1R	2 Sept.	1600	4851.0–4860.6	200.0–209.6	9.6	9.47	99
				HOLE 603E			
1R	6 Sept	0215	5588.4–5598.0	936.4–946.0	9.6	0.58	6
2W	8 Sept	1240	5910.0–5923.4	1258.0–1271.4			(wash)
3W	8 Sept	2320	5929.0–5931.0	1277.0–1279.0			(wash)
4W	9 Sept	1540	5931.0–5941.7	1279.0–1289.7			(wash)
				HOLE 603F			
1W	10 Sept	1700	4650.0–4682.6	0.0–32.6			(wash)
2W	12 Sept	0230	4682.6–5630.5	32.6–980.5			(wash)
3W	12 Sept	1445	5630.5–5850.1	980.5–1200.8			(wash)
4W	13 Sept	0820	5850.8–6023.2	1200.8–1373.2			(wash)
5W	13 Sept	1745	6023.2–6147.8	1373.2–1497.8			(wash)
6R	13 Sept	2140	6147.8–6157.3	1497.8–1507.3	9.5	9.84	104
7R	14 Sept	0115	6157.3–6166.4	1507.3–1516.4	9.1	5.0	55
8W	14 Sept	0920	6166.4–6190.2	1516.4–1540.2			(wash)
9R	14 Sept	1245	6190.2–6195.7	1540.2–1545.7	5.5	2.95	54

truncated or onlapping strata of lesser thickness would not show up on the profiles studied (Sheriff, 1977). The boreholes show that unconformities sometimes appear to be conformable seismic boundries in places where they represent gaps. On the continental slope, the angles between reflections are much more disparate, which makes unconformable contacts easier to recognize. As a general rule, the unconformities fall into two categories:

1) Those that can be recognized from basin to basin (Blake Plateau basin, Baltimore Canyon trough, Georges Bank basin) and appear to be nearly coincident with the "global" periods of erosion postulated by Vail, et al. (1977); and

2) Those that have more limited extent within a single basin and do not necessarily coincide with those of the Vail scheme.

The major unconformities have been correlated by Poag (in press) with the so-called global peiods of erosion outlined by Vail, et al. (1977) and Zeigler (1982) and may provide a means of identifying major depositional cycle boundaries (Figs. 95-4 and 95-5).

Sea level change and paleobathymetric cycles

Studies of paleobathymetric cycles inferred from analyses of Atlantic offshore boreholes by Poag and co-workers have also revealed good correlations with the supercycles of sea level fluctuation described by Vail, et al., 1977; see Poag and Hall, 1979; Poag, 1980, 1982a,b; and Poag and Schlee, in press. Figure 95-6 shows a comparison of this sea level curve with paleobathymetric curves derived from the B-2, B-3, GE-1 (southeast Georgia embayment) and G-1 and G-2 wells (Georges Bank Basin). In general, the correspondence of deep and shallow bathymetry with high and low sea levels is remarkably close in the Mesozoic section and supercycles are easy to identify; it is more difficult to correlate the Cenozoic section. Depositional cycles are broadly uniform from basin to basin for Mesozoic strata, but interbasin variability increases considerably in the Cenozoic.

Subsidence history, thermal evolution, and crustal structure

The sedimentary rocks that accumulated in the Baltimore Canyon trough record the vertical movements (uplift and subsidence) of the crust and upper mantle that have occurred at the U.S. continental shelf and slope through time. A number of studies have shown that the principal factors contributing to the subsidence of the continental shelf and slope of the Baltimore Canyon trough are thermal contraction and sedimentary loading (Fig. 95-7; Steckler and Watts, 1978; Watts and Steckler, 1979; Royden and Keen, 1980).

The main contributor to the subsidence history of the Baltimore Canyon trough following rifting is sedimentary loading (e.g. Steckler and Watts, 1978). Sedimentary loading can account for the overall shape of the basement underlying the trough, the existence of a coastal plain, and the occurrence of relative stratigraphic highs near the shelf

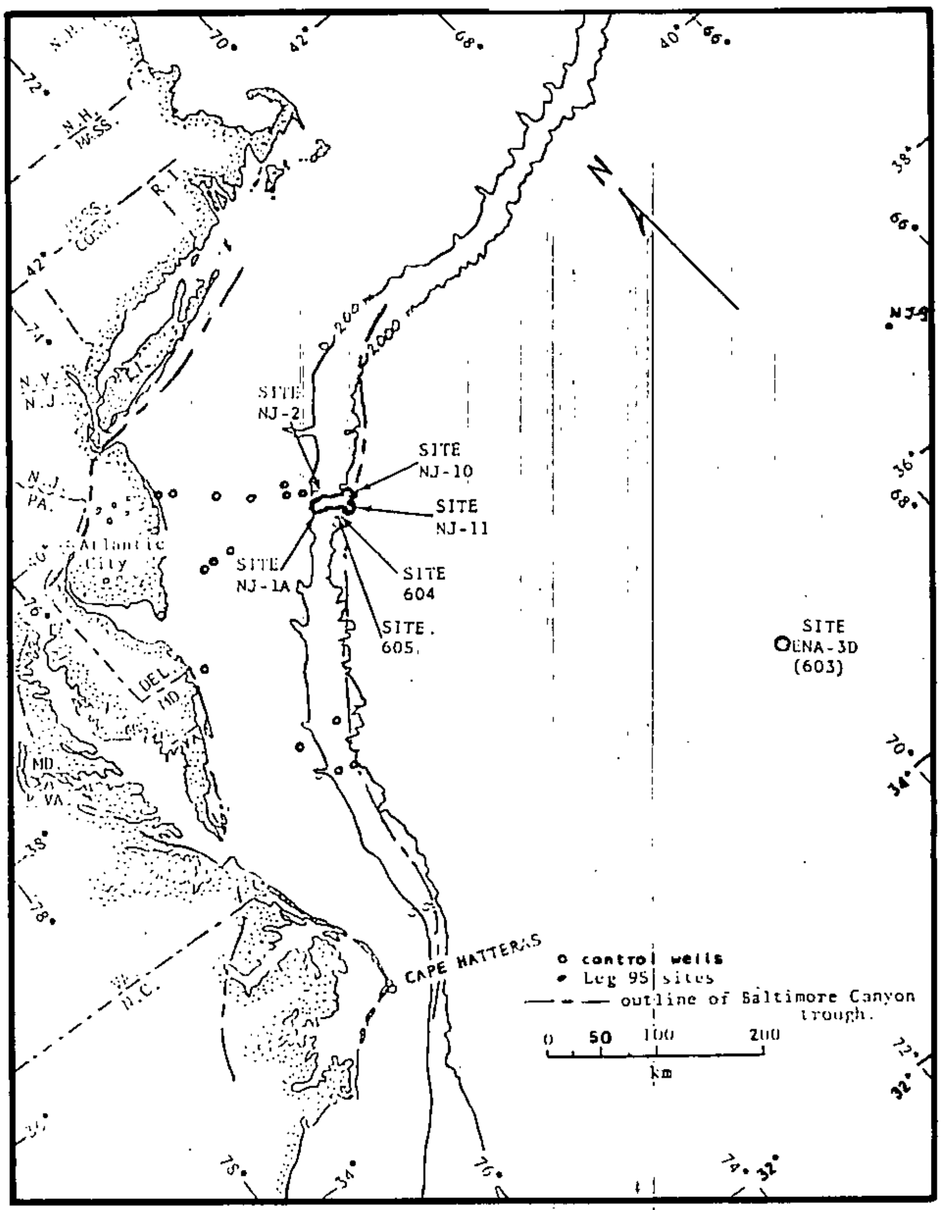


Figure 95-1. Chief control wells and Leg 95 sites.

break. The effects of thermal contraction and sedimentary loading have been combined recently into models for the thermal and mechanical evolution of passive continental margins (e.g. Watts and Steckler, 1979; Beaumont, et al., 1982; Royden and Keen, 1980). In these models thermal contraction occurs following crustal and lithospheric extension at the time of rifting while sedimentary loading occurs by flexure of a crust and lithosphere that progressively increases its flexural rigidity with age.

The models (thermal and mechanical) have implications for the crustal structure of the Baltimore Canyon trough. For example, in order to explain the subsidence history at the COST B-2 well, a substantial amount of crustal and lithospheric thinning (ca. 20 km) is required. If the thickness of the crust prior to rifting was 30-35 km then the subsidence history implies that the crust is only about 10-15 km thick in the vicinity of the well.

An important application of the thermal and mechanical models from the point of view of the New Jersey Transect objectives is that they allow the stratigraphy of the marigin to be predicted for different ages following rifting. For example, preliminary modeling studies show that thermal contraction and sedimentary loading, in combination with long-term changes of sea level, may explain some of the main features of the margin that have been identified on seismic reflection profiles of the shelf and slope off New Jersey, such as coastal on- and offlap. Measurements of on- and offlap were one of the means by which Vail, et al. (1977) estimated sea-level changes through time. The models predict that following rifting, passive margins should show patterns of onlap as the lithosphere cools and

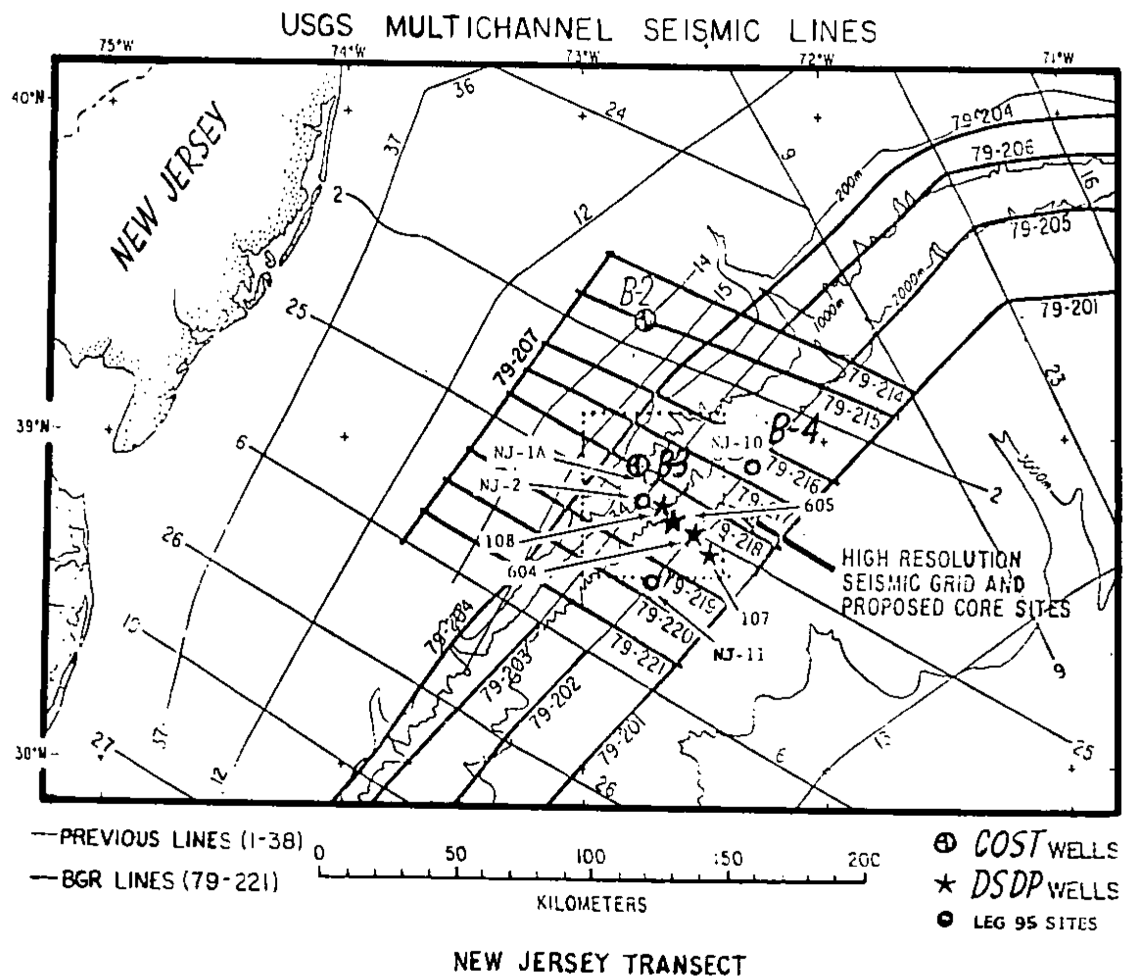


Figure 95-2. Multichannel seismic grid available for studies relative to the New Jersey Transect.

increases its rigidity with time (e.g. Steckler and Watts, 1981). This suggests that since the beginning of many of the "cycles" of on- and offlap correlate with the age of rift/drift transitions in the world's passive margins, the cycles may be partly tectonically controlled. If this is the case, then the major cycles of Vail, et al. (1977) (e.g., their super-cycles) may be widespread, since many widely-separated continental margins rifted at similar times, but they may not be worldwide.

Drilling Results

Site 612

Site 612 was selected to provide a midslope (1404 m water depth) stratigraphic section along the New Jersey Transect. Its position at the junction of USGS multichannel seismic profile Lines 25 and 34 affords excellent correlation of the sedimentary sequences here with seismic sequences recorded on the dense grid of seismic lines crossing this part of the New Jersey margin (Figs. 95-8 and 95-9). The site is located just updip of the broad submarine outcrop of middle Eocene siliceous carbonate-rich strata that was sampled by DSDP Leg 11 at Site 108. It serves as the stratigraphic link between the COST B-3 well on the upper slope 12 km to the north and Site

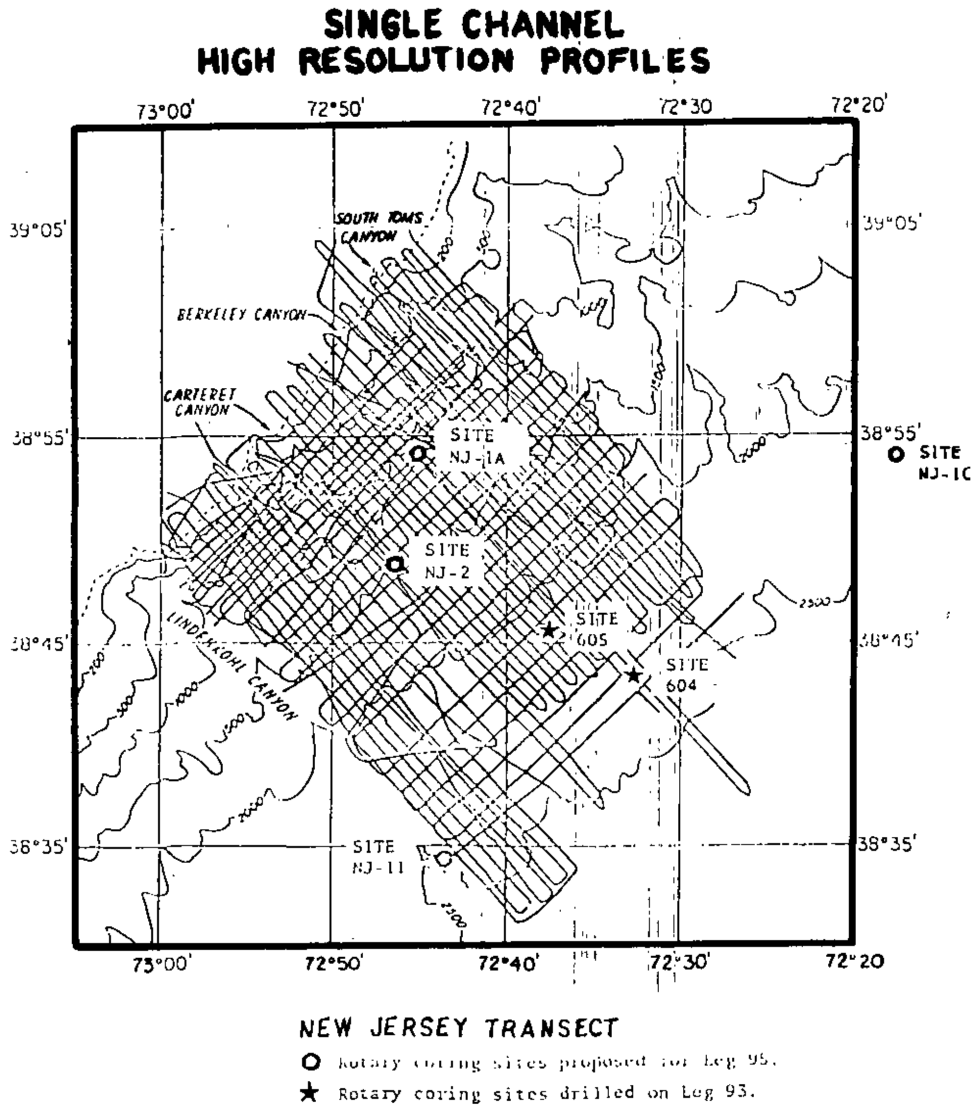


Figure 95-3. Single channel high-resolution seismic grid in the New Jersey Transect area.

605 on the upper rise, 14 km to the southeast. Chief operational objectives were to continuously core the section to approximately 800 m and to obtain a suite of downhole geophysical logs.

In terms of scientific goals, this site was selected to provide the most complete Cenozoic and Upper Cretaceous section possible for this part of the margin, given the limitations of open-hole drilling. The principal specific objectives were:

1. To establish the composition, stratigraphic framework and depositional environments of sediments constituting the middle continental slope.

2. To accurately date the biostratigraphic gaps, unconformities, and major seismic reflections in the section.

3. To document the lateral variability of lithofacies and biofacies between the COST B-3 well and Site 605.

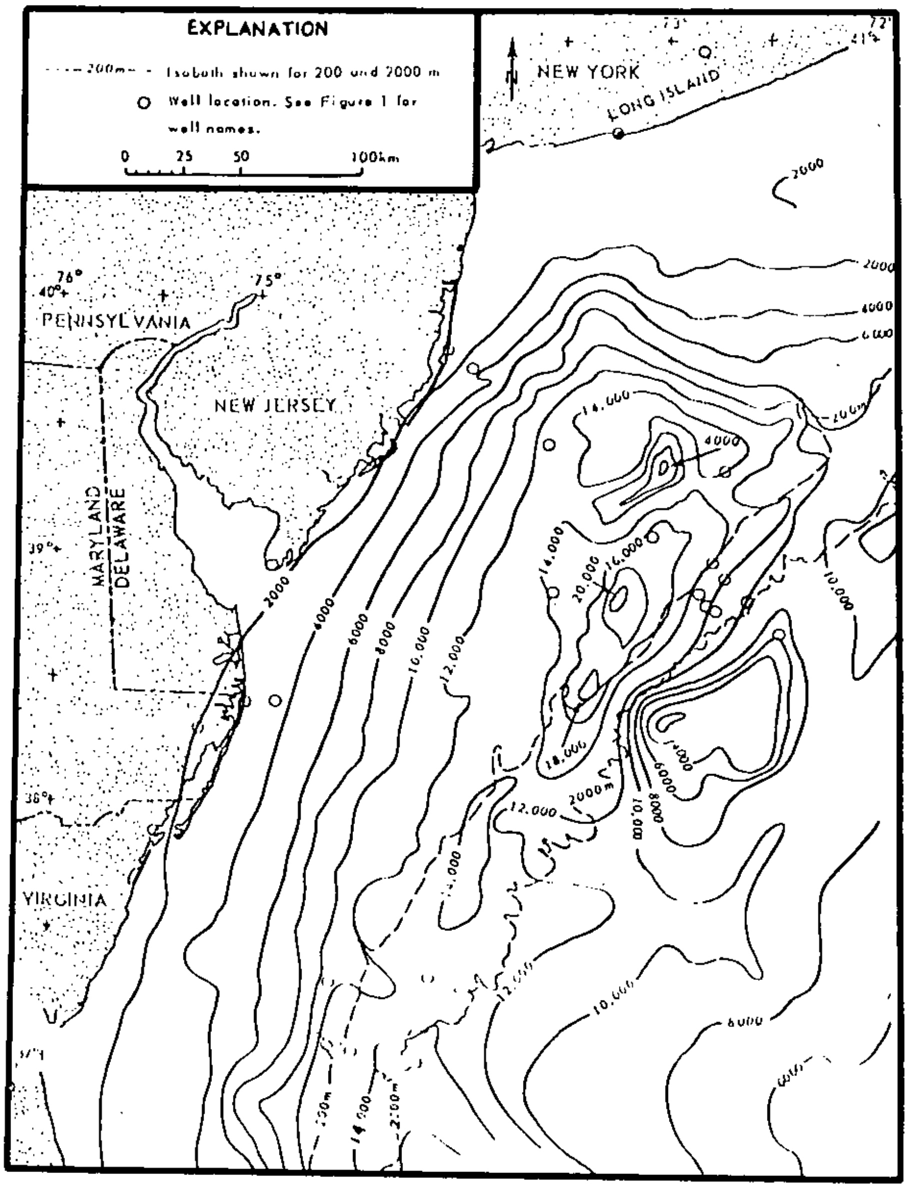


Figure 95-4. Isopach map of sedimentary fill in Baltimore Canyon Trough. (Data from Mattick and Bayer, 1980).

4. To identify depositonal sequences and evaluate their relationships with seismic sequences, relative sea level changes, oceanic current patterns, water mass composition, sediment provenance and accumulation rates, and with basin subsidence history.

Results

Five distinct lithologic units were documented at Site 612 (Figs. 95-10 and 95-11). The lowermost (Unit V) comprises 27.8 m of thin black, foraminifer or nannofossil chalks alternating with mudstone and shale of late Campanian age. The major component is fine-grained terrigenous detritus (chiefly clay with subordinate amounts of quartz sand or silt and mica). The clay enrichment relative to overlying Maestrichtian beds is clearly reflected in the consistently higher values recorded on the gamma ray log (20-30 GAPI units higher). The dark color is in part attributable to an abundance of organic matter and pyrite. The TOC value of 2.68% is the highest and only significant amount recorded at Site 612.

Rich, varied, diagnostic foraminiferal and calcareous nannoplankton were present in the upper Campanian unit, but radiolarians were not observed. A low planktonic-benthic foraminiferal ratio of 3:1 (in more than 250 um size fraction) and the general nature of the benthic assemblage are suggestive of shelf deposition. Sedimentation rate cannot be determined because of the incomplete penetration of the Campanian.

The upper boundary of this Campanian unit is an erosional contact with lower Maestrichtian strata that coincides with a distinct upward increase in sonic velocity and a major upward decrease in the abundance of benthic foraminifera. The acoustic impedance at the contact produces a weak, undulating reflection at 2.56 s on Line 25 that can be traced across truncated underlying reflections.

The geometry of this Campanian unit in depth section (Line 25) in conjunction with the paleoecological inferences drawn from foraminiferal assemblages and lithology suggest that Site 612 was an outer shelf location during late Campanian.

Lithologic Unit IV comprises ca. 84.6 m of dark gray, marly, intensely burrowed foraminifer-nannofossil and nannofossil-foraminifer chalks, including some lithified limestone

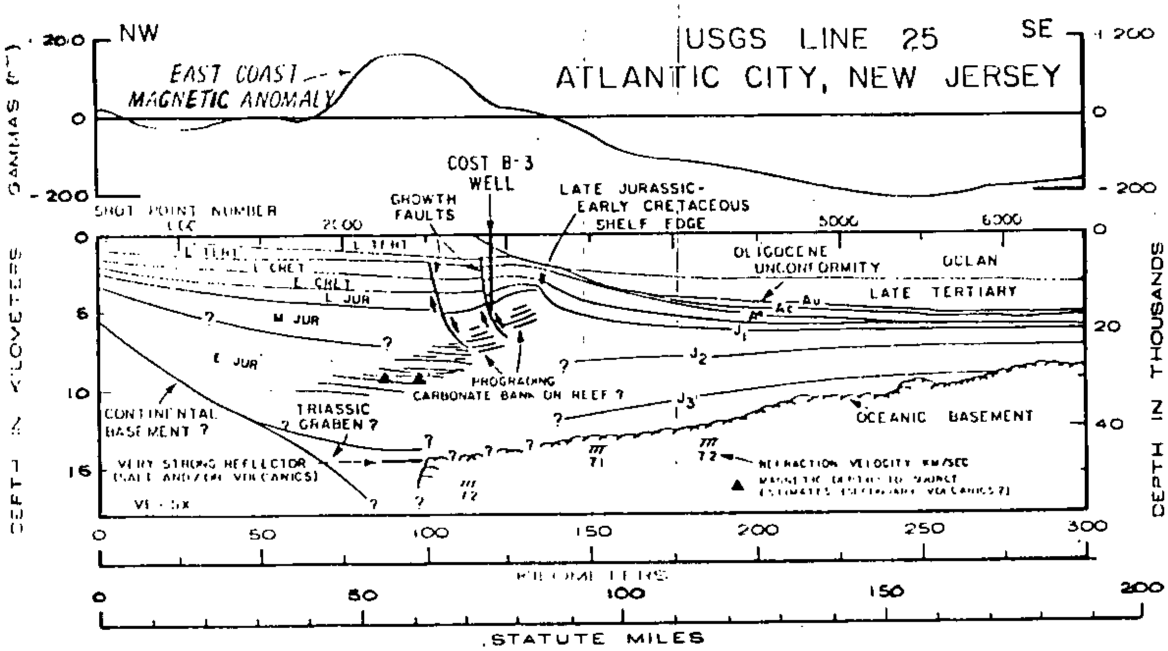


Figure 95-5. Schematic structural cross section of Baltimore Canyon Trough along USGS Line 25. (From Grow, 1980.)

layers. Terrigenous components are present throughout, but decrease significantly toward the top (e.g., clay ranges from 30-50%). Average sedimentation rate was 2.1 cm/ky.

Calcareous microfossil groups are well represented in these strata and indicate an age of early and middle Maestrichtian. Radiolarians are rare and poorly preserved (only observed in Core 612-61, at the top of the section).

The top of the Maestrichtian unit is placed within a poorly recovered core interval (612-60). Because the distance between the lower Eocene beds above and the middle Maestrichtian below is less than 9 m, it is presumed that the contact is unconformable. This inference is supported by the fact that a similar stratigraphic interval is missing in updip wells. A high-amplitude reflection is found at 24.8 s on Line 25 representing the top of the middle Maestrichtian section and can be widely traced.

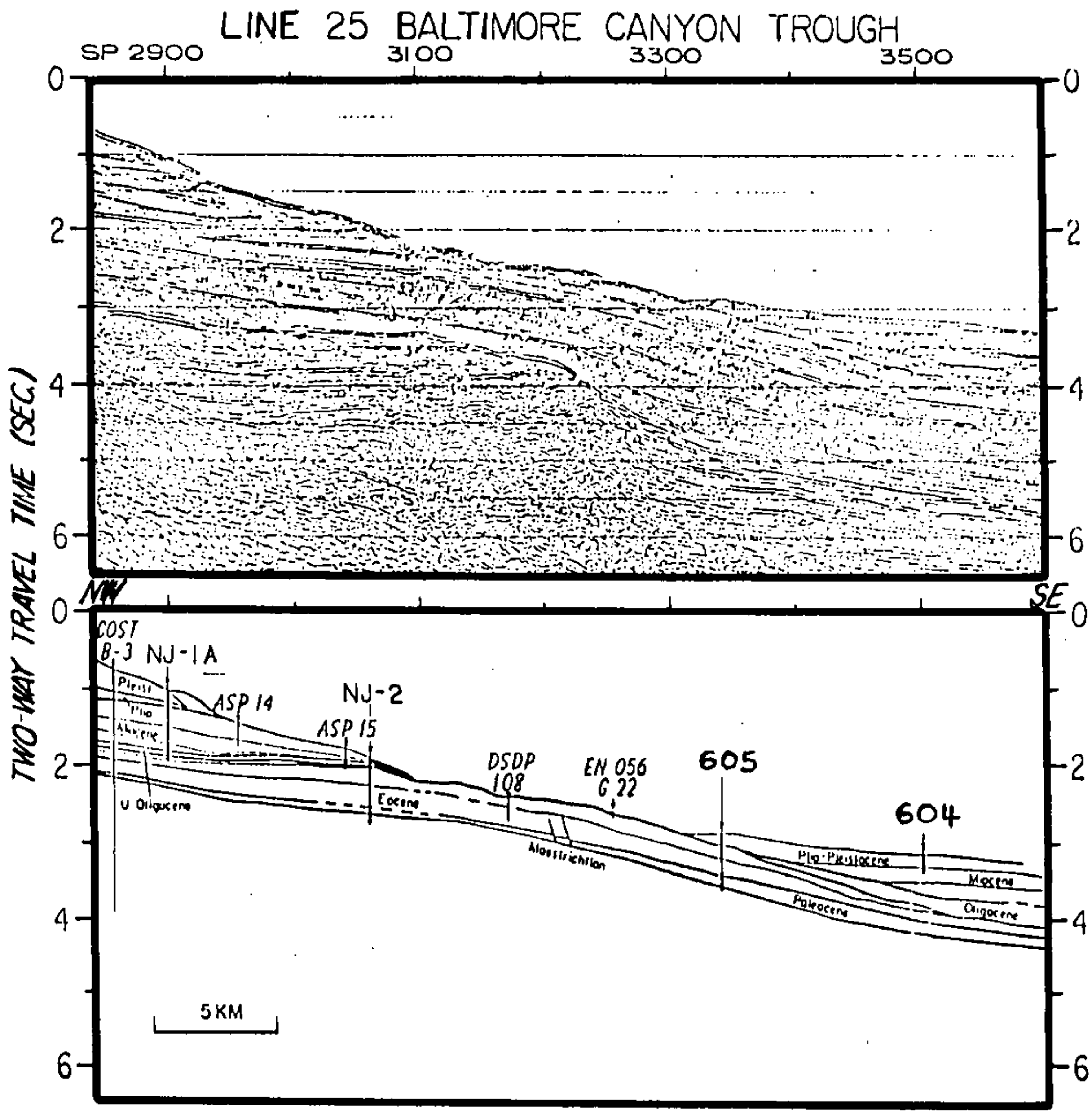


Figure 95-6. Leg 95 site locations and general stratigraphy along Line 25.

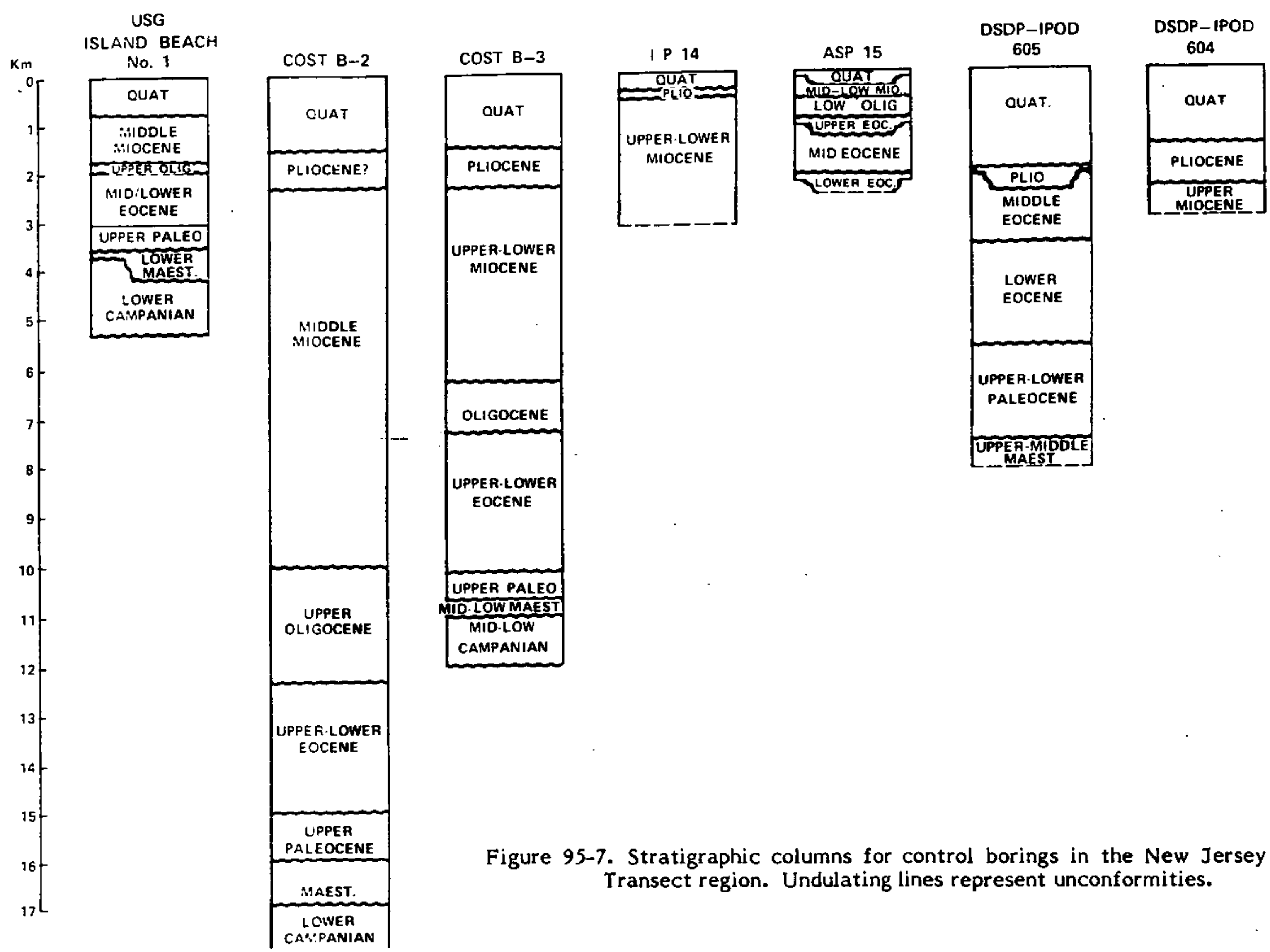


Figure 95-7. Stratigraphic columns for control borings in the New Jersey Transect region. Undulating lines represent unconformities.

The depth-section geometry of the Maestrichtian unit suggests that the shelf edge was still southeastward of Site 612, but paleontologic data suggest that the water deepened relative to late Campanian depths.

A significant increase in gamma ray values between 556 and 552 m (increase of 25 GAPI units) indicates a clay-enriched zone, which also yields lower sonic velocity values. Clay enrichment is a characteristic of Paleocene strata which are present at the B-3 well and at Site 605. Tracing the Paleocene seismic sequence toward Site 612 from 605 and B-3 suggests that a very thin section could be present there. Thus a 4 m Paleocene (?) section is tentatively recognized at Site 612.

The early Eocene brought a major change in depositional region to Site 612, as it did to the shelf and upper slope. Light gray, carbonate-enriched, biosiliceous oozes and chalks dominate. This regime appears to have lasted through the early Oligocene, although inter-

A GEOLOGIC MAP OF THE CONTINENTAL SLOPE
BETWEEN LINDENKOHL AND SOUTH TOMS CANYONS

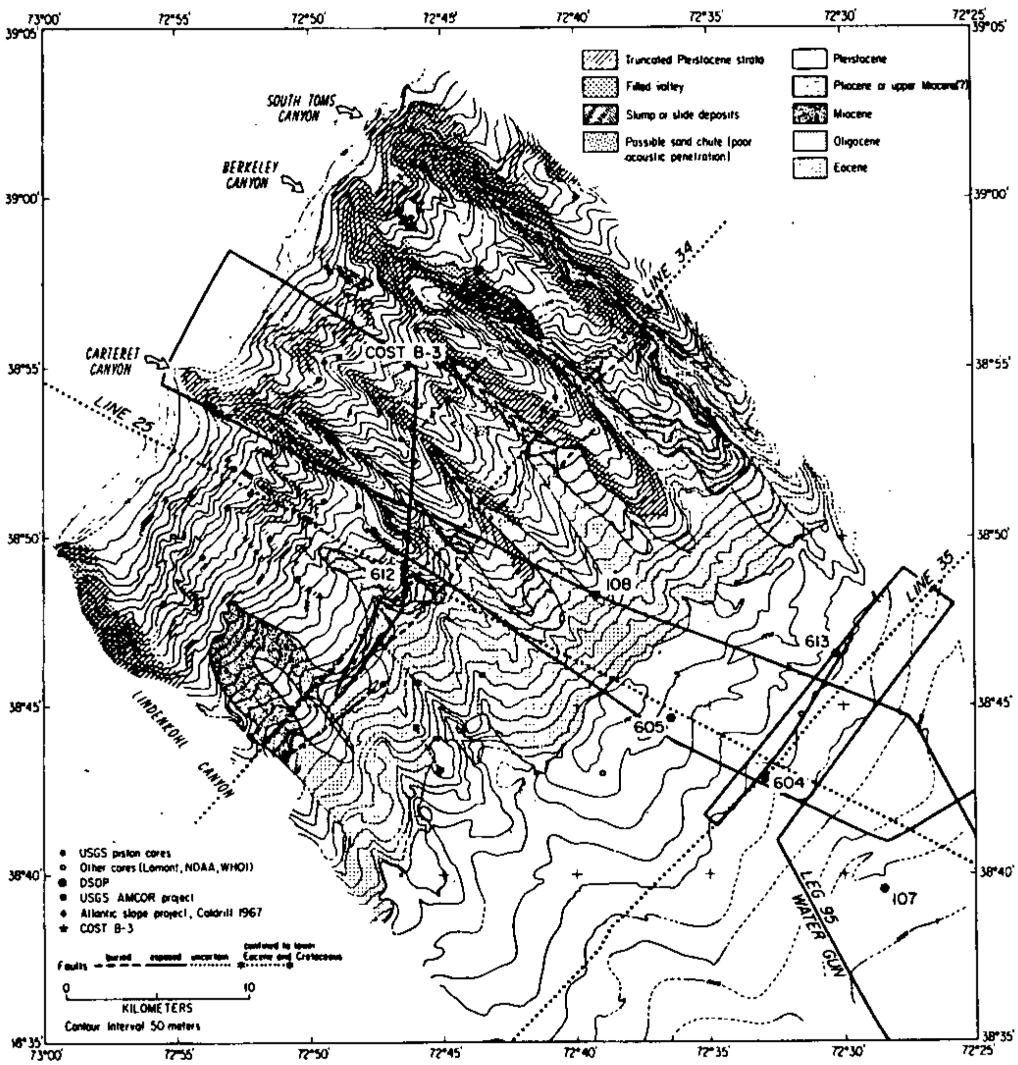


Figure 95-8. Geological map of New Jersey margin in vicinity of Leg 95 coring sites. (From Robb et al., 1981.)

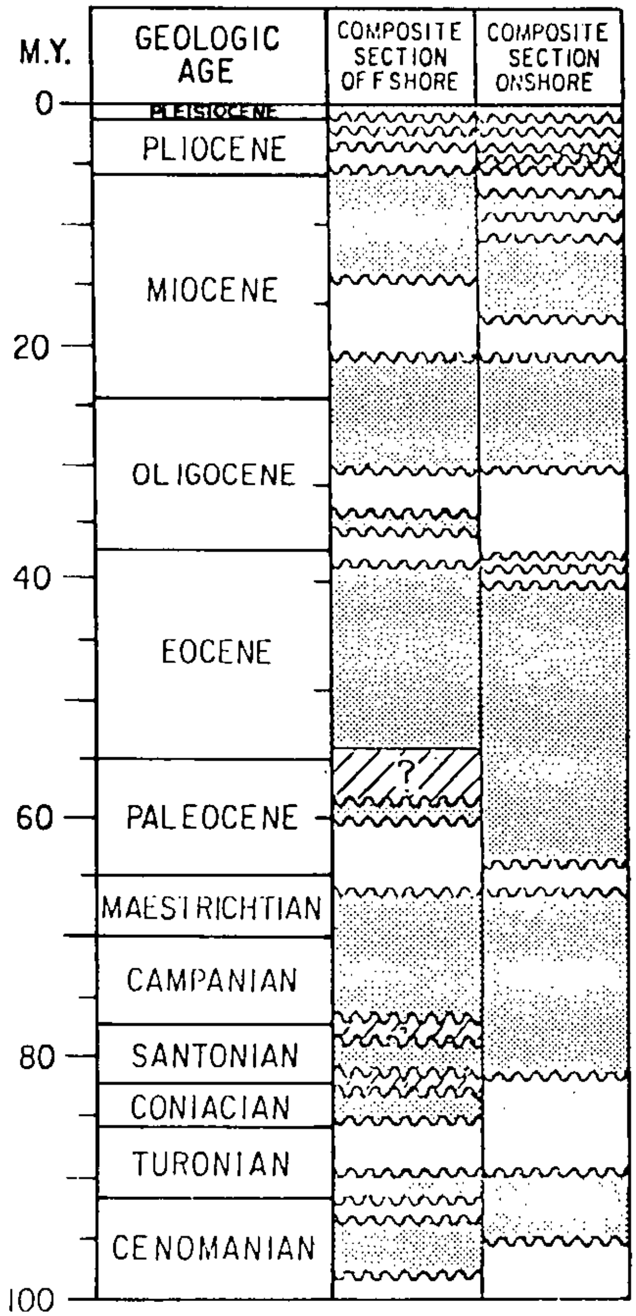


Figure 95-9. Composite geologic columns showing major sedimentary sequences and unconformities of Baltimore Canyon Trough.

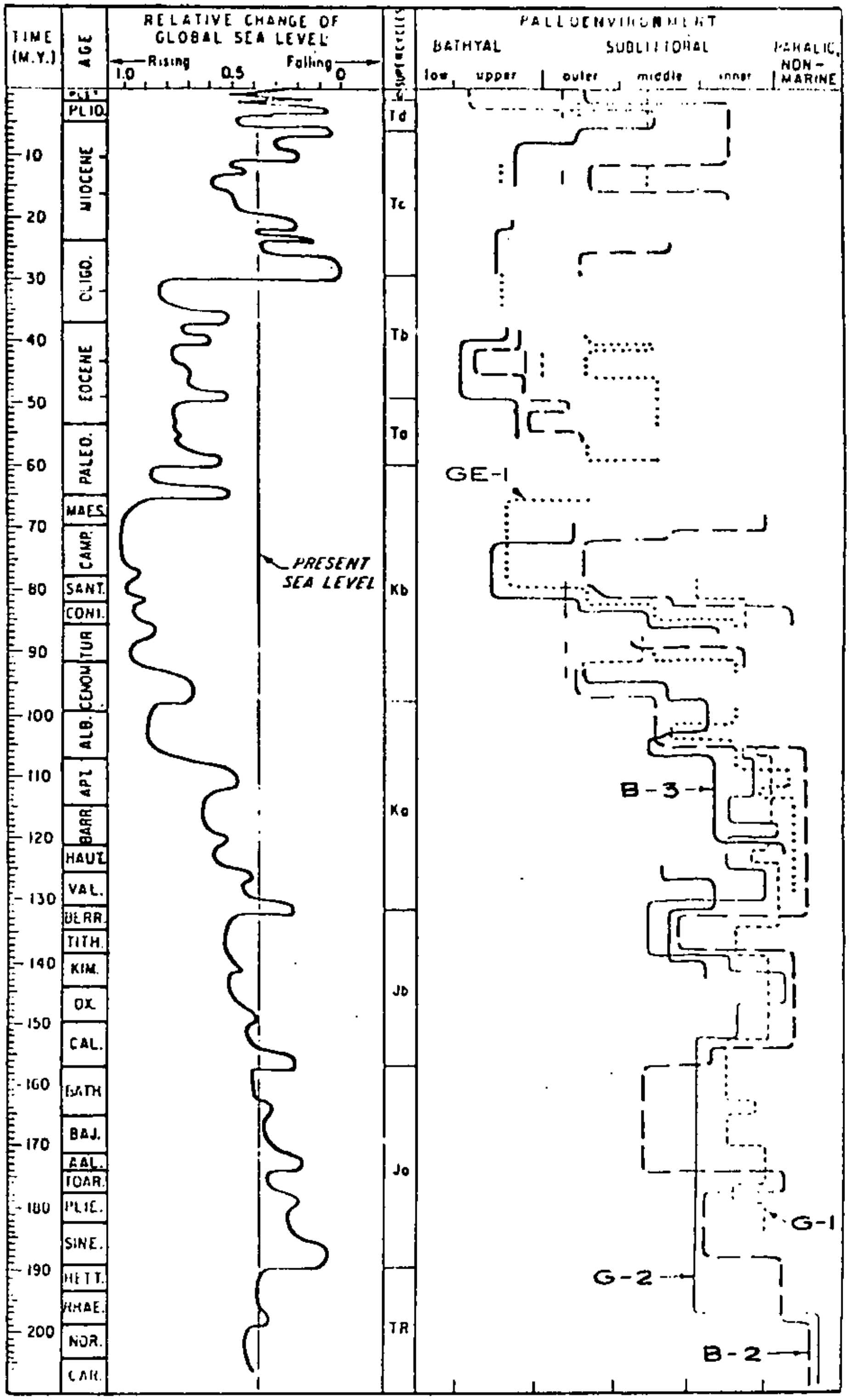


Figure 95-10. Comparison of sea level curves and paleoenvironmental curve for U.S. Atlantic margin wells. GE-1 well is in southeast Georgia embayment; G-1 and G-2 wells are in Georges Bank basin.

rupted by one significant erosional event. A total of at least 416 m of these deposits is present at Site 612. Diagenetic characteristics have been used to recognize two distinctive lithologic units within this sequence. The upper part, assigned to lithologic Unit II (187.4 m thick) contains well-developed, microfossil assemblages that indicate an early Oligocene to middle Eocene age. The abundance of siliceous microfossils (radiolarians and diatoms) is especially notable in Unit II, and distinguishes it from Unit III. A zone of progressive, downward intensifying silica diagenesis begins around 245 m BSF and culminates in an 8-m zone of porcellanite at the base of the middle Eocene. Sonic velocities reach peak values for the Site in this interval (2.28 km/s on sonic log; 2.52 km/s horizontal measurement from shipboard velocimeter). The top of the porcellanite at 323.4 m is taken as the top of lithologic Unit III (ca. 231 m thick) below which variably intense diagenesis has converted most of the biosiliceous components to silica cements. The top of a zone of high salinities in interstitial waters is nearly coincident with the top of the porcellanite (ca. 300 m).

Both Units II and III contain bathyal microfossil assemblages, as would be expected from evidence of a major Cenozoic marine transgression noted in the shelf and coastal plain borings. The seafloor must have been well oxygenated as indicated by the pervasive, intense burrowing, light colored sediments, and sparsity of organic carbon. The gently seaward sloping geometry seen on the depth section of Line 25 suggests that no distinctive

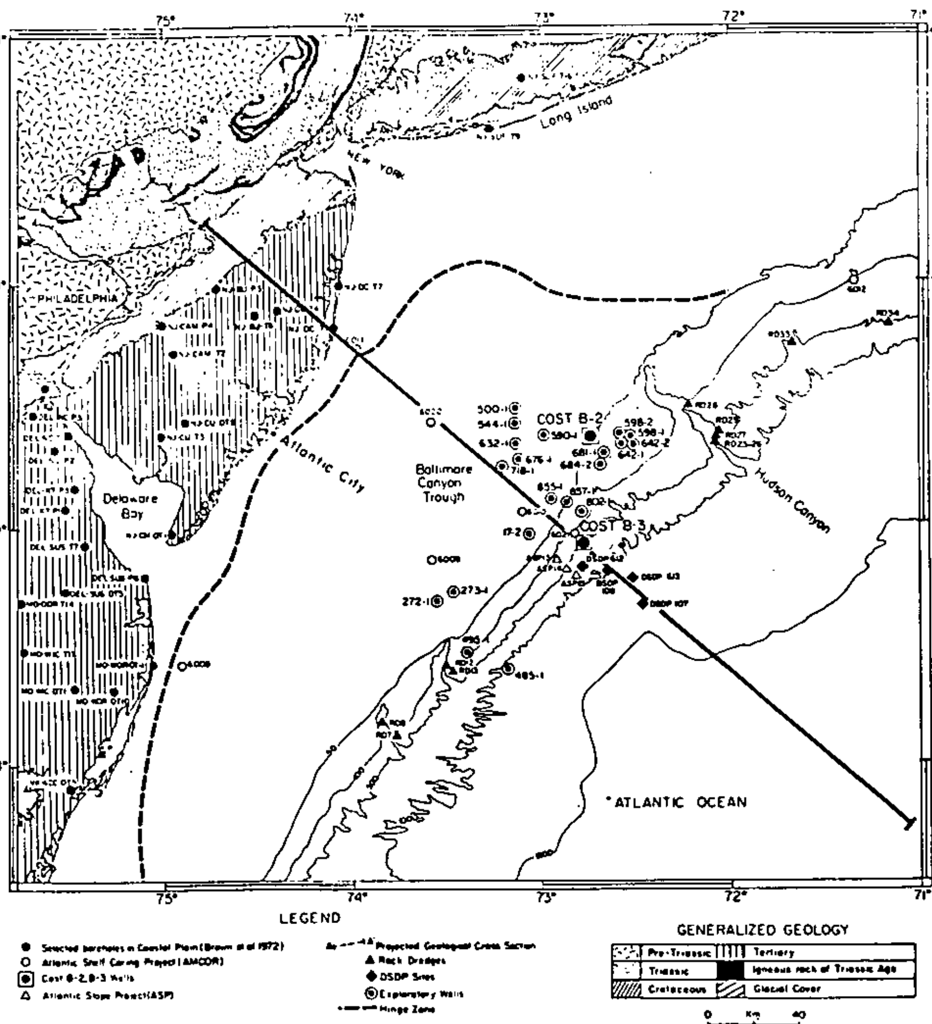


Figure 95-11a. Summary map showing location of COST-B-2 and B-3 wells and exploratory wells off New Jersey.

shelf edge was developed. Rather, a wide carbonate ramp formed the continental margin during the Paleogene.

Rates of deposition increases from about 2.1 cm/ky in the middle Maestrichtian to about 3.9 cm/ky in the early Eocene, but decreased again to about 2.5 cm/ky in the middle Eocene.

The Paleogene section is bounded at the top and bottom by erosional unconformities, and contains two additional ones that form the lower Eocene-middle Eocene and middle Eocene-upper Eocene contacts. Each contact is marked by identifiable seismic reflections, permitting regional extrapolation of each depostional sequence. The extrapolations show that the middle Eocene sequence thins significantly updip towards the B-3 well projection on Line 25, and crops out downdip just southeast of Site 612. The upper Eocene sequence is thickest between the B-3 well and Site 612, and does not appear to be present southeastward from 612 for more than 0.5 km distance. Upper Oligocene strata seen in the B-3 well appear to be absent southeastward of ca. shot point 2960 on Line 25.

The Oligocene-Eocene contact appears to be biostratigraphically and lithostratigraphically conformable, constituting the only significant chronostratigraphic boundary that is not marked by an erosional surface at Site 612. The depositional rate of the interval was also the highest for the Tertiary, reaching 5.2 cm/ky.

A depositional regime characterized by an increase in terrigenous detritus and low carbonate contents (carbonate bomb analysis) invaded Site 612 sometime between the early Oligocene and late Miocene and has been maintained to the present. The sediments resulting from this terrigenous phase are placed in lithologic Unit I (135 m thick), which is subdivided into three parts.

The lower contact of Subunit IC (28.4 m thick) is an unconformity representing a hiatus of ca. 25 m.y. Therefore, the precise beginning of terrigenous influence must be based on evidence from updip wells, which indicate a change near the Oligocene-Micoene transition. Subunit IC is composed of chiefly dark gray to olive gray muds, containing light brown, irregularly-dispersed barite concretions, and abundant diatoms (as much as 40%).

The calcareous and siliceous microfossils are moderately well represented and preserved in this subunit, inentifying it as late Miocene in age. A distinct upward increase in gamma ray values on the geophysical log marks the lower unconformable contact and reflects the increased clay content. This subunit accumulated at the lowest rate of any unit cored at Site 612 (0.5 cm/ky).

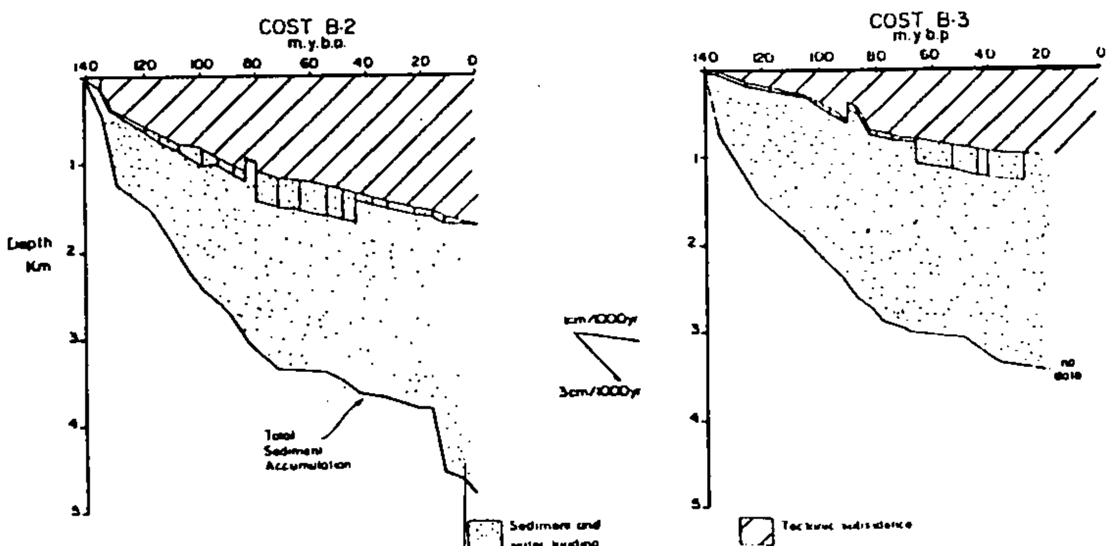


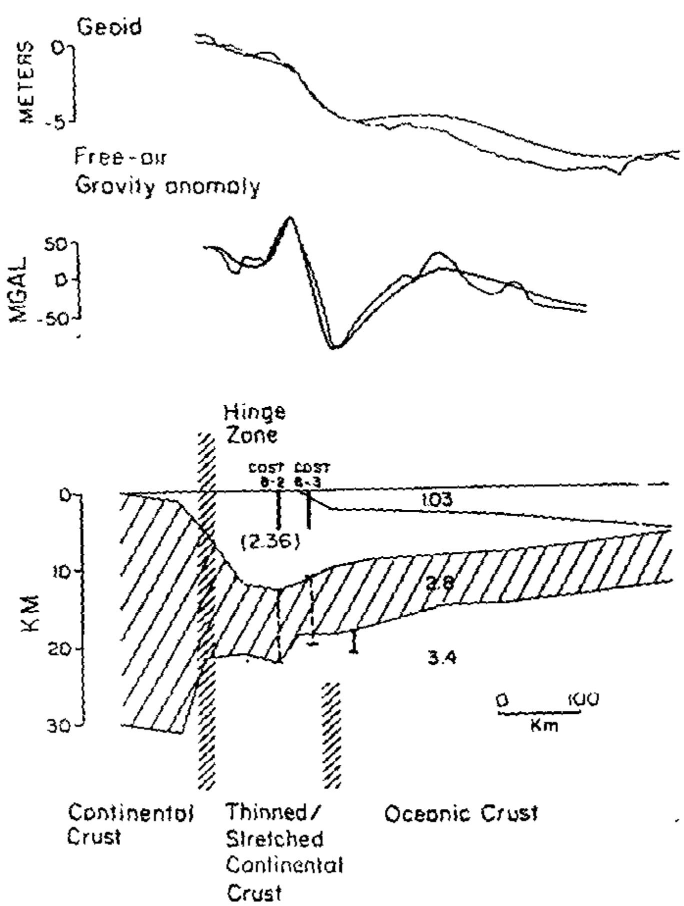
Figure 95-11b. Tectonic subsidence and sediment accumulation at the COST B-2 and B-3 wells. The tectonic subsidence has been computed using "backstripping" techniques.

Lithologic Subunit IB (69.65 m thick) is separated from Subunit IC by an erosional contact separating the Late Miocene biota from a Pliocene one. The chief lithologic characteristic of Subunit IB is the presence of alternating mud and glauconite sand sequences. The muddy sediments are interrupted repeatedly by glauconite-quartz sand beds, which commonly have sharp, eroded basal contacts. Some beds contain as much as 50% glauconite grains which are fresh, irregular, and unoxidized, indicating very little, if any transport. The glauconite enrichment indicates a high original organic content, but TOC values are low. The rate of sedimentation also was low (1.8 cm/ky).

Lithologic Subunit IA (uppermost Pleistocene) is much like Subunit IC, lacking the plethora of glauconite sand layers within the terrigenous muds, although containing glauconite-filled burrows.

It is separated from Subunit IB by a basal unconformity, and its microfossils indicate that the lower Pleistocene is missing here. In fact the total Pleistocene section (36.95 m thick) accumulated in no more than about 0.44 m.y., making it by far the most rapidly accumulated unit (greater than 80 cm/ky).

Lithologic Unit I is too thin at Site 612 to be easily separated into subunits on seismic profiles, and is too near the seafloor to have been logged. However, similar sequences were recorded at the ASP 15 core hole.



... of crustal structure of the Baltimore Canyon

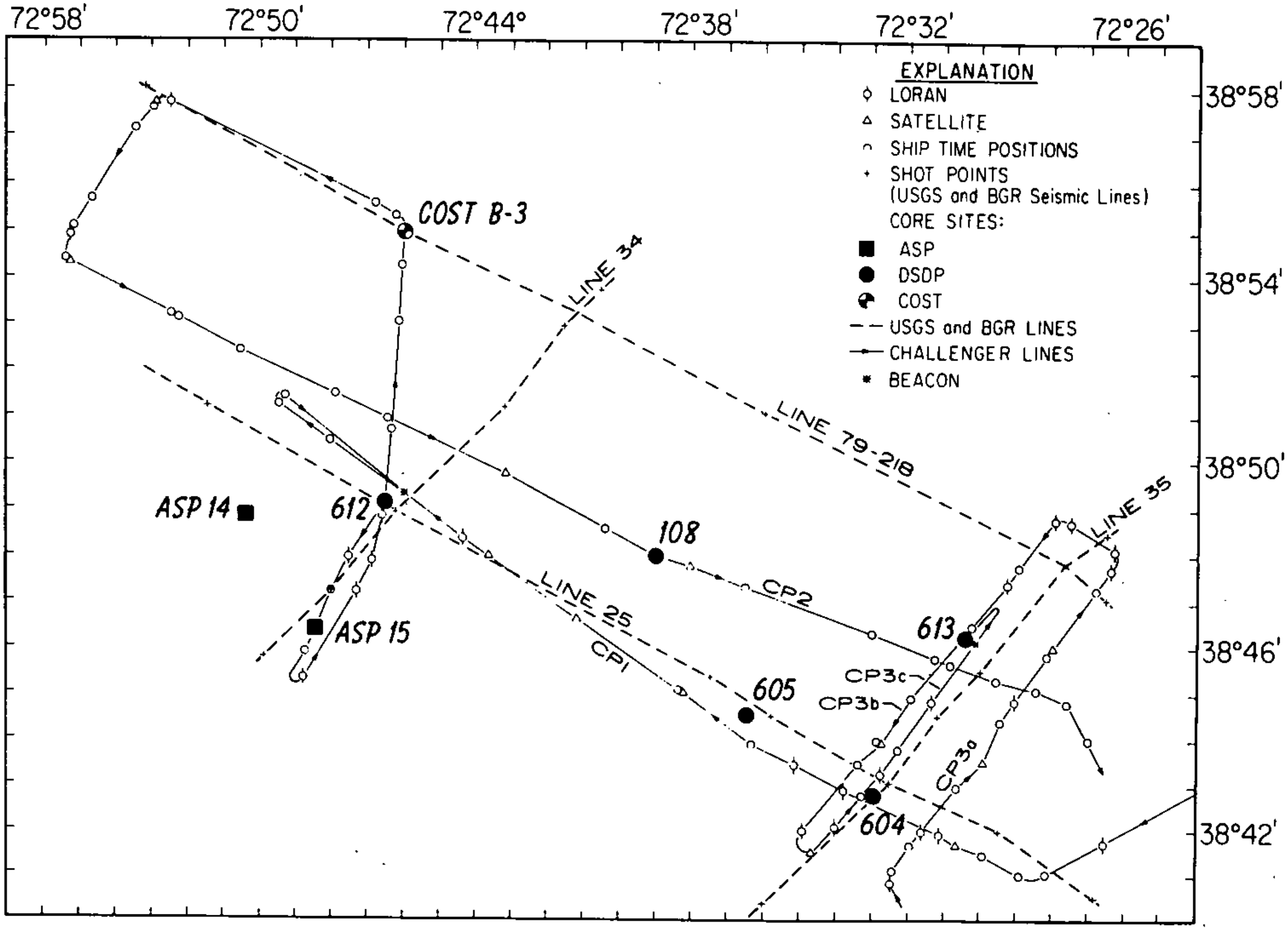


Figure 95-13. Map of multichannel and Challenger lines in vicinity of Sites 612, 605, 108, 604, and 613.

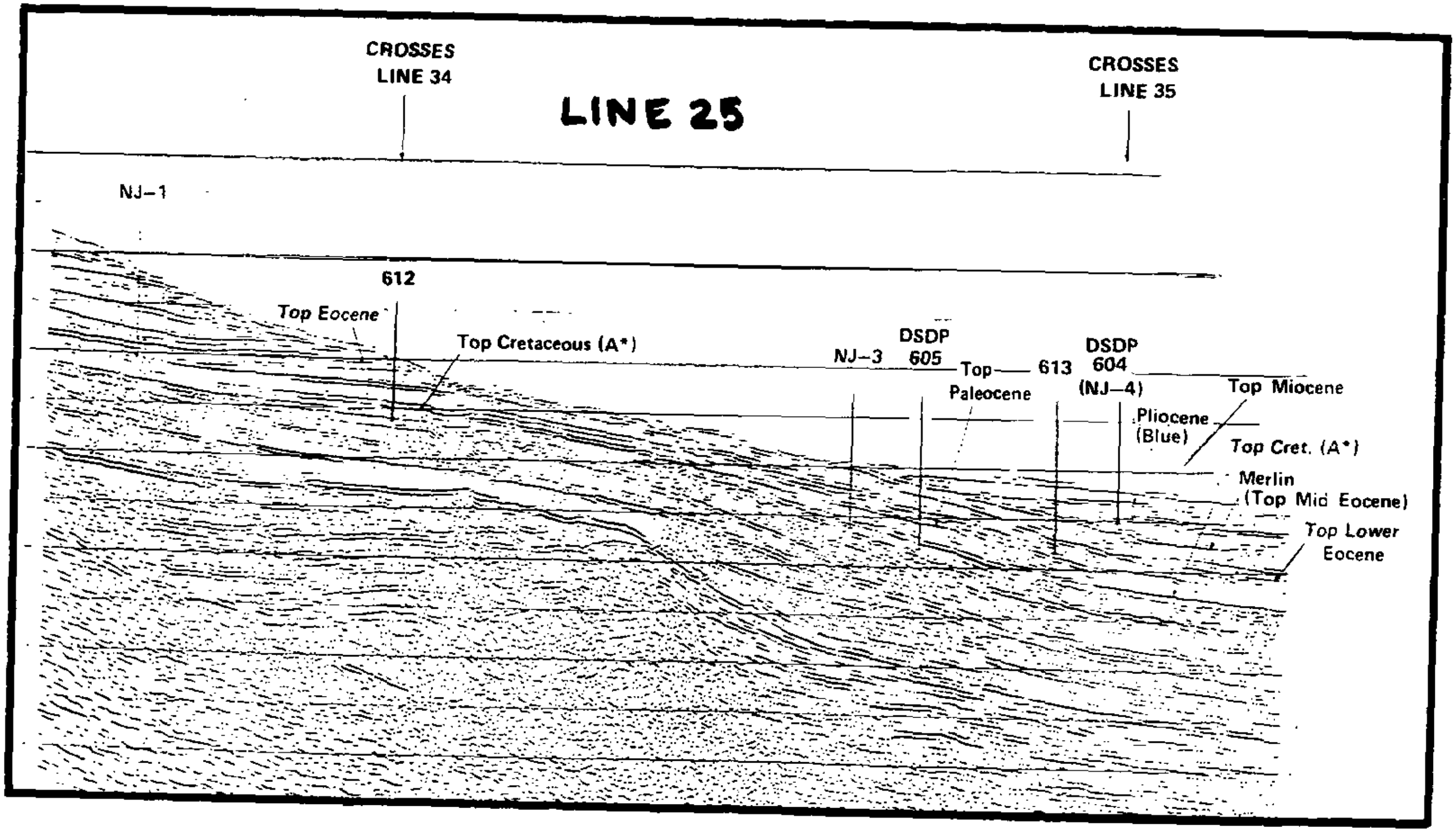


Figure 95-14. Segment of USGS multichannel Line 25 showing location of Sites 612, 605, 613 and 604. Sites 605 and 613 are projected onto the line.

Site 613

Site 604 (Leg 93) was originally selected as the seawardmost (downdip) coring location on the margin segment of the New Jersey Transect (Fig. 95-9). Here the depositional sequences, unconformities and biofacies of the upper continental rise could be analyzed and compared with those of the updip sites (612, 605). It was thought that a fairly complete upper rise stratigraphic sequence could be cored at Site 604, but caving sands of late Miocene age proved to be impossible to penetrate at that location. Thus Site 613 (2332 m water depth) was a second attempt to penetrate these upper rise strata. It was considered especially important to achieve this penetration, as extrapolation of sequences cored updip at Site 605 indicated that original seismostratigraphic interpretations of pre-upper Miocene section at Site 604 were probably in error. That is, a major period of channeling thought to represent middle Oligocene sea level fall, appeared more likely to be an intra-Eocene event.

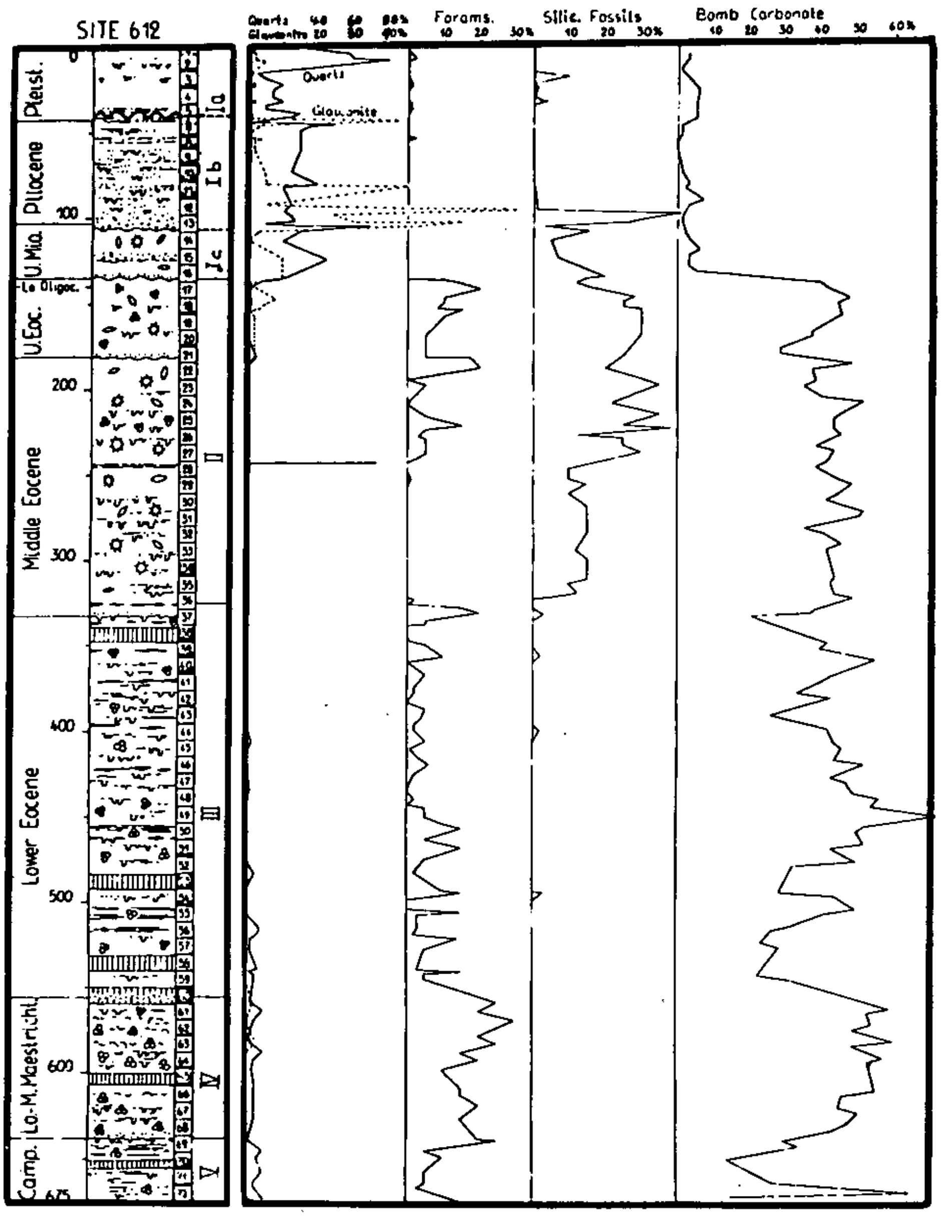


Figure 95-15. Lithostratigraphic column for Site 612.

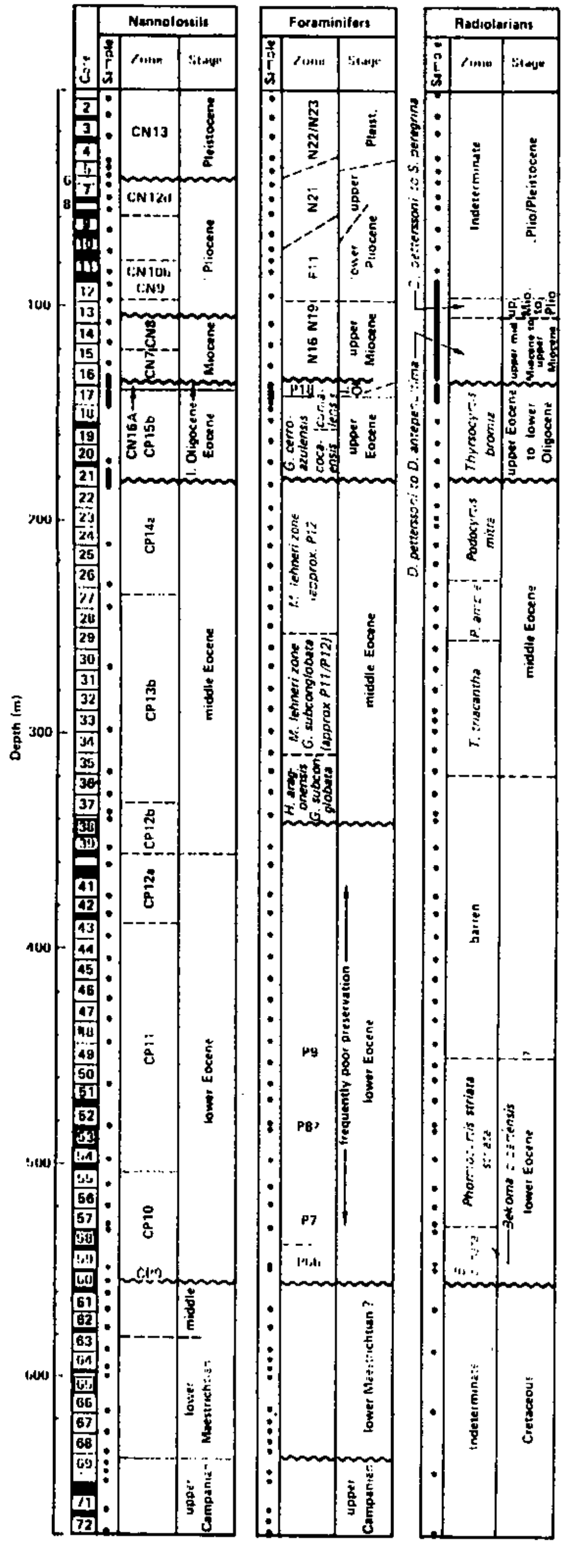


Figure 95-16. Biostratigraphic columns for Site 612.

Several different site locations were considered before a presite water-gun survey by Challenger showed a spot where the Miocene sand unit was only ca. 10 m thick as it crossed the top of an inter-channel ridge (Fig.95-12). This careful survey for the best location proved fully warranted as we experienced no trouble penetrating the Miocene sand which indeed is ca. 10 m thick at Site 613.

In view of the short period of time left for coring at this last site of Leg 95, the upper 116 m section was washed and spot cored. From there, continuous coring with the XCB was maintained to a depth of 581.9 m BSF, except for one 29-m washed interval (154.1-182.9 m BSF).

The principal scientific objectives were:

1. To establish the composition, stratigraphic framework, and depositional environments of sediments constituting the upper continental rise.

2. To accurately date the biostratigraphic gaps, unconformities, and major seismic reflections in the section

3. To establish the timing of two major episodes of seafloor channeling that were indicated on seismic reflection profiles.

4. To document the lateral relationships of lithofacies and biofacies between Sites 605 and 613, especially with regard to silica diagenesis.

5. To identify depositional sequences and evaluate their relationships with seismic sequences, relative sea level changes, oceanic current patterns, water mass composition, sediment provenance, and with subsidence history.

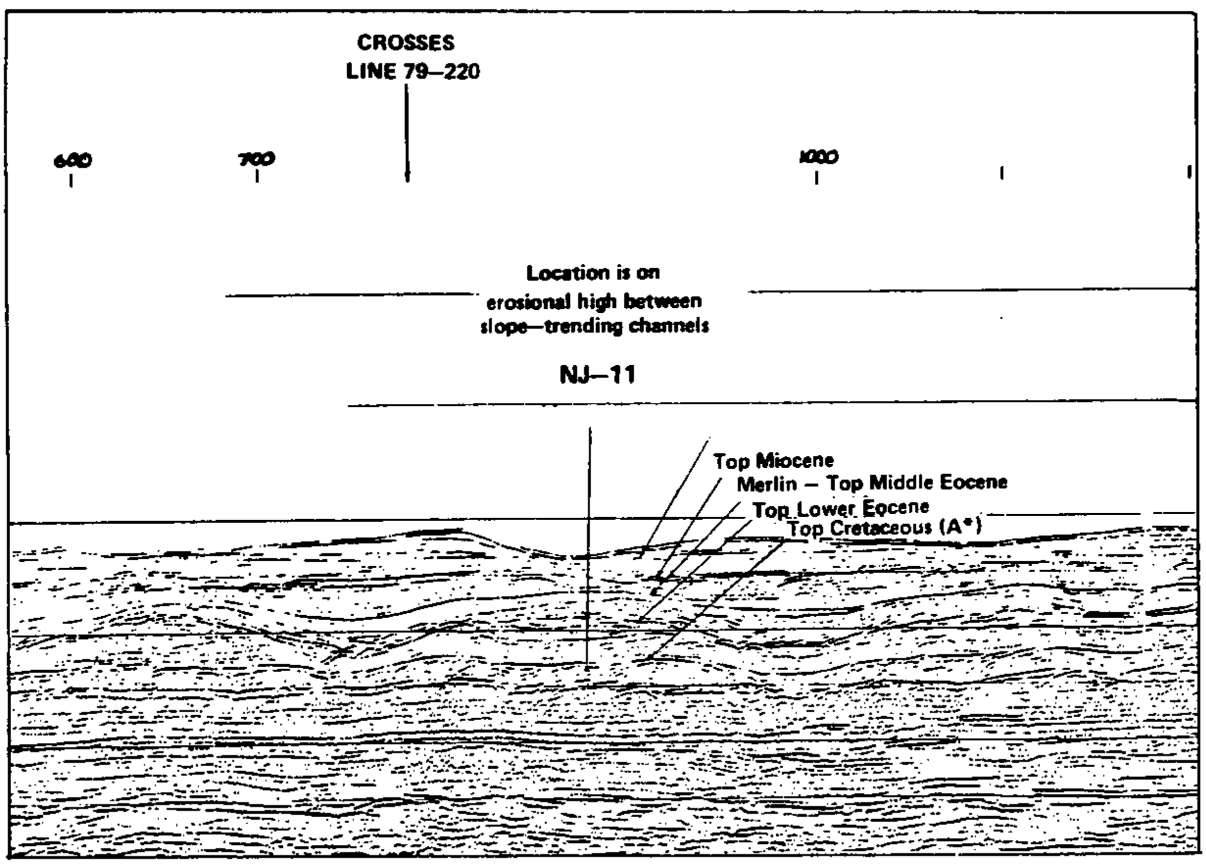


Figure 95-17. Segment of USGS Line 35 showing proposed locations of undrilled Site NJ-11 and NJ-10 and drilled Sites 604 and 613. Site 613 is projected to the line.

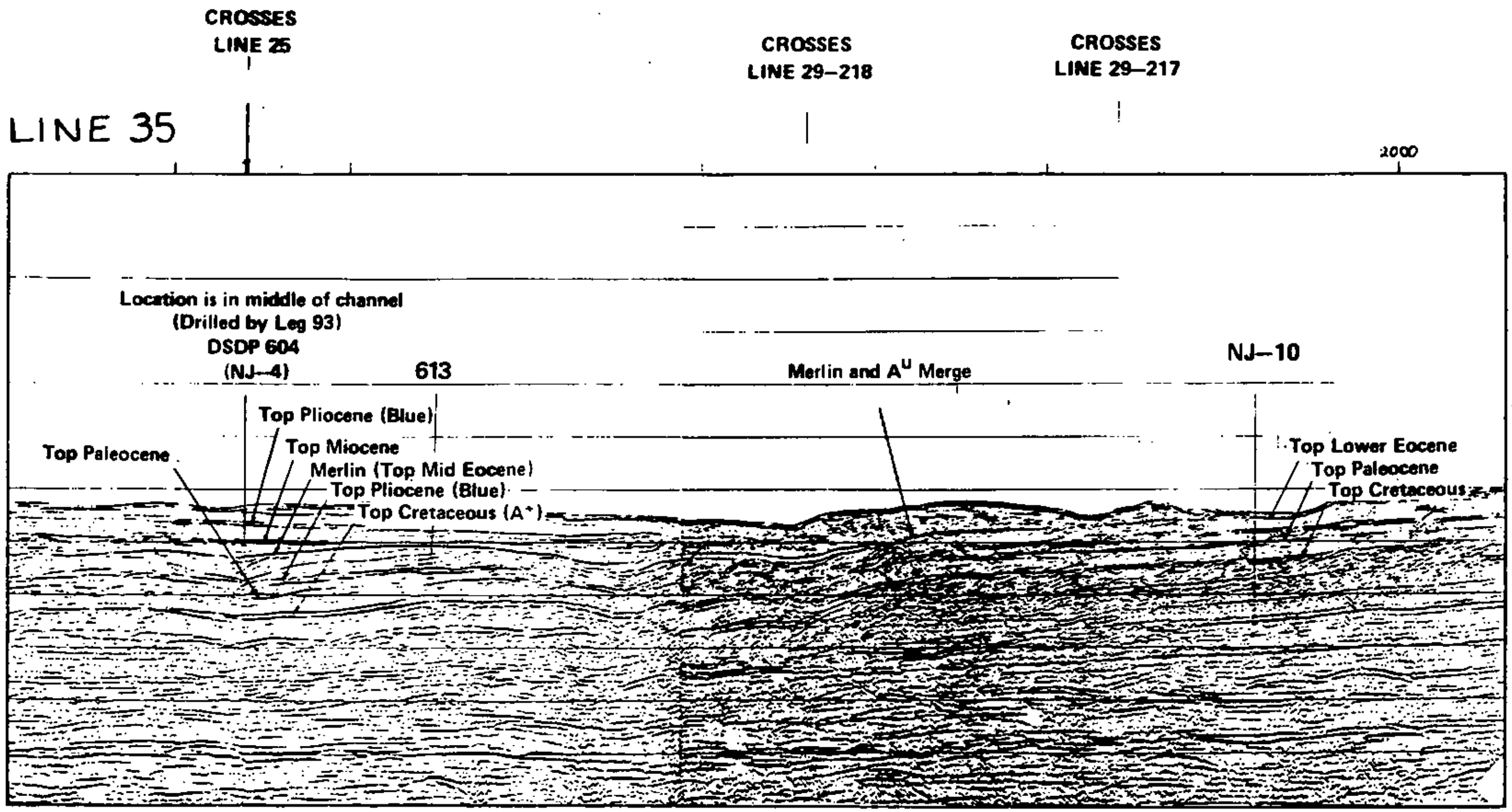


Figure 95-17. (cont'd.)

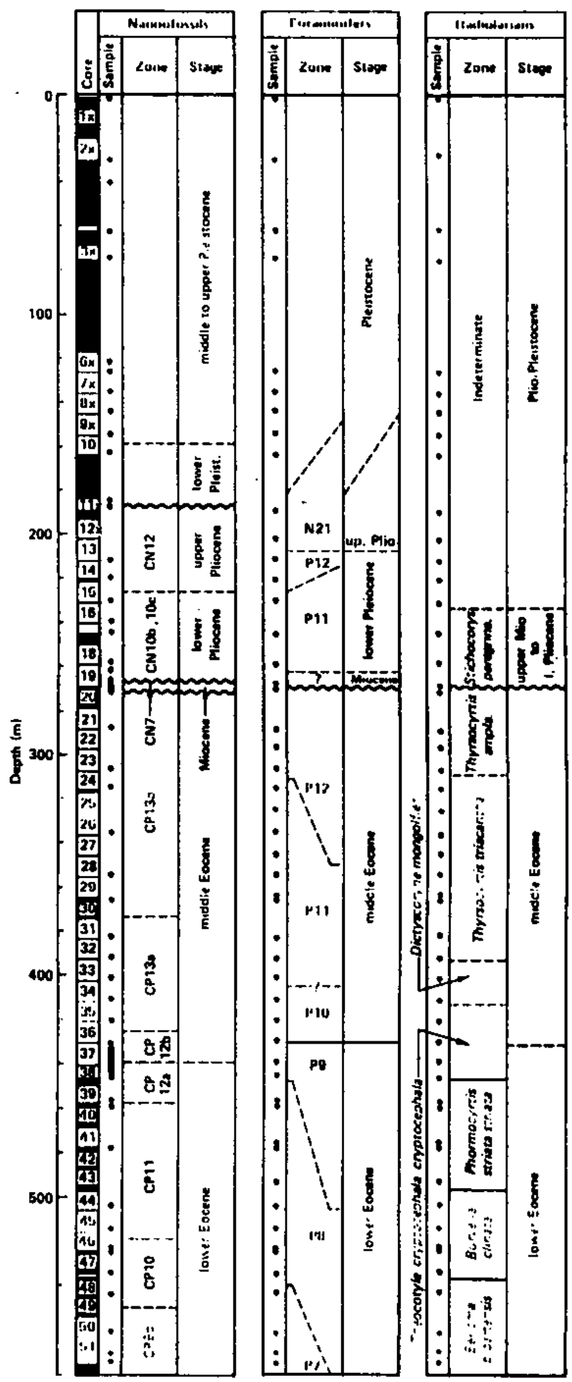


Figure 95-19. Biostratigraphic columns for Site 613.

Results

Three distinct lithologic units were documented at Site 613 (Figs. 95-13 and 95-14). The lowermost unit penetrated, lithologic Unit III, comprises 139.9 m of porcellaneous nannofossil chalks and limestones and nannofossil porcellanites of early Eocene age. The light greenish gray to light gray sediments are generally densely burrowed, except in some slumped intervals. Slumping is extensive in this unit as opposed to the virtual lack of slumps in its counterpart (lithologic Unit III) at Site 612.

Diagenesis of the porcellaneous strata is not uniform throughout Unit III. Some layers have become hard porcellaneous limestones or nannofossil porcellanites, while others with similar compositions remain poorly lithified chalks. Swelling and cracking when rinsed with fresh water is characteristic of some intervals although very little clay content was detected by X-ray diffraction.

Increased sonic velocities due to the silica diagensis are notable on the downhole geophysical log and in shipboard measurements. Shipboard values show a downward increase from 1.799 to 2.074 km/s at the top of the unit and peak values of 2.301 and 2.368 km/s between 475 and 490 m. Log values also climb to 2 km/s or more near the top of Unit III and peak to as much as 2.379 in the 481 to 508 m interval. Low gamma ray values reflect the minor clay content.

Microfossil assemblages in Unit III are partly dissolved and moderately to poorly preserved. Etched and dissolved diatoms and radiolarians are present at the very top of Unit III, but the diatoms are absent throughout most of the section. Benthic foraminifers, although poorly preserved, form an association tentatively interpreted as having accumulated in lower bathyal depths. A lower slope paleogeographic position for Site 613 during the early Eocene is supported by the geometry of Unit III as seen on a seismic depth section (Line 25). The unit slopes seaward to the southeast from Site 612, where its gradient flattens, resembling a slope/rise transition, approximately beneath Site 613.

The minimum average sediment accumulation rate for lithologic Unit III is ca. 2.0 cm/ky, but the presence of numerous slumped intervals indicates that frequently the emplacement of sediment was much more rapid.

The contact between Unit III and overlying Unit II appears on seismic profiles as a deeply scoured erosional surface approximating the middle-lower Eocene contact, but which in places cuts down into Paleocene strata, and Unit III is entirely removed. However, Site 613 was chosen to avoid such channels and is located where Unit III forms a sedimentary ridge between two channels. The middle-lower Eocene contact at Site 613 is a highly disturbed zone of slumping in which lower Eocene beds belonging to Unit III have been incorporated into slump blocks of Unit II (middle Eocene). However, no biostratigraphic gap was noted. The separation of Unit III from Unit II is based upon the highest appearance of porcellanite, approximately 2 m below the middle-lower Eocene contact.

Lithologic Unit II (278.4 to 44.0 m BSF) comprises 163.6 m of intensely burrowed, light greenish gray to grayish yellow green siliceous nannofossil chalk. Carbonate from bomb measurements varies from 34% to 61%; biosilica constitutes as much as 45%. Several slumps are present in this unit, displaying overturned folds and variably dipping bedding surfaces that are not burrowed. A single 5-cm thick volcanic ash layer was noted at 400 m. This ash bed may prove to be a useful correlation horizon in this region, as a similar bed was also noted in approximately the same stratigraphic position at Site 605.

The general uniformity of lithologic Unit II is reflected in the gamma ray and sonic velocity logs whose traces display little variation. Sonic velocity gradually increases from ca. 1.9 km/s at the top of the unit to ca. 2.1 km/s near the base. Shipboard velocity measurements yielded somewhat lower values ranging from ca. 1.6-1.8 km/s. The zone of slumping across the Units II/III transition displays a series of gamma ray peaks. The small hole diameter in this interval suggests swelling clays.

Both calcareous and siliceous microfossils are abundant and well preserved in Unit II, and clearly establish the bulk of the unit as being of middle Eocene age. However the last 7 m.y. of middle Eocene time is not represented by deposition here. The precise nature of the disturbed lower-middle Eocene biostratigraphic transition remains to be established by post-cruise studies.

Benthic foraminiferal assemblages of Unit II are again of the lower bathyal type, but faunas which are generally thought to have preferred abyssal depths are present in moderate to large numbers. The geometry of the unit as seen on the Line 25 depth section is similar to that of the lower Eocene, suggesting that the slope/rise transition was near Site 613. Similar conditions to the early Eocene

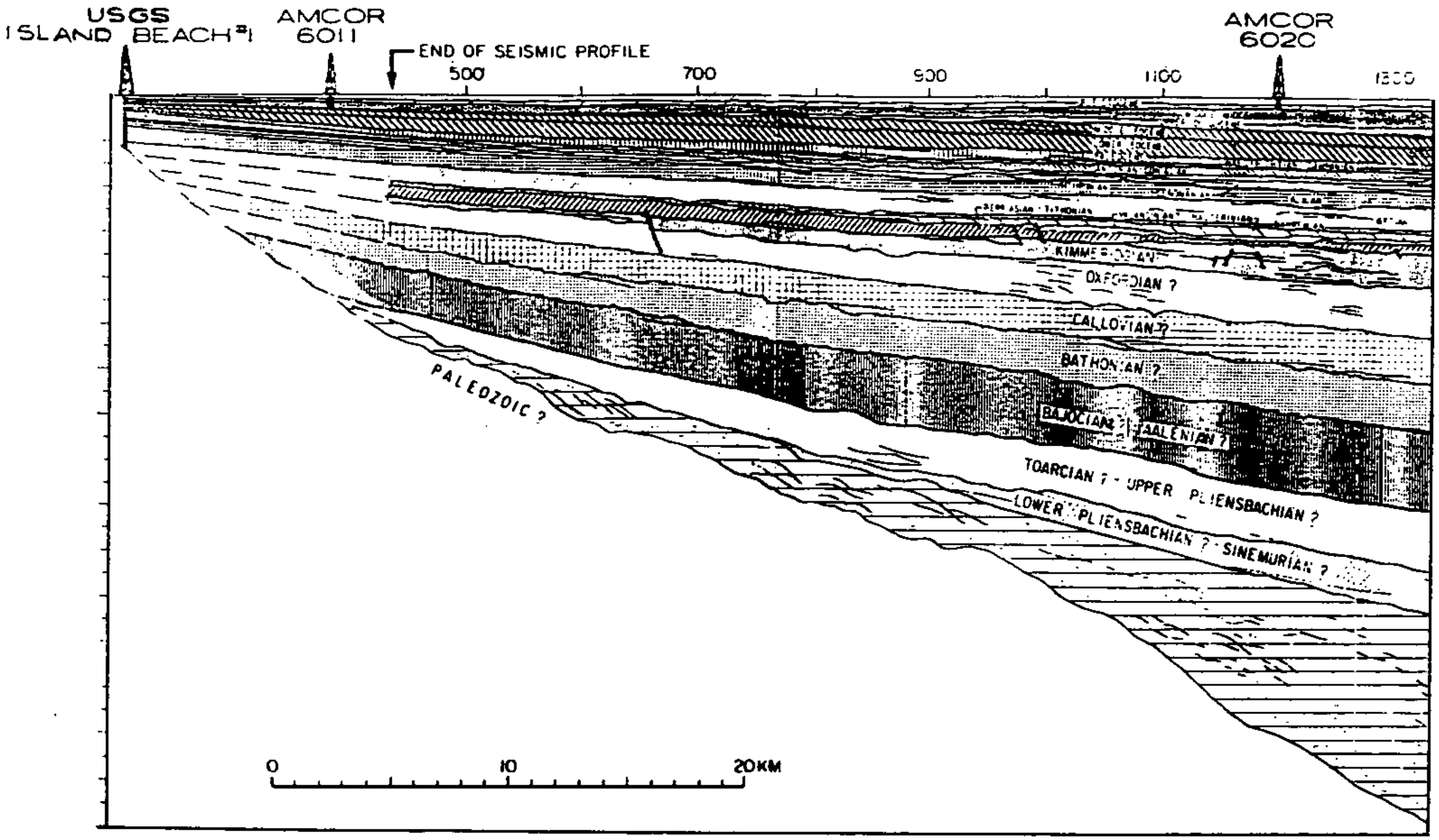


Figure 95-20. Chronostratigraphic section across depocenter of Baltimore Canyon Trough (from Poag, in press).

are also indicated by the similar average sedimentation rate of 3.3 cm/ky.

Lithologic Unit I comprises the upper 270 m of Site 613 and is composed of a complex sequence of interbedded, greenish gray to dark greenish gray mud or calcareous mud (containing variable amounts of diatoms), glauconite or pyritic silty sand, and sandy mud. The section was not continously cored, which along with poor recovery of certain intervals, complicates the lithologic interpretation.

Three subunits were recognized, as in Unit I of Site 612. Subunit IA (0.0-119.8 m) was only partly cored and recovery was poor. Four mineralogically distinct zones were recognized. Zones 1 and 3 contain interlayered, glauconitic, quartzose sand, silty sand, sandy mud, and mud; Zones 2 and 4 are comprised of mud, marly nannofossil ooze, and nannofossil diatomaeous ooze. Middle Eocene lithoclasts are also incorporated into Zones 2 and 4. A conglomeratic mud, containing 3-cm pebbles of quartz sandstone and calcareous sandstone marks an erosion surface at the basal contact with Subunit IB.

The upper part of Subunit IB (total interval 119.8-186.6 m) is chiefly greenish gray unbedded homogeneous mud to calcareous mud with sporadic glauconitic silty sand. The glauconite decreases downward between ca. 145-154 m and silty, pyritic and calcareous mud becomes prominent. A significant downward increase of ca. 30 GAPI units on the gamma ray log corresponds to the glauconite decreases. Evidence of slumping is seen in this seciton.

Within wash core 10X (154.0-183.9 m) the calcareous, greenish gray mud interlayered with coarse sandy glauconitic mud similar to the upper part of Subunit IB, reappears. A major decrease of gamma ray values ca. 178.5 m suggests that this is the top of the lower interval of greenish gray mud and glauconitic mud.

The basal contact of Subunit IB is a sharp erosional break at 186.6 m that is coincident with the Pliocene-Pleistocene contact.

Lithologic Unit IC (186.6-278.0 m) is chiefly structureless, dusky yellow green, nannofossiliferous siliceous mud containing sporadic silty, glauconitic-quartzose laminae. Glauconite rarely occurs in laminae and is never found in beds thicker than 1 cm. A zone of especially fine-grained clay-rich sediments between 223 and 233 m shows up as a significant bridge on the caliper log and an increase in gamma ray values. The base of Subunit IC contains a glauconitic, conglomeratic sand mixed with nannofossiliferous mud. Granule-size pebbles overlie a scoured surface at 266.45 m that approximates the Pliocene-upper(?) to middle(?) Miocene contact. Subunit IC extends to the bottom of Core 19 at 269.0 m. A coring gap of ca. 9.4 m folows, at the bottom of which 20 cm of middle Eocene Unit II was recovered. The gamma ray characteristics suggest that the unconformable contact between Units I and II is at ca. 278 m BSF.

The microfossils of Unit I are variably abundant and preservation is good to poor, depending upon the sediment type (sands generally have poorer assemblages). Shipboard indentification of biozones and chronostratigraphic boundaries are approximate and need to be refined by further studies on shore. Benthic foraminifers of the Neogene-Quarternary section are generally bathyal assemblages, but mixtures of displaced shallow water associations are typical in the Pleistocene strata.

Average sedimentation rates within Unit I range from ca. 1cm/ky in the Miocene, to 2.4 cm/ky in the Pliocene to 11.7 cm/ky in the Pleistocene.

Seismostratigraphic analysis shows that the Miocene unit is chiefly a series of chaotic channel fill deposits that smoothed the deeply channeled middle Eocene surface, following a period (or periods) of erosion and nondeposition. Some authors have attributed the erosion to a mid-Oligocene sea level fall, but we find no evidence of Oligocene sediments in this region, and thus, cannot comment on the precise timing of the erosional event(s).

Reflections in the top of the Miocene unit are truncated and Pliocene reflections onlap them. More uniform deposition took place in the region during Pliocene and Pleistocene, but slumping and downslope displacement of strata appear to have been common.

Summary and Conclusions

Two continuously cored drill sites on the New Jersey middle slope and upper rise have completed the second phase of scientific ocean drilling along the New Jersey Transect. The transect was conceived as a means of analyzing the stratigraphic framework and depositional history of an entire passive continental margin, beginning on the New Jersey Coastal Plain and terminating on the lower contintental rise. The abundance of publicly available geological and geophysical data on the coastal plain shelf and upper slope

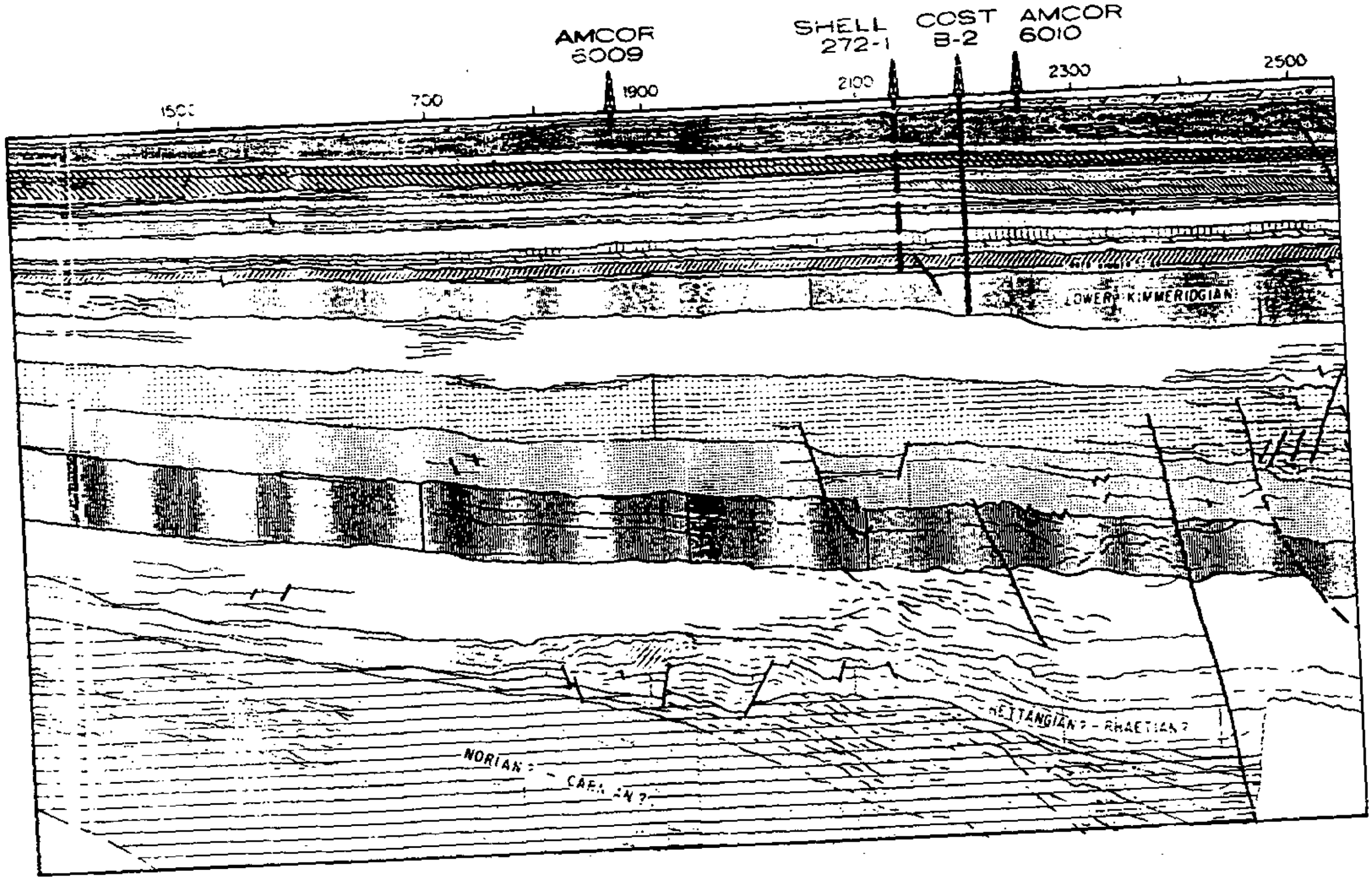


Figure 95-20 (cont'd).

provides an extensive data base for the shoreward segment of this transect. USGS multichannel seismic Line 25 serves as the key control line, providing detailed seismostratigraphic data across the depocenter of the Baltimore Canyon trough, and extending from the inner shelf to the middle continental rise (Fig. 95-15).

Phase one of the DSDP-IPOD New Jersey Transect drilling was undertaken by Leg 93, which drilled two sites on the upper rise (Sites 604 and 605) and also drilled a 1576-m section at Site 603, which serves as the basinward termination of the transect.

Phase two of the New Jersey Transect drilling involved establishment of two additional stratigraphic reference sections; one on the middle slope (Site 612) and one on the upper rise, downdip from Site 605 (Site 613). Both sites were nearly continuously cored and a suite of downhole geophysical logs was obtained at each.

The stratigraphic studies of Poag and coworkers (Poag, 1979, 1980, in press; Poag and Schlee, in press; Schlee, 1981; Libby-French, 1981) have established the broad regional stratigraphic and depositional framework of the shelf and upper slope of New Jersey. In particular, they have documented a series of depositional episodes punctuated by widespread erosion, whose pattern resembles a response to sea level fluctuations, such as envisioned in the widely discussed Vail model (Vail,et al., 1977; Vail and Hardenbol, 1979; Vail and Todd, 1981). In a general sense, the depostional sequences documented at Sites 612 and 613 fit very well into the previously established shelf-slope framework (Fig. 95-16).

For example, at Site 612, seven unconformable sequence boundaries were penetrated, and six of the contacts were recovered undisturbed in our cores. Except for one exceptionally long hiatus, these unconformities have equivalents on the shelf, and can be traced widely on the seismic profiles. At Site 613, four major sequence boundaries were penetrated. Three are unconformable contacts, but only two were recovered. The fourth sequence boundary comprises a disturbed "zone' of intense slumping, separating the lower and middle Eocene strata.

One of the most interesting new developments regarding unconformities along this segment of the margin is our documentation of a long period (35-37 m.y.) of erosion and/or nondeposition at both sites between the middle Eocene and the late Miocene (at Site 612 a small part of the late Eocene and early Oligocene is present unconformably between the middle Eocene and upper Miocene strata). Extrapolation of the core data along the grid of seimic lines suggests that upper Eocene, lower and upper Oligocene and lower and upper Miocene strata are virtually absent from the lower slope and upper rise. However, we cannot rule out the possibility that very thin layers of these units might exist undetected by the limited resolution of our seismic lines.

Seismic Line 35, which crosses the depositional strike through Site 604 and near Site 604A and 613, clearly reveals a series of stacked buried channels, whose ages and origins have challenged seismostratigraphers since they were discovered. Under the influence of the Vail model of sea level change, the general consensus has been that the channeling resulted from a mid-Oligocene sea level fall. Our drilling at Site 613 has revealed that one series of channels was formed between the early and middle Eocene. The lower Eocene surface is generally eroded from the shoreline (Island Beach No. 1 well; Poag, in press) across the shelf (truncations on seismic lines, although biostratigraphic data are indeterminate due to poor preservation), through Sites 612, 605 and 613, and basinward (seismic extrapolations seaward of 613).

Biostratigraphic gaps have been documented on the shelf and slope, indicating the removal of section from these updip regions. On Line 35, some channels can be seen to completely remove the lower Eocene strata, cutting deeply into the Paleocene section. At Site 613, however, which appears to have been near the slope-rise transition during the early and middle Eocene, the presence of frequent slumps indicates a depositional regime in which displaced sediments were accumulating. These base-of-the-slope accumulations increased during the middle Eocene and eventually filled the channels on the lower Eocene-Paleocene surface.

A second series of channels is stacked above the middle-lower Ecoene series, upon the middle Eocene surface. The chronostratigraphic unit has had a complex history of erosion, as revealed by its wide outcrop belt along the lower slope, and by truncated reflections in its upper strata. It has presumably undergone several periods of erosion since the late Eocene, and is still being worn away along its outcrop. Middle Eocene clasts have been recorded in the Miocene and Pleistocene strata at Sit 613 and in surficial piston cores along the lower slope and rise (Poag, unpub. data).

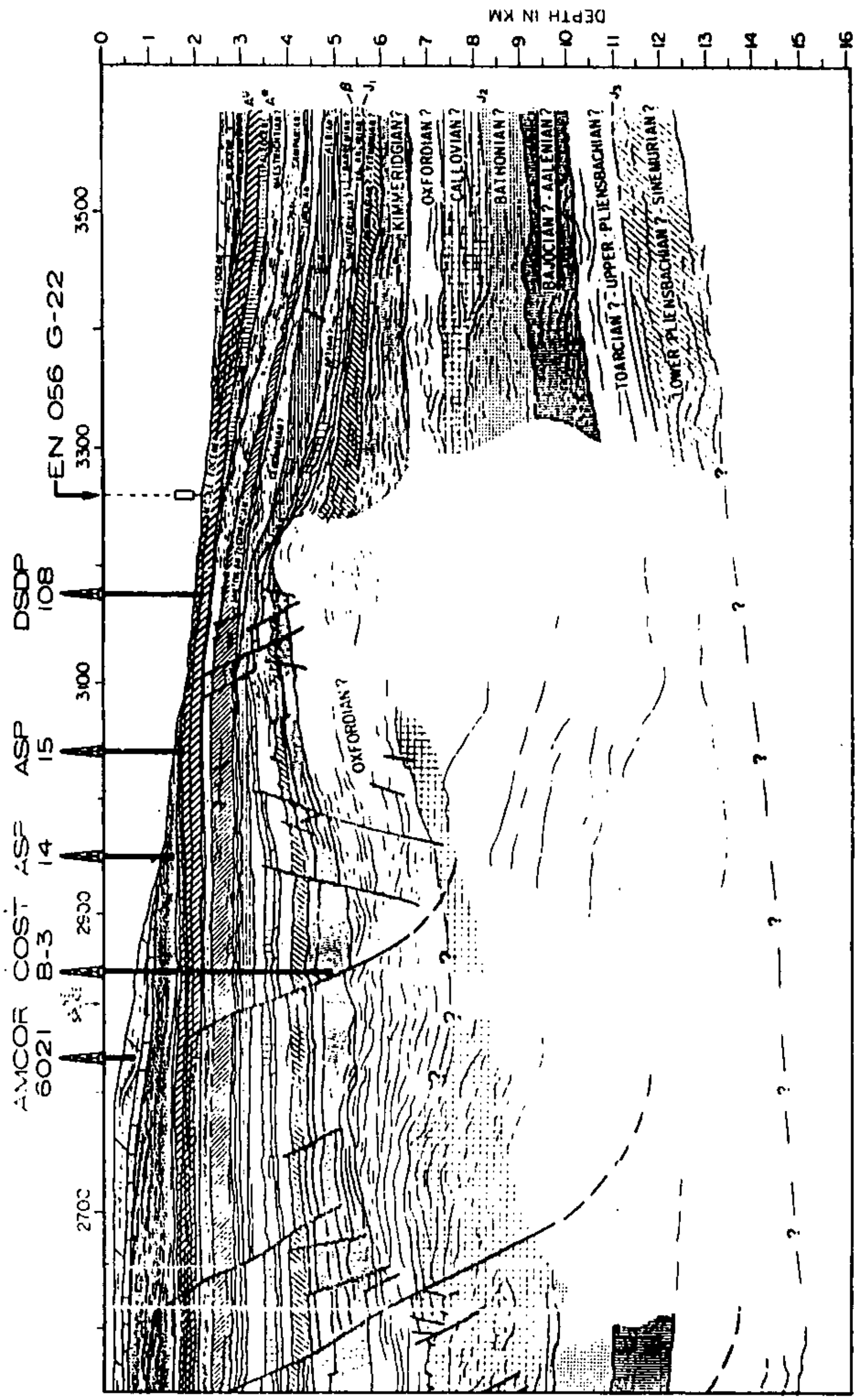


Figure 95-20. (cont'd.)

Filling of these middle Eocene channels took place during the late Miocene, as revealed at Sites 604, 604A, and 613, perhaps during the low stand of sea level associated with the Messinian salinity crisis. The coarse sands, gravels and lithoclastic conglomerates at Site 604 and 613 indicate that the channel fill came from the shelf and was dumped on the lower slope and upper rise in rather chaotic fashion.

These findings demonstrate that with continuously cored, shallow-penetration sections, carefully placed on seismic transect lines, we can easily obtain the fundamental geologic data necessary to unravel the complex Cenozoic stratigraphy and depositional history of sediment-rich passive margins. The concept of multi-site transects has developed late in the DSDP program but the immense value of their systematic approach to margin evolution has been amply demonstrated by the results of such legs as 78, 80, 93 and 95. Moreover, we would hope that the sections now drilled constitute only the initial steps towards a more comprehensive appraisal of margin development. The New Jersey Transect, in particular should stimulate new proposals for additional sites along Line 25 and its joining seismic grid, especially those aimed at deeper targets within the Mesozoic sequences.

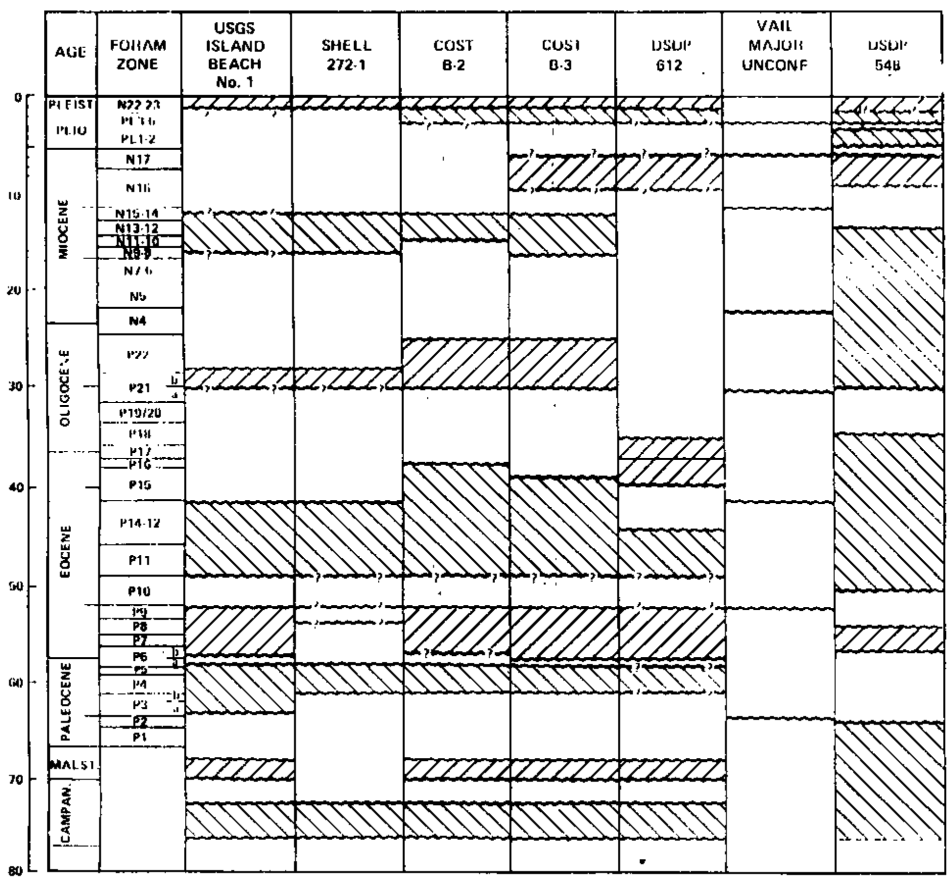


Figure 95-21. Comparison of depositional sequences and unconformities of New Jersey margin and Goban Spur (Site 548, Leg 89) with position of major unconformities in Vail model.

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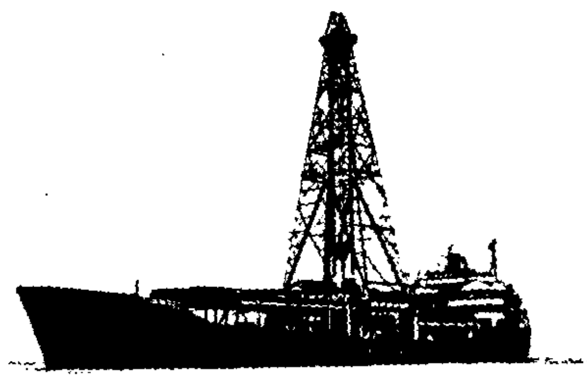

Leg 96

Mississippi Fan

Leg 96 began 29 September 1983 at Ft. Lauderdale, Florida , and ended 8 November, 1983 at Mobile, Alabama.

Introduction

DSDP-IPOD Leg 96 investigated a large deep-sea fan--the Mississippi Fan, Gulf of Mexico--and two types of intraslope basins on the continental slope off Louisiana. This was the first leg of the Project dedicated to sedimentological studies of a specific type of deposit.

Glomar Challenger left Fort Lauderdale, Florida on 29 September, and arrived in Mobile, Alabama on 8 November, 1983. Several sites and alternate sites had been approved; these sites are described in the Leg 96 Cruise Prospectus. A total of 11 sites was drilled of which 9 were located on the Mississippi Fan and one each in Orca and Pigmy intraslope basins (Fig. 96-1).

One of the most dramatic of deep-sea accumulations typically occurs seaward of large deltas and at the mouths of submarine canyons. In very short periods of geologic time large volumes of sediment are transported downslope from shelf environments, often via submarine caynons, onto the lower continental slope and rise as well as the abyssal plains, resulting in a thick sedimentary accumulation known as a deep-sea fan. Research on modern fans has thus far [illegible] address transport-depositional processes, distribution of sedimentary facies, vertical sedimentary sequences, time frames, and geochemical and geotechnical characteristics of deep-sea fans. Comparisons with ancient turbidite sequences have been partially unsatisfactory because of differences in scale of observations and differences in data collecting techniques. Time equivalent deposition of sands and large volumes of mud and clays are especially difficult to document in modern environments when accumulation rates are high. Such relationships can seldom be determined in ancient deposits, which results in erroneous interpretations. Drilling of a modern deep-sea fan on Leg 96 was a very constructive attempt to better understand ancient equivalents.

Drilling in the intraslope basins, formed between active salt and shale diapirs, provided insight into another mode of deep water sedimentation not yet recognized in the stratigraphic column. It was hoped that drilling results in these basins would determine if their depositional processes have any similarity to those on deep-sea fans.

Mississippi Fan

The Mississippi Fan is a semiconical, slope-rise depositional system of Quaternary deposits extending about 600 km from near the present Mississippi River delta onto the Sigsbee and Florida Absyssal Plains. It covers an area in excess of 290,000 km^2 and has a volume greater than 300,000 km^3. [illegible] thickest part of this [illegible]

Table 96-1. Leg 96 coring summary.

HOLE	DATES (1983)	LATITUDE	LONGITUDE	WATER DEPTH*	PENETRATION (m)	NO OF. CORES	METERS CORED	METERS RECOVERED	PERCENT OF RECOVERY
614	1-2 October 1983	25°04.08'N	86°08.21'W	3310 m	37.0	5	37.0	37.07	100
614A	2-4 October 1983	25°04.08'N	86°08.21'W	3310 m	150.3	13	75.0	56.06	75
615	4-9 October 1983	25°13.34'N	85°59.53'W	3268 m	523.2	52	419.3	175.29	42
615A	9-10 October 1983	25°13.35'N	85°59.55'W	3268 m	208.5	17	74.5	51.93	70
616	11-14 October 1983	26°48.67'N	86°52.83'W	2983 m	371.0	34	307.8	143.38	47
616A	14-15 October 1983	26°48.65'N	86°52.86'W	2983 m	132.4	4	38.4	24.21	63
616B	15-16 October 1983	26°48.66'N	86°52.85'W	2983 m	204.3	22	143.2	113.74	79
617	17-18 October 1983	26°41.93'N	88°31.67'W	2467 m	191.2	21	130.1	111.58	86
617A	18-19 October 1983	26°41.93'N	88.31.67'W	2467 m	73.0	8	73.9	56.94	77
618	19-21 October 1983	27°00.68'N	91°15.73'W	2412 m	92.5	11	78.0	67.47	87
618A	21 October 1983	27°00.68'N	91°15.73'W	2412 m	47.6	3	28.7	18.52	65
619	21-22 October 1983	27°11.61'N	91°24.54'W	2259 m	208.7	25	134.4	111.88	83
619A	22-23 October 1983	27°11.61'N	91°24.54'W	2259 m	5.3	1	5.3	5.30	100
620	23-26 October 1983	26°50.12'N	88°22.25'W	2608 m	422.7	45	421.3	197.95	47
621	26-29 October 1983	26°43.86'N	88°29.76'W	2481 m	214.8	34	157.3	136.83	87
622	29-30 October 1983	26°41.41'N	88°28.82'W	2491 m	208.0	26	132.7	100.17	75
622A	31 October 1983	26°41.41'N	88°28.82'W	2491 m	5.6	1	5.6	5.55	99
623	1-2 November 1983	25°46.09'N	86°13.84'W	3177 m	202.2	20	110.2	89.24	81
624	3-4 November 1983	25°45.24'N	86°16.63'W	3183 m	199.9	23	109.8	75.32	69
624A	5-6 November 1983	25°45.24'N	86°16.63'W	3183 m	207.6	22	103.7	86.76	84
						387	2586.2	1665.19	64

Seismic studies reveal that eight acoustic reflectors have fan-wide occurrence and define at least seven depositional units. Structure and isopach mapping of these reflectors shows that the individual units or fan lobes are not stacked vertically, but rather that a shifting of both succeeding fan lobes and their submarine canyons takes place with time (Coleman, Bouma, Prior and Adams, in press). In addition, these fan lobes show a gradual progradation into deeper water with time. Each fan lobe has a convex upward cross section that forces the next one to be developed adjacent to it. The youngest fan lobe was the main study target of Leg 96, although we were able to drill into or through the next older one at a number of sites and thus provide more data on the time-stratigraphic framework of the Mississippi Fan.

The youngest fan lobe can be divided into four major zones, including the submarine canyon. The structure and isopach maps indicate that such divisions are characteristic of the underlying fan lobes as well, although the finer details are obscure because of lack of seismic resolution. The four major zones are:

1. An upslope erosional submarine canyon: Mississippi Canyon;

2. An upper fan lobe area at the base of slope, characterized by a large, nearly filled erosional channel;

3. A middle fan lobe area which is aggradational in character, convex in cross section, and has a sinuous channel running along its apex;

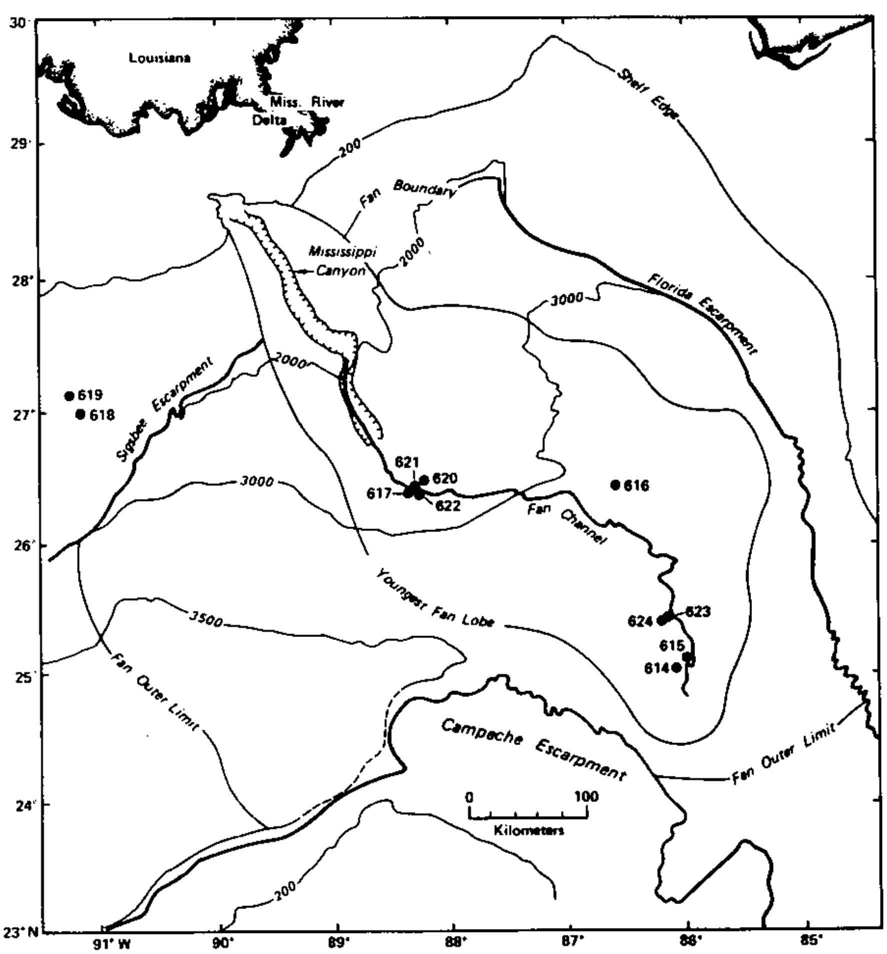

Figure 96-1. Location map showing sites drilled on DSDP leg 96.

4. A lower fan lobe area which is an aggradational zone with one recently active channel and several abandoned ones.

The modern fan lobe of the Mississippi Fan contains a very characteristic channel-levee complex. On the upper fan area this complex consists of a large scour-and-fill structure that is nearly filled. The channel in the upper (or northern) half of the area has a slightly irregular course and frequently changes in cross sectional shape because of the controlling influence of large diapirs. Further down the upper fan lobe the channel becomes slightly sinuous, has well-developed levees, and contains a recent central channel.

At the base of the slope where the aggradational middle fan starts we see the central channel becoming very sinuous with well-developed levees and overbank areas. The size of the channel, as well as its sinuosity, decreases downfan; while the channel has a width of about 3 km on the upper part of the mid-fan and a modern depth (topographic relief) of 40-50 m, it is about 300-500 m wide and 10-25 m deep on the lower fan at a water depth of 3100 m. Although difficult to distinguish on side-scan sonar, we see minor channel bifurcations near the channel terminations on the lower fan. Sonographs also reveal images paralleling the recent channel that are tentatively interpreted as abandoned channels. These images suggest that the channel shifts position frequently near the terminus of the fan-wide channel complex.

Each of the seven fan lobes identified seismically has a maximum thickness ranging from 300 to 600 m. The youngest lobe is about 400 m thick in the mud line on the mid fan area. The bottom of the channel fill in the upper fan lobe is irregular in shape because of width variations but shows an average depth of 400-700 m below the mud line. This same channel is about 300 m below the mid fan, and about 150 m below the mud line in the zone where the middle fan changes into the lower fan. In the outer part of the lower fan lobe parallel acoustical reflectors obscure channel fills. Very likely, they are minor and the small channels are short lived.

Four sites were drilled in the lower fan area: Site 614 to a depth of 150 m sub-bottom, Site 615 to 523 m sub-bottom, Site 623 to a depth of 191 m sub-bottom and Site 624 to a depth of 200 m sub-bottom (Fig. 96-1). An excellent set of well logs was collected at Sites 615, 623 and 624 providing stratigraphic information for many of the poorly-recovered sections, especially those in the thicker sand intervals.

A total of 5 sites was occupied on the mid-fan area, in an attempt to investigate all the significant morphologic and seismic characteristics of that region. Site 616 (penetration 371 m) proved to be located on a different fan lobe rather than on the outer flank of the modern fan lobe (Fig. 96-1). In addition, the upper section recovered at Site 616 has been interpreted as a large slump. For this reason, this site is discussed in the lower fan lobe section below.Sites 617, 620, 621, and 622 were all located along a cross sectional transect over the central channel area, including levees and overbank deposits (Fig. 96-1). Site 617 (penetration 191.2 m) was placed on the inner side of a meander bend in a swale between two ridges. Sites 621 (penetration 214.3 m) and 622 (penetration 208.0 m) were both located within the central channel near the presently deepest part or thalweg and near the inner bend, respectively. Site 620 (penetration 422.7 m) was located on the northeastern flank or overbank area approximately 18 km from the channel. Core recovery was generally good to a depth of about 60 m, below which both the Hydraulic Piston Corer and the Advanced Piston Corer were unable to complete a full 9.5-m stroke. The Rotary Corer was used at Site 620 with poor results; although this was anticipated, it seemed the only tool capable of drilling deeper in stiff muds with sand interbeds. Interpretation of the lithostratigraphy in the unrecovered intervals was accomplished at Sites 620, 621 and 622 with a suite of well logs.

The Safety Panels did not provide clearance to core through the channel fill on the upper fan because of the potential problem of free gas or hydrocarbons. This unfortunately makes a complete understanding of the total fan somewhat tenuous.

Middle Fan Lobe Area

Sites were drilled on the mid-fan area in three different morphologic areas: Sites 621 and 622 in the central channel, Site 617 to the southwest in a swale near the inner bend of the local channel meander, and Site 620 in overbank deposits about 18 km northeast from the channel.

The central channel on the apex of the mid-fan shows good sinuosity in the drilled area, as initially reported by Garrison, Kenyon and Bouma (1982) based on GLORIA data and later recorded by Sea MARC I from Lamont-Doherty Geological Observatory during the pre-cruise survey and partially detailed by Racal-Decca with their deep-towed side-scan sonar. The channel itself is about 3 km wide, shows bedforms on the bottom, and is flanked by a series of ridges and swales. The topographic and morphological characteristics suggest that the central channel has a migratory nature; seismic records are not of sufficient quality to confirm or deny this interpretation. Though we expected that documenting the abundance of sand and silt at the different mid-fan sites would help to unravel these problems, results at Sites 617 and 620 proved somewhat inconclusive; the findings at Sites 621 and 622 provided the answer.

Site 617 was cored to a depth of 191.2 m with the Advanced Piston Corer. Recovery was about 86%. The main objectives at this site were to study the characteristics of the sediments infilling the swales and the underlying levee deposits, and to obtain information about the vertical sequence of sediments in the attempt at determining whether the sinuous channel has displayed meandering tendencies during its development.

The entire cored section consists of levee-overbank deposits, characterized by thin fine-grained turbidites (Fig. 96-2). The vertical sequence initially coarsens upward and then fines upward to the base of the thin overlying Holocene unit. The Holocene (Ericson Zone Z; Ericson and Wollin, 1968) consists of a 25-cm thick marly foraminiferal ooze at the top; an accumulation rate of about 67 cm/1000yr. This grades downward into a section of thin-bedded mud turbidites, muds with silt laminae and thin silt beds, and zones of "homogeneous" muds. Seismic correlation of Ericson Zone X to this site gives an accumulation rate of 1190 cm/1000yr., which is much higher than at any of the sites located further down the fan (Fig. 96-3). This extremely high sedimentation adjacent to the channel is surprising considering the paucity of sand recovered.

Site 620 is located about 18.3 km north-northeast from the central channel. It is just inside the area reportedly covered by a large slump (see Site 616). This site was selected as being far enough from the channel to ensure a more or less constant deposition of overbank sediments without significant erosional unconformities. Thin-bedded turbidites were expected, and the proposed site was expected to penetrate through the upper two lobes and therefore provide good data on the overall deep-sea fan framework.

Total penetration at Site 620 was 422.7 m. Because the entire section was rotary cored in an attempt to reach the proposed total depth (770 m sub-bottom) without getting the drill pipe stuck, the quality of these unconsolidates mud and clay cores was very poor. Total recovery was only 47%, but successful logging provided lithostratigraphic information for the poorly recovered intervals.

The upper 20 cm of the Holocene (Ericson Zone Z) consists of a marly foraminiferal ooze. It has a computed accumulation rate of 25 cm/1000 yr. This is underlain by terrigenous clays and muds with varying amounts of silt and fine sand intercalations (Fig. 96-2). About 80% of the cored section show no discernible sedimentary structures. Its texture is about 20% silt and 80% clay. The gamma log supports these visual observations. Two sequences were observed, both showing a slight coarsening upward. Both belong to Ericson Zone Y and have a sedimentation rate of 1175 cm/1000 yr. (Fig. 96-3). The deposits are interpreted as fine-grained turbidites and hemipelagic sediments. They must have originated from the channel as overflow during the passing of major turbidity currents or other transport mechanisms.

Site 621 (214.8 m penetration) was located in the channel near the deepest part of a meander. The objectives of this site were to analyze the type of sediments that constituted the channel fill, and to obtain insight into the major transport mechanisms that move large quantities of sediment from shelf depths to the aggradational middle and lower fans in a very short geological time frame. We expected to find either large amounts of sand or, in the case of a conduit, major amounts of clays forming a passive fill.

The sediment section at Site 621 consists of a thin Holocene marly foraminiferal ooze, underlain by muds with some thin sandy and silty turbidites that gradually changed into "homogenous" muds with increasing silt contents downhole (Fig. 96-2). With the exception of a few silt and sand beds and occasional color bands, it was a very monotonous section. At a depth of about 160 m, the gradual downhole coarsening trend became obvious because of an increase in the abundance of thin-bedded turbidites. At a depth of 195 m, a pebbly mudstone was encountern by gravel (Fig. 96-4). This clean gravel obviously was washed during coring and has to be a sandy gravel or gravelly sand. Both the pebbly mud and the gravel show up as high-amplitude reflectors on seismic records. The entire core section falls within Ericson Zone Y. The average sedimentation rate is 1111cm/1000 yr. (Fig. 96-3), although most of the sediments probably accumulated from discrete instantaneous geologic events.

The foraminifers in the channel fill sediments were mostly reworked and derived from neritic environments, similar to those found on the lower fan. The sediments at the overbank area (Site 620), however, contained a sparse population of reworked Cretaceous planktonics and in situ bethics. This means that most foraminifera are transported as sand-sized clasts and do not overflow the channel. Certain bathyal benthic species can live in the overbank environment in spite of the high accumulation rate.

Drilling results at site 621 clearly demonstrate the fact that the channel was a deep conduit through which gravel, sand and most silt moved by either turbidity current action and/or debris flows. Some or all of these transport mechanisms must have included density flows thicker than the channel depth to account for the large amount of overbank material; transport of nearly all of the coarser material was confined inside the conduit. Based on the coring and faunal determinations, the minimum depth of the channel may have been 110-160 m.

Seismic records show an upward displacement of the channel floor in steps coupled with discrete lateral movements. This means that the channel is migratory in nature, and that its fill is mainly a lag overlain by hemipelagic fill. Interpretation of the many ridges and swales seen on high-resolution seismic records and side-scan sonar now becomes possible: each time the channel became an active conduit it built up its floor and constructed levees. The next pulse caused a lateral move (migration), and the same process repeated itself. New levees were formed and the tops of older ones were eroded. The overall process is quite similar to a meandering fluvial system. The bedforms seen on the EDO side scan can only be interpreted as transverse sand waves constructed in the upper foraminiferal ooze. Studies other than coring or drilling will have to be used to further document these features.

Site 622 would ideally have been located near the inner bend of the same meander belt on which Site 621 was located. Because proximity to both the 13.5 and 16 kHz beacons prevented dropping of a third beacon at the desired location, the site had to be moved to a comparable morphologic position in the next meander to the east. The objectives of this site were to determine if any lateral sediment distribution patterns were present that appear similar to meandering fluvial system. The hole was drilled to a depth of 208 m sub-bottom. The overlying Holocene marly foraminiferal ooze was 25 cm thick, which may be compatible to that at Site 621, if the influence of coring the interface is taken into account. The sediment section at Site 622 is very similar in overall aspect to that at Site 621. The pebbly mudstone was drilled at a depth of 199 m sub-bottom. Overlying is a fining-upward sequence of which the lower sands are much thicker (65 vs. 34 m) than at the thalweg site (Fig. 96-2).

Lower Fan Lobe Area

Four sites (Sites 614, 615, 623, and 624; Fig. 96-1) were occupied on the lower fan to identify the sediment characteristic and modes of sediment transport within the youngest fan lobe and to compare those with the older, underlying fan lobes. Other main objectives were to determine the biostratigraphic sequence and age relationships of several succeeding fan lobes, to establish accumulation rates for the uppermost lobes, and to identify the sediment provenance. Successful well logs were run at Sites 615, 623 and 624 to obtain more complete lithostratigraphic information than was possible in the poorly recovered intervals.

Site 614 (penetration 150.3 m) was located near the terminal end of the modern lower fan channels and their interfingering depositional lobes. Extremely stiff clays prevented good core recovery, while sands tended to be washed out. Poor core recovery prohibited accurate determinations of sand/clay ratios, but our estimates suggest that the cored section contains 70% net sand. The recovered sediments were generally barren of planktonic foraminifers, but contained sparse benthics typical of inner and middle neritic environments. A thin Holocene cover, about 1.5 m thick, has a thin marly foraminiferal ooze at the top. The remainder of the cored section falls within Ericson's Zone Y (late Wisconsin glacial stage) and consists mainly of turbidites (Fig. 96-2).

Site 615 was drilled in the same general area, 21 km northeast of Site 614. It was located on the western levee of the central channel. The channel at this location is only about 400 m wide and 10 m deep. Total penetration at Site 615 was 523.2 m using a combination of the Advanced Piston Corer and the Extended Core Barrel. Three fan lobes and the top of a fourth one was cored. The sediments were dominantly graded muds containing only displaced fauna (Fig.96-2). Planktonic as well as deep-water benthic fauna are very rare, implying a nearly continuous deposition of sands and clays during the late Wisconsin glacial stage. Recovered faunal assemblages indicate that most the

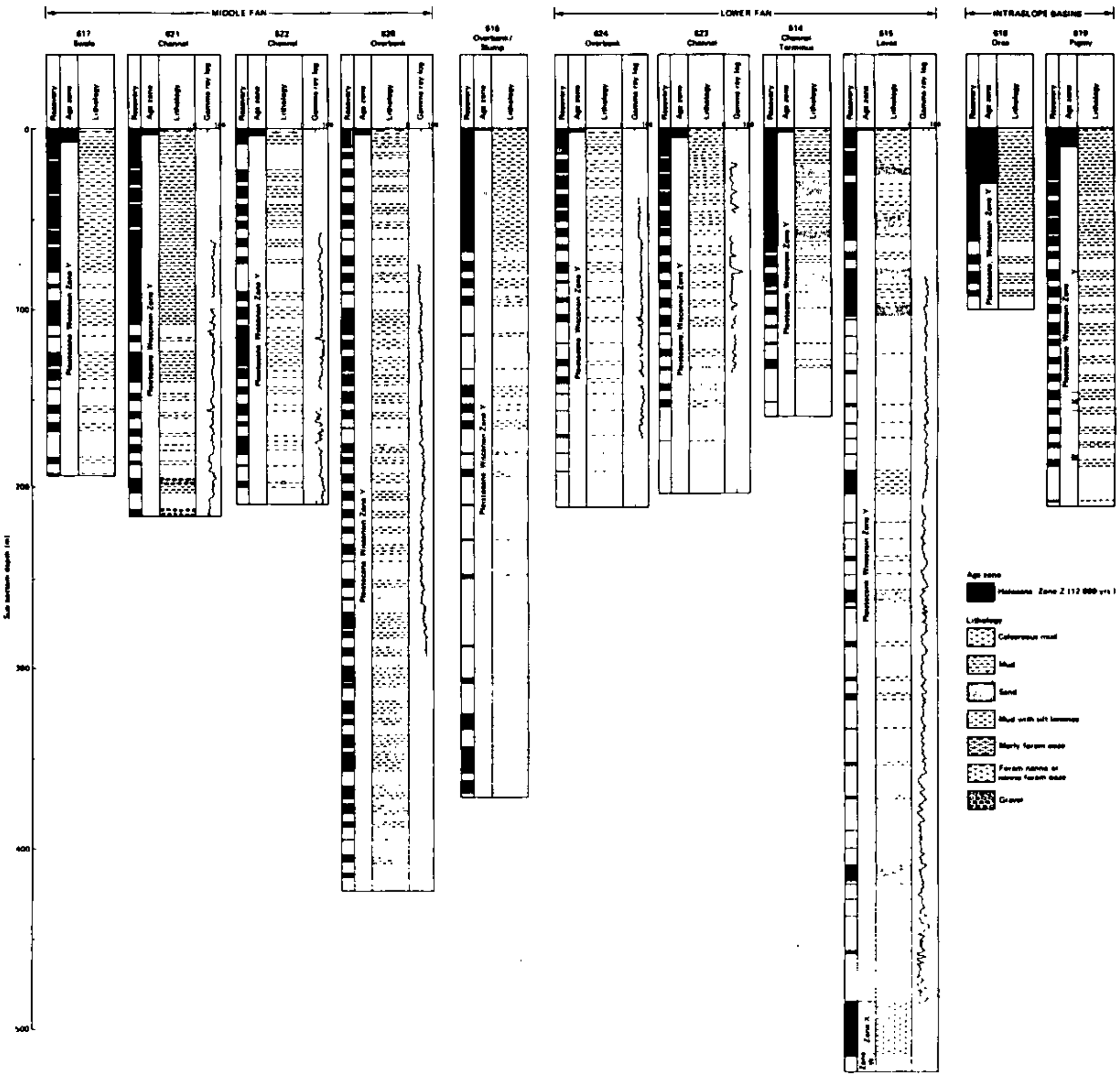

Figure 96-2. Stratigraphic summary of sites drilled on DSDP Leg 96, showing age, core recovery, general lithology, and well logging results.

sediments were derived from inner and middle neritic environments. As at Site 614, the major mode of sediment transport was by turbidity currents. Well logs from Site 615 show that the youngest fan lobe (199 m thick) contains a total of 82 m net sand (41%). A total of 184 m (65%) of the underlying, 267 m thick fan lobe is net sand. Both fan lobes fall within the Ericson Zone Y and have average accumulation rates of 646 cm/1000 yr. (Fig. 96-3). The fan lobe, or part of a fan lobe, that underlies the upper two consists of 29 m nannofossil ooze (Ericson Zone X, late Wisconsin interstadial). That lobe shows grading upsection from a basal zone of thin breccia to a nannofossil foraminiferal ooze to a nannofossil ooze. It is interpreted as a debris flow deposit that likely originated near the De Soto Canyon area; the recovered fauna indicates a shallow carbonate platform origin including pinnacle reef environment. The ooze unit has an average accumulation rate of 75 cm/1000 yr., although it may have been one instantaneous geologic event. The lobe bottomed in Ericson Zone W (early Wisconsin glacial) muds with shallow water origin. The well logs clearly demonstrate that the nonrecovered core intervals were sandier than estimated from the recovered cores (core estimates is 15.6% while gamma log estimate is 59.6%).

Neither Site 614 nor 615 showed any gas except for traces of methane in the calcareous debris flow deposit at Site 615.

Sites 623 and 624 were located 55 km north-northwest of Site 615 in the transitional area between the middle and lower fan areas, where seismic reflection profiles show a buried channel. The main objective of these sites was to core and log this zone where the influence of the channel on sand and silt transport starts to decrease before "fanning out" in lower fan depositional lobes. One hole (Site 623) was drilled through the edge of the buried channel (total depth 191 m below sub-bottom) and one hole (Site 624) 4.8 km away to study levee and overbank deposits in this part of the modern fan lobe (total depth 200 m sub-bottom). Both sites were logged successfully; a duplicate hole was taken at Site 624 in the levee and overbank deposits and recovered cores were reserved for shore based geotechnical studies.

Both Sites 623 and 624 contain similar lithologic sections, although the sediments at Site 624 are slightly finer grained. The sediment cores and the well logs suggest one indistinct fining-upward sequence, although this sequence could also be divided into many indistinct fining-upward (channel deposits), coarsening-upward (overbank deposits), and saw-tooth patterns (levee deposits). With out further analyses, boundaries are insufficiently clear to present a final interpretation.

Cores and well logs collected at Sites 623 and 624, together with the acoustic patterns of slightly irregular reflectors (rather than good channel cuts or distinct parallel reflectors), strongly suggest that the channel maintains its position for only a short time, does not significantly meander, and frequently shifts to a new position.

Site 616 (total depth 371.0 m sub-bottom) was intially thought to be located on the outer flank of the middle lobe. There were two main objectives for drilling this site: first, the upper 100 to 110 m at this location has been interpreted by Walker and Massingill (1970) as a wide-spread slump based on USNS Kane 3.5 kHz records; it was hoped that drilling this site would successfully test this interpretation. Second, we hoped to investigate the sedimentologic, paleontologic, geochemical and geotechnical properties of the flank deposits and to locate the boundary between the modern fan lobe flank and the underlying lobe. The drill pipe became stuck at 371 m sub-bottom and had to be severed at the lowermost joint of the 5½ in. drilling pipe. Although the entire cored section was much finer grained than observed at the lower fan sites, it subsequently became obvious that the results did not agree with those from other sites drilled on the mid-fan. Rexamination of seismic records indicated a series of acoustical zones that offlap onto a deeper reflector at 445 m sub-bottom and thin out toward the north and east (Fig. 96-5). Those offlapping units are present at Site 620 but not at Site 617. We therefore conclude that we drilled a different lobe fan at Site 616 than at all other sites.

The upper 100 to 105 m drilled at Site 616 consists of a fine-grained mud with silt and fine sand intercalations that display steep dips (up to 65°) in discrete zones separated by thin units of highly disturbed material (Fig. 96-2). This sequence obviously resulted from emplacement by mass-movement processes. The source of the sediment is unknown because the foraminiferal assemblages were poorly developed. Our current interpretation is that this upper zone represents a number of slides. Underlying these slides we penetrated two lobe fans (Fig.96-2). The uppermost lobe is approximately 88 m thick with a total of 33.8 m of sand (38.5%) and represents an upward-fining sequence. The lower lobe was only partially cored. It appears to display a coarsening-upward sequence with a minimum of 7% net sand. Both lobes fall in Ericson's

Zone Y. These fan lobes have a minimum accumulation rate of 373 cm/1000 yr., excluding the overlying slide deposits (Fig.96-3). Based on seismic correlations of Ericson's Zone X the accumulation rate could be as high as 563 cm/1000 yr. Post cruise geophysical studies, especially of the recent data collected by the University of Texas, may enable us to place this site in its proper prospective.

Important Shipboard Observations and Conclusions, Mississippi Fan

1. Seismic analyses indicate that the Mississippi Fan is built by a number of elongated fan lobes that are not stacked vertically, but switch laterally and prograde basinward.

2. Each fan lobe is basically a channel-levee-overbank system.

3. Each fan lobe can be divided into a canyon, an upper fan lobe, a middle fan lobe, and an outer fan lobe.

4. Canyon: Mississippi Canyon is an erosional feature formed at or near the shelf break as a result of slope failure followed by retrogressive slumping.

5. The upper fan lobe is characterized by a large erosive channel that is nearly filled. The northern part is confined between diapirs. The southern part is slightly sinuous, has massive levees, and has a central channel incised in its fill.

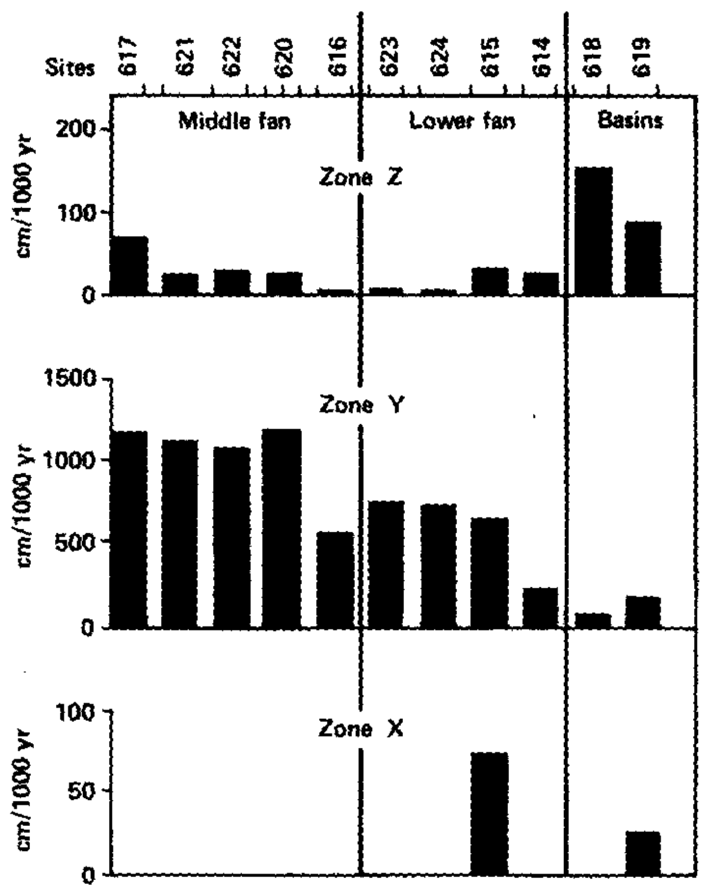

Figure 96-3. Undecompacted accumulation rates of ...

6. The middle fan lobe is convex upward in cross section, is about 400 m thick, 150 m wide, and has a 3-4 m wide sinuous channel at its apex. This channel is nearly filled. The dimensions and sinuosity of the channel decrease down fan.

7. The lower fan is an aggradational area where the channel becomes small and shallow, has levees, and may bifurcate before it terminates. Several, slightly parallel abandoned channels are located nearby, suggesting a short active life followed by abandonment. Channel terminations not only jump laterally but likely also back and forth with an overall progradation. At the end of a channel, one (or more?) lenticular or oblong depositional lobes are deposited.

8. A first estimate on amounts of clay, silt, sand, and gravel in the Mississippi Fan suggests that the source of this material was very high in clay content.

9. The channel on the upper and mid-fans has acted as a conduit for transport of sand and finer sediment to the lower fan. Volume calculations of how much was deposited outside the channel and on the lower fan will show if this is really a sand-efficient system.

10. The upper and middle fan channel is filled with coarse-grained material retained during transport. The channel fill accumulates by lateral migration and vertical aggradation. This coarse-grained sediment is overlain by a more passive fill consisting mainly of fine-grained sediments.

11. The channel on the mid-fan must have been of sufficient depth to prevent turbidity currents from carrying much coarse material at levels higher than its levees. However, most of the turbidity currents must have been thicker than the channel depth to allow large quantities of fine-grained material to flow over the levees and to build the overbank deposits. Based on seismic, coring, and faunal determinations, the minimum depth of the channel may have been 110 to 160 m.

12. The gravel found in the mid-fan channel must be time equivalent to sands in the lower fan.

13. The channel in the mid-fan is migratory. Each time it moves upward and lateral it builds levees. Several rows of levees support the migratory nature.

14. The channel on the lower fan seems to have shifted its position frequently rather than being stable or migratory. The sediments in that area show alternations of indistinct fining-upward (channel deposits), coarsening-upwards (overbank deposits), and saw-tooth patterns (levee deposits).

15. Nearly all the sections cored fall in the Ericson Zone Y (late Wisconsin glacial). Tentative average accumulation rates on non-decompacted sediments show rates ranging from about 2 m/1000 yr. (middle fan) to 6 to 7 m/1000 yr. (lower fan). This necessitates nearly continuous sedimentation in a geologic sense.

16. Fauna is very sparse. Displaced Cretaceous foraminifera and nannofossils are not common. Planktonic foraminifers are rare in the Y zone. The displaced benthic species indicate a neritic origin. Mid-fan Site 620 (overbank) is the exception, containing bathyal benthics, many radiolarians and few planktonics. Consequently, displaced benthic species are mainly transported inside the channel (similar to silt and sand grains), and only a few spill over onto the overbank areas.

17. During Ericson's Y zone two fan lobes have been deposited that are separated by a weak seismic reflector but sedimentologically could be separated into two major vertical sequences.

18. Local and maybe long distance mass movements are not uncommon.

19. All cored sediments (clays) are underconsolidated. At Site 620, over-pressuring starts at a depth of 390 m where a pressure equal to lithostatic pressure is present.

20. Although organic matter is present, the amount seems to be low. This may explain why biogenic methane was scarce at all the sites drilled.

Intraslope Basins

The continental slope off Louisana and east Texas is characterized by a large-scale hummocky topography that is caused by underlying diapirs. Most of these diapirs are assumed to consist of salt of Louann age (Middle and Late Jurassic) and to be overlain by Tertiary shales (Martin and Bouma, 1978; Martin, 1978). Locally the salt may outcrop or be very near the water/sediment interface. Typically, no two adjacent diapirs are of the same size or shape (Martin, 1980) or effect the overlying sediments in the same way (Bouma, 1983).

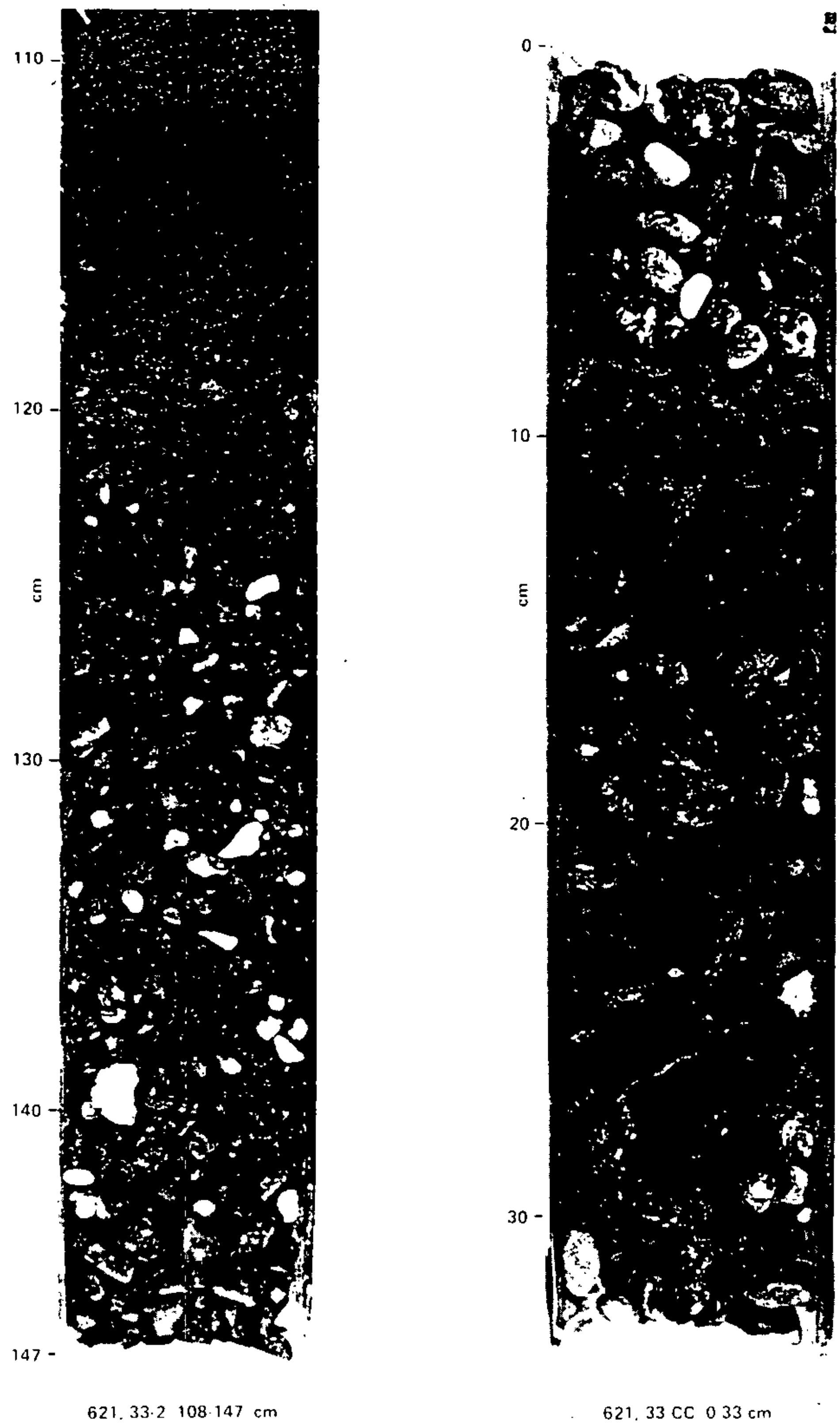

Figure 96-4. Core photos of 621-33-2, 108-147 cm and 33,CC (0-33 cm), showing sand, pebbly sandy mud, and gravel recovered at base of hole.

The depressions between the diapirs--called intraslope basins--also vary in size, depth, and shape. The utilization of seismic stratigraphy, aided by the collection of piston and gravity cores, has provided a tentative classification of these intraslope basins into three major types: (1) blocked-canyon intraslope basins, (2) interdomal basins, and (3) collapse basins.

A blocked-canyon intraslope basin is formed either by blockage of the thalweg of a submarine canyon or upper fan valley caused by upward-moving diapirs or is part of a series of intraslope basins that were subjected to bottom transport of sediment that originated from the same shallow-water source. The sediments in the axis of such a basin contain coarse material that gradually changes laterally into clays where the layers onlap onto the sides of the diapirs. The bottom contact of the coarse material often forms a low-angle unconformity with underlying sediments. The coarse material or "sands" likely are overlain by muds of shallow-water origin; these can be topped by hemipelagic and pelagic deposits. The coarser material can be deposited either by turbidity currents or by debris flows, or the interval can be partly or completely composed of slump material. Acoustically, the coarse-grained interval appears either transparent, semitransparent, or a combination of both with scattered hyperbolics. The overlying muds likely are of turbidity current origin; acoustically they form discontinuous, more or less parallel, reflectors. The upper part of the sequence, the pelagic and hemipelagic sediments, is represented acoustically as thin, parallel, continuous reflectors.

This vertical acoustical sequence is also visible in a lateral direction, suggesting a lateral fining of the sediment. The seismic sequence can be incomplete, and no pattern has been detected in relative thicknesses of the three intervals. Present data suggest that each complete sequence does not exceed 0.25 s in thickness; often they are much thinner.

Some similarity in seismic sequence can be seen between this type of intraslope basin and the Mississippi Fan, specifically in the upper fan (Bouma and Garrison, 1979; Bouma, 1981, 1983; Bouma, et al., 1981). Well-published examples are the Gyre Basin and Pigmy Basin; both show acoustical sequences well.

The second type of intraslope basin--an interdomal basin--forms when a group of upward-moving diapirs coalesce, thereby surrounding a depression with a wall and eliminating any possibility of coarser-grained sediments entering that depression by means of bottom transport. As a result only hemipelagic and pelagic sediment can accumulate.

Orca Basin is the only known example of this second category of intraslope basins. This basin is exceptional in that it contains a hypersaline, anoxic layer of bottom water about 200 m thick (Trabant and Presley, 1978). Seismically one observes salt outcropping on multichannel records on the northeast side of the basin (Bouma, 1983). Mini sparker and air gun records do not show sub-bottom reflectors that may indicate either the thickness of the anoxic bottom sediments or the contact with underlying, older deposits.

The third type of intraslope basin--collapse basins--are small, irregularly shaped depressions commonly found on diapiric tops. A graben structure can often be observed. Collapse basins are the smallest of the three types of intraslope basins. They are either formed by tensional collapse of the overburden or result from vertical collapse because of solution of salt from the top of the diapir (Martin and Bouma, 1978; Bouma, 1983). The normally flat or slightly upward bulging bottom is located above the surrounding seafloor and separated from it by a surrounding rim. The sediments are typically hemipelagic and pelagic. Acoustic profiles over these basins show thin, parallel reflectors, often disturbed by growth faults and normal faults. Studied examples are Carancahua and East Breaks Basins (Bouma, et al., 1981).

The main objective of drilling one site in each of the two most important types of intraslope basins was to obtain a complete upper Pleistocene stratigraphic record. Because of the unique anoxic conditions in Orca Basin, we wanted to establish the organic and inorganic characteristics of the anoxic and the underlying oxic sediments, and to establish the source of the brine. It was expected that biostratigraphic resolution might be good enough to provide enough insight into the timing of slope diapiric activities. A final objective at Pigmy Basin was to correlate the observed acoustic sequence with lithological types, sea level variations, climatic zones, and sediment processes.

Site 618 was located near the center of the northern subbasin in Orca Basin (Fig. 96.-1) Drilling was terminated at 92.5 m because of the poor faunal content in the primarily displaced sediment. Core recovery was excellent to a depth of 62.5 m; below that, average recovery dropped less than 50%. The near-surface sediments were gray rather than black as had been predicted. From 0 to 16 m the sediments were a very uniform clay, displayed an abundance of gas-escape structures, and contained an abundance of reworked benthic foraminifera. This unit was interpreted as a local Holocene slide.

Underneath this slide we cored a 1.5 m zone of dark black anoxic sediments. Downhole the sediments again became a gray clay, and contained occasional thin interbedded dark black clays. The deepest black layer encountered occurred at a sub-bottom depth of 41 m; the remainder of the cored sequence consisted predominantly of gray clays (Fig. 96-2).

Because of the abundance of gas expansion cracks, few sedimentary structures could be observed and sampling for paleomagnetic determinations could not be done. The sediments contained mixed planktonic, dominantly displaced, foraminiferal assemblages. Interstitial water analyses showed a rapid decrease in salinity from about 270 ppt at the surface to about 45 ppt at a depth of 30 m below which it stayed about constant. Very small, white, crystalline gas hydrates were found in the upper cores.

The Holocene sediment accumulation at Site 618 is computed to be 158.3 cm/1000 yr. (Ericson Zone Z); a mnimum accumulation rate of 83.6 cm/1000 yr. was computed for the underlying drilled section belonging to the Ericson Zone Y (Fig. 96-3).

Site 619 (penetration 208.7 m) is located in Pigmy Basin (Fig. 96-1). The basin is northeast-southwest trending, has a flat floor at a water depth of about 2260 m and steep sloping walls formed by the adjacent diapirs. The walls rise to about 700 m above the basin floor.

The continuously cored section consists of muds and clays containing an abundant benthic and planktonic fauna (Fig. 96-2). The hemipelagic muds contain only a minor amount of thin (coarse) sandy-silty turbidites and do not show any significant influence of mass movement. The absence of gas and the abundance of foraminifera made this site ideal for a detailed upper Pleistocene stratigraphy; closely-spaced samples for shore-based biostratigraphic, paleomagnetic, and oxygen isotope stratigraphic studies were collected.

A well-preserved and rather complete stratigraphic section of the Wisconsin was cored at Site 619. Ericson's Zones Z, Y, X, and W were penetrated. Computed sedimentation rates were 83.3 cm/1000 yr. for the Holocene (Zone Z, 10 m thick), 183.3 cm/1000 yr. for the late Wisconsin glacial (Zone Y, 136 cm thick), 23.8 cm/1000 yr. for the Wisconsin interstadial (Zone X, 10 m thick), and a minimum of 76.5 cm/1000 yr. for the early Wisconsin glacial (Zone W, 52 m cored) (Fig. 96-3).

The predominantly clay section contains an abundance of bathyal benthic foraminifers in the lower part of the cored Zone W (early Wisconsin glacial), in addition to displaced shallow neritic benthic species. A prominent ash layer was cored at a sub-bottom depth of 141.5 m, coinciding with the top of Ericson's Zone X. This ash may be the Y-8 ash of Kennett and Huddlestun (1972) deposited 84,000 yr. B.P.

Diapiric movement forming this basin must have been minor during the late Pleistocene

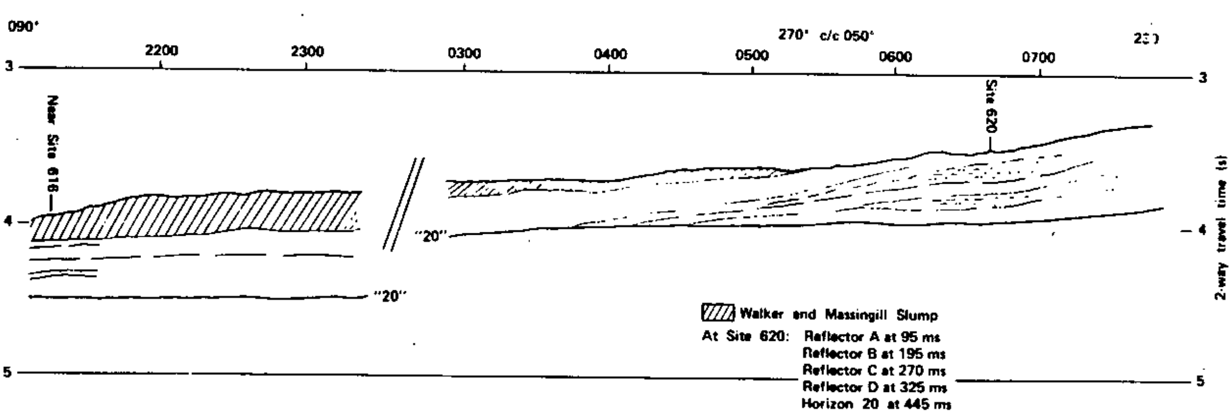

Figure 96-5. Seismic reflection profile collected on board Glomar Challenger Leg 96 showing offlapping reflectors observed at Site 616.

because a minimum of mass-movement deposits were observed in the cored section. In spite of the fine-grained nature of the sediments, we were able to detect compositional changes at depths predicted by seismic reflectors; differences in sediment composition are small, but apparently sufficient to provide the necessary impedance contrast.

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DEEP SEA DRILLING PROJECT

INFORMATION HANDLING GROUP

Background

The DSDP data bank is a dynamic library of information. As the Project has expanded so have the areas of responsibility of the DSDP Information Handling Group (IHG). Not only has the volume of data multiplied, but the kinds of data and information handled have also increased. The IHG manages all aspects of routine collection, storage, and retrieval of data, in addition to specialized areas of scientific interest which require computer-assisted technology. We have three primary goals in this work: (1) to preserve the data collected by DSDP operations for future use; (2) to make data readily available to qualified scientists upon request; and (3) to provide advice and assistance by means of computer reduction and display of data to contributors to the Initial Reports. Now that the project is in a close out stage, these goals take on a new perspective with emphasis on the completion for archives and future research. Our major effort today is to produce a clean package of DSDP prime and process data which eventually will be available to the scientific community through the National Geophysical and Solar Terrestrial Data Center (NGSDC) in Boulder, Colorado.

Data Availability

The DSDP Sample Distribution Policy restricts the release of scientific data gathered aboard GLOMAR CHALLENGER to those immediate members of the respective shipboard scientific party for a 12-month period following completion of the cruise. This policy excludes the Preliminary Report on underway data containing track charts and data indexes; these data have immediate unlimited distribution. DSDP may require reimbursement for expenses if a data request costs more than $50.

Table DSDP-1 summarizes and categorizes the data. With the exception of the seismic data, which are available only on microfilm or hardcopy, all data are stored and are available on magnetic tape and microfilm. Investigators can also obtain copies of the original data (shipboard forms) on microfilm, or they can view them at DSDP headquarters at Scripps Institution of Oceanography or at Lamont-Doherty Geological Observatory.

A major work effort towards updating the data bases for visual core descriptions, smear slide descriptions, and paleontology is in its final stage of completion.

The hard rock minor- and major-chemical analyses files continue to be modified and updated as more data is published and coded. The hard rock paleomagnetics data base is now available upon request for those legs specified in Table DSDP-2.

Logging data were collected on selected legs. These data are available on magnetic tape or analog strip charts for Legs 60, 61, 63-65, 67, 68, 70-76 and 78; analog records are only available for Legs 66 and 69; magnetic tapes are available for selected sites from Legs 46, 48, 50 51, 52 and 57.

Data Handling and Retrieval Tools

The special reference files (Sitesummary, Guide, Ageprofile, and Coredepth, see Table DSDP-2) are used independently and in coordination with other files in (a) multi-step searches, and (b) generation of standard files with assigned ages (from Ageprofile) and/or sub-bottom depths (from Coredepth).

The Sitesummary file contains key data for each hole including drilling statistics, site location, age of sediments, presence of basement sediment and hard rock descriptions.

The Guide (to DSDP cores) also summarizes data published in the Initial Reports (Legs 1-34)[1], but in a different format than in the Sitesummary file. It comprises thirty categories of data which summarize the characteristics of each core. The Guides are available on microfiche and magnetic tape. All of these files can be accessed by DATAWINDOW - DSDP's principal program for the retrieval and display of data.

DATAWINDOW transfers data between tape and disk storage, updates tapes, corrects records, and monitors the tape status within a tape series (storage unit for our data base files). Access is accomplished through independent easily modifiable data dictionaries which the program references in both its interactive and batch modes of operation. Individual requests can easily be constructed

Table DSDP-1.

DEEP SEA DRILLING PROJECT - DATA BASE STATUS
Physical Properties, Quantitative and Analytical Core Data

DATA FILE	LEGS	COMMENTS
Carbon-carbonate (shore lab)	1-79	No data for Legs 46, 72
Carbonate-BOMB (ship)	68, 70-73, 78-80, 84, 85, 89, 90, 94	
Grain-size (sand-silt-clay) (shore lab)	1-76	No data for Leg 16. Legs 64 & 65 not yet available.
G.R.A.P.E. (gamma ray attenuation porosity evaluator) (shipboard measurements, processed and edited onshore)	1-87, 89-90, 94-96	No data collected on Leg 46. Legs 45, 88, 91-93 GRAPE to be completed.
Hard Rock Major-Element Chemical Analyses (prime and onshore labs)	13-19, 22-30, 32-39, 41, 42A, 43, 45-46, 49, 51-55, 58-65, 68-70.	No data for Legs: 1-12, 20-21, 31, 40, 42B, 44, 47-48, 50, 56-57. Includes igneous and metamorphic rock and sediment composed of volcanic material.
Hard Rock Minor-Element Chemical Analyses (prime and onshore labs)	13-19, 22-26, 28-34, 36-39, 41-42A, 43, 45-56, 49, 51-55, 58-65, 68-70	No data for Legs: 1-12, 20-21, 27, 35, 40, 42B, 44, 47-48, 50, 56. Same set of data source as major-element file.
Hard Rock Paleomagnetics	14-16, 19, 23, 25-29, 32-34, 37-38, 41-43, 45-46, 49, 51-55, 58-66, 70.	No data for Legs: 1-13, 17-18, 20-22, 24, 30-31, 35-36, 39, 40, 47-48, 50, 56-57.
Sonic Velocity (shipboard, Hamilton Frame)	3-95	Leg 71 not completed.
Water Content (shipboard lab)	1-88	No data for Leg 41
Long-core Spinner Magnetometer Sediment Paleo-magnetics	68, 70-72, 75	From hydraulic piston cores. This is a CLOSED data base due to rust contamination of cores and sediment disturbance.

Table DSDP-1 (continued)

DEEP SEA DRILLING PROJECT - DATA BASE STATUS
Physical Properties, Qualitative and Analytical Core Data

DATA FILE	LEGS	COMMENTS
Discrete Sample Magnetics, sediment	71-73, 75	From hydraulic piston cores.
Alternating Field Demagnetization	72, 73, 79	From hydraulic piston cores.

Lithological and Stratigraphic Core Data

DATA FILE	LEGS	COMMENTS
Paleontology (onshore labs)	1-65	From Initial Reports. Includes 10,000 species from 24 bug groups.
SCREEN	1-66	Output from JOIDESSCREEN. Computer-generated lithological classification includes basic composition data, average density, and age of layer.
Smear Slide Descriptions	1-91	Shipboard observations. (There are no smear slides for Legs 83 & 88)
Thin Sections	49 only	Legs 37, 45, 46, 51-55, 57-64 keypunched.
Visual Core Descriptions	1-75	Shipboard observations. Leg 74 to be completed.

Table DSDP-2

DEEP SEA DRILLING PROJECT - DATA BASE STATUS
Underway Data

DATA FILE	LEGS	COMMENTS
Bathymetry	7-9, 13-56, 61-80	
	7-9, 12-80	
	3-80	
	1-80	Seismic data available only in hardcopy or microfilm.
Merged format files (MDG77)	1-80	
SPECIAL REFERENCE FILES		
Sitesummary	1-96	Hole oriented.
DSDP/Guide	1-34	Core oriented. Microfiche or tape.
Ageprofile	1-96	Hole, core, section. From biostratigraphy.
Coredepth	1-96	Hole-core. Primary reference tool.
AIDS TO RESEARCH		
Datawindow		Search & retrieval program, data base maintenance.
Mudpak		Plotting program, handles multiple parameters.
Maps		Topographic maps with DSDP sites.
DASI/Inquiry		DSDP affiliated scientists & institutions searchable.
Keyword Index-Search		Constructed from bibliography & sample request files. Searchable keywords & site numbers.
Sample Records		Point data inventory.
Data Data		Series of informal specific memoranda containing detailed descriptions of procedures and capabilities of the IHG.

using DATAWINDOW's versatile search commands. Through DATAWINDOW, investigators can search the data bases by leg(s), site(s), ocean area(s), and age(s), in addition (or linked) to specific elements stored in each data base.

Areas of Support and Endeavor

The DSDP programming staff continues to provide the engineering group with mathematical and computer support for advanced engineering data collection (shipboard), reduction, and analysis.

Requesting Information or Data

We encourage researchers to use all these extensive data systems described above. Address your requests for information or data to:

Information Handling Group
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
(Tel: (619) 452-3526.

(Nancy Freelander, DSDP Information Handling Group).

[1]DSDP will soon resume encoding and completing the Guides.

CORE REPOSITORIES

Samples from DSDP Legs 1-90 are available to investigators for studies which will result in published papers. We encourage investigators who desire samples to obtain a statement of the NSF/DSDP sample distribution policy and a sample request form from the DSDP Curator before submitting requests. (A statement of the sample distribution policy also appears in the Initial Reports and in the Initial Core Descriptions.) We ask that requests for samples be as specific as possible. Requestors should specify the hole, core, section, interval in centimeters measured from the top of each section, and sample volume in cubic centimeters. Refer to the graphic core descriptions in the Initial Reports and/or the Initial Core Descriptions for core details.

Samples for research which will be reported in publications other than the Initial Reports cannot be distributed until one year after the completion of a cruise or two months after publication of the Initial Core Descriptions for the cruise, whichever occurs sooner.

The DSDP Curator can approve many standard requests in his own office, but requests for material of particularly high interest (e.g., certain hydraulic piston cores, key stratigraphic boundaries) or for large volumes of material must be forwarded by the Curator to the NSF Sample Distribution Panel for review and approval.

Cores from the Atlantic and Antarctic oceans and the Mediterranean and Black seas (Legs 1-4, 10-15, 28, 29, 35-53 71-82, and 93-96) are at the East Coast Repository at the Lamont-Doherty Geological Observatory. Cores from the Pacific and Indian oceans and the Red Sea (Legs 5-9, 16-27, 30-34, 54-70, and 83-92) are at the West Coast Repository at the Scripps Institution of Oceanography. The thin sections and smear slides from a particular cruise are stored at the same repository as the cores from that cruise. Photographs of all cores and prime data and publications from all legs are kept at each repository. Frozen samples (collected specifically for organic geochemical analyses), interstitial water samples, and gas samples from all DSDP legs are kept at the West Coast Repository. Interested scientists may view the cores, core photographs, or other associated data at either repository by making arrangements in advance with the Curator. Investigators wishing to visit either are urged to request appointments well in advance because each repository is currently booked with visitors three to four months ahead.

Many thin sections that were loaned to investigators are missing from the collection. Their absence diminishes the usefulness of the collection to the entire scientific community. We ask all investigators who have borrowed thin sections or smear slides to return them as soon as possible to the repository where the corresponding cores are stored.

Please address your questions or sample requests to:

The Curator
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093
Tel. (619) 452-3528

(Amy B. Altman, DSDP Assistant Curator).

Paleontologic data from Initial Reports of Deep Sea Drilling Projects Volumes 1-41 are now available for computer searches. The system includes all fossil groups cited in these volumes. For information contact:

Lillian Musich
Information Handling Group
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

DSDP Site Map Updated

Topography of the Oceans with Deep Sea Drilling Project sites now available through Leg 82. To request map contact:

Barbara J. Long
Information Handling Group
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

FOCUS

LETTER FROM THE PLANNING COMMITTEE CHAIRMAN

It is a fact—we now have an Ocean Drilling Program. The FY 1985 budget request has been defined by the National Science Foundation, the SEDCO 471 has been selected as the new drilling platform, the new JOIDES science advisory structure is functioning, and a drill plan for the first year has been set by the Planning Committee.

The NSF budget request for the Ocean Drilling Program is $27.6 m for FY 1985. Although costs for the program are expected to rise to $37.6 m in FY 1985, the contribution from the other member nations is expected to jump from $2.2 m (1984) to $10 m in FY 1985.

The D/V SEDCO 471 has been selected as the new ocean drilling platform. Advantages over the Glomar Challenger are many and include a longer drilling string, more space for labortatories and personnel, bare rock spud-in, and eventually a riser system. A photograph of the ship appears on the cover of this issue. More detailed specifications appear in the "Report from JOI Inc.".

By the time you recieve this issue of the journal, the JOIDES advisory panels will have met and made their recommendations to the Planning Committee at the special PCOM meeting in Washington, D.C. on 21-23 March. With the help of the various panels and working groups, PCOM will have finalized the drilling schedule to December 1986, and will have organized the long term planning for ODP beyond 1986.

Several proposals have been recieved by JOIDES, but more input is needed from the scientific community. Guidelines for the submission of drilling ideas and proposals are included in this issue.

J. Honnorez

OCEAN DRILLING PROGRAM

GUIDELINES FOR THE SUBMISSION OF PROPOSALS/IDEAS

A. General Information

JOIDES accepts input by individuals or groups into the Ocean Drilling Program as:

1. **Ideas/suggestions** for scientific ocean drilling. Examples are objectives (a specific process), drilling targets, downhole and other experiments, etc. Such input generally lacks either geographic specificity, site survey data, or both.

2. **Drilling proposals** (minimum requirements are detailed in section C.)

Ideas and proposals will be reviewed and prioritized by one or more JOIDES advisory panels. Only mature proposals are ultimately considered and prioritized by the Planning Committee, which plans the actual drilling. Thus ideas which become part of the drilling program do so either by evolving into a mature proposal, or by incorporation into an existing proposal with multiple objectives. Propsals are considered mature when accompanied by a specific set of minimum data listed in section C and provided by the proponents or JOIDES (certain technical data may not be readily available to proponents). It follows that the time required for an idea or proposal to be processed by the JOIDES science advisory structure and become part of the drilling plan will depend in large part on the completeness of the required data at the time of submission. Proponents are therefore urged to submit as complete a package as possible. Lead time requirements are given in section D. All submissions should be sent in triplicate to the JOIDES Office.

B. Review Process

Ideas/suggestions or proposals are submitted to the JOIDES Office which forwards the material to the appropriate advisory panel(s) for review. The JOIDES panels review and prioritize the ideas/proposals and advise the Planning Committee of their recommendations. The panels may request additional information from the proponents and may suggest that the idea/proposal be modified to enhance its scientific merit. Some ideas/proposals of limited scope may be incorporated by the advisory panels into a proposal of broader scope.

Thematic Panels are primarily concerned with the process aspects of the science. Regional Panels and Working Groups review the proposal within the context of a particular geographic region (e.g. additional "sites of opportunity" may be recommended for drilling, to maximize the scientific payoff of drilling in that particular region). As the proposal matures and proceeds through the advisory system, service panels make recommendations regarding technical aspects of the proposed drilling (e.g. site survey review, safety review, engineering and technology review, downhole measurements review, etc.).

The Planning Committee monitors and directs the proposal review process, reviews the recommendations of the advisory panels, decides the fate of proposals, and ultimately integrates the approved proposals into a detailed drilling plan and ship track.

C. Minimum Requirements

I. Minimum Proposal Requirements (Mature Proposal)

The following items should be discussed in the proposal; submit a Site Proposal Summary Form for each proposed site.

a) Specific scientific objectives with priorities.

b) Proposed site locations and alternative sites.

c) Background information, inluding regional and local geological setting and identification of existing geophysical/geological data base.

d) Drilling requirements for each objective (e.g. estimated drilling time, steaming time, water depth, drill string length, reentry, etc.)

e) Logging, downhole experiments and other supplementary programs (estimated time, specialized tools and requirements, etc.)

f) Known deficiencies in data required for:

1) location of drill sites

ODP SITE PROPOSAL SUMMARY FORM

Proposed Site:

General Objective:

General Area:
Position:
Alternate Site:

Thematic Panel interest:
Regional Panel interest:

Specific Objectives:

Background Information:
Regional Data:
Seismic profiles:

Other data:

Site Survey Data - Conducted by:
Date:
Main results:

Operational Considerations

Water Depth: (m)   Sed. Thickness: (m)   Total penetration: (m)

HPC _____   Double HPC _____   Rotary Drill _____   Single Bit _____   Reentry _____

Nature of sediments/rock anticipated:

Weather conditions/window:

Territorial jurisdiction:

Other:

Special requirements (Staffing, instrumentation, etc.)

Proponent:

Date submitted to JOIDES Office:

2) interpretation and extrapolation of drilling results.

g) Statement of potential safety problems in implementing proposed drilling.

h) Other potential problems (weather window, territorial jurisdiction, etc.).

i) The name of an individual assigned as a proponent for each site who will serve as a contact for JOIDES when additional information is required.

2. Submission of Ideas/Suggestions

Ideas and suggestions for ocean drilling may be submitted to the JOIDES Office in letter form, preferably with as much background information as possible.

3. Letters of intent to submit may be sent to the JOIDES Office.

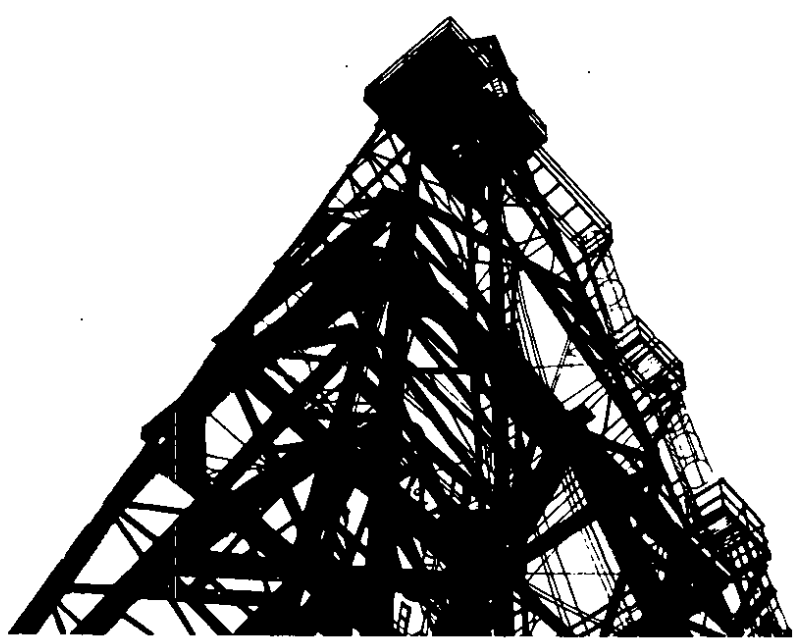
D. Lead Time

As a general rule a minimum 18-24 months lead time is required from the time of proposal submission to actual drilling. Less lead time may be acceptable in cases where site surveys are not required.

E. All submissions should be sent in triplicate to the JOIDES Office .

JOIDES Office, University of Miami, RSMAS,
4600 Rickenbacker Causeway, Miami, FL 33149
Telephone: Area Code 305, 361-4168

(The JOIDES Office will move to the University of Rhode Island on 1 October 1984.)



JOINT OCEANOGRAPHIC INSTITUTIONS INC.

REPORT FROM JOI INC.

The Science Operator, Texas A & M University, is completing contract negotiations with Sedco Incorporated of Dallas for the long term charter of a drilling ship for the Ocean Drilling Program (ODP). The 470-foot ship designated is Sedco/BP-471 owned jointly by Sedco and British Petroleum.

The ship is 70 feet wide with a displacement of 16,596 long tons. The derrick towers 200 feet above the waterline. The dynamic positioning system is capable of maintaining ship position while drilling water depth of 27,000 feet.

The Sedco/BP-471 is one of the world's most modern, best equipped drillships. Its rated drilling depth capabilities rank among the top of the worldwide dynamic positioning drillship fleet. The rig will be converted so that 30,000 feet of drill pipe for sampling deep ocean basins and trenches can be used and so that a riser system for drilling in 6,000 feet of water can be deployed to retrieve cores from margin areas.

Design of laboratories and special scientific drilling equipment has begun at Texas A & M under PCOM's guidance. Conversion testing and shakedown of the ship is scheduled for next fall. The first scientific cruise is scheduled for January 1985.

Site Surveys

A subcontract for conduct of the Blake-Bahama Survey is to be awarded to a team led by the University of Texas with Dr. James Austin as Principal Investigator. Other team members include scientists from Lamont-Doherty Geological Observatory, University of Syracuse, University of Miami, University of Delaware, and Woods Hole Oceanographic Institution. Field work is scheduled for April 1984.

Request for Proposals to conduct surveys on the Mid Atlantic Ridge (Kane Fracture Zone) and the Chile Triple Junction has been approved by the JOI Site Survey Planning Committee and National Science Foundation for issue mid-February.

IPOD SITE SURVEY DATA BANK

The IPOD Site Survey Data Bank at Lamont-Doherty Geological Observatory has recently (July-December 1983) received the following data:

- -Bathymetric contour map of West African Continental Margin, Dakar - Monrovia, from E.J.W. Jones, United Kingdom.
- -Full size originals of all OMD figures from atlases 2, 3, 4 and 5 (areas I, IIIE, IIIW, and IV), from D. Kinney, GSA.
- -GEBCO bathymetric plotting sheets, Northwest African margin area, from French Hydrographic Office.
- -GEBCO bathymetric plotting sheets, Southern Atlantic Ocean area, from Argentine Hydrographer Office.
- -Navigation charts of seismic reflection and Sea MARK I surveys, Mississippi Fan, from S. Shor, Lamont-Doherty Geological Observatory.
- -Final Technical report and four SEABEAM maps from East Pacific Rise Hydrogeology Site Survey (ARIADNE cruise 2).

Sediment Paleomagnetism Data Now Available

The sediment paleomagnetism data base contains shipboard paleomagnetic measurements taken by the discrete-sample spinner magnetometer, the alternating-field demagnetizer and the long-core spinner magnetometer. The file is restricted to paleomagnetic measurements of cores recovered by the hydraulic piston corer. The long-core spinner-magnetometer sediment-paleomagnetism file is complete with measurements from DSDP Legs 68, 70-72 and 75. Discrete-sample spinner magnetometer sediment-paleomagnetism data are available for DSDP Legs 71-73 and 75.

Address Requests for these data to:

Donna Hawkins
Information Handling Group
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093

JOIDES COMMITTEE AND PANEL REPORTS

PLANNING COMMITTEE

J. Honnorez, Chairman

The Planning Committee met 13-15 September 1983 in Seattle, Washington. Items from the minutes of that meeting are reported here.

Deep Sea Drilling Project Report

M. Salisbury reported for DSDP.

Glomar Challenger Operations: Leg 88

The north Honshu earthquake occurred while the HIG recording pack for the downhole seismometer experiment was being monitored on deck and refurbished. The power-pack for the recorder was replaced and the recorder lowered back into the hole; it is still recording. The DARPA seismometer monitored 6 days of shooting while hard-wind to the Challenger, but the passive recording phase of the experiment failed when the recording package flooded.

Leg 91 (Tonga Trench)

Oldest sediments at the Tonga/Kermadec site may be Jurassic; dating using radiolaria is still underway.

Leg 93 (Hole ENA-3)

As the drill string was lost at Site ENA-3 while drilling in the lower Cretaceous, insufficient pipe remained to continue drilling at ENA-3 so the ship was told to proceed to sites NJ-3 and NJ-4 of the New Jersey transect. NJ-4 stopped in Miocene sands; the target was Cretaceous. NJ-3 was a success and reached the Maestrichtian.

Leg 94 (Northeast Atlantic Paleoenvironment)

All six prime sites were drilled with a 100% combined recovery. Glacial cycles were apparent in the magneto-stratigraphic record. Sediment lithology at the crests and troughs of drifts was similar. A penetration record of 743 m was made with XCB at one of the drift sites. The advanced piston corer was successfully tested during Leg 94.

Leg 95 (New Jersey Transect + return to ENA-3, in progress)

The number of targets was reduced because of the work already carried out during Leg 93. The first target (NJ-2) was a success and reached Campanian sediments using APC (advanced piston coring) and XCB (extended core barrel). This was the first real test of the AHPC/XCB combination. Schlumberger logged this leg.

Challenger then returned to site ENA-3. Expected penetration rate using a new diamond drag bit was 2-3 times the normal rate. Approximately 1300 m were drilled (wash-down, no cores) before the bit stuck in a sand layer. Wash-down drilling is now being attempted with a regular bit. If the previous depth is not reached in 4 or 5 days, the ship will be free to return to the New Jersey transect targets.

Discussion

J. Honnorez read the folowing motion from the Passive Margin Panel minutes (31 Aug.-2 Sept. meeting):

"The PMP recommends to PCOM that alternate contingency sites should be adopted to Leg 96 to safeguard against potential bacterial methane problems in the Mississippi Fan area. The sites in order of priority should be new site MF-14 in the Fan abyssal plain and CAR-7. PPSP approval for site MF-14 should be sought immediately; CAR-7 has been previously approved."

PCOM MOTION: The Planning Committee adopts the PMP resolution with respect to site MF-14.

M. Salisbury continued: A change of scientific crew will take place on 6 October to accommodate the large number of scientists wishing to participate in Leg 96. The scientists are primarily from academic institutions, not industry.

Demobilization will begin 8 November; a shipyard has not yet been selected.

Engineering

M. Salisbury informed the Planning Committee that engineering development was still in progress at DSDP during the phase down.

Recent coring and core instrumentation developments were described .

A new type of diamond bit has been tested on Leg 95.

A feasibility study of bare-rock drilling has been completed; the conclusion is that bare-rock drilling is feasible. One system uses a gimbaled cone which seeks vertical when set; cement is then pumped through the cone into a ballast box fitting on the sea floor.

A computer program has been developed which predicts drill string stress and strain under many simulated conditions.

Publications

Initial Reports volumes completed this year are 69, 71, 72, and 76. Vols. 73 and 74 will soon be completed. Volumes 78, 77, 80, 81 and 79 will be published in that order during the coming year.

Core Repositories

The SIO repository is overloaded; vans and temporary buildings in the parking lot are being utilized for temporary storage. The LDGO repository will be filled when the Leg 94 cores are curated. Following PCOM recommendations, temporary help has been hired to assist in upgrading the core collection. Some of the cores will be rephotographed.

PCOM is asked to review and establish a policy for "complex" sample requests. Some cores are severely depleted and the archive halves may have to be sampled. Decisions have so far been made on an ad hoc basis by the curator in consultation with NSF.

PCOM Consensus:

The core curator and NSF should continue to handle unusual requests; NSF should seek outside advice when necessary.

National Science Foundation Report

H. Zimmerman reported for the Foundation.

Personnel directly related to the Ocean Drilling Program are:

G. Gross - Director, Ocean Sciences Division
S. Toye - Program Officer
H. Zimmerman - Science Officer
A. Sutherland - Engineering/Operations Officer

Beginning 1 October 1983 the Ocean Drilling Program will be part of the Ocean Sciences Division, which is one of four divisions under AAEO. Ocean Sciences is made up of two sections and one program (Ocean Drilling). S. Toye heads the Program and reports directly to G. Gross.

The FY 1984 budget has been approved by both Houses of Congress and the President. The budget is detailed on p. 9 of the June 1983 PCOM minutes.

The FY 1985 budget is planned at $36M, allowing for a full operational year.

The JOI AODP proposal will be reviewed on 21 September. IPOD members will participate in the review.

ODP Science Operator Report

S. Gartner reported for TAMU.

AODP Building

The building requirements are being refined and will lead to a preliminary plan. The building is envisioned as a two-story structure on or near the TAMU campus with easy access to the TAMU airport.

Science Operator Proposal

The TAMU proposal was given to JOI and eventually incorporated into the JOI proposal, now under review at NSF. The drillship RFP was mailed last week. Important dates are given in the following schedule:

25 August 1983 - Mailed RFP to NSF for review

8 September 1983 - Expected date for issuance of RFP to prospective bidders

29 September 1983 - Preproposal conference

7 October 1983 - Deadline for written questions regarding the RFP

8 November 1983 - Proposal Due Date

23 November 1983 - Tentative date for selection of subcontractor

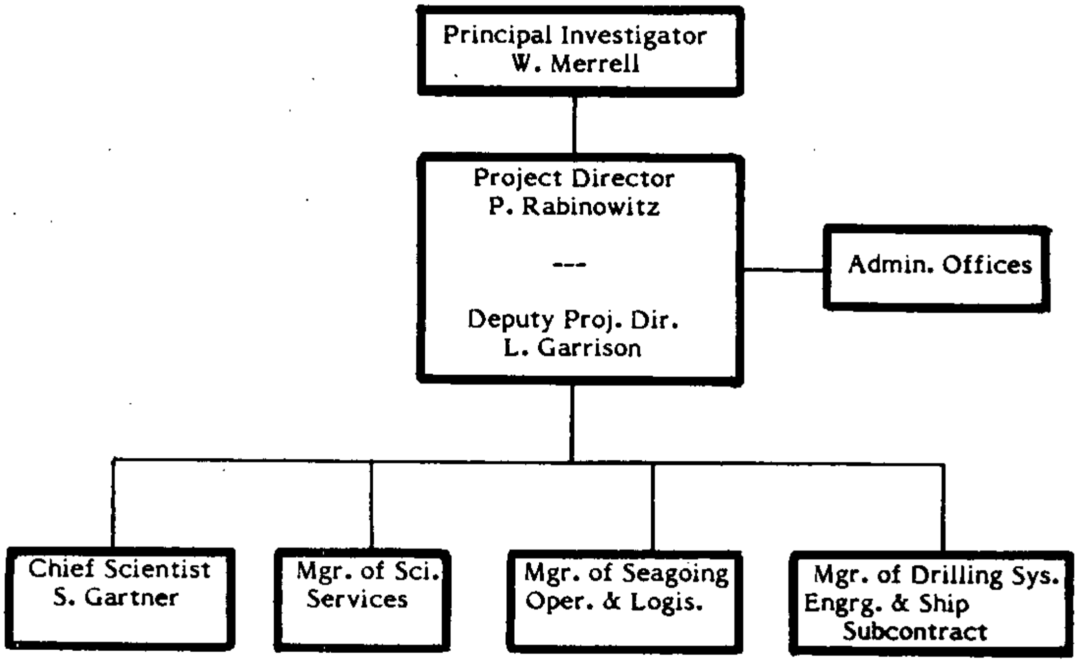
June 1984 - Ship conversion

September 1984 - Shakedown cruise

October 1984 - Drilling commences

Science Operator

TAMU/ODP Organization Chart



Other ODP Science Operator Items

a) **scientific equipment and computer** - a list of items has been assembled which would require 300 sq.ft.; about 600 sq.ft. will be available on the ship. The selection process is underway.

b) **numerical data base** - will be discussed with the IHP; a meeting has been scheduled on 13-14 October 1983 at TAMU.

c) **publications** - the present "Initial Reports" type publication is being evaluated. PCOM input is needed to determine if a true "initial reports" series with publication within one year after the cruise is preferable, followed by a "final report" series.

d) **clearance for drilling in territorial waters** - the Law of the Sea Treaty, although ratified by most countries, was not ratified by the U.S. The U.S. has instead negotiated a series a bilateral agreements with individual countries. A rigid protocol now exists to seek permission to drill in territorial waters - requests must be made through the State Department. As much as 7 months lead-time may be required to secure permission.

JOI Report

J. Baker, JOI President, reported.

Site Surveys

The minutes of the JOI Site Survey Panel meeting (27 July 1983) were distributed to the Planning Committee.

PCOM Consensus:

Enforce the existing policy of supplying site survey information with a drilling proposal, as stated in Supplement No. 3 of the JOIDES Journal Special Issue Vol. III, No. 3, 1977.

Status of Site surveys

Peru/Chile has been awarded to HIG.

Bahamas - The RFP was issued 24 August and bids are due at the end of September.

Gulf of Mexico - PMP has requested addition surveys. Schedule is:

1 November 1983 - issue RFP

10 December 1983 - select contractor
15 January 1984 - issue award
July 1984 - survey report due

Advanced Ocean Drilling Project

Responses to the RFP for the new drilling vessel are due 8 November. The JOI management proposal for the AODP will be reviewed 21 September. The review panel will also include non-U.S. members, as recommended by the Executive Committee at the April 1983 meeting.

Wireline Services Contractor (LDGO) Report

R. Anderson reported that logging services and analysis will utilize state-of-the-art technology. International participation is essential to the success of the program, and much of the technology resides outside of the U.S.

Standard Tools

Following the directive of the Planning Committee, a commercial firm will provide standard tools. Schlumberger and Wellex were considered, and Sclumberger was selected because of numerous benefits to the project. A Schlumberger logging engineer will be assigned permanently to LDGO. A LDGO logging engineer will also be trained by Schlumberger. A research agreement will provide the project with access to all state of the art software for log analyses. The cost for Schlumberger services if $1.83M/yr. with the price tied to Africa scale costs; the price will be recalculated each 31 December.

Research Tools (not offered by Schlumberger)

- Dipmeter compatible with AODP pipe
- Borehole televiewer
- 12 channel sonic logging tool for seismic refraction experiments

LDGO will purchase (not develop) the specialized tools.

Shipboard Analysis Workstation

A dedicated computer for log analyses will be on board the vessel.

Shorebased Logging Analysis Center

The center will offer state of the art analytical capability to the scientific community. Schlumberger software will be supplemented with software developed at the center.

Logging Advisory Structure

The Executive Committee has authorized a Logging Advisory Panel (EXCOM Motion 254, minutes 30 August - 1 September meeting). The panel should consist of research managers representing the mining and petroleum industries and various national laboratories, and other persons involved in new developments in the logging industry.

Downhole Measurements Development (WHOI)

R. von Herzen reported that WHOI is preparing a proposal to JOI to use U.S. funds to develop downhole measurements (not routine logging). WHOI would establish a core group to provide coordination and engineering.

Standard recording formats for shipboard and seafloor data would be developed to make data from separate experiments more compatible.

Wireline reentry will be developed to allow access to holes with the use of a drill string.

Funds for development would be distributed to scientists by a peer review system under JOI.

Executive Committee Report

J. Honnorez reported on the last EXCOM meeting in Swindon, England, 30 August -1 September 1983 (see the previous issue of the JOIDES Journal for the minutes of the EXCOM meeting).

The Executive Committee passed motions endorsing the science advisory structure proposed by PCOM, and approved the tentative drilling schedule for the first phase of the Advanced Ocean Drilling Project.

The 6 point PCOM resolution (p. 78 June issue, JOIDES Journal) regarding core curating was considered by EXCOM. Each point was considered separately. The following motions were adopted after modification:

#1. The existing sample distribution policy is adopted without substantial change.

#4. Initial Core Descriptions should be reinstated in published form.

#6. It is desirable that sample distribution should be accomplished within 2 months of receipt of request.

PCOM recommendations 2, 3 and 5 were not adopted by the EXCOM.

The Executive Committee was asked to define PCOM terms of membership. A draft terms of membership resulted and referred back to PCOM via the following EXCOM motion:

"Move that each member of the Executive Committee shall designate one member of the Planning Committee and an alternate to serve in the absence of the designated member. Commencing January 1, 1984, one quarter of the Planning Committee members shall rotate off the Committee annually, so that its membership is replaced every four years. Reappointment shall be made only in exceptional circumstances. All appointees to the Planning Committee shall satisfy the fundamental criteria of having the ability and commitment to provide mature and expert scientific direction to the program. Balance of fields of specialization on the Planning Committee shall be maintained, as far as possible, by information consultation amongst the U.S. member institutions prior to selection of their appointees. The chief scientists of the science operations and wireline logging contractors and an appointee of the NSF are non-voting, liaison observers."

The Planning Committee accepted the above terms of membership via the following motion introduced by W. Bryant and seconded by J. Cann:

PCOM MOTION: The Planning Committee accepts the Executive Committee version of PCOM membership.

ODP Initial Drilling Schedule

J. Honnorez noted that it was unfortunate that the Site Survey Panel had not met recently, but that a full panel meeting would be held in late November or early December. The European members did meet 6-7 September in Paris. J. Jones informed Honnorez by telephone that site specific information is needed as soon as possible for future legs to plan surveys. Input has been requested from OCP, OPP, PCOM and proposal proponents.

Ocean Crust Panel Meeting, 24-26 August, Halifax.

R. Moberly Reported.

OCP considered the PCOM request to discuss OCP targets including the Mid Atlantic Ridge, FAMOUS vs. 23°N, Hole 504B, etc.

OCP reaffirmed the need for early development of bare rock drilling, reviewed the priorities of OCP legs, and provided PCOM with a list of potential Ocean Lithosphere Panel members.

The OCP prefers the FAMOUS site if bare rock drilling and reentry (and therefore deep basement penetration) are available; if bare rock drilling will be capable of single-bit hole only, then 23°N or the Kane Fracture Zone is the preferred site.

OCP Priorities:

1. deepen hole 504B; improved drill bits are required.

2. ridge axis

3. major fracture zone (among the various fracture zones, the Kane Fracture Zone is preferred)

OCP noted that back arc drilling is not part of the early drilling schedule, but some targets could be found in the eastern Mediterranean.

OCP recommendations on site surveys are:

FAMOUS - site specific surveys are not required, but at a later date regional studies should be done.

Kane Fracture Zone - survey to identify sediment ponds within transform part of fracture zone.

PCOM Consensus:

The Planning Committee favored early development of bare rock drilling, and felt that an axial ridge site near the Kane Fracture Zone would cover the OCP recommended objectives.

PCOM MOTION: The Planning Committee adopts the area in the vicinity of 23°N and The Kane Fracture Zone as the location of an axial drilling leg and a test of bare rock drilling.

Passive Margin Panel Meeting (31 August-2 September at LDGO)

E. Winterer reported.

PMP recommendations regarding core storage:

1. The sole repository for future ODP cores should be in perpetuity the scientific institution responsible for the management of ODP at that time on the grounds of operational facility and to provide ease of access to cores at post-cruise meetings thereby reducing travel and improving efficiency.

2. Existing core storage facilities are to be retained at LDGO and SIO and not transferred to TAMU or any future science operator to avoid disturbance and ensure preservation of the cores.

3. There should be a single JOIDES appointed curator in charge of curating at TAMU, SIO and LDGO.

Gulf of Mexico - PMP recommended the following:

"In considering the drilling objectives and priorities of sites in the Gulf of Mexico, PMP identifies and emphasizes the importance of a concentrated and dedicated effort to address the birth and closure of the Eastern Gulf of Mexico area. This can be addressed by drilling focused on the Jurassic stratigraphy of the Eastern Gulf for the birth, and on the Cretaceous-Tertiary stratigraphy of the S.W. Straits of Florida and the Yucatan Basin (CAR-7) to document the closure by Cuba. It is considered that the results will provide an outstanding contribution of wide interest to the earth science community at large.

The PMP recommends site specific MCS and dredging to document sites in the W. Straits of Florida and Eastern Gulf to address Jurassic and Cretaceous-Tertiary stratigraphy. If necessary, single trace digital processing of the MCS data may be done in the first instance to provide initial documentation of sites for safety review. However, the site specific MSC surveys should be of an appropriate grid spacing to allow structural mapping of key horizons and to allow seismic facies intepretation by detailed velocity analysis of key intervals."

Bahamas and Straits of Florida

Priority 1. The nature and origin of the Cretaceous event initiating channel development and Tertiary unconformities in the channels (deep drilling):

-improved regional MCS coverage is essential.

-seismic lines should be directly linked to onshore wells/dive sites.

-inspect/purchase commercial well data logs and seismic data.

-prepare structure contour maps on red, pink and blue horizons. These will advise depths to the key horizon and thus identify areas for site specific survey for sites at red level; they will also enhance understanding of regional geology/tectonics.

Priority 2. Slope/channel facies distribution (HPC): High resolution digital single channel seismic data are needed to document the transition from bank to channel. The seismic grid should be of 1 km spacing and the survey carried out on the windward and leeward sides of the banks.

Priority 3. Origin of escarpment erosion/-retreat: a regional MCS line plus a local grid if necessary.

Priority 4. S.W. Bahamas/Cuban tectonics: It was evident to the PMP that the problems of the S.W. Bahamas and their relation to Cuban tectonics are not well understood, not least because of difficulties in seismic interpretation. The PMP therefore recommended preparation of good structure maps and examination of commercial MCS to assess the difference between carbonate buildups, folds and diapirs.

R. Sheridan et al. were asked to prepare a draft document assembling available data for use in the RFP for the required site survey; they are unable to provide the document, however, because of a potential conflict of interest (proponent and possible site survey contractor).

At present the Bahamas leg lacks site surveys to locate the drill sites.

Labrador Sea

At the PMP meeting C. Keen presented a review of the Labrador Sea and identified areas and drilling objectives.

PMP recommended to PCOM "that a drilling program be developed in the Labrador Sea to compare the west margin of Greenland with that of Labrador and to address the 60 my volcanic event. To achieve the drilling program, regional and site specific MCS will be necessary to see through the lava flows. The PMP recognizes that it may not be possible to identify windows in the lavas that will facilitate penetration of the pre-60 my, post and syn-rift section. The PMP therefore recommends development of an alternate drilling program in the outer Orphan Basin to provide a comparison with the conjugate margin drilled during Leg 80. In this area, open file

MCS and well data are available and only site specific data may be needed. The PMP notes that the Newfoundland Basin considered as a second alternate will be surveyed next year."

E. Winterer noted that icebergs were a severe hazard off Labrador but were sparse off west Greenland. TAMU should begin to investigate the operational problems.

Canada will do the required surveys; M. Keen and J. Jones have already corresponded on survey requirements.

Site ENA-8 near Newfoundland is still a viable target.

Norwegian Sea

A potential problem exists in securing permission to drill from the Norwegian Ministry of Petroleum.

The PMP passed the following motions:

1. The highest priority in the Norwegian Sea is to address the problem of dipping reflectors and margin subsidence by a drilling transect of the Voring-Lofoten area. The Jan Mayen Ridge is a secondary objective.

2. PMP recommends in the first instance a comprehensive synthesis of the available ESP, MCS data should be made to identify sites where drilling to the sublava reflector (K) is feasible and to provide initial input at an early stage to the PPSP and Norwegian authorities. Commercial well data should be used if available as input to the synthesis and leg. Second packages should be developed for the Jan Mayen Ridge and Lofoten Basin to provide alternate sites in the event that logistic, safety considerations prevent drilling of the Voring Plateau-Lofoten prime transect.

3. PMP recommends that this synthesis should begin immediately by a task group who should also be charged with identifying the need for site specific MCS as a consequence of their study which should include structure mapping of key horizons.

4. PMP suggests that this group should include Eldholm, Mutter, Hinz, Ronnevik, Montadert and Thiede.

PCOM Consensus:

The Planning Committee expressed its endorsement of PMP actions in the following motion:

PCOM MOTION: The Planning Committee accepts the PMP motions (listed above), endorses the synthesis task group nominations, and urges immediate action.

Galicia

PCOM consensus: In view of the availability of site survey data for Galicia, and potential weather problems in the Norwegian Sea, Galicia is a good alternate leg for the Norwegian Sea leg. Permission from Spain will be required.

N.W. Africa

PMP passed the following motions relating to a N.W. Africa leg:

1. PMP recommends that drilling off N.W. Africa fully utilize the regional and site specific surveys synthesized for OMD and recently made by LDGO and the BGR to identify candidate sites to document the age of the first ocean crust and to examine the period of transition from rifting to spreading. Reentry to deepen and log 547 is also of high priority and exploits a unique opportunity to recover pre-Rhaetian sediments on an Atlantic margin

2. PMP conceptually supports the OPP proposal for N.W. African drilling but considers that the objectives defined in the first motion are of higher priority requiring deeper drilling.

Mediterranean Sea

PMP discussion of the Mediterranean Sea resulted in the following motions:

1. PMP recognizes the importance of many proposed sites in the Mediterranean in both the regional as well as the thematic context. PMP recommends that the Mediterranean provides a natural laboratory to test the thematic problem of back arc basin development and therefore recommends a focused transect of holes through the Tyrrhenian Sea as a well documented example of a back arc basin. In addition, the ability to apply high resultion biostratigraphic techniques not subject to dissolution, ash layers and well documented regional geology optimizes the value of the transect. The transect would also contribute important data on post Messinian paleogeography.

2. Notwithstanding recommendation 1 above, PMP endorses, given adequate drilling time, proposals to address tectonic problems

such as rate of convergence, vertical uplift across the Hellenic Arc and the opening of the Arabian Sea also relevant to paleo-oceanography.

3. PMP believes that the Rhone Fan is a superbly well documented example of a deep sea fan and therefore recommends that the Rhone Fan be fully evaluated against other fan studies and the results of Leg 96 and then prioritized in terms of fan drilling in the AODP program.

PMP also provided a list of names for consideration for the AODP science advisory structure.

Ocean Paleoenvironment Panel Meeting (25-26 August at GSO/URI).
J. Kennett reported.

OPP provided the Planning Committee with a list of potential panel members for the AODP advisory structure.

The meeting produced the following question and recommendations to PCOM:

1. Question - In view of the 4-5 mo. period required to fill DSDP sample requests, we wonder if it would be possible to allocate funds to hire (student) technical persons to assist in answering sampling requests at DSDP respositories.

2. Recommendation - In view of past difficulties in making penetration depths greater than 1500 m with single-bit holes, the OPP would like to go on record as opposing reoccupation of Site 603 during Leg 95 as a single-bit hole. Approximately 16 days could therefore be spent in expanding the New Jersey transect.

3. Recommendation - OPP recommends a) that future post-cruise meetings be planned at the repository where cores from that leg are housed and b) that paleontologists and paleomagneticists be allowed to meet at least 4 days in advance of the rest of the scientific party for post-cruise meetings in order to coordinate zonations and complete site summaries. This would better facilitate productive post-cruise meetings.

OPP recommendations re. future drilling:

Gulf of Mexico - the UT proposal is endorsed and OPP recommends additional drilling in the northeastern Gulf of Mexico near DeSoto Canyon. A network of multichannel

Bahamas - OPP supports in principle t Sheridan et al. proposal but consider: number of objectives too numerous foi leg. The "slope transect" is considere highest priority.

Additional surveys are recommended.

Labrador Sea

The Labrador Sea is considered by OPP be an important leg for paleo-oceanograp studies. Important objectives include:

1. late Neogene ice initiation in the Nort ern Hemisphere

2. Paleogene climate

3. Arctic and Atlantic gateway

Mediterranean Sea

OPP has a high level of interest in this region and identified two broad types of objectives:

1. deeper objectives (Miocene-Jurassic) aimed at the history of Tethyan circulation.

2. shallower objectives (Tertiary); an E-W traverse across the Mediterranean basin.

Also considered were a reoccupation of Site 374 (4000 m depth), and a transect across the Ionian basin slope.

A multichannel seismic array was recommended for the Ionian basin.

N.W. Africa

OPP strongly endorsed the Circumsahara Transect proposal and suggested a seaward entension of the E-W transect.

Weddell Sea

OPP is concerned with logistics in relation to site surveys and recommends the RFP be issued as soon as possible.

PCOM Consensus:

After reviewing the recommendations from the various panels, the Planning Committee attempted to determine the status of the initial AODP legs (Table A.)

The panel chairmen

objectives of each leg. This information will be made available to JOI and to the Site Survey panel.

R. Hyndman (Canada) will confer with M. Keen (Canada) to try to secure Canadian vessels to provide ice protection for the drilling vessel during the Labrador Sea leg.

The Sediments and Ocean History Panel will be instructed to consider the Rhone Fan in competition with other deep sea fans as a drilling objective.

For the time being, two legs will be considered for N.W. Africa.

PCOM MOTION: A Norwegian Sea task group of about 6 members with Olaf Eldholm (Norway) as chairman is established by the Planning Committee.

The task group is expected to act as soon as possible in realizing the Labrador Sea leg.

TABLE A

INITIAL DRILLING PHASE, ODP

(E) = Essential
(D) = Desirable

L = Lithosphere Panel
T = Tectonics Panel
S = Sed. & Ocean History Panel

Area	General Objective	Panels	Needs (Surveys, tech./engeer., panel coord; permits, etc.)	Proponents
Gulf of Mexico	Early opening of east Gulf (PMP) 2 holes, 1500 m.	T	(E) Site sp. surveys (Cuba/Mex. auth.); RFP	D. Roberts
	Cuban closing (wedge & Neogene history)		(E) Site sp. survey (Cuba auth.); RFP	
	Yucatan basin (CAR-7) (1000 m+)		(D) Site sp. (Mex. auth.)	
	W. Gulf tephrochrono. (1 site)	H	(D) Site sp. (Mex. auth.)	J. Kennett
	DeSoto Canyon (2 sites, double HPC)		(D) Site sp.	"
Bahamas	Cretaceous channels, 2 holes, 1000 m+ (PMP)	T, S	Bahamas auth.	R. Sheridan W. Schlager
	Facies, HPC, 3-4 cores (OPP)	T, S	Bahamas auth.	
	Blake escarpment	T,S,L		
Barbados	Active thrusting processes	T(L,H)	Barbados auth. Drill in casing = engeer. problem	
Mid. Atl. Ridge	Ridge Crest processes 23°N (Crest + Kane Frac. Zone)	L	(D) One SEABEAM across ridge Test barerock drilling + reentry	P. Robinson
Labrador Sea	W. margin, Greenland/Labrador (PMP) a) 60 my volcanic event b) Outer Orphan basin Compare Goban Spur - Orphan Basin	T(S)	Can./Denmark/Greenland auth.	M. & C. Keen
	Onset N.Am. glaciation (OPP) Paleogene climates Gateway problem	S	Logistics (Baffin Bay)	L. Jansa Kratska
Norwegian Sea	Voring-Lofoten		Norway auth.	Olaf
	Jan Mayen Ridge		Coordination among proponents	
Galicia	Listric faulting		Spain auth.	Boillot
	Early rifting, 4 holes			

SCIENCE ADVISORY STRUCTURE

Downhole Measurements Panel
Terms of Reference

An informal meeting among several PCOM members produced the following guidelines:

A. **General Purpose.** To determine the physical state, chemical composition, and dynamic processes in ocean crust and its sediment cover from downhole measurements and experiments. Areas of responsibility include: routine logging (including industry standard and special tools widely used in ODP); routine data processing and interpretation; new and adapted logging tools, techniques, and data processing; downhole experiments and data acquisition (including downhole recording).

B. **Mandate.**

1. Reports to and advises PCOM on logging and downhole measurement programs of ODP.

2. Advise on, and recommend to the ODP wireline service operator, the required logging facilities.

3. Advise the ODP Science Operator on the scientific desirability, technical feasibility, scheduling and operational requirements of proposed programs.

4. Interface and coordinate with WHOI (U.S.) and other national downhole instrumentation development groups.

5. Solicit and expedite new logging capabilities and experiments.

6. Evaluate new technology and recommend future measurement directions.

C. **Structure.** Membership consists of well-balanced representation approximately half logging and other downhole technologists and half with scientific backgrounds and interests. The Wireline Services Operator and Science Operator of ODP shall each be represented by non-voting members on the Panel.

PCOM MOTION: The Planning Committee accepts the above Downhole Measurements Panel terms of reference.

The PCOM has reviewed and revised its policy regarding the submission of data in support of future drilling proposals. Drilling proposals based on proprietary data will not be considered by the AODP advisory structure.

Any proposal for future drilling submitted to an AODP panel for consideration must be accompanied by appropriate background information and regional and site specific survey data.

Proposal Data packages submitted to the IPOD/AODP data bank at LDGO become a permanent part of the AODP data archive, and will be distributed as needed for the evaluation of drilling objectives, adequacy of regional and site specific survey data, safety/pollution prevention review, and clearance requirements.

Thematic Panels

The Planning Committee discussed the mechanism for nominating and approving panel members. Non U.S. members may designated (name) members, whereas U.S. members can only nominate panel members. PCOM approves all panel members, as expressed in the following motion introduced by J. Cann and seconded by D. Hayes:

PCOM MOTION: Membership of thematic panels will be appointed by the Planning Committee, which will maintain a balance among non-U.S. JOIDES Participants, U.S. JOIDES institutions and others.

PCOM Membership Rotation

The Planning Commmittee will provide the Executive Committee with a list of present membership, their field of expertise, and their length of office. EXCOM will also be notified of changes in PCOM membership. EXCOM is expected to make new appointments when it feels changes in the PCOM membership are necessary.

JOIDES Archives

J. Honnorez informed members that EXCOM has directed PCOM to consider the fate of files of the various JOIDES panels.

PCOM MOTION: Move that all DSDP engineering development files be sent to Texas A & M University as soon as possible.

Ocean Drilling Program - name of new drilling project/program.

PCOM MOTION: The Executive Committee is requested to restore an international character to the name of the new drilling program/project.

Continental Scientific Drilling Committee

R. Andrews, Executive Secretary of the Committee, reported on continental drilling activities in an attempt to improve communication, data exchange, etc. with the ocean drilling program. He noted that about $500M/yr is spend by the Federal government (mostly DOE) on continental drilling. The Committee tries to use the "non-scientific" drilling to provide scientific data. A small increase in cost (for example, to log a DOE hole) may result in significant scientific data.

RECENT JOIDES PANEL AND COMMITTEE MEETINGS

Oct 1983	13-14	Information Handling Panel (Texas A & M University)
Nov 1983	9-10	Executive Committee (Texas A & M)
	28-29	Site Survey Panel Meeting (Woods Hole Oceanog. Inst.)
Jan 1984	5-6	Downhole Measurements Panel (Scripps Inst. Oceanog.)
	5-7	Tectonics Panel (Washington, D.C.)
	10-12	Planning Committee (Texas A & M)
	23-24	Mediterranean Working Group (Paris)
	24-26	Atlantic Regional Panel (Paris)
Feb 1984	9-10	Central & Eastern Pacific Regional Panel (U. Texas, Austin)
	14-15	Southern Oceans Panel (University of Rhode Island)
	27-28	Western Pacific Regional Panel (San Francisco)

FUTURE JOIDES PANEL AND COMMITTEE MEETINGS

Mar 1984	1-2	Lithosphere Panel (Texas A & M University)
	4-7	Caribbean Working Group (Barbados)
	6-7	Executive Committee (Washington, D.C.)
	7-8	Norwegian Sea Working Group (Oslo, Norway)
	19-20	Sediments & Ocean History Panel (U. Rhode Island)
	19-20	Indian Ocean Panel (Washington, D.C.)
	21-23	Planning Committee Meeting (Washington, D.C.)
May 1984	21-23	Planning Committee Meeting (France)
June 1984	19-21	Executive Committee (France)
Sept 1984	25-27	Planning Committee Meeting (Hawaii) - tentative

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Major- and Minor-Element Analyses

Major- and minor-element analyses for igneous rocks are now available as listings or for computer searches. Both shipboard and shore laboratory data are included for DSDP Legs 13-62 and Legs 64-65. For information contact:

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