2. SITE 264

The Shipboard Scientific Party

SITE DATA

Date Occupied: 22 December, 1972
Date Departed: 24 December, 1972
Position: 34°58.13'S; 112°02.68'E
Water Depth: 2876 corrected meters (echo sounding)
Water Depth (adopted): 2873 meters (drill pipe from rig floor)
Total Penetration: 215.5 meters
Number of Cores: 19
Total Section Cored: 180.5 meters
Total Section Recovered: 98.4 meters
Percentage Core Recovery: 55%
Oldest Sediment Cored:
  Depth below sea floor: 170.7 meters
  Lithology: Conglomerate
  Age: Santonian or older
Basement:
  Depth below sea floor: 0.20 sec (reflection time)
  Depth below sea floor: ≥171 meters (drilled)
  Average velocity to basement: ≤1.71 km/sec
  Lithology: Volcaniclastic rocks

Principal Results: A thin Neogene and a well-developed Paleogene sequence of carbonate oozes and chalks, with some chert, was cored at this site. The oldest material taken, beneath Cenomanian/Santonian cherts, was Cenomanian or pre-Cenomanian volcaniclastic conglomerate, but yielded poor recovery. The inferred average velocity of the carbonate sediments of 1.71 km/sec is consistent with the interpretation that the top of the volcaniclastic conglomerate corresponds to the strong acoustic basement reflector. The question of the continental versus oceanic nature of true crystalline basement remains unresolved. The unconformities recorded here span the following intervals: (1) upper Miocene-upper Eocene, (2) lower Eocene-mid Paleocene, (3) mid Paleocene-Santonian. The Eocene section cored at Site 264 has no known counterpart in the onshore Perth Basin or in DSDP sites east of the Ninetyeast Ridge. A cool subtropical deep-water environment prevailed (with some fluctuations) at this site from at least Late Cretaceous to Present.

BACKGROUND AND OBJECTIVES

The objectives at Site 264 were threefold: (1) To complement the biostratigraphic results obtained at Site 26-258, especially the Early Cretaceous portion of the section. (2) To sample acoustic basement to determine its “continental” versus “oceanic” nature. (3) To test components of the drawworks and drilling rig repaired in Fremantle at a site near port.

Background Information

Site 264 is located near the southern edge of the Naturaliste Plateau (Figure 1), about 125 km southwest of Site 26-258. The water depth at Site 264 is approximately 2900 meters, and 300 to 400 meters of sediment overlie acoustic basement. Seismic reflection profiles from Eltanin 45 show an acoustically transparent sediment cover much thinner than the cover present at Site 26-258 where several internal reflectors are also recorded. The acoustic basement is defined by a strong, rough reflecting surface that appears to be continuous with the surface that defines the steep southern escarpment of the Naturaliste Plateau (Figure 2).

Because of the relatively thin sediment cover at Site 264 and the pinching out of prominent reflectors as one proceeds toward Site 264 from Site 258, it was anticipated that a significant portion of the section deposited at Site 258 is missing at Site 264.

---

1Dennis E. Hayes, Lamont-Doherty Geological Observatory, Palisades, New York (Co-chief scientist); Lawrence A. Frakes, Florida State University, Tallahassee, Florida (Present address: Monash University, Clayton, Victoria, Australia) (Co-chief scientist); Peter J. Barrett, Victoria University of Wellington, Wellington, New Zealand; Derek A. Burns, New Zealand Oceanographic Institute, Wellington, New Zealand; Pei-Hsin Chen, Lamont-Doherty Geological Observatory, Palisades, New York; Arthur B. Ford, U.S. Geological Survey, Menlo Park, California; Ansis G. Kaneps, Scripps Institution of Oceanography, La Jolla, California; Elizabeth M. Kemp, Florida State University, Tallahassee, Florida (Present address: Bureau of Mineral Resources, Canberra City, Australia); David W. McColllum, Florida State University, Tallahassee, Florida (University of South Carolina, Beaufort, South Carolina); David J.W. Piper, Dalhousie University, Halifax, Nova Scotia; Robert E. Wall, National Science Foundation, Washington, D.C.; Peter N. Webb, New Zealand Geological Survey, Lower Hutt, New Zealand (Present address: Northern Illinois University, de Kalb, Illinois).
A major sedimentary hiatus (from about 80 m.y. to 10 m.y.) was recorded at Site 258. The coring program at Site 264 was initially designed to investigate the presence of a similar hiatus, or others; to collect closely spaced samples in that part of the section older than Cenomanian; and to sample acoustic basement. A recent study by Markl (1974) provides a complete review of the geological and geophysical setting of the Naturaliste Plateau.

**OPERATIONS**

The location of Site 264 was selected preliminarily on the basis of a northeast-southwest Eltanin 45 crossing of the south flank of the Naturaliste Plateau. Approach to the area was made at 170 rpm (the EM log was down) along nearly the same track as that of Eltanin. The site was chosen on the basis of the profiler record, which showed 0.20 sec of sediments (two-way travel time) over a high in the acoustic basement. The ship continued past the site on course 220° at slow ahead until the towed gear was retrieved, then reversed course and returned to the selected site using the PDR trace as a guide for dropping beacon.

During the first day of drilling, deployment of a drifting sonobuoy was made impossible because the ship's heading into wind, sea, and swell from the southwest put her stern-first to a one-knot current. The wind and sea shifted to the northeast during the second day, the ship's heading was altered, and a sonobuoy record was obtained. The apparent reflecting horizons below acoustic basement could be caused by side echoes or internal multiples as well as real subbasement layering.

On departure from the site, the underway gear was streamed on a heading of due west. Then following a jog to the north, the ship made another crossing of the site on a heading of 145° and passed about 0.8 miles to the southwest of the beacon.

Summary of coring at Site 264 is shown in Table 1.

**LITHOLOGY**

At Site 264 the first hole penetrated 171 meters of pelagic carbonate sediment and 35 meters of underlying volcanics. Hole 264A was drilled at the same location to 158.5 meters, and cored over two 19-meter intervals in order to recover important uncored intervals in Hole 264. Three sedimentary and one volcanic unit are described in Table 2.

**Unit 1**

Unit 1 is a soft, pinkish-gray, foram nanno ooze. The percentage of foraminifera, as indicated by the percentage "sand," ranges from 20% to 50% in the upper 27 meters, but is only 9% to 14% in the lower 4 meters. Carbonate content ranges from 92% to 95%. Sponge spicules are present in trace amounts to about 3%. The sediments appear structureless throughout, except for subtle mottles about 1 cm across in the upper part of the unit. Severe deformation is evident in about a third of the core, mostly in the lower part of the unit.

Angular quartz grains and pale brown equant glass fragments up to 100µ across are present in trace amounts through most of the unit, but both quartz and glass comprise 2% in the interval from 12 to 18 meters subbottom. The glass is basaltic (n = 1.57).
### Table 1
Coring Summary, Site 264

<table>
<thead>
<tr>
<th>Core</th>
<th>Date (Dec. 1972)</th>
<th>Time</th>
<th>Depth From Drill Floor (m)</th>
<th>Depth Below Sea Floor (m)</th>
<th>Cored (m)</th>
<th>Recovered (m)</th>
<th>Recovery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole 264</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>22</td>
<td>1255</td>
<td>2883.0-2892.5</td>
<td>0.0-9.5</td>
<td>9.5</td>
<td>8.3</td>
<td>87</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>1410</td>
<td>2908.5-2918.0</td>
<td>25.5-35.0</td>
<td>9.5</td>
<td>9.0</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>1518</td>
<td>2937.0-2946.5</td>
<td>54.0-63.5</td>
<td>9.5</td>
<td>9.5</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>1628</td>
<td>2947.5-2956.0</td>
<td>63.5-73.0</td>
<td>9.5</td>
<td>9.4</td>
<td>99</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>1735</td>
<td>2956.0-2965.5</td>
<td>73.0-82.5</td>
<td>9.5</td>
<td>6.3</td>
<td>66</td>
</tr>
<tr>
<td>6</td>
<td>22</td>
<td>1846</td>
<td>2965.5-2975.0</td>
<td>82.5-92.0</td>
<td>9.5</td>
<td>4.9</td>
<td>52</td>
</tr>
<tr>
<td>7</td>
<td>22</td>
<td>2001</td>
<td>2975.0-2984.5</td>
<td>92.0-101.5</td>
<td>9.5</td>
<td>5.1</td>
<td>53</td>
</tr>
<tr>
<td>8</td>
<td>22</td>
<td>2111</td>
<td>2984.5-2994.0</td>
<td>101.5-111.0</td>
<td>9.5</td>
<td>5.2</td>
<td>53</td>
</tr>
<tr>
<td>9</td>
<td>22</td>
<td>2224</td>
<td>3013.0-3022.5</td>
<td>130.0-139.5</td>
<td>9.5</td>
<td>2.2</td>
<td>23</td>
</tr>
<tr>
<td>10</td>
<td>22</td>
<td>2344</td>
<td>3041.5-3051.0</td>
<td>158.5-168.0</td>
<td>9.5</td>
<td>3.3</td>
<td>35</td>
</tr>
<tr>
<td>11</td>
<td>23</td>
<td>0108</td>
<td>3051.0-3060.5</td>
<td>168.0-177.5</td>
<td>9.5</td>
<td>2.0</td>
<td>21</td>
</tr>
<tr>
<td>12</td>
<td>23</td>
<td>0320</td>
<td>3060.5-3070.0</td>
<td>177.5-187.0</td>
<td>9.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>23</td>
<td>0500</td>
<td>3070.0-3079.5</td>
<td>187.0-196.5</td>
<td>9.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>23</td>
<td>0700</td>
<td>3079.5-3089.0</td>
<td>196.5-206.0</td>
<td>9.5</td>
<td>1 frag</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>23</td>
<td>0933</td>
<td>3089.0-3098.5</td>
<td>206.0-215.5</td>
<td>9.5</td>
<td>1 frag</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180.5</td>
<td>98.4</td>
</tr>
</tbody>
</table>

### Table 2
Lithologic Units, Site 264

<table>
<thead>
<tr>
<th>Unit</th>
<th>Lithology</th>
<th>Subbottom Depth (m)</th>
<th>Unit Thickness (m)</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Foram nanooze</td>
<td>0-31</td>
<td>31</td>
<td>Late Miocene to Recent</td>
</tr>
<tr>
<td>2</td>
<td>Nanno ooze to nanno chalk</td>
<td>31-163</td>
<td>132</td>
<td>Early to late Eocene</td>
</tr>
<tr>
<td>3</td>
<td>Clay-rich nanno chalk</td>
<td>163-171</td>
<td>8</td>
<td>Late Cretaceous (Santonian?)</td>
</tr>
<tr>
<td>4</td>
<td>Altered volcanlastic rocks</td>
<td>171-206</td>
<td>35+</td>
<td>Late Cretaceous or older</td>
</tr>
</tbody>
</table>

**Unit 2**

Unit 2 consists almost entirely of coccoliths, with trace amounts of forams and sponge spicules. The carbonate percentage ranges from 82% to 93%. The non-calcareous fraction is dominated by finely divided clay, some acicular crystals about 10µ long, and a few grains, up to about 20µ, of angular quartz. The X-ray mineralogy (Zemmels, this volume) shows that the clay is largely montmorillonite and that the acicular crystals are probably clinoptilolite, presumably from alteration of volcanic glass. In the lower 3 meters, however, the clay content increases to 15%.

The upper 61 meters of Unit 2 is stiff, white nanno ooze. The upper contact is sharp, and subcircular mot-
Unit 3

The upper contact of Unit 3 is sharp, is marked by a greenish-gray film, and appears to record an unconformity. The unit comprises yellowish-gray nanno chalk with from 10% to 30% clay and trace amounts of sponge spicules and forams. In the upper part of the unit the clay is in the form of equant plates 1 to 10 µm across, in contrast to the acicular and cryptocrystalline habits of clay in the overlying units. In the lower part, which is separated from the upper by 4 meters of lost core, the acicular and cryptocrystalline clays return. A sample from a dusty yellow patch at 162.9 meters just below the unconformity is carbonate free and largely consists of clinoptilolite (52%) and apatite (25%) with minor barite and palygorskite. A more typical sample, from 169.7 meters, is 98% carbonate, though the noncarbonate fraction is dominated by alteration products of glass, palygorskite (41%), and clinoptilolite (14%), the remainder being largely montmorillonite.

Unit 4

Unit 4 consists of comparatively hard volcanioclastic and possibly volcanic flow or pyroclastic rocks that apparently lie unconformably beneath nanno chalk of Unit 3. The unit is poorly sampled through a drilled interval of about 38 meters, which extends to the base of the hole. Except in the lowest recovered part of Core 11, samples from this unit chiefly are broken and abraded fragments from core catchers of Cores 12 through 15. In addition, Core 13 contained eight rounded fragments up to about 6 cm across.

The varied lithologies of the samples, as well as unevenness of drilling rates, indicate a high degree of heterogeneity in the sequence. Lithologies of some clasts are repeated in different parts of the drilled section, and systematic vertical changes are not apparent. Volcanic conglomerate, seen in the lower 30 cm of the recovered part of Core 11, apparently caps Unit 4 and was recovered also from the core catcher of Core 14. The conglomerates are composed of subrounded pebbles of andesite and vitrophyre up to 6 cm long in a matrix of coarse sand, in part possibly tuffaceous and cemented by sparry calcite. Nearby, matrix-free fragments of albitized holocrystalline andesitic rock and altered rhylitic vitrophyre may be parts of large clasts but conceivably represent, respectively, hypabyssal intrusive and volcanic units. It is not clear whether fragments of andesite and vitrophyre from the remainder of the hole represent large clasts within a volcanogenic sedimentary rock, or lithic fragments in a pyroclastic rock. One or two volcanic flows may also be represented.

Most rocks of Unit 4 are strongly altered, possibly due to physical and chemical interactions with seawater during their formation. Albitized andesites predominate among the samples, with lesser amounts of fresher andesite and of apparently more siliceous vitrophyre. Little-altered primary labradorite (An₆₀-₇₅) is rare in the andesites, the original plagioclase being replaced in part or completely by albite and oligoclase. Fresh crystals show weak normal zoning to rims of andesine (An₃₀-₅₀). Altered crystals exhibit irregular patchy zoning and commonly are saussuritized and clouded by numerous tiny inclusions. Primary mafic minerals, even in rocks with fresh feldspars, are completely altered to a variety of secondary products including iron oxides, chlorite, and green to brownish amphiboles and micas. Two of the 17 thin sections showed well-formed pseudomorphs after olivine or pyroxene. Relict textures suggest that originally they were interstitial or intergranular. Rare vesicles are filled by quartz, partly spherulitic chaledony, and lesser chlorite. Some vesicles record as many as five distinct phases of deposition. Red to gray vitrophyres, devitrified and otherwise altered, occur as obvious clasts in volcanic conglomerate from Core 11 and from the core catcher of Core 14, and as individual fragments without matrix in Core 13 and its core catcher. Some vitrophyres have vitroelastic and perlitic structures.

Chemical and petrologic study of the volcanic rocks has shown that the composition of the crystalline rocks is largely andesitic and that the vitrophyres range from andesite to rhyolite. The study concludes that the source terrane was probably an island arc or continental margin orogenic belt not unlike that of southern Asia.

PHYSICAL PROPERTIES

General

Bulk-density determinations using the GRAPE technique and sonic-velocity measurements were made on selected sections of nearly all cores obtained. Several porosity and additional bulk-density measurements were obtained from syringe samples. These data points have been plotted (Figure 6). With the exception of perturbations associated with the stratigraphic contact in Core 2 which are discussed below, the following general observations seem to hold. Porosity remains relatively constant at about 57% to 88% down to 100 meters. Bulk density gradually increases from somewhat less than 1.70 g/cc near the surface to just over 1.80 g/cc at 150 meters. In the depth range from 60 to 100 meters, the bulk densities obtained from GRAPE appear to be 0.2 to 0.3 g/cc less than nearby syringe values. Sonic velocities of the sediment hold relatively constant between 1.51 and 1.55 km/sec near 170 meters subbottom at the base of the sediments.

Measurements Across an Unconformity

A sharp stratigraphic contact was found about 75 cm down in Section 4 of Core 2, at 31 meters subbottom. Above the contact is upper Miocene foraminiferal ooze, while below is upper Eocene foraminiferal ooze which shows considerable mottling in the 30 cm just below the contact. The changes in physical properties across this boundary are illustrated in Figure 3. Downward, porosity and water content increase while bulk density and sonic velocity decrease. While these changes are internally consistent, they are difficult to explain physically without additional information. The most obvious changes in sediment character, i.e., the difference in ages and the presence of forams above the contact and their absence below, would most reasonably lead one to expect a decrease in porosity in going down through the contact.
Figure 3. Change in porosity, water content, wet bulk density, and sonic velocity across the Eocene/upper Miocene unconformity in Section 4 of Core 2.

**Hard-rock Samples**

The following sonic-velocity measurements were obtained on rock samples.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Sonic Velocity (km/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-1, 65</td>
<td>Chert</td>
<td>3.85 (avg. of 2 measurements)</td>
</tr>
<tr>
<td>11-2, 135/140</td>
<td>Conglomerate (top piece)</td>
<td>4.65</td>
</tr>
<tr>
<td></td>
<td>Conglomerate (large piece)</td>
<td>3.98 (avg. of 2 measurements)</td>
</tr>
<tr>
<td>11, CC</td>
<td>Altered basalt</td>
<td>3.97 (avg. of 2 measurements)</td>
</tr>
<tr>
<td>12, CC</td>
<td>Altered basalt</td>
<td>3.93</td>
</tr>
<tr>
<td>13, CC (#1)</td>
<td>Altered basalt (sm dim parallel to cut face)</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.34 (lge dim parallel to cut face)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.61 (perpendicular to cut face)</td>
</tr>
<tr>
<td>(#2)</td>
<td>Altered basalt</td>
<td>4.47 (perpendicular to cut face)</td>
</tr>
<tr>
<td>15, CC</td>
<td>Altered basalt with veinlet</td>
<td>5.02 (perpendicular to cut face)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.95 (sm dim parallel to cut face)</td>
</tr>
<tr>
<td></td>
<td>Altered basalt without veinlet</td>
<td>4.68 (perpendicular to cut face)</td>
</tr>
</tbody>
</table>

**BIOSTRATIGRAPHIC SUMMARY**

**Foraminifera**

**Neogene**

The Neogene sediments at Site 264 consist of 30.8 meters of Pliocene and Pleistocene foramin-bearing nanno ooze which disconformably overlies Eocene nanno ooze. Foraminifera are abundant throughout this interval and are well preserved, except in the basal few meters where severe corrosion is evidenced by abundant test fragments, limited diversity, and a dominance of large, thick-walled specimens.

The section down to the disconformity is apparently complete and accords well with the distribution of
foraminifera in the New Zealand late Tertiary and with the zonation and local stages for this area. Two zones were recognized: the Globorotalia miozea sphericomiozea Zone of the upper Miocene Kapitean stage, and the Globorotalia inflata Zone, a broad interval covering the Pliocene and Pleistocene (Opoitian to Hawera stages). A finer subdivision of this interval was not attempted. The Pliocene-Pleistocene boundary was determined by a major change in faunal character between Cores 2A and 1A that includes (a) disappearance of Globorotalia limbata (last occurrence in Section 2 of Core 2A), Globigerinoides extremus, and Globorotalia triangula Theyer; and (b) the appearance of common Globorotalia truncatulinoides in Core 1A in contrast to its absence below.

The faunas throughout have a mid-latitude aspect, being dominated by members of the G. miozea-sphericomiozea-inflata and G. crassaformis s.l. lineages. Above its first occurrence in the lower Pliocene, G. inflata is the dominant element of all faunas examined. Although tropical forms such as G. menardii and Pulleniatina were occasionally seen, they never occur as more than one or several specimens per sample examined.

Globorotalia miozea conoidea ranges to the top of the Kapitean stage, and Globorotalia conomiozea was seen in the basal 2 meters of this interval. G. miozea sphericomiozea ranges into the lower part of the Globorotalia inflata Zone, where it is abundant, along with an entire series of morphologically transitional specimens to G. puncticulata (= G. inflata auct.) and Globorotalia triangula. Such an evolutionary sequence had been proposed by McInniss (1965) and is well developed at Site 264. Globorotalia crassaformis first occurs in the lower Pliocene; in this section, it appears to evolve from a form figured by Blow (1969) as G. subsictula Conato. Two biostratigraphically significant taxa, used in lower latitude zonations, occur at Site 264—Globoquadrina altispira and Sphaeroidinella seminudina. Both disappear simultaneously in the lower part of the G. inflata Zone at this site. Globigerina nepenthes, which in low-latitude sequences ranges to the mid-Pliocene, disappears at the base of the G. inflata Zone. Globorotalia margaritae is very rare and was seen only in the G. miozea sphericomiozea Zone. One right-coiling specimen of Pulleniatina prinalis was seen in the lower G. inflata Zone.

Paleogene

The boundary between the late Miocene and late Eocene is well defined in Section 4 of Core 2 at a depth of 76 cm.

Late Eocene foraminifera are confined to the lower part of Core 2. Planktonic taxa dominate and include Chilougembelina cubensis (first upward appearance), Globanomalina micro, Globigerina linaperta, Globorotaloides turgida, and Globigerapsis index. This
fauna closely resembles those of the New Zealand Arnold Series. The fact that *Pseudogloboboquadrina primitiva* is present lower in this section but absent in this interval suggests a post-Borongian age, probably correlating with the late Eocene Kaitan stage. The environment is interpreted as deep, warm temperate water.

Abundant and well-preserved mid Eocene faunas are present in core catchers of Cores 3-9 and slightly lower in Core 3A, as well as in Sample 4A-2, 123-125 cm. Pelagic taxa again dominate, significant taxa including *Globigerina triloculinoides*, *Pseudogloboboquadrina primitiva*, *Globanomalina micra*, *Globorotaloides turgida*, *Globigerapsis index*, and *Globigerina linaperta*. This interval correlates with the New Zealand Porangan and Bortonian stages (mid Eocene), with the presence of *Globigerapsis index* in the interval between core catchers of Cores 3 and 6 also indicating a correlation with the latter stage. Benthonic taxa constitute a minor part of the fauna with species of the latter stage. Benthonic taxa include a minor part of the fauna with species of *Pleurostomella*, *Pullenia*, *Aragonia*, *Stilostomella*, *Nuttallides*, and *Pullenia* present and ostracodes and fish teeth also noted. The change in lithology observed between core catchers of Cores 6 and 7 coincides with the entry of *Globigerapsis index* at the Porangan-Bortonian stage boundary. A slight hiatus might be present at this level. Environmental conditions are regarded as similar to those prevailing in the late Eocene, i.e., deep open water and warm temperate.

A thin succession of early Eocene is present between Samples 4A-4, 123-125 cm and 10-3, 132-139 cm. Planktonic taxa present include *Globigerina triloculinoides*, *Pseudogloboboquadrina primitiva*, *Globorotalia australiformis*, *Globorotalia crater*, *Globorotaloides turgida*, *Globigerinella hispins*, and *Globanomalina micra*. Dominant benthonic taxa include species of *Siphotextularia*, *Pullenia*, *Vulvulina*, *Cibicidales*, *Stilostomella*, *Bulimina*, *Pleurostomella*, and *Gyroidinoides*. The presence of *Globorotalia crater* (probably a senior synonym of *G. formosa* and *G. aragonensis*) allows confident correlation with the *G. crater* Zone (early Eocene) and Mangaorapan and Heretaunga stages (both early Eocene) of New Zealand. This interval is also correlated with the *G. formosa* and *G. aragonensis* zones of Trinidad. Open water pelagic conditions are again indicated.

A sharp color change in Core 10-3, at 40 cm, marks the boundary between the early Eocene and mid Paleocene.

Mid Paleocene faunas are dominated by planktonic taxa, including the following taxa: *Globorotalia pusilla*, *G. uncinata*, *G. angulata*, *G. pseudomenardii*, *G. pseudobulloides*, *G. chapmani*, *G. mckannai*, and *Globigerina triloculinoides*. This interval is correlated with the *G. pusilla-angulata* Zone and *G. pseudomenardii* Zone of Trinidad and with part of the *G. triloculinoides* Zone of New Zealand. The presence of *Gaudryina whangaia* and *Clavulina anglica* indicates a correlation with the New Zealand Teurian stage. This interval is an approximate correlative of the Kings Park Shale, Perth, Western Australia. Contamination from the underlying Cretaceous is indicated by the presence of *Heterohelix ruessii*, *Globigerinelloides asperus*, and *Rotalipora evoluta*. The higher proportion of benthonic taxa, along with the reworking noted above, suggests that the early Eocene was shallower than the middle and late Eocene. Deep open water conditions persisted.

**Cretaceous**

Cretaceous faunas are confined to Core 11, down to Sample 11-2, 110 cm. At this level the almost entirely pelagic Cretaceous sediment rests abruptly on indurated conglomerate. The fauna is dominated by well-preserved tests of *Heterohelix ruessii*, *Globigerinelloides asperus*, *Hedbergella planispira*, *H. deltoens*, and *Schackoquina multispirata*. Marginotruncana coronata and *Globotruncana linnetana* are present in very small numbers. *Rugoglobigerina* was not observed. Benthonic taxa include species of *Marssonella*, *Lenticulina*, *Dentalina*, *Frondicularia*, *Pullenia*, *Gyroidinoides*, and *Globorotaliids*. This mixed assemblage appears to be made up of elements having a total range of Cenomanian to Campanian. From the available taxa, it seems certain that pelagic conditions persisted nearly through the Upper Cretaceous. No tests of *Albian Tickenella* or *Hedbergella washiens*, were recovered so reasonable to suggest that the underlying conglomerate is Albian or older. Alternatively, in view of the highly contaminated Cretaceous faunas encountered here, it is possible that the conglomerate and volcanic rocks might be incorporated within a Cretaceous slump mass.

**Nannofossils**

The sediments recovered from this site range in age from Recent to Cretaceous. Sediments in Cores 1-10 contain moderate to abundant nannofossils with moderate to good preservation. In contrast, however, the chalks in Core 11 contain poorly preserved nannofossils, with a large amount of background fragmented nannofossil debris.

At Site 264 the upper sediments provided a relatively short Pleistocene-upper Miocene section (Cores 1, 1A, 2A, and 2). Species commonly present in this part of the section include: *Emiliania huxleyi*, *Gephyrocapsa oceanica*, a small *Gephyrocapsa* species; *Cyclcoccolithus lepiopus*, *Gephyrocapsa oceanica*, *Heliocopspahuera sellii*, *Pseudoemiliania lacunosa*, *Cyclococcolithus macintyre*, *Discocystea brouweri*, *D. pentaradiatus*, *D. surculus*, *Reticulofenestra pseudumbilica*, *Discocystea asymmetricus*, *D. challengerii*, *D. variabilis*, *Ceratolithus rugosus*, *C. tricornuculatus*, *Sphenolithus abies*, *Ceratolithus primus*, and *C. amplificus*. The distribution of the nannofossil species gives the following subdivision of this upper section. Pleistocene: Sample 1-1, 77 cm to Sample 2A-3, 120 cm (Zones NN21-NN19); Upper Pliocene: Sample 2A-5, 125 cm to Sample 2A-6, 75 cm (Zones NN18-NN16); Lower Pliocene and Upper Miocene: Sample 2A-6, 75 cm to Sample 2-4, 76 cm (Zones NN15-NN12).

Between Samples 2-4, 76 cm and 2-4, 120 cm is an unconformity, clearly identifiable by changes in lithology, color, and time gap. The sediments below the unconformity (Samples 2-4, 120 cm to 10-3, 40 cm) range from upper Miocene to upper Eocene. The underlying Eocene section is extremely thick (Core 2 to Core 10) and ranges in age from upper Eocene to lower Eocene, with a par-
particularly long middle Eocene component. The lower part of the Eocene section ends in a lower Eocene-middle Paleocene unconformity in Core 10.


The distribution of these species allows the Eocene section to be subdivided as follows: upper to upper middle Eocene: Sample 2-4, 120 cm to Sample 3-3, 40 cm (D. saipanensis and D. tani zones) (Zones NP17-NP18); middle Eocene: Sample 3-4, 40 cm to Sample 10-2, 24 cm (N. quadrata and D. sublodoensis zones); lower Eocene: Sample 10-2, 60 cm to Sample 10-3, 143 cm (D. lodoensis and M. tribrachiatus zones).

Between Sample 10-3, 143 cm and Sample 10-3, 145 cm there is a hiatus. This hiatus appears to be well defined by a lithologic and color change, but is not as well defined faunally. The lowest recognizable white Eocene sediment is in the D. lodoensis Zone (NP13). Below this, within a transitional zone of mixed lithology between the white Eocene and lower greenish Paleocene sediments, are a number of small pockets of sediment rich in Marthasterites tribrachiatus. Within the same transitional zone are pockets of sediment containing only a very few nannofossils. The lower part of Core 10 can all be placed in the middle Paleocene (lower Heliotolithus kleinpellii Zone NP6 and upper Fasciculithus tympaniformis Zone NP5). However, these same sediments also contain a small amount of reworked Cretaceous nannofossils. The lower zones of the Paleocene are not present, and as this part of the section was not recovered, it cannot be determined whether the Paleocene rests unconformably on the Cretaceous sediments below.

The chalk section in Core 11 is Upper Cretaceous in age. The youngest diagnostic nannofossils found in these sediments were Kampnerius magnificus and Micula staurophora indicating a Campanian/Santonian age.

Radiolaria

Low quantities of moderately preserved Eocene Radiolaria are present between Core 2, Section 5 and Sample 3, CC. Radiolaria are absent or occur only in trace amounts throughout the remainder of the cores.

The stratigraphic zonation of the sediments containing Radiolaria is difficult to determine, because low-latitude index species are absent. However, on the basis of overall occurrences of several species (Lychnocanomops biaculiculate, Eusyringium fistuligerum, Lithochytris vespertilio, Thecampe amphora, Calocyclas hispida, Thecampe urceolus, Lophocytis blaurrra, Lychnocanomops baiurrra, and Phormocytis striata striata), it appears that from Sample 3, CC to Core 2, Section 5 the sediments are within the interval from the Podocystis mira Zone to Thysocyritis trapezia Zone (upper middle Eocene to upper Eocene).

Diatoms

Core-catcher samples were investigated for this site with all but Sample 2, CC being barren. The diatoms recovered were poorly preserved and extremely low in number. The diatoms identified in 2, CC are; Melosira sulcata, Stephanopixis turris, Triceratium sp., Araonhildiscus ehrenbergii, Hemiaulus polymorphus.

Silicoflagellates

All calcareous nanno ooze sediments recovered at this site were barren of silicoflagellates except sediments in Sample 2, CC. Silicoflagellates were very rare in 2, CC with only four to five specimens counted per slide. The silicoflagellates identified were as follows: Naviculopsis biaculiculate, Naviculopsis constricta, Corbisema archangelskianna, and Mesocena oamaruensis var. quadrangula. These species can occur concurrently in either the late Oligocene or the late Eocene; however, a late Eocene date is favored on the basis of biostratigraphic evidence from other microfossil groups.

Palynology

Eleven samples from the carbonate sequence at Site 264 were macerated and acid-insoluble residues examined; 10 samples were selected from the Eocene sequence, 1 from the Late Cretaceous basal interval. All, however, proved virtually barren—only in Sample 10-3, 125-127 cm were rare spinose acritarchs observed. The lack of palynomorphs is possibly due to oxidation during deposition, or else to extreme dilution of organic-microbial microplankton by calcareous skeletons.

SUMMARY AND CONCLUSIONS

Site 264 is located in 2873 meters of water just north of the southern flank of the Naturaliste Plateau and about 180 km west of Cape Leeuwin. Seismic profiles from Eltanin 45 and the site survey reveal a broad structural depression containing up to about 600 meters of acoustically transparent sediments and apparently isolated from the 1-km-thick Naturaliste sedimentary sequence. The site was positioned on the south flank of this depression in an effort to obtain sediments older than the Lower Cretaceous glauconitic silts sampled at Site 258 (Leg 27) and to determine whether the basement rocks are of oceanic or continental affinity.

The sedimentary column at Site 264 consists of 171 meters of calcareous oozes, foram-bearing at the top but made up predominantly of calcareous nannofossils (Figure 5). Unconformities detected by gaps in biostratigraphic zonation, separate (1) Miocene and
Figure 5. Comparison of Glomar Challenger seismic profile on approach to Site 264 and the drilled section. The strong reflector at about 0.2 sec below the sea floor probably corresponds to the top of the volcaniclastic conglomerate.

younger strata from an Eocene sequence, (2) Eocene from middle Paleocene, and, probably, (3) Paleocene from Late Cretaceous (Campanian-Santonian).

The volcaniclastic sequence at the base of the hole probably does not represent oceanic basement (layer 2) in view of its clastic character and its range of intermediate to basic composition. Rather, the volcanic sequence may be a basal or near-basal continental sequence deposited in a small depression in a volcanic terrane. Submergence of the basin to moderately great depths had occurred by Santonian time, probably by the Albian as at Sites 255 and 258. Accumulation of calcareous oozes began by Early Late Cretaceous and has continued, perhaps intermittently, until the present. Erosion, probably by bottom currents in the latest Cretaceous and earliest Cenozoic, stripped off much of the Cretaceous sediment and some of the debris was incorporated in the mid Paleocene sediments.

The depression drilled at Site 264 probably had a Late Cretaceous/Cenozoic history similar to that of both the northeastern part of Naturaliste Plateau proper, as seen at Site 258, and of Broken Ridge, as indicated by Site 255 (Leg 26). However, Site 264 is unique for this region in that it contains Santonian or older volcanic conglomerate suggesting Mesozoic coastal volcanism, and in that a well-developed section of Eocene carbonates is preserved, suggesting that Paleogene erosion patterns in the region were erratic.

REFERENCES


### BIOSTRATIGRAPHY

<table>
<thead>
<tr>
<th>FORAMS</th>
<th>NANNOS</th>
<th>RADIALS</th>
<th>DIATOMS</th>
<th>AGE</th>
<th>COLUMN</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. inflata</td>
<td>NN20 &amp; 21</td>
<td>BAREN</td>
<td>BAREN</td>
<td>PLEISTOCENE</td>
<td>264A</td>
</tr>
<tr>
<td>G. inflata</td>
<td>NN19</td>
<td>BAREN</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. inflata</td>
<td>NN13 to 18</td>
<td>UP, MIOCENE</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NP16 &amp; 17</td>
<td>7</td>
<td>8</td>
<td>UP, EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. angiozoides</td>
<td>NP 14 &amp; 15</td>
<td>BAREN</td>
<td>BAREN</td>
<td>MIDDLE EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. Linaperta</td>
<td>NP 12 &amp; 13</td>
<td></td>
<td></td>
<td>L. EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NP 6</td>
<td></td>
<td></td>
<td>MIDDLE PALEOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. kigginsi</td>
<td>PP 19</td>
<td></td>
<td></td>
<td>MID. PALEOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. Linaperta</td>
<td>NN9 to 11</td>
<td></td>
<td></td>
<td>CONGLOMERATE</td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN7 to 10</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN10 to 12</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN13 to 18</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN19</td>
<td>BAREN</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN20 &amp; 21</td>
<td>BAREN</td>
<td>BAREN</td>
<td>PLEISTOCENE</td>
<td>264A</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN19</td>
<td>BAREN</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN13 to 18</td>
<td>UP, MIOCENE</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NP16 &amp; 17</td>
<td>7</td>
<td>8</td>
<td>UP, EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. angiozoides</td>
<td>NP 14 &amp; 15</td>
<td>BAREN</td>
<td>BAREN</td>
<td>MIDDLE EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. Linaperta</td>
<td>NP 12 &amp; 13</td>
<td></td>
<td></td>
<td>L. EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NP 6</td>
<td></td>
<td></td>
<td>MIDDLE PALEOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. kigginsi</td>
<td>PP 19</td>
<td></td>
<td></td>
<td>MID. PALEOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. Linaperta</td>
<td>NN9 to 11</td>
<td></td>
<td></td>
<td>CONGLOMERATE</td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN7 to 10</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN10 to 12</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN13 to 18</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN19</td>
<td>BAREN</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN20 &amp; 21</td>
<td>BAREN</td>
<td>BAREN</td>
<td>PLEISTOCENE</td>
<td>264A</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN19</td>
<td>BAREN</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN13 to 18</td>
<td>UP, MIOCENE</td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NP16 &amp; 17</td>
<td>7</td>
<td>8</td>
<td>UP, EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. angiozoides</td>
<td>NP 14 &amp; 15</td>
<td>BAREN</td>
<td>BAREN</td>
<td>MIDDLE EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. Linaperta</td>
<td>NP 12 &amp; 13</td>
<td></td>
<td></td>
<td>L. EOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NP 6</td>
<td></td>
<td></td>
<td>MIDDLE PALEOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. kigginsi</td>
<td>PP 19</td>
<td></td>
<td></td>
<td>MID. PALEOCENE</td>
<td>264</td>
</tr>
<tr>
<td>G. Linaperta</td>
<td>NN9 to 11</td>
<td></td>
<td></td>
<td>CONGLOMERATE</td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN7 to 10</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN10 to 12</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
<tr>
<td>G. miazea</td>
<td>NN13 to 18</td>
<td></td>
<td></td>
<td></td>
<td>264</td>
</tr>
</tbody>
</table>

**FIGURE 6.** Graphic hole summary, Site 264.
### Site 264 Hole 1 Core 1 Cored Interval: 0-9.5 m

<table>
<thead>
<tr>
<th>ME</th>
<th>ZONE</th>
<th>FOSSIL CHARACTER</th>
<th>LITHOLOGY</th>
<th>LI THOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>A</td>
<td>G</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Site 264 Hole 2 Core 2 Cored Interval: 25.5-35 m

<table>
<thead>
<tr>
<th>ME</th>
<th>ZONE</th>
<th>FOSSIL CHARACTER</th>
<th>LITHOLOGY</th>
<th>LI THOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>A</td>
<td>G</td>
<td>2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Sec. 2 (14 cm):
- 90% nannos (mostly coccoliths, a few discoasters)
- 8% forams
- 2% sponge spicules up to 200 microns long

Contact sharp but dragged down up to 30 cm at edge of core.

White (N9) stiff NANNI Ooze. Very pale orange (10YR 8/2) mottles (burrows) up to 2 cm across scattered through and fading out at the base of the 30-cm interval below the contact. Sec. 6 (5 cm):
- 95% nannos (coccoliths)
- TR sponge spicules
- TR rad fragments

Explanatory notes in Chapter 3
### FOSSIL CHARACTER

**Core Catcher**

- **Z,c White, stiff, uniform NANNOOOZE.**

- **Light gray discontinuous laminae in Sec. 2 from 86 to 96 cm.**

- **White (N9), stiff NANNOOOZE. Slightly plastic beds 10 to 20 cm thick alternate with more plastic beds 5 to 10 cm thick.**

- **Sec. 4 (92 cm):**
  - 99% nannos (mainly coccoliths - a few discoasters)
  - TR forams
  - TR sponge spicules

  Several thin conchoidal flakes up to 2 cm across at chart from 91 to 108 cm in Sec. 4.

#### EXPLANATORY NOTES IN CHAPTER 1

---

### SITE 264

<table>
<thead>
<tr>
<th>ZONE</th>
<th>FOSSIL CHARACTER</th>
<th>ZONE</th>
<th>FOSSIL CHARACTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**LITHOLOGIC DESCRIPTION**

- White, stiff, uniform NANNOOOZE.

- Light gray discontinuous laminae in Sec. 2 from 86 to 96 cm.

- White (N9), stiff NANNOOOZE. Slightly plastic beds 10 to 20 cm thick alternate with more plastic beds 5 to 10 cm thick.

- Sec. 4 (92 cm):
  - 99% nannos (mainly coccoliths - a few discoasters)
  - TR forams
  - TR sponge spicules

  Several thin conchoidal flakes up to 2 cm across at chart from 91 to 108 cm in Sec. 4.
Site 264 Hole Core 5 Cored Interval: 73-82.5 m

Site 264 Hole Core 6 Cored Interval: 82.5-93 m

White (N9) plastic NANNO Ooze.

Mainly soft to stiff but with 4 or 5 stiffer patches in Sec. 2, 3, and 4. Mostly stiff to semilithified in the lower part of Sec. 3 and in Sec. 5. Softer parts probably due to drilling deformation.

Sec. 3 (85 cm):
- 99% nannos (mostly coccoliths)
- TR forams
- TR sponge spicules
- TR glass fragments

Sec. 1 (140 cm):
- 99% nannos (mostly coccoliths)
- TR glass fragments

White (N9) NANNO CHALK. About five pieces 5 to 10 cm long of semilithified chalk separated by soft plastic areas in each section.
Hole Core 7 Cored Interval: 92-101.5 m

Fossil Character

Core Catcher

Lithologic Description

White Nanno ooze with flakes of light bluish gray (5B 7/1) chert.

Sec. 1 (57 cm):
- 98% nannos (mostly coccoliths)
- TR clay
- TR glass fragments

Sec. 2 (46 cm):
- 99% nannos (mostly coccoliths)
- TR forams
- TR sponge spicules
- TR clay

Bluish white (5B 9/1) Nanno ooze. Streaks of very dusky purple (5P 2/2) a few millimeters wide every 5 to 15 cm.

Flakes and nodules of light bluish gray (5B 7/1) chert range up to 6 cm across.

Scattered stiff patches about 5 cm across and intervening soft areas suggest brecciation during drilling.

...
### Site 264 Hole Core 10 Cored Interval: 158.5-168 m

<table>
<thead>
<tr>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light bluish gray (5B 7/1) chert nodules 4 to 6 cm long in Sec. 1 (142 and 147 cm) and Sec. 2 (2 cm).</td>
</tr>
<tr>
<td>White semi-lithified CLAY-RICH NANNO CHALK, Drilling breccia includes core up to 20 cm long. A yellowish gray cludge surrounds the fragments, Clay content increases from 16% in Sec. 1 (342 cm) to 20% in Sec. 3 (136 cm).</td>
</tr>
</tbody>
</table>

### Site 264 Hole Core 11 Cored Interval: 168-177.5 m

<table>
<thead>
<tr>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellowish gray (5Y 8/1) semi-lithified CLAY-RICH NANNO CHALK. A few light-colored laminae both horizontal and complexly deformed at time of deposition. Laminae have lower clay content and higher glass fragment and foram content than the dominant yellowish gray lithology.</td>
</tr>
<tr>
<td>cf: Sec. 1 (138 cm) white Sec. 3 (137 cm) yellowish gray</td>
</tr>
</tbody>
</table>

### Site 264 Hole Core 12 Cored Interval: 177.5-187 m

<table>
<thead>
<tr>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>One piece 8 cm long of heavily limoniised, dark yellowish brown (10YR 4/4), dense, fine-grained basalt with zoning to 5YR 4/4. Original mafics entirely altered to chlorite and Fe oxides.</td>
</tr>
<tr>
<td>NOTE: High and variable coring speed suggests that lithologies represented by cores 10 through 15 are soft and heterogeneous, such as sediment with interbedded volcanic condensate and basalt pillows.</td>
</tr>
</tbody>
</table>

---

**Explanatory notes in Chapter 1**
**Site 264**

**Hole**

**Core 13**

**Cored Interval**: 187-206.5 m

**LITHOLOGIC DESCRIPTION**

- **Core Catcher**

**SITES**

- **ZONE**
- **FOSSIL CHARACTER**
- **AGE**
- **SECTION**
- **LITHOLOGY**
- **DEFORMATION**

**LITHOLOGY**

**DEFORMATION**

**FOSSIL CHARACTER**

**FOSSIL ABUNDANCE**

**FOSSIL PRESERVATION**

**Site 264**

**Hole**

**Core 14**

**Cored Interval**: 196.5-206 m

**LITHOLOGIC DESCRIPTION**

- **Core Catcher**

**SITES**

- **ZONE**
- **FOSSIL CHARACTER**
- **AGE**
- **SECTION**
- **LITHOLOGY**
- **DEFORMATION**

**LITHOLOGY**

**DEFORMATION**

**FOSSIL CHARACTER**

**FOSSIL ABUNDANCE**

**FOSSIL PRESERVATION**

**Site 264**

**Hole**

**Core 15**

**Cored Interval**: 206-215.5 m

**LITHOLOGIC DESCRIPTION**

- **Core Catcher**

**SITES**

- **ZONE**
- **FOSSIL CHARACTER**
- **AGE**
- **SECTION**
- **LITHOLOGY**
- **DEFORMATION**

**LITHOLOGY**

**DEFORMATION**

**FOSSIL CHARACTER**

**FOSSIL ABUNDANCE**

**FOSSIL PRESERVATION**

**Explanatory notes in Chapter 1**

---

Eight fragments from 2 to 6 cm across of medium gray to greenish gray, fine-grained, crystalline to aphanitic volcanic rocks. Four have plagioclase phenocrysts (mainly albite) and five have scattered quartz- and chlorite-filled amygdales.

This section:

Core 13, Sec. 1, Piece #1: Altered andesitic (An30-35) vitrophyre
#2: Albitised fine-grained basalt
#4: Albitised dacitic vitrophyre
#6: Silicified andesitic vitrophyre

Note: These fragments may have rolled out into the tube from the core catcher after the barrel came on deck.

Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with interbedded volcanic conglomerate and basalt pillows.

Nine fragments 2 to 6 cm across of yellowish gray to light to dark greenish gray (5Y 8/1-4/1) fine-grained and aphanitic volcanic rocks.

This section:

Core 13, CC, Piece #1: Chloritised fine-grained basalt
#2: Albitised fine-grained basalt
#4: Albitised dacitic vitrophyre
#6: Ferruginous andesitic vitrophyre

Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with interbedded volcanic conglomerate and basalt pillows.

---

One fragment 7 cm long of moderately sorted conglomerate with subrounded to rounded pebbles up to 4 cm across. The sandy, tuffaceous matrix is held together by calcite and chlorite cement. Pebbles are altered basaltic vitrophyre.

This section:

14-CC

Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with interbedded volcanic conglomerate and basalt pillows.

---

One piece 6 x 6 x 6 cm of olive gray to dark greenish gray (5Y-5GY 4/1) dense, fine-grained, albitised basalt.

This section:

15-CC

Note: High and variable coring speed suggests that lithologies represented by cores 12 through 15 are soft and inhomogeneous, such as sediment with interbedded volcanic conglomerate and basalt pillows.
Site 264 Hole A Corel Cored Interval: 8.5-18 m

LITHOLOGIC DESCRIPTION
Pinkish gray (5YR 8/1) soft but coherent FORAM-RICH NANNOOZE. Soupy in places near top and bottom of core. Fine light gray and white mottles in places up to 3 cm in size scattered throughout.

Sec. 3 (139 cm):
80% nannos
15% forams
5% glass fragments (10-40 μm)

Sec. 5 (142 cm):
65% nannos
25% forams
4% sponge spicules
2% quartz
2% glass fragments (n=1.57)

Site 264 Hole Core 2 Cored Interval: 18-27.5 m

LITHOLOGIC DESCRIPTION
Grayish pink (5R 9/1) soft (and in some areas soupy) FORAM-NANNO OOZE. 'Vertical bedding' in Sec. 3, 4, and 5.
Site 264 Hole A Core 3 Cored Interval: 139.5-149 m

**LITHOLOGIC DESCRIPTION**

Bluish white (5B 9/1) Semilithified NANNO CHALK. Mainly as drilling breccia with 4 to 6 Semilithified fragments of core width and from 3 to 14 cm long in each section, except for 26-51 cm in Sec. 1, which is undisturbed.

A few purplish black (5P 2/1) streaky patches 2 or 3 mm across in Sec. 2.

Light gray chert fragments 2 to 4 cm across in Sec. 2 (100 cm), Sec. 4 (102 cm), Sec. 6 (147 cm), and in the core catcher.

Sec. 3 (100 cm):
- 95% nannos
- 2% clay
- TR forams
- TR glass fragments
- TR ferruginous specks

Site 264 Hole A Core 4 Cored Interval: 149-158.5 m

**LITHOLOGIC DESCRIPTION**

Bluish white (5B 9/1) Semilithified NANNO CHALK. Brecciated by drilling in Sec. 1 and 2; almost homogenized in Sec. 3 and 4.

Light gray chert nodules and fragments.

A few faint horizontal laminae and small light gray patches, seams in Sec. 5.

Sec. 5 (100 cm):
- 95% nannos
- TR forams
- TR glass fragments
- 5% clay

Explanatory notes in Chapter 1