3. MESOZOIC CHALK AND CHERT ON THE PACIFIC PLATE NEAR JAPAN: DSDP SITE 195

The Shipboard Scientific Party[1]

SITE DATA

Occupied: 22-29 Sept 1971

Position: Abyssal floor east of Izu-Bonin Trench;
lat 32°46.4′N
long 146°58.7′E

Water Depth: 5958 meters

Number of Cores: 5

Total Penetration: 392 meters

Deepest Unit Recovered: Upper Jurassic or Lower Cretaceous cherty limestones of the lower transparent acoustic layer

Main Results: The lower transparent layer consists of cherty marls and limestones. These sediments contain nannofossils which range from the Upper Jurassic to the Lower Cretaceous. Acoustic basement was not reached.

BACKGROUND

The failure to penetrate the opaque layer or core into basement at Site 194 left our principal drilling objectives in the area unattained. The seismic reflection record obtained by Dr. T. A. Davies on ARIES VII indicated that east of the Izu-Bonin Trench at about 30°N the lower transparent layer is several hundred meters thick. However, to drill to the base of the transparent layer along the ARIES VII traverse would have required a drill string exceeding the 22,500-foot contract limit.

There seemed to be a chance that elsewhere in the area the lower transparent layer might be somewhat thinner and its base lie at a shallower depth. With this prospect, a southerly course was set upon departing from Site 194. At 1500 on 22 September, the profiler recorded an attractive section of upper transparent (0.2 sec), opaque (0.16 sec), and lower transparent (0.05 sec) lying above acoustic basement. The thickness of the total acoustic section indicated could be estimated as 350 meters, and the inferred basement depth was about 1000 feet shallower than the 22,500-foot contract limit.

The location of Site 195 and local bathymetry are shown on Figures 1 and 2, respectively. Acoustic stratigraphy is shown in Figures 3 and 4.

Figure 1. *Location of Site 195.*

OPERATIONS

After crossing the site (on 178°) the ship's course was reversed to recross the prospect. Further examination confirmed our favorable expectation, and consequently the ship was slowed to 5 knots, and at 1530 on 22 September 1971 the beacon was dropped while the ship was under way.

At 0915 on 23 September, the mud line was detected by the weight gauge at 5971 meters. The nearly identical PDR depth of 5968 meters was adopted as the mud line. The first core was cut 63 meters below the mud line (6031-6040 meters) with pumps off, and 8.5 meters of soft radiolarian ooze were recovered. In view of this result, it was decided to continue washing ahead without the center bit (6040-6088 meters, see Table 1). Core 2 was cut (6088-6097.5 meters) after a slight increase in drilling resistance was noted. The center bit was then put in and drilling continued (6097.5-6164 meters) at a rapid rate until at 6145 meters the rate abruptly decreased to 6 meters per hour. Drilling continued until a slight increase in rate suggested that coring might be appropriate. The center bit was pulled and 6 meters were cored (Core 3, 6164-6170 meters) at which point the drilling rate markedly decreased again. Core 3 contained about a gallon of drilling debris consisting of pea-sized chert chips and one large button of chert the diameter of the core. As Core 3 was taken, 3

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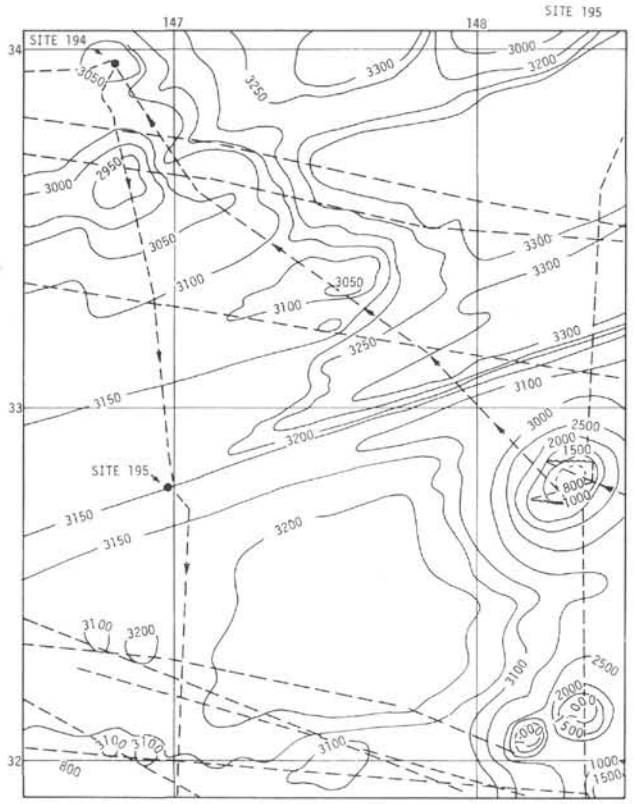

Figure 2. *Bathymetry in the vicinity of Site 195 (based on various sounding lines). Contour interval 100 tau (1 tau = 1/400 sec.).*

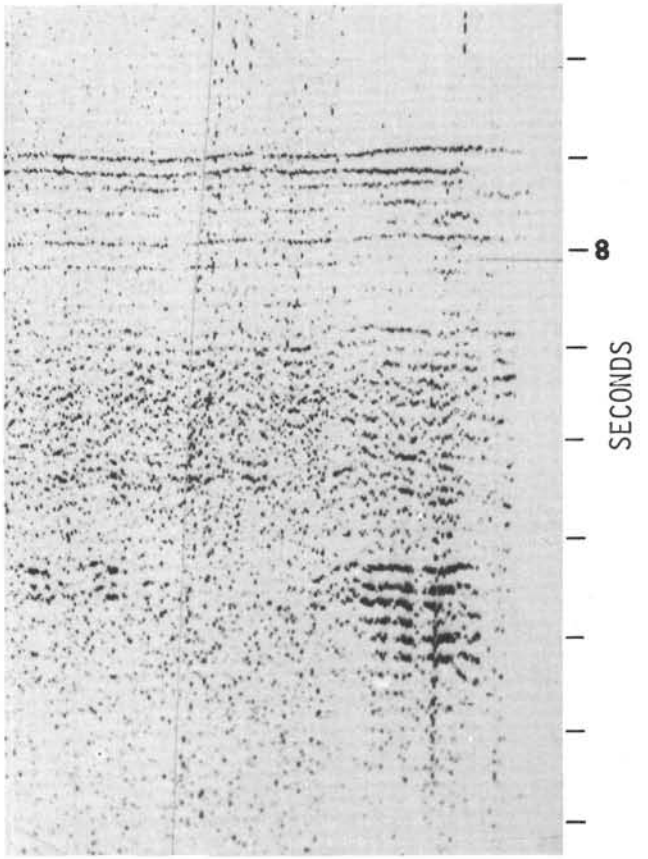

Figure 3. Glomar Challenger *seismic profile across Site 195 on site approach.*

meters of fill were found in the hole. In view of the hazardous drilling conditions posed by the fill, it was decided to insert the center bit and drill ahead.

At 6202 meters the drilling rate increased and it appeared that the chert-bearing formation may have been penetrated. Thus, at 6240 meters, the center bit was pulled and Core 4 cut, from 6240 to 6246 meters. No core was recovered, and the barrel became blocked with chert. The center bit was reinserted and the hole drilled to 6278 meters in another attempt to core the upper part of the lower transparent layer. Upon lowering the core barrel 10 meters of fill were encountered in the hole. After part of this fill was penetrated, it became impossible to raise the string, although, fortunately, the stuck string could still be rotated. After 2 hours of pulling and rotating, and after pumping 125 barrels of mud, the string broke free. It was decided that the condition of the hole was too bad to permit further drilling and the bit was brought above the mud line. Hole 195 was then abandoned in preparation of spudding in Hole 195A where a further attempt to sample the lower transparent layer and basement would be made.

At 1800 on 24 September 1971 Hole 195A was spudded in at the same location as Hole 195 without altering position. The plan was to drill through the section without coring until the lower part of the lower transparent layer was reached. The prime objectives were to core the lowermost part of the transparent layer and the acoustic basement. It was judged that drilling directly to the deep prime objective would minimize hole collapse and perhaps avoid the hole collapse and infill which frustrated the attempts at Holes 194 and 195. The hole was drilled to 6324 meters maintaining good pump pressure and circulation. A total of 400 barrels of mud was circulated at frequent intervals in order to clear the hole. Only 1 or 2 meters of fill were noted as each joint was added. When preparing for coring, the overshot was sent down and it was found that the center bit would not unlatch. The pin sheared and the overshot was brought to the surface. After a second unsuccessful attempt, it was decided to drill ahead in the hope of dislodging the center bit and perhaps of establishing the depth to basement. However, drilling ahead to 6351 meters and another attempt to pull the center bit were unsuccessful, neither dislodging the center bit nor establishing basement, so at 1845 on 25 September it was decided to abandon Hole 195A.

The drilling procedure employed at Hole 195A appeared to produce better hole conditions, and despite the disappointment at the inability of extracting the center bit, prospects otherwise looked better for drilling to depth in this area than before this attempt. It was decided to come to the surface to replace the bit, inspect the latch and repair it if necessary, put in an offset, and drill Hole 195B at the same location.

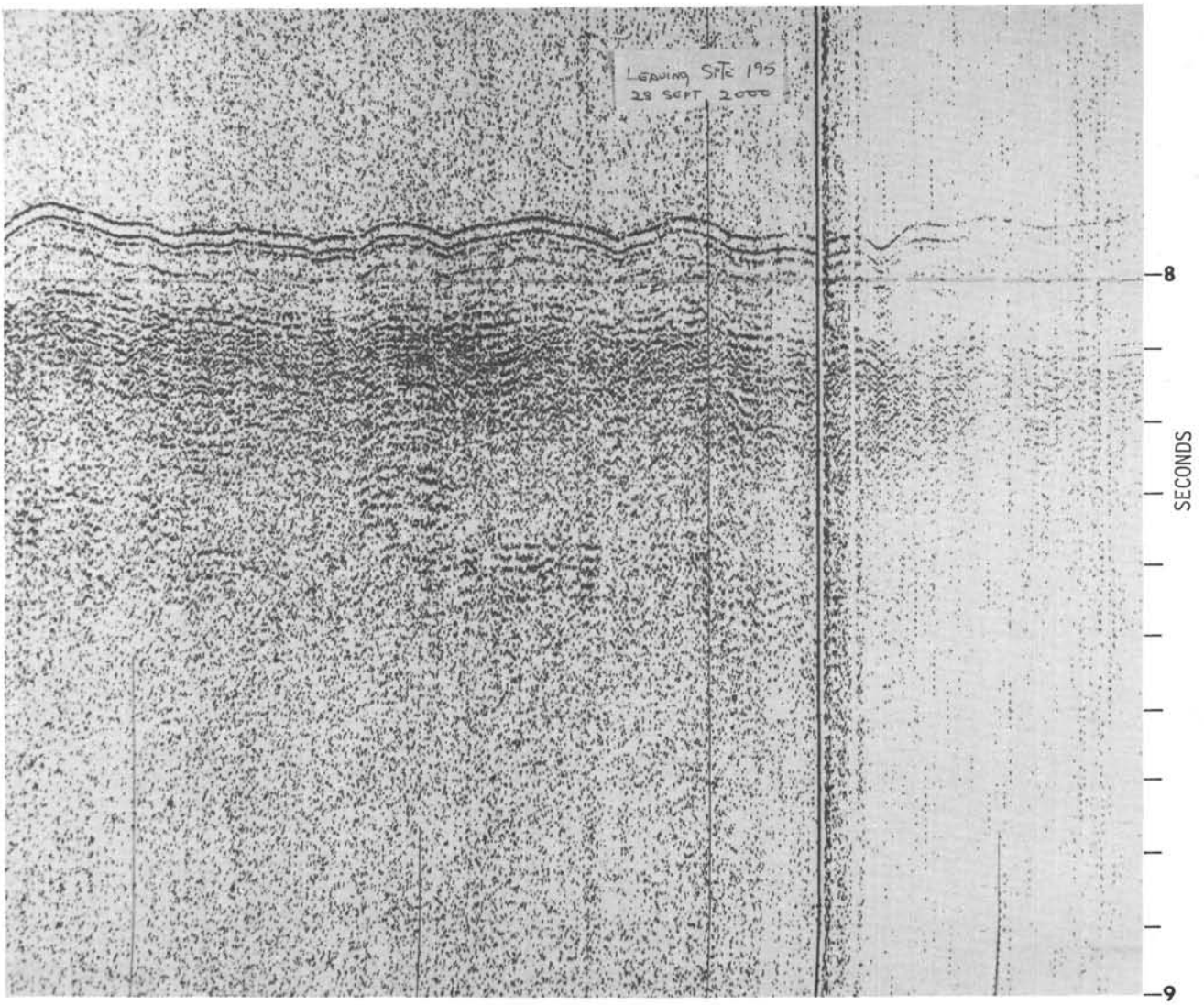

Figure 4. Glomar Challenger *seismic profile across Site 195 on departing site.*

The mud line was reached at 2215 on 26 September 1971 and Hole 195B spudded in. The hole was drilled with a four-cone roller bit. The three-cone bit used for Holes 195 and 195A was well worn when recovered, with a quarter of the inserts missing. The hole was drilled to 6325 meters before the center bit was retrieved for coring. Only about 1 meter of fill was found as each successive joint was added. However, after the center bit was retrieved, 10 meters of fill were found in the hole. Then it was found that the string could not be raised, so for about 1 hour the string was rotated and pulled up until it broke loose. After pumping more mud, it was considered opportune to drop the core barrel in anticipation of coring the interval below 6325 meters. Core 1 (6325.5-6335 meters, see Table 2) consisted of several lumps of chalk and several large pieces of chert. Core 2 (6335-6339 meters) was cut immediately below Core 1 with very little circulation and maximum weight. The bumper subs were kept closed. Recovery in Core 2 consisted of a few chips of chert. Core 3 (6357-6360 meters) was cut after drilling down one joint with the core barrel in place. Although only 1 meter was recovered, it consisted of cored chalk, chert, and limestone and not chips as was the case of all previous cores attempted at depths below the upper transparent layer. While recovering the core barrel, the string stuck in the hole, and only after 3 hours of pulling at high loads up to 575,000 pounds did the string become free about 100 meters above the bottom of the hole. This was the fourth hole in the area; three of these had been abandoned because of bad hole conditions which stuck the string despite the use of unusually large quantities of mud. However, basement had not been reached, and we still could not make a positive statement about the age and composition of basement (or layer b) in the area. It was decided to abandon Site 195 and move to a new site in the northwest Pacific where our general objectives could be pursued under somewhat different and hopefully improved conditions.

NATURE OF THE SEDIMENTS

Seven cores were recovered out of eight attempts in three holes at Site 195—four cores out of five attempts in Hole 195 and three cores out of three attempts in Hole

TABLE 1
Coring Summary, Hole 195

Core	Date (Sep)	Time	Subbottom Depth (m) Top	Subbottom Depth (m) Bottom	Total Depth (m) Top	Total Depth (m) Bottom	Cored (m)	Recovered	Age	Lithology	Paleontology
1	23	1230	63	73.0	6031	6040.5	9.5	8.5 m	Quaternary	Mottled silty clay with rads and ash	Radiolaria
2	23	1600	120	129.5	6088	6097.5	9.5	5.0 m	Late Miocene	Brown clay	Radiolaria
3	23	2300	190	196.0	6164	6170.0	6.0	0.5 m	Valang-E. Haut.	Chert, limestone	Radiolaria
4	24	0620	272	278.0	6240	6246.0	6.0	Center bit	Valanginian-E. Hauterivian	Chert, limestone	Nannoplankton
5	24	1200	310	310.0	6278	6278.0	0	Center bit	Valanginian-E. Hauterivian	Limestone chips	Nannoplankton

Note: Mud line is at 5968 meters.

TABLE 2
Coring Summary, Hole 195B

Core	Date (Oct)	Time	Subbottom Depth (m) Top	Subbottom Depth (m) Bottom	Total Depth (m) Top	Total Depth (m) Bottom	Cored (m)	Recovered	Age	Lithology	Paleontology
1	27	1820	357.5	367.0	6325.5	6335.0	9.5	CC	Valanginian-E. Hauterivian	Chert, chalk	
2	27	2110	367.0	371.0	6335.0	6339.0	4.0	CC	Valanginian-E. Hauterivian	Chert	
3	28	0100	389.0	392.0	6357.0	6360.0	3.0	1 m	Valanginian-E. Hauterivian	Chert, chalk, limestone	

Note: Mud line is at 5968 meters.

195B. An unrecoverable center bit prevented coring in Hole 195A, which had been drilled into the opaque layer.

Two major lithologic units were sampled; an upper unit, approximately 170 meters thick, of noncalcareous, diatomaceous, ash-rich clays of late Tertiary age, and a lower unit of interbedded early Hauterivian to Valanginian chalks, marls, and chert. An unconformity, or a very condensed sequence, must be present between the late Miocene of Core 195-2 and the Cretaceous of Core 195-3 (Figure 5).

Recovery in the upper clays was moderate to good, although coring disturbance was severe. No primary sedimentary structures were preserved. Recovery in the chalk-marl-chert sequence was very poor. Except for the last core taken (3B), only core-catcher samples, comprising fragments of chert with adherent or intercalated chalks, were obtained. As a result of the high pumping pressures to drill the chert and keep the hole clear, it is likely that the relatively high proportion of chert recovered was not representative of its abundance in the sedimentary column at Site 195. The sequence most probably consists of chalks and marls such as those recovered in Core 3B, with relatively thin beds, lenses, or nodules of chert. Supporting evidence is provided by the recovery of early Hauterivian to Valanginian nannofossils in center-bit samples between Cores 3 and 4 and between Cores 4 and 5, and also in the bit samples of Holes 195A and 195B. Since acoustic basement was not reached at this site, the total thickness of the chalk-chert sequence has not been determined. Correlation of the drilled section, acoustic stratigraphy, and drilling rates at Site 195 is shown in Figure 6.

Cores 195-1 (63-73 meters) and 195-2 (120-129.5 meters)

Both cores contain diatomaceous, ash-rich, noncalcareous clays and silty clays of transitional Plio/Pleistocene (195-1) and latest mid-Miocene (195-2) age. The clays are olive brown to yellowish brown in color and are mottled throughout with darker brown silty clays which contain manganese micronodules in concentrations up to 5% or 10% which is considerably higher than in the remainder of the clays. The rate of accumulation (roughly 20 m/m.y.) is rather high for abyssal, noncalcareous clays, suggesting terrigenous influences.

Diatoms are the most significant microfossils in these clays, their abundance reaching up to 25%. Silicoflagellates are common in Core 195-1; Radiolaria are relatively scarce throughout.

Cores 195-3 (190-196 meters), 195-4 (272-278 meters), 195B-1 (357.5-365 meters), 195B-2 (367-371 meters), 195B-3 (389-392 meters)

These cores sampled early Hauterivian to Valanginian chert, marl, and chalk. Most of the chert is brown in color, although light gray to black chert was also present in Cores

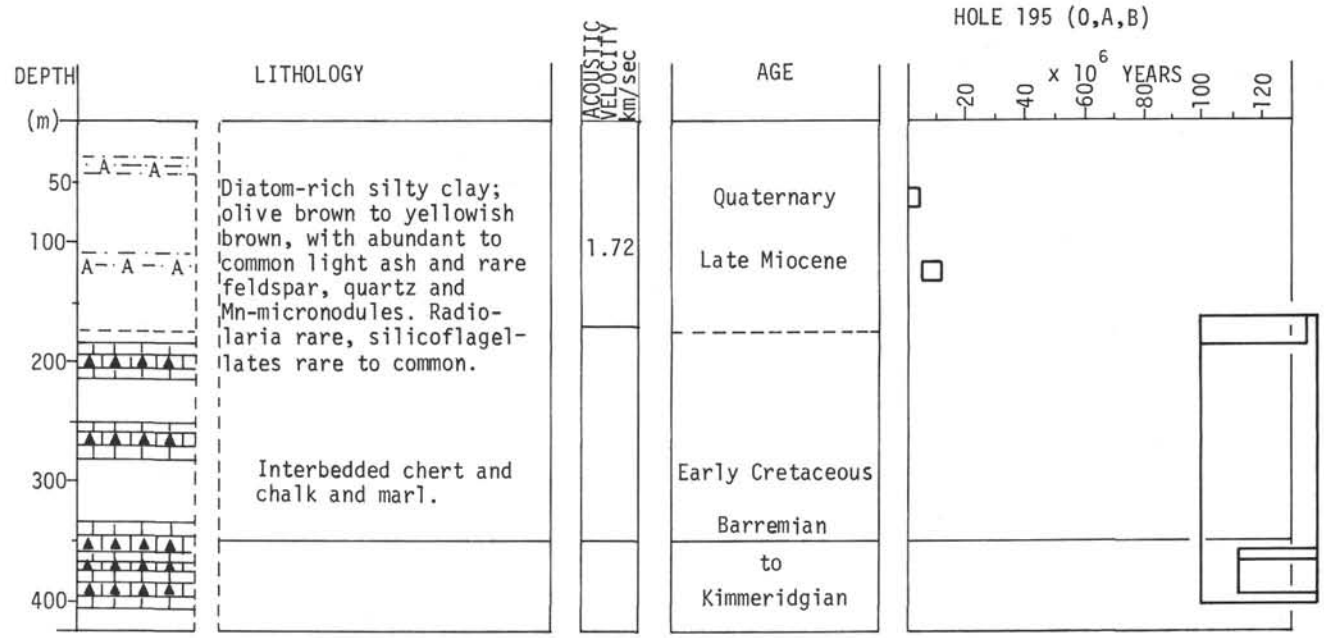

Figure 5. *Generalized stratigraphy of Site 195.*

3 and 3B. Except Core 195B-3, practically all the chert was recovered as sand to pebble-size fragments, showing typical conchoidal fracture.

Chalk and chert are intimately associated in the samples recovered, the chalk often occurring in lenses or laminae in the cherts. Cores 4, 1B, and 2B recovered both chert and chalk fragments, and in Core 1B partly silicified chalk is in contact with chert.

The chalks consist mainly of lutitic calcite, and a subordinate (usually not more than 10% or 15%) amount of

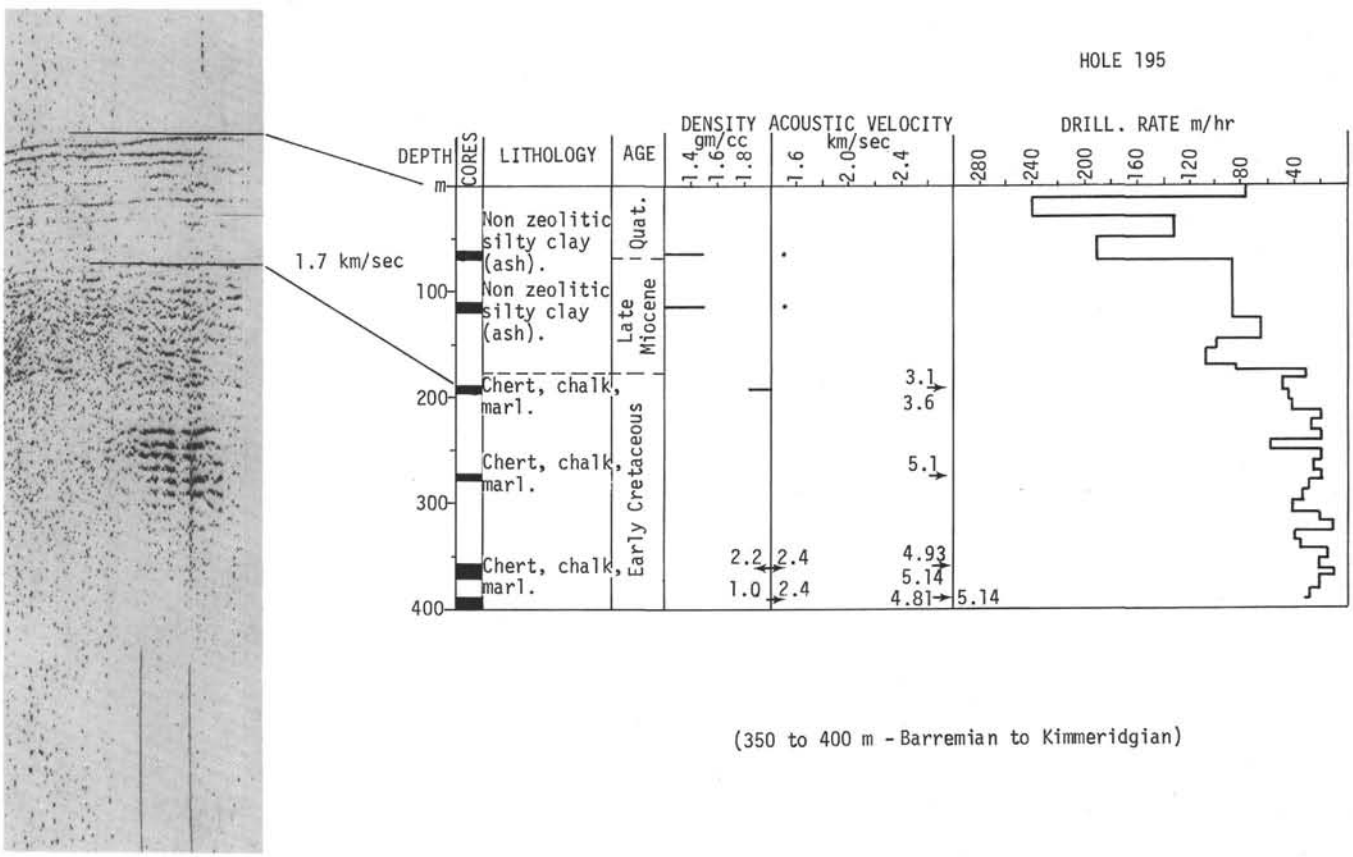

Figure 6. *Correlation of drilled record at Site 195 with seismic reflection profile.*

recognizable calcareous nannofossils. The only other fossils present are Radiolaria. Except for higher clay content, the marls are similar in composition to the chalks. In addition, in Core 3B, they contain the only foraminifera recovered at Site 195. They also display trace fossils of the chondrites type.

BIOSTRATIGRAPHIC SUMMARY

Radiolarians, silicoflagellates, diatoms, nannofossils, and foraminifera were recovered from this site.

Cenozoic Sediments

In Hole 195 only siliceous fossils were recovered from sediments of Cenozoic age. Radiolaria are well preserved in Core 1 (63-72.5 meters below the sediment surface) and Core 2 (120-129.5 meters below the sediment surface). They are common in Core 1 and the first section of Core 2 and rare in the remaining sections of Core 2. Silicoflagellates are common and well preserved only in Core 1. Diatoms are few and well preserved in both Cores 1 and 2.

Based on Hays' (1970) zonation for Radiolaria in the north Pacific, the presence of *Lamprocyrtis heteroporos* throughout Core 1 and rare *Eucyrtidium matuyami* in the first two sections suggests that the lower part of the core is Pliocene and the upper part transitional between the Pliocene and Pleistocene. The zonation of Riedel and Sanfilippo (1970) and the species ranges of Riedel and Sanfilippo (1971) for the equatorial Pacific tend to confirm this conclusion. *Pterocanium prismatium* is rare throughout the core and *Spongaster tetras tetras*, while never common, increases in frequency toward the top of the core, suggesting again a transition from the Pliocene to the Quaternary. The presence of fairly frequent *Ommatartus avitus*, in Section 6 only, is anomalous.

Core 2 is below the range of the zonation established for the north Pacific, and the age assignment is based on the zonation established for the equatorial Pacific. The presence of a few *Stichocorys peregrina*, together with rare *Stichocorys delmontense*, suggests a late Miocene age (*Stichocorys peregrina* Zone) slightly older than Core 194-2.

Mesozoic Sediments

Radiolaria were recovered from all the core-catcher and bit samples of Mesozoic age at this site and nannofossils from Hole 195 center bits 4 and 5, 195A center bit 1, and all 195B core catchers. Foraminifera were recovered only from Core 195B-3.

Radiolaria

Five chert samples were examined from Sample 195-3, CC (190-196 meters below the sediment surface). Radiolaria ranged from common and moderately well preserved to few and poorly preserved. All the samples contained some elements of a similar fauna, although not all of the distinctive species noted were present in all the samples. One distinctive form, *Dictyomitra somphedia*, present in three of the samples examined, is described in a separate chapter on Radiolaria elsewhere in this report, and other distinctive forms are illustrated. A number of these forms are apparently closely related to known but as yet undescribed Late Cretaceous forms, and it is on that basis that this sample is considered to be Late Cretaceous in age. One sample of gray chert contained very rare specimens of four Early Cretaceous forms, *Acaeniotyle bilumaria, A. tribulosa, Dictyomitra* (?) *lacrimula*, and *Sphaerostylus lanceola* group. Because they appear in only one of the five samples prepared, they are considered to be contaminants.

From Sample 195-4, CC (272-278 meters below the sediment surface) two chert samples were examined, a dark reddish brown chert which contains only a few very poor Radiolaria and a sample of pink chert with common poor Radiolaria. The fauna is considered to belong to the *Acaeniotyle tribulosa* assemblage. As the sample is dated Valanginian to early Hauterivian on the basis of nannofossils, it is possible to consider its age as near the top of this range.

The center-bit sample before attempting Core 5, which may contain sediments from 278-310 meters below the sediment surface, has a few moderate to very poorly preserved Radiolaria; the variability in the preservation suggests mixing. Besides the presence of many of the forms recognized in Sample 195-4, CC, numerous forms present in the older samples from Hole 196 are also present, and the sample is considered to be near the top of the *Sethocapsa trachyostraca* assemblage range, Valanginian to early Hauterivian according to nannofossils.

No core was recovered from Hole 195A. Two samples were examined: one from the center bit before Core 1 was attempted and the other scrapings from the drill bit at a total depth of 6351 meters (383 meters below the sediment surface). The center bit contained rare moderate to poorly preserved Radiolaria, probably mixed, and probably Cretaceous in age. The bit sample contained a few well-preserved Quaternary and Neogene Radiolaria obviously the result of downhole contamination, and a few Early Cretaceous Radiolaria, *Syringocapsa limatum, Sethocapsa trachyostraca*, and *Sethocapsa leiostraca*, and is considered to be near the base of the *Sethocapsa trachyostraca* assemblage range, Valanginian to early Hauterivian age according to nannofossils. No Paleogene Radiolaria were observed among the contaminants.

From Hole 195B, Cores 1 and 2 (at depths of 357.5-367 meters and 367-371 meters below the sediment surface, respectively) had recovery of core-catcher samples only. The presence of only one specimen of *Staurosphaera septemporata*, together with the presence of *Sethocapsa trachyostraca, Syringocapsa limatum, Dictyomitra cosmoconica*, and small forms of the *Sphaerostylus lanceola* group indicates the samples are near the bottom of the *Sethocapsa trachyostraca* assemblage range and suggests that these two samples are intermediate in age between Core 196-4 (Valanginian to early Hauterivian on the basis of nannofossils) and Sample 196-5, CC (Early Cretaceous-?Late Jurrasic). According to nannofossils the maximum age is Valanginian.

Only a few very poor indeterminate Radiolaria, among them pyritized members of the *Sphaerostylus lanceola* group, were recovered from the core catcher of Core 3 at a total depth of 6360 meters (389-392 meters below the sediment surface), and no age determination can be made.

Thus at Hole 195 two distinct Early Cretaceous radiolarian faunas can be recognized: in Core 195-4 a fauna belonging to the *Acaeniotyle tribulosa* assemblage and in

Cores 195A-1 bit sample, 195B-1, and 195B-2 a fauna belonging to the *Sethocapsa trachyostraca* assemblage.

Nannofossils

Nannofossils were recovered from the center bit of Cores 195-4, 195-5, 195A-1, and the core catcher of 195B-1, 195B-2, and 195B-3. The nannofossil assemblages are comparatively poor, showing fair to strong overcalcification. While the Early Cretaceous Radiolaria could be divided into two assemblages, no biostratigraphic differentiation could be determined among the nannofossils. Stratigraphically significant species which occur throughout and which restrict the age from Valanginian to early Hauterivian according to Thierstein (1971) are *Cretarhabdus crenulatus* (sensu Thierstein), *Markalius circumradiatus,* and *Cruciellipsis cuvillieri.*

Foraminifera

Assemblages of deep-water calcareous and agglutinated benthonic foraminifera were recovered from Core 195B-3 only. They consist of relatively various species of *Lenticulina, Dentalina, Lagena, Nodosaria, Ramulina, Lingulina, Frondicularia, Pseudonodosaria, Spirillina, Dorothia,* etc., including such indicative species as *Lenticulina kugleri, L. munsteri, L. crassa, Frondicularia hastata, Spirillina neocomiana, Dorothia praeoxycona, D. ouachensis,* etc. These assemblages are practically the same as those from the upper Hauterivian-lower Barremian limestones penetrated by Holes 49 and 50 on the western flank of the Shatsky Rise. This age determination stands close to data of nannoplankton (Valanginian to early Hauterivian). A certain difference is connected apparently with our limited knowledge of stratigraphic distribution of foraminiferal and nannoplankton species in the earliest Cretaceous sediments of the Pacific Ocean.

Biogenic components found in Site 195 cores are as follows:

Core 1:

Foraminifera: none.
Nannofossils: none.
Radiolaria: The presence of *Lamprocyrtis heteroporos* throughout and rare *Eucyrtidium matuyami* in Sections 1 and 2 suggest the lower part of the core is Pliocene and the upper part transitional between the Pliocene and Pleistocene. Also present throughout are rare tropical forms, *Pterocanium prismatium* and *Spongaster tetras tetras.*

Core 2:

Foraminifera: none.
Nannofossils: none.
Radiolaria: The presence of a few *Stichocorys peregrina,* together with rare *S. delmontense,* indicate a late Miocene age (*Stichocorys peregrina* Zone).

Core 3:

Foraminifera: none.
Nannofossils: none.
Radiolaria: In the chert of the core catcher: *Dictyomitra somphedia,* saturnalin rings with branched spines and undescribed forms similar to undescribed forms known from the Late Cretaceous.

Core 4:

Foraminifera: none.
Nannofossils: Only scraps of chalky sediment from the center bit contain nannofossils. Stratigraphically important species are *Cruciellipsis cuvillieri, Markalius circumradiatus* of Valanginian to early Hauterivian age. The moderately preserved, abundant nannofossils also include *Parhabdolithus embergeri, Lithraphidites carniotensis, Apertapetra gronosa, Stephanolithion laffittei,* and *Watznaueria barnesae.*
Radiolaria: In the chert of the core catcher: *Dictyomitra* (?) *lacrimula* and *D. leptoconica* together with the absence of *Sethocapsa trachyostraca* and *Staurosphaera septemporata* indicate the *Acaeniotyle tribulosa* assemblage.

Core 5:

Foraminifera: none.
Nannofossils: Only scraps of chalky sediment from the center bit contains nannofossils. Stratigraphically important species are *"Cretarhabdus crenulatus"* (sensu Thierstein), *Cruciellipsis cuvillieri,* and *Markalius circumradiatus* of Valanginian to early Hauterivian age.
Radiolaria: A sample from the centerbit before Core 5 was attempted yielded *Sethocapsa trachyostraca, Staurosphaera septemporata, Dictyomitra* (?) *lacrimula, Syringocapsa agolarium,* and *Dibolachras tytthopora,* indicating the *Sethocapsa trachyostraca* assemblage.

Core 1A:

Foraminifera: none.
Nannofossils: Only scraps of chalky sediment from the center bit contains nannofossils. Stratigraphically important species are *Cruciellipsis cuvillieri* and *Markalius circumradiatus* of Valanginian to early Hauterivian age.
Radiolaria: Scrapings from the drill-bit contained Quaternary and Neogene Radiolaria, the result of downhole contamination. Early Cretaceous Radiolaria present are: *Dictyomitra leptoconica* and common *Syringocapsa limatum* and *Sethocapsa trachyostraca,* indicating the early part of the *Sethocapsa trachyostraca* assemblage.

Core 1B:

Foraminifera: none.
Nannofossils: Stratigraphically important is only *Markalius circumradiatus,* indicating a Valanginian maximum age. The rather poorly preserved, assemblage contains also *Diazomatolithus lehmani, Parhabdolithus embergeri,* and *Watznaueria barnesae.*
Radiolaria: The presence of *Dictyomitra cosmoconica* together with the absence of *Sethocapsa cetia* and *Syringocapsa agolarium* indicate the lower part of the *Sethocapsa trachyostraca* assemblage intermediate in age between Cores 195-4 and 195-5.

Core 2B:

Foraminifera: none.
Nannofossils: Stratigraphically important species are *"Cretarhabdus crenulatus"* (sensu Thierstein), *Cruciellipsis*

cuvillieri, and *Markalius circumradiatus* of Valanginian to early Hauterivian age.

Radiolaria: The presence of *Dictyomitra cosmoconica, Sethocapsa leiostraca,* and *Sethocapsa trachyostraca,* together with the absence of *Sethocapsa cetia* and *Syringocapsa agolarium* indicate the lower part of the *Sethocapsa trachyostraca* assemblage.

Core 3B:

Foraminifera: Not numerous but relatively diverse calcareous and agglutinated foraminifera: *Lenticulina kugleri, L. munsteri, L. crassa, L. subulata, Frondicularia hastata, Lingulina praelonga, Spirillina neocomiana, Dorothia praeoxycona, D. zedlerae, D. ouachensis, D.* aff. *hauteriviana,* etc. Upper Hauterivian to lower Barremian.

Nannofossils: Stratigraphically important species are *"Cretarhabdus crenulatus"* (sensu Thierstein), *Cruciellipsis curvillieri,* and *Markalius circumradiatus* of Valanginian to early Hauterivian age.

Radiolaria: Only rare poor, indeterminate Radiolaria, among them pyritized members of the *Sphaerostylus lanceola* group.

PHYSICAL PROPERTIES

Measurements of bulk density and sonic velocity on Site 195 samples are shown in Figure 7.

Bulk densities were measured using the GRAPE, syringe, and water displacement methods, as applicable. Two syringe samples were taken from adjacent positions in each barrel as a check on consistency. Syringe density determinations fall within the range of GRAPE densities, although somewhat higher than the mean. This may be explained by the disturbed nature of the material in the core, which probably has different properties at the edges and center.

Because recovery was so poor, it is impossible to give any accurate report of trends with depth. The overall density of the lower 200 meters obviously depends on the proportion of the softer matrix in which the chert is imbedded, and on this subject there is almost no information.

In the acoustic velocity measurements, the sediment in the upper 150 meters shows very low velocity, not significantly higher than that of seawater, although the velocity in the sediments could have been changed by disturbance due to drilling. A few samples of chert and limestone showed acoustic orthotropicity, in which the velocity in the bedding plane was always slightly higher than that across it. The cherts sampled had a wide range of acoustic velocities, from 3.11 to 5.14 km/sec.

The limestones sampled show a significant decrease in sonic velocity between 360 and 390 meters, and although there are only three data points, it is at least possible to speculate that this change is related to the interface between the opaque and lower transparent section of the profiler record.

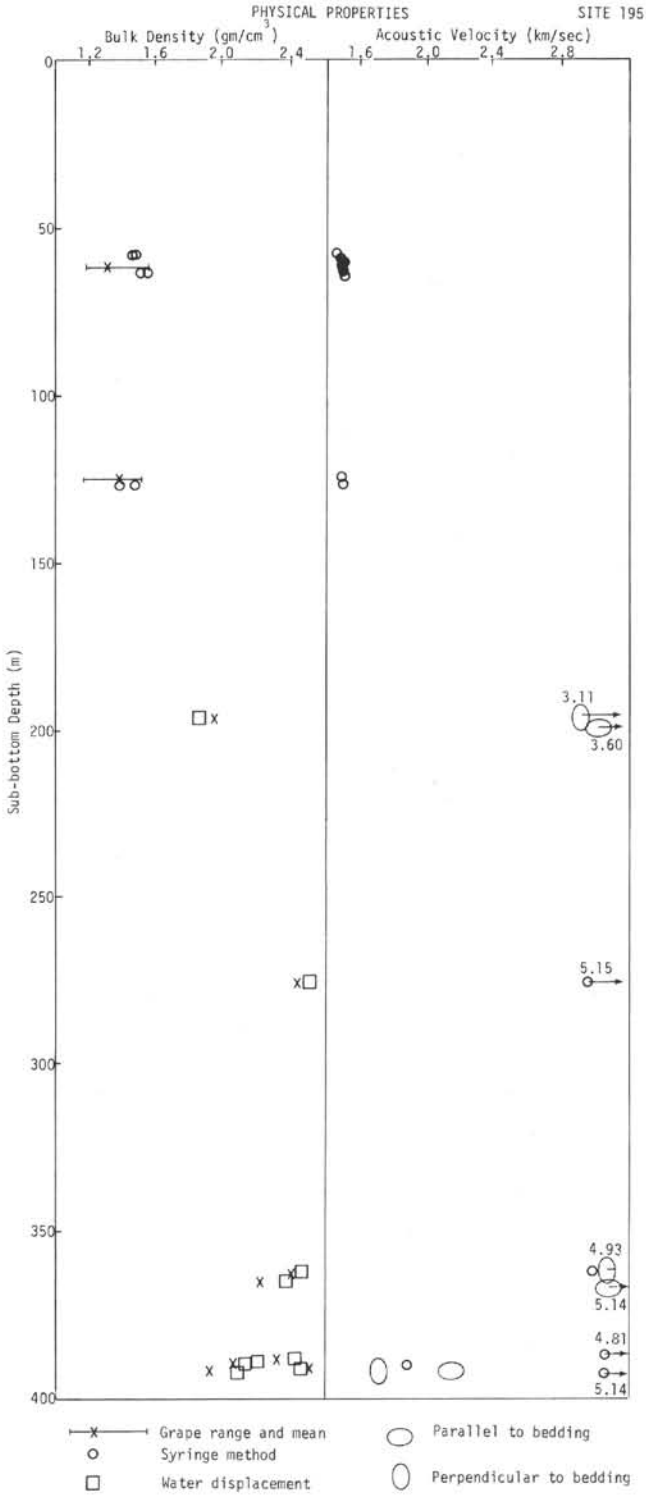

Figure 7. *Measured values of bulk density and compressional sonic velocity vs. depth below sea floor at Site 195.*

CONCLUSIONS

The late Miocene to Quaternary wedge of ashy clays reaches a thickness of approximately 150 meters at this site, which now lies over 800 km from probable sources in the Japan-Bonin Arc.

The clays of this modern blanket can be distinguished from the underlying more slowly deposited early Tertiary clays by the virtual absence of zeolites. The chert barrier corresponds to the top of the acoustic opaque layer and is found in Mid-Cretaceous sediments. The opaque layer and the lower transparent layer cannot be distinguished at this location on the basis of the lithology of core samples or in the drilling rates.

Acoustic basement was not reached. If it is volcanogenic oceanic crust, the age of crust in this area could not be much older than Late Jurassic, since the chalk sequence in which the hole bottomed can be assumed to have been deposited at a normal rate of approximately 10 m/m.y. and thus could not be more than about 10 m.y. younger than the age at total depth. However, there is no evidence that the rather smooth "acoustic basement" in this area is igneous other than the fact that similar-looking reflections have been found to be basement in areas of younger crust. It seems, however, a safe working hypothesis that the basement age at Site 195 is Upper Jurassic.

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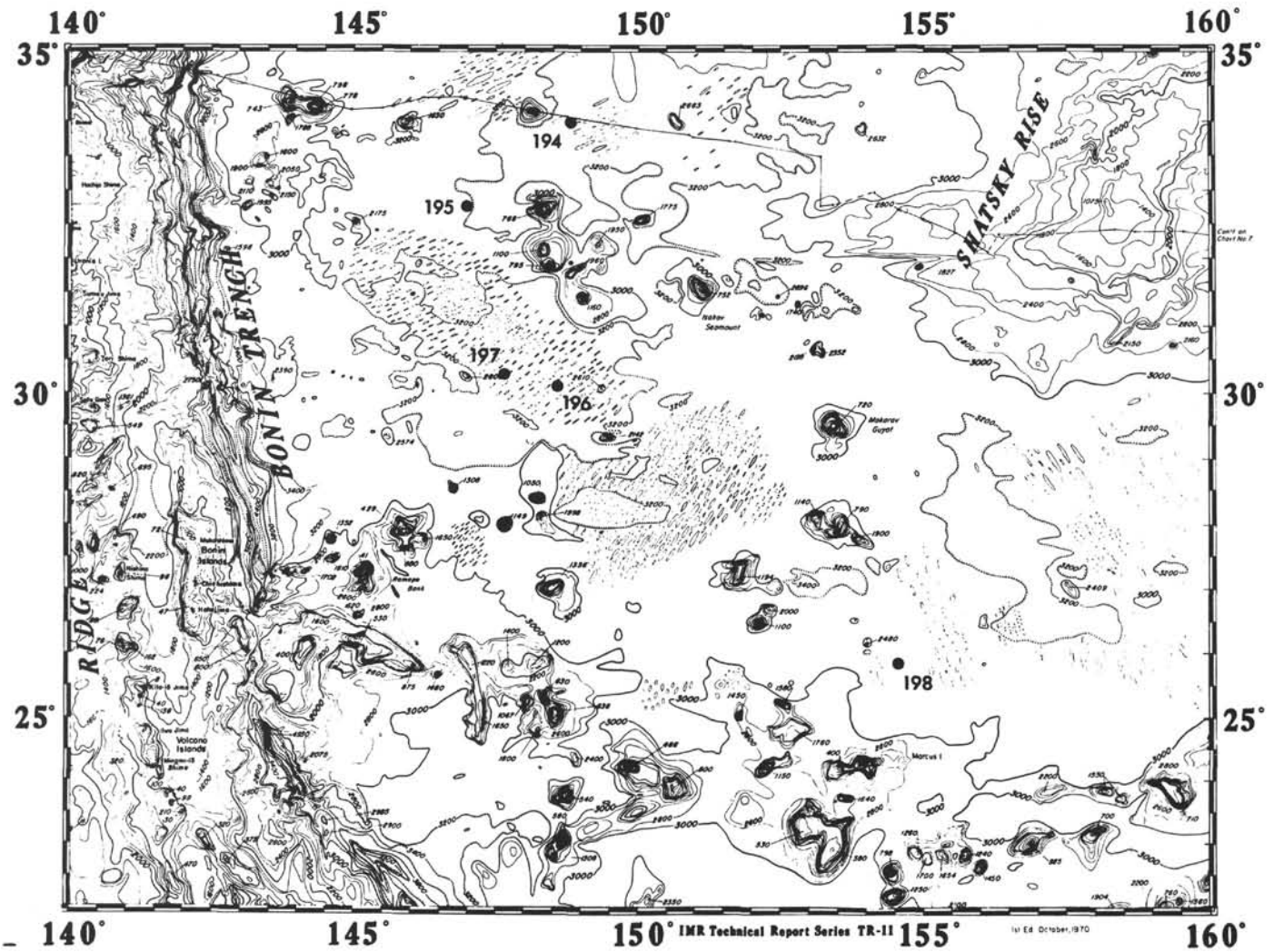
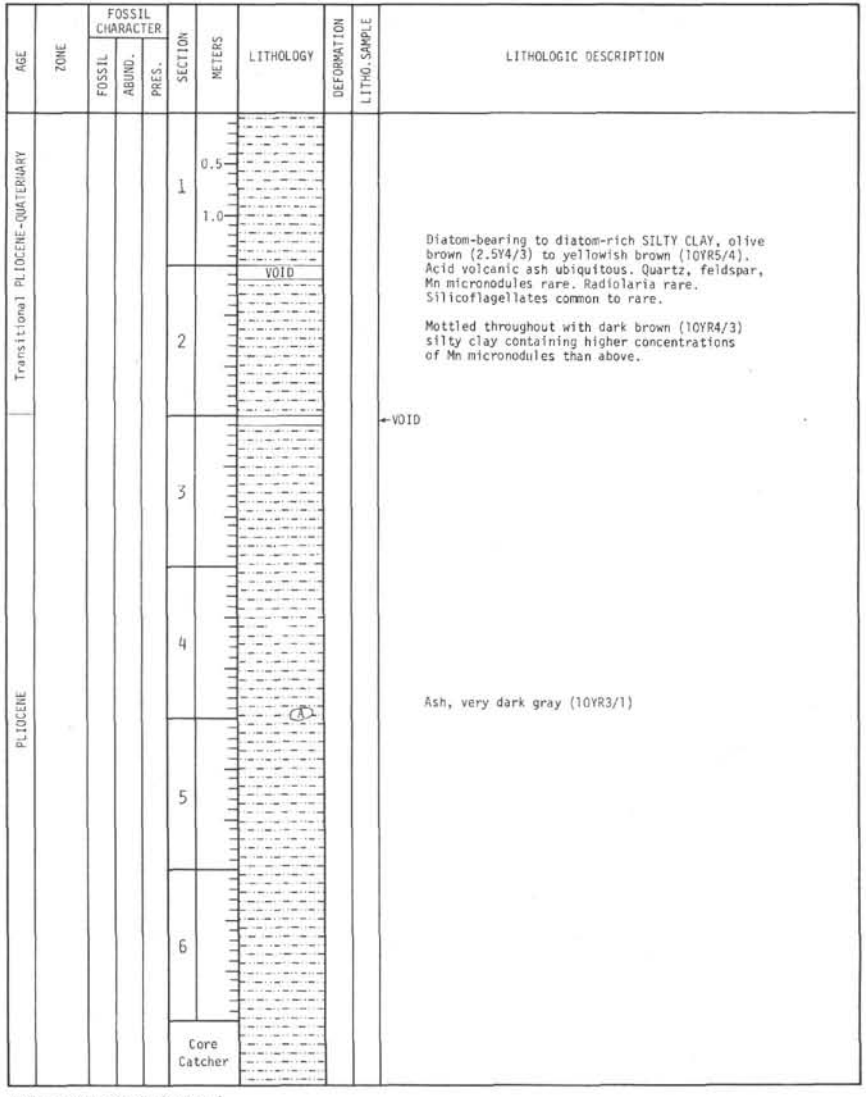


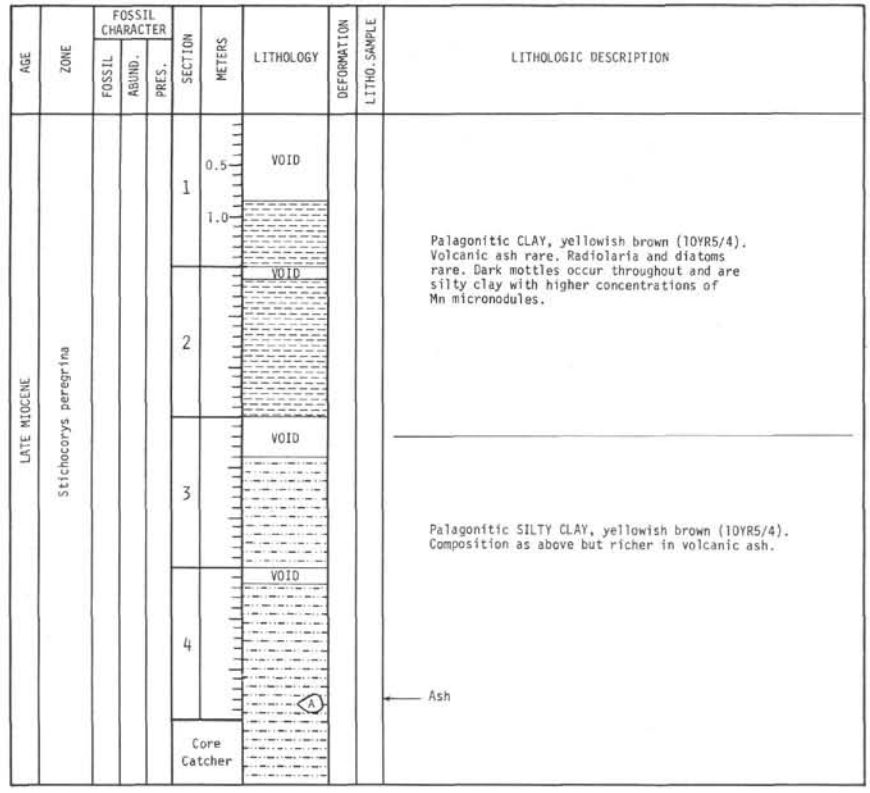
Figure 8. *Bathymetric chart of northwest Pacific showing location of DSDP Sites 194-198 (isobaths in tau from T. E. Chase et al).*

Site 195 Hole Core 1 Cored Interval: 63-72.5 m

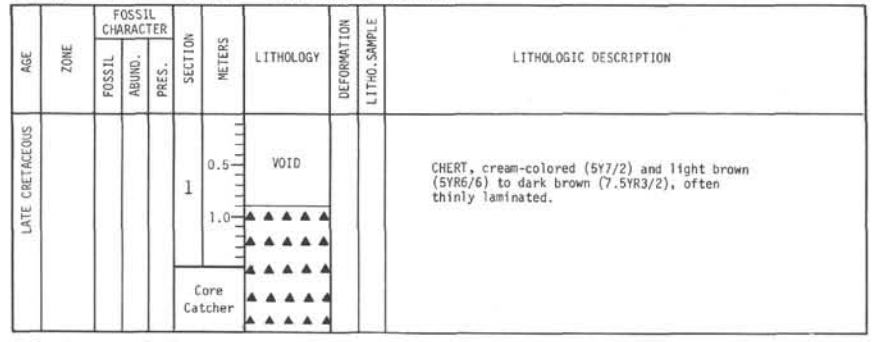


Explanatory notes in Chapter 1

Site 195 Hole Core 2 Cored Interval: 120-129.5 m



Site 195 Hole Core 3 Cored Interval: 186-202 m



Explanatory notes in Chapter 1

Site 195 Hole Core 4 Cored Interval: 272-278 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	FOSSIL CHARACTER: ABUND.	FOSSIL CHARACTER: PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
VALANG.-E. HAUTERIV.	*				Core Catcher					CHERT, moderate reddish brown (10R4/6) to moderate yellowish brown (10YR5/4).

Explanatory notes in Chapter 1 *Acaeniotyle tribulosa assemblage

Site 195 Hole Core 5 Cored Interval:

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	FOSSIL CHARACTER: ABUND.	FOSSIL CHARACTER: PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					Core Catcher					NO RECOVERY

Explanatory notes in Chapter 1

Site 195 Hole B Core 1 Cored Interval: 357.5-367 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	FOSSIL CHARACTER: ABUND.	FOSSIL CHARACTER: PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
VALANG.-E. HAUTERIV.	*				Core Catcher					CHERT, moderate reddish brown (10R4/6), laminated; with interbeds of hard, grayish pink (5R8/2) to very light gray (N8) CHALK, which contains ~5% nannofossils and 95% nannocalcite.

Explanatory notes in Chapter 1 *Sethocapsa trachyostraca assemblage

Site 195 Hole B Core 2 Cored Interval: 367-371 m

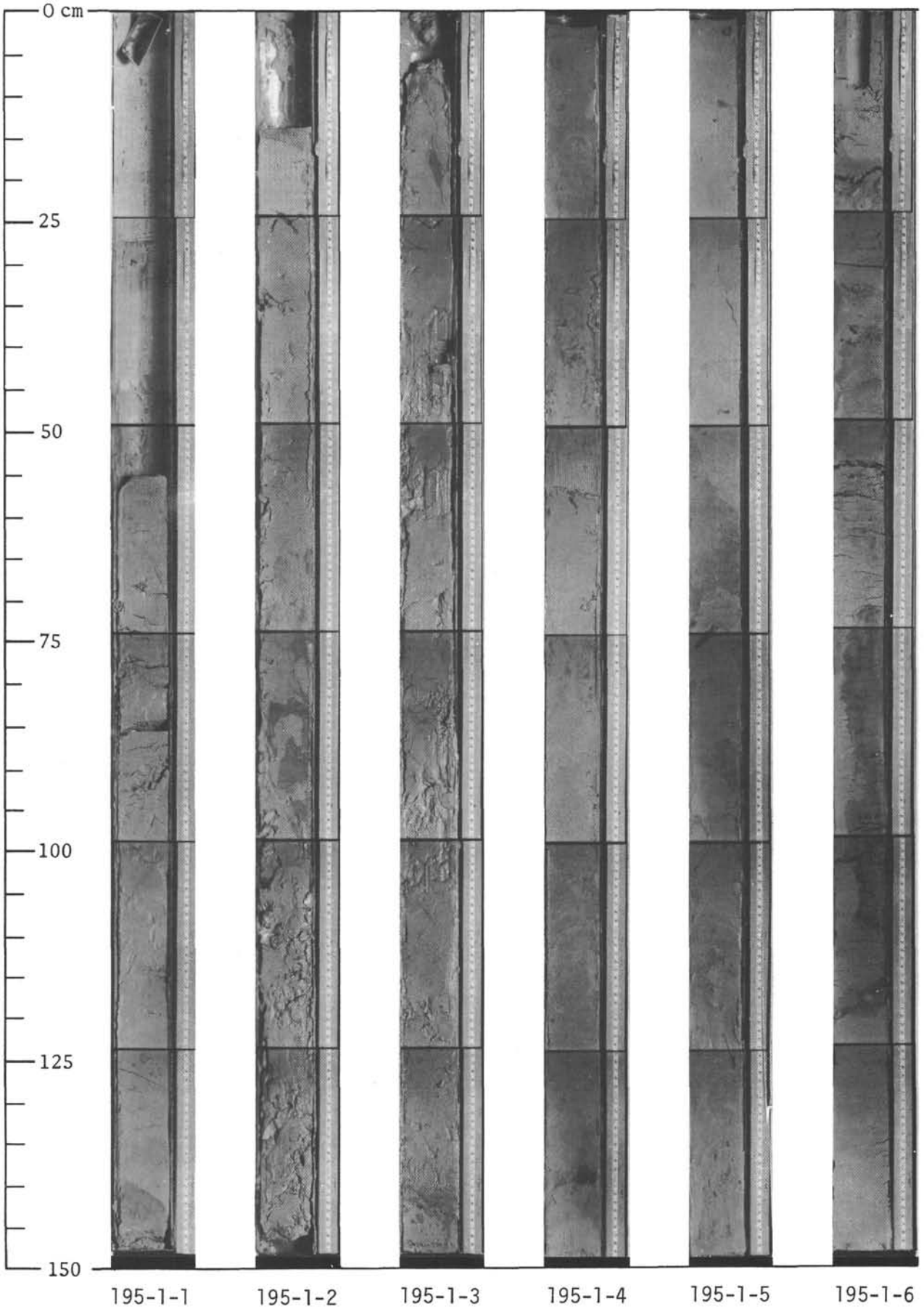
AGE	ZONE	FOSSIL CHARACTER: FOSSIL	FOSSIL CHARACTER: ABUND.	FOSSIL CHARACTER: PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
VALANG.-E. HAUTERIV.	*				Core Catcher					CHERT, moderate brown (5YR4/4) to grayish brown (5YR3/2), and intercalated white (N9) to bluish white (5B9/1), dense, CHALK.

Explanatory notes in Chapter 1 *Sethocapsa trachyostraca assemblage

Site 195 Hole B Core 3 Cored Interval: 389-392 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	FOSSIL CHARACTER: ABUND.	FOSSIL CHARACTER: PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
VALANG.-E. HAUTERIV.					1	0.5 1.0				Interbedded CHERT in various shades of brown and light gray to black, CHALK, light gray, and MARL, gray to greenish-gray. Chalk and marl contain abundant calcareous nannofossils and clay to fine silt-size calcite. CC-fragments of above
					Core Catcher					

Explanatory notes in Chapter 1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125
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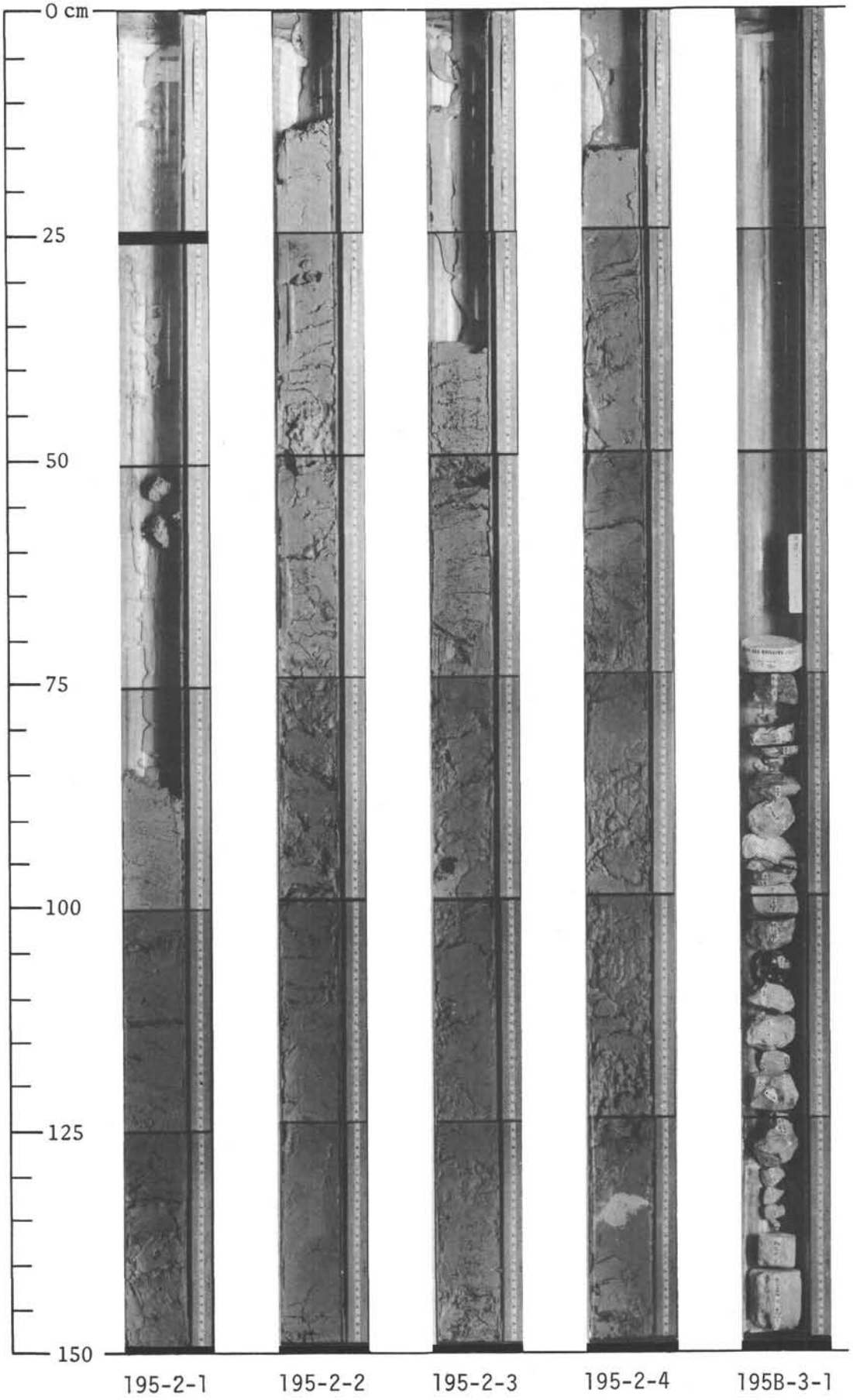
195-1-2
195-1-3
195-1-4
195-1-5
195-1-6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195-2-2
195-2-3
195-2-4
195B-3-1