5. SITE 205

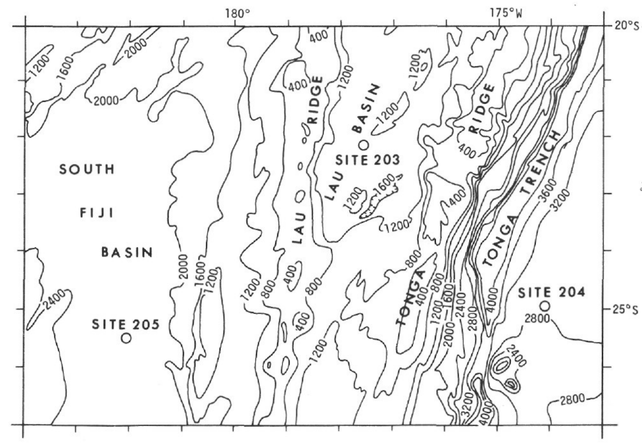
The Shipboard Scientific Party[1]

Location: South Fiji Basin

Position: 25°30.99′S, 177°53.95′E

Water Depth: 4320 meters

Total Penetration: 355 meters



Contour interval 400 fathoms. (After Mammerickx, Chase, Smith, and Taylor, 1971. Bathymetry of the South Pacific, Charts 11 and 12: Scripps Institution of Oceanography, California.)

Summary: Since late Miocene there has been a slow accumulation of abyssal brown clay. Nannofossil ooze with relatively high concentrations of volcanic debris was accumulated through the late Miocene following a brief nonaccumulation period in the early Miocene. Below this unconformity is nannofossil ooze which was accumulated in relatively deep water beginning by the late Oligocene. The hole bottomed in an extrusive basaltic pillow lava.

BACKGROUND AND OBJECTIVES

General

Site 105 is located just west of the break in slope between the western flank of the Lau Ridge and the central South Fiji Basin. The site was one of two possible locations proposed principally on the basis of data available from R/V *Conrad*. The objectives of these holes were to obtain information on the age of formation of the South Fiji Basin and to provide a middle-low latitude biostratigraphic sequence from this area of the southwest Pacific. Because of the constraint of available time, a final selection of only one site was made, selecting the alternate which appeared more representative of regional conditions. This was the second of the series to be drilled on Leg 21 in several of the marginal basins in this region of the southwest Pacific.

Review by the JOIDES Panel on Pollution Prevention and Safety indicated that the site and drilling program were satisfactory with continuous coring, moderate drilling precautions, and standard abandonment procedures.

Site Survey

The survey for Site 205 was conducted in August 1971 by the R/V *Kana Keoki*. The site is located just west of the break in slope between the Lau Ridge and the relatively flat floor of the South Fiji Basin (Figure 1). The ridge slope is overlain by approximately 0.5 sec of reflectively stratified sediments which are generally conformable with the structure of the acoustic basement. At the base of the slope in water depths of 4000 to 4300 meters, the basement rises to form a series of basement hills with relatively thin sediment cover. These hills appear to be elongated in the north-south direction, parallel to the trend of the Lau Ridge. The ridge sediments become more acoustically transparent over these hills suggesting disturbance and possibly emplacement of the hills after some sediment had

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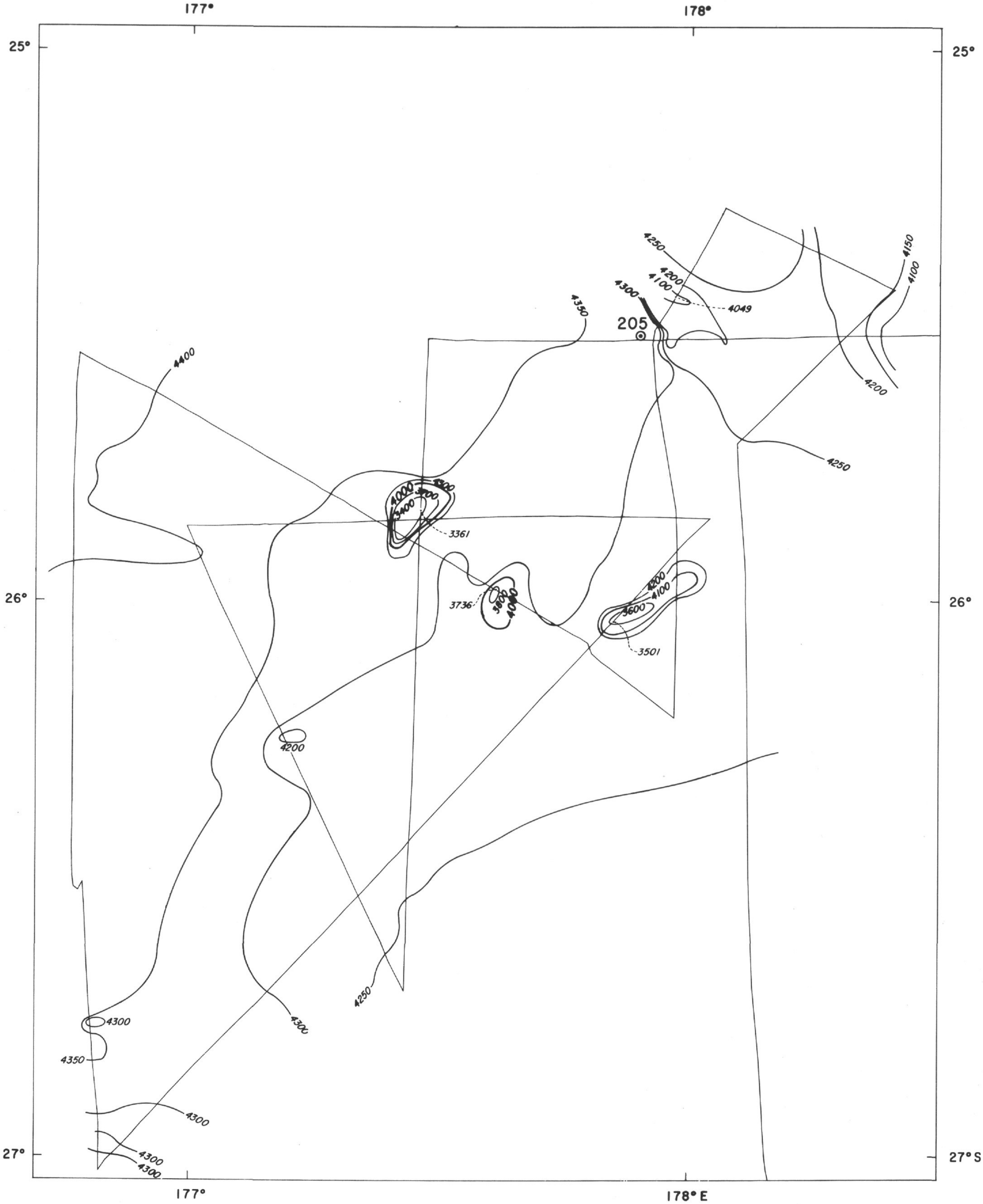


Figure 1. *Bathymetry at Site 205 (uncorrected meters). Site survey R/V* Kana Keoki *Site survey August 1971.*

accumulated. This transparent section is the deepest (0.1-0.2 sec) of the sedimentary section on the western slope of the Lau Ridge. Farther west, the sediments thicken to 0.75 sec, of which the upper 0.3 to 0.4 sec is acoustically well stratified, while the lower section is acoustically transparent.

Apparently associated with the basement hills are several localized basement intrusions into the basin sediments. These do not produce any surface relief. In conjunction with the site survey, a series of sonobuoy wide-angle reflection/refraction profiles was shot by the *Kana Keoki*. These profiles demonstrate a very irregular crustal structure in the South Fiji Basin (Hussong, 1972).

OPERATIONS

Site Approach

The specific location of Site 205 was selected in an attempt to provide a complete sedimentary section without the excessive thickness of the basin sediments farther west. The site approach virtually coincided with the *Kana Keoki* track from Site 204 which greatly simplified the problem of identification of structures (Figure 2). Because of the steep basement slopes near the intrusions, two crossings were made prior to dropping the beacon on the third pass.

In terms of reflecting horizons, the sedimentary section at the site appears to be complete, although it is thinner here than to the west. On the underway record (Figure 2) the basement depth at the site as selected is 0.4 sec, with a thick basement reflector extending to over 0.5 sec. The proximity of the basement intrustions suggested that this broad character in the basement reflector may represent sills and/or thermally metamorphosed sediments above the second layer.

Sonobuoy

The on-site sonobuoy profile (Figure 3) provided a clearer and more detailed interpretation of seismic structure. Table 1 presents the reflector depths together with characteristics and initial interpretations.[2] Recording was in various frequency bands between 10 Hz and 640 Hz (annotated on Figure 3) to characterize the reflectors. Strongest reflectors occur at 0.08 and 0.49 sec (10-40 Hz band), at the lower frequencies the upper surfaces of the reflectors are faint to nonexistent, and the reflector depths are generally 0.03 sec deeper. Depths to these reflectors in this and succeeding sonobuoy records were measured on higher frequency portions of the profile.

Less well-defined reflectors occur in the higher frequency bands at depths of 0.18, 0.24, 0.33, 0.39, and 0.49 sec. The 0.39-sec reflector is suggested in the 10 to 40 Hz band. The 0.49-sec reflector is probably the second layer and may be as deep as 556 meters. The position of the 0.39-sec reflector suggests an intrusive structure related to the basement structures near the site.

[2]Final correlations of sonobuoy profiles using laboratory-measured velocities, other physical properties, and lithologic boundaries are presented in Part II of this Initial Report.

Drilling Program

Coring at this site was planned to be continuous, in response to both the biostratigraphic objectives and the recommendations of the Safety and Pollution Prevention Panel. With the exception of the interval from 187 meters (Core 20) to 283 meters (Core 24) where washing, pumping mud, and coring were alternated in an effort to keep the hole stable, the section was continuously cored. Thirty-two cores were recovered (Table 2).

Following the coring of basalt in Core 31, an additional core was run specifically to obtain a hard rock sample. This did not penetrate through the basalt and the hole was terminated.

Before completing this site, an attempt was made to obtain a surface core with the prototype piston corer. This was unsuccessful due to improper functioning of the corer.

The site was abandoned at 1530 hours on 21 November, gear was streamed, and a seismic reflection profile was run over the beacon before setting course for Site 206.

LITHOLOGY

General

Site 205 was continuously cored to a depth of 355 meters below the sea floor. Thirty-two cores were cut, but from eight of these no core was recovered. The loss of core is believed to be the result of either the water-saturated, soupy sediments leaking out of the core barrel or, in the case of cores from the interval between 150 and 283 meters, of the pumping that was required to keep the hole open.

Summaries of each of the cores are given in Appendix F.

The stratigraphy in this hole can be conveniently divided into four units. They are, from top to bottom:

1) Unit 1 (0 to 32 m)—iron-oxide-bearing, glass-shard-rich clay and vitric ash with varying amounts of interbedded nannofossil ooze (late Miocene to Recent)

2) Unit 2 (32 to 276 m)—nannofossil-bearing vitric ash, or its more lithified equivalent, vitric tuff (late Miocene-early mid-Miocene)

3) Unit 3 (276 to 337 m)—glass-shard-bearing nannofossil ooze or its more lithified equivalent, chalk, or limestone interbedded with nannofossil vitric ash or tuff (late mid Oligocene)

4) Unit 4 (337 to 355 m)—basalt (late mid Oligocene or younger)

Unit 1 (Iron-oxide Clay and Nannofossil Ooze)

This unit, penetrated in Cores 2 and 3, forms the upper part of the sequence. The dark reddish brown iron-oxide clay is rich in glass shards and zeolite. Pumice fragments are scattered sparingly throughout the unit, and there are layers of nearly pure vitric ash. In the lower part of the predominantly clay section are layers less than 50 cm thick of nannofossil ooze-bearing volcanic glass, and zeolite. The contact with Unit 2 is apparently gradational, and the lithologies are intercalated.

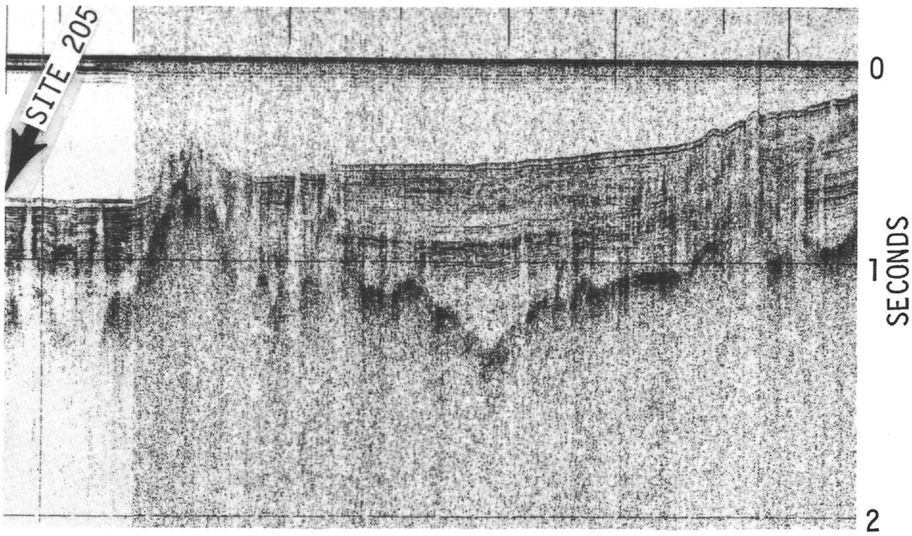


Figure 2. *Seismic profile* Glomar Challenger *approach to Site 205 showing slope break.*

Unit 2 (Vitric Ash and Minor Nannofossil Ooze)

The upper part of this unit (Cores 5 to 7) is glass-shard-rich nannofossil ooze interlayered with nannofossil-rich, glass-shard ash. Radiolaria form a substantial part of the biogenic component in the upper part of the unit but also extending down into Core 8. The sediments are creamy and were easily cut by the wire cheese cutter. Below the middle of Section 7-4, the unit is mainly coarser-grained volcanic glass and pumice that is lithified to semilithified and had to be cut by a saw. The lowest thick (1 meter) bed of nannofossil ooze appears in Core 11 and is underlain by nearly pure vitric ash or tuff.

The color of most of Unit 2 is shades of brown and gray, and in many places the core is thinly banded and variegated. Dark gray layers were generally found to be mainly volcanic, and layers colored shades of brown were richer in nannofossil ooze. Subangular lapilli-sized fragments of light gray pumice with phenocrysts of clear ?feldspar and amphibole are scattered throughout the unit. The screened fine sand and larger sized fraction of the core catchers in Units 1 and 2 are mainly pumice, light and dark vesicular volcanic glass, bipyramidal clear quartz, and pyroxene and amphibole crystals. The presence of volcanic quartz and the low refractive index (< 1.56) of most of the glass suggest that siliceous andesite volcanism contributed the detritus. Much of the glass is devitrified and X-ray data show a significant amount of montmorillonite clay that probably developed from alteration of the volcanic glass.

Some shallow-water foraminifera in samples from Cores 8 through 22, together with some rounded ash fragments, suggest that at least some of the volcanic detritus was transported by ocean currents into this deeper part of the basin.

There are very few sedimentary structures in the section except for mottling. Only some faint cross-lamination and penecontemporaneous deformation surrounding lapilli fragments were found.

Parts of Units 2 and 3 that are relatively undisturbed by drilling are slightly to moderately mottled due to organic burrowing. In places there is evidence of several stages of burrowing. The only burrows identified are *Zoophycos* in Core 23.

Unit 3 (Glass-shard-bearing Nannofossil Ooze and Chalk Interbedded with Nannofossil Vitric Ash)

The upper contact of Unit 3 is at 205-24-2, 40 cm, and coincides with a disconformity separating early middle Miocene nannoplankton-bearing sediments from those of late Oligocene age. The only megascopic evidence of erosion or nondeposition at the contact is the presence of a sandy layer several millimeters thick. Just below the contact there is a sharp color change oblique to the bedding that may be related to the same event.

Much of Unit 3 is vitric ash similar to Unit 2, but includes more nannofossil ooze at its top or chalk at its base. Most of the nannofossil-rich beds are light shades of brown or gray, and the layers richer in volcanic material are darker colored. However, some lighter colored layers of pink and gray are nearly pure ash. As a result, the proportion of volcanic ash to nannofossil ooze could not be determined accurately by color alone. Much of the volcanic glass is devitrified. Clay minerals and zeolites are products of this alteration.

The base of Unit 3 is drawn at the contact of basalt with limestone. The basalt was originally interpreted as being intrusive, principally on the basis of the limestone being considered a baked aureole developed in nannofossil ooze by coming into contact with the basalt. However, detailed examination (see Chapter 13) indicates:

1) Complicated and repetitious contacts of basalt and limestone in the core,

2) A sequence of detailed textural changes very closely resembling that in submarine pillow basalts, and

3) Manganese-enriched, iron-oxide coating of both glass rim and crystalline basalt. These suggest that the basalt was a submarine flow (probably with pillow structures) that formed at great depth of water during sedimentation of nannofossil ooze.

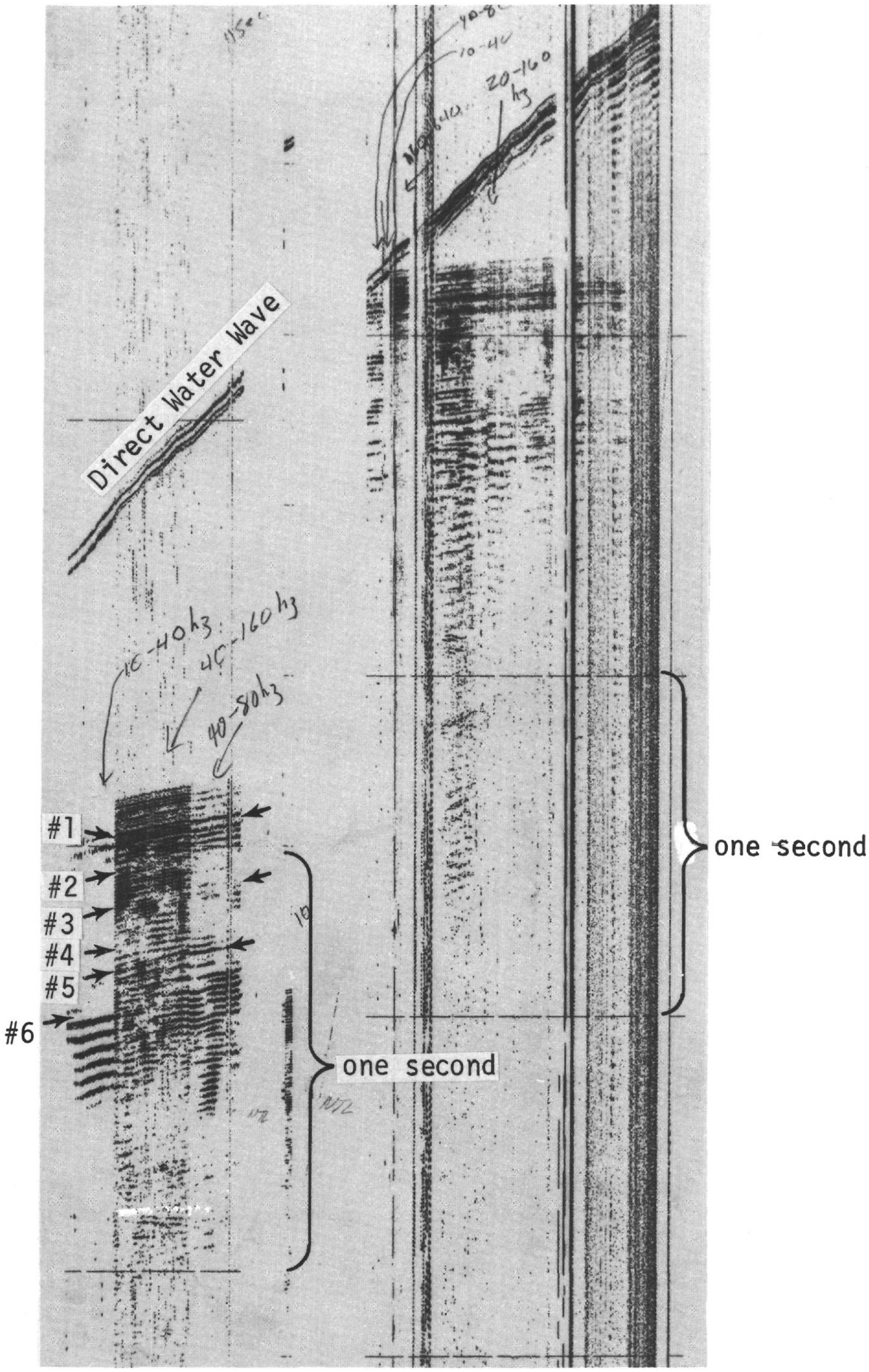


Figure 3. *On-site sonobuoy profile at Site 205.*

Unit 4 (Basalt)

This unit that forms the bottom of the hole is composed of finely crystalline basalt. Altered feldspar phenocrysts make a network of crystals resembling a diabase texture. The basalt, except for the glassy margins, is obviously vesicular (up to 25% vesicles in places), but the vesicles are generally small averaging <2 mm and rarely up to 3 mm. No change in composition or texture was seen in the more than 9 meters cored, and the basalt over this distance appears homogeneous.

Sequence of Geologic Events Interpreted from Lithology

Late Middle Oligocene

Deep and quiet water deposition of nannofossil ooze is not far above the carbonate compensation depth. Volcanic ash showers presumably from volcanoes of intermediate composition in the Tonga-Lau Ridge area accompanied the pelagic sedimentation. The basalt pillow lava was extruded during this period.

TABLE 1
Site 205 Sonobuoy Data

Reflector	Depth (sec)	Nature	Estimated Velocity Structure (m/sec)	Estimated Depth (m)
1	0.08	Strong, low frequency return	1600	64
2	0.18	Weak, high frequency good	1800	154
3	0.24	Moderate/weak		208
4	0.33	Weak, high frequency good	1800	289
5	0.39	Moderate, low frequency faint (possible intrusion)	1800	343
6	0.49	Strong, low frequency return (possible 2nd layer)	4400	563

Early Miocene

Essentially nondeposition or very slight submarine erosion.

Early Middle Miocene to Late Miocene

Depositional history similar to that in the late Oligocene, but increase (especially in the middle Miocene) in amount and size of volcanic detritus reaching the site. Some of the rounded volcanic fragments and shallow-water benthonic foraminifera were probably transported to the site by ocean currents.

Late Miocene to Recent

Deposition of abyssal brown clay and minor amounts of nannofossil ooze near the carbonate compensation depth. Volcanic ash showers of intermediate composition periodically reached the site.

TABLE 2
Coring Summary, Site 205

Core	Date	Time	Depth from Drill Floor (m)	Depth Below Sea Floor (m)	Cored (m)	Recovered (m)	Recovery (%)
1	11/24	1640	4330-4339	0-9	9	0	0
2	11/24	1800	4339-4348	9-18	9	7.3	81
3	11/24	1925	4348-4357	18-27	9	7.7	86
4	11/24	2100	4357-4366	27-36	9	0	0
5	11/24	2220	4368-4377	38-47	9	9.2	100
6	11/24	2345	4377-4386	47-56	9	9.2	100
7	11/25	0130	4386-4395	56-65	9	9.0	100
8	11/25	0300	4395-4404	65-74	9	6.2	69
9	11/25	0430	4404-4413	74-83	9	0	0
10	11/25	0600	4413-4422	83-92	9	3.1	34
11	11/25	0730	4425-4434	95-104	9	3.7	41
12	11/25	0905	4434-4443	104-113	9	1.0	11
13	11/25	1035	4443-4452	113-122	9	0	0
14	11/25	1220	4452-4461	122-131	9	4.7	52
15	11/25	1345	4461-4470	131-140	9	5.4	63
16	11/25	1545	4472-4481	142-151	9	6.8	76
17	11/25	1705	4481-4490	151-160	9	5.5	61
18	11/25	1830	4490-4499	160-169	9	0	0
19	11/25	2000	4499-4508	169-178	9	0	0
20	11/25	2120	4508-4517	178-187	9	2.0	22
21	11/25	2240	4528-4537	198-207	9	0	0
22	11/26	0030	4546-4555	216-225	9	0	0
23	11/26	0210	4576-4585	246-255	9	6.2	69
24	11/26	0410	4604-4613	274-283	9	5.0	56
25	11/26	0540	4613-4622	283-292	9	3.8	42
26	11/26	0710	4622-4631	292-301	9	6.4	71
27	11/26	0926	4631-4640	301-310	9	7.8	87
28	11/26	1100	4640-4649	310-319	9	6.9	77
29	11/26	1230	4649-4658	319-328	9	8.3	92
30	11/26	1400	4658-4667	328-337	9	4.2	47
31	11/26	1600	4667-4676	337-346	9	0.6	7
32	11/26	1850	4676-4685	346-355	9	4.7	52
Total					288	134.7	47

Note: Echo sounding depth (to drill floor) = 4330 meters;
drill pipe length to bottom = 4330 meters.

BIOSTRATIGRAPHY

General

The 30 sedimentary cores obtained from Site 205 represent a sequence that includes the late middle Oligocene to late Oligocene and the middle Miocene to early Pliocene. The sequence can be divided into five units for biostratigraphic discussion.

1. Core 2, which is the uppermost sedimentary core collected, contains a sparse microfauna consisting only of a few species of radiolarians, none of which are age diagnostic. The age of the uppermost part of the sequence is thus unknown.

2. Sections 3-2 to 205-8, CC contain abundant to common calcareous nannofossils and rare to moderately abundant planktonic foraminifera. Radiolaria are represented by few to common specimens throughout most of this unit. Most of this unit ranges in age from the late late to early late Miocene [Zone N18 to about N15 of Blow (1969) and about Zone NN12 to NN9 of Martini (1971)]. The Miocene-Pliocene boundary is placed between Samples 205-3-2, 112-114 cm and 205-3-3, 114-116 cm. The former sample is of early Pliocene age, based on the first upward appearance in this sample of the nannofossil *Ceratolithus rugosus,* indicator of the NN13 Zone of Martini, 1971. The latter sample contains a late Miocene foraminiferal fauna with no evidence of reworking. In contrast, calcareous nannofossil assemblages throughout Core 3 contain substantial reworking.

3. The boundary between the middle and late Miocene occurs between Cores 8 and 10, there being no recovery in Core 9. Cores 10 to Sample 205-24-2, 22 cm contain generally common, but variable numbers of calcareous nannofossils and rare to moderately abundant planktonic foraminifera. Radiolaria are absent. This unit ranges in age from the late middle to early middle Miocene [approximately Zone N14 to N9 of Blow (1969) and Zone NN8 to approximately NN5 of Martini (1971)].

The sediments of early middle Miocene age are underlain disconformably by sediments of late Oligocene age (Sample 205-24-2, 40 cm). The entire early Miocene, represented by planktonic foraminiferal Zones N8 to N2 and nannofossil Zones NN4 to NN1, is absent.

4. Samples 205-24-2, 45 cm to 205-29, CC contain abundant calcareous nannofossils which provide the ages for all of the cores within this unit. Radiolaria are present in only Sample 205-24, CC and foraminifera at a few levels. The calcareous nannofossils indicate that this unit is of late Oligocene age [approximately equivalent to the Duntroonian and early Waitakian stages of New Zealand (Edwards, 1971)]. This age is supported by the Radiolaria in Sample 205-24, CC, which indicate an age range from the early early Miocene to late Oligocene, and by foraminifera in Sections 24-3, 28-1, and Sample 205-29, CC, which suggest a late Oligocene age. Foraminiferal assemblages are of low diversity and show evidence of substantial dissolution.

5. The limestone in Core 30 is moderately to highly lithified, but contains calcareous nannofossil assemblages of late middle Oligocene age. Planktonic foraminifera are very rare.

Both the planktonic foraminifera and, to a much lesser extent, the calcareous nannofossils display somewhat close affinities with forms occurring in the temperate latitudes of New Zealand. At the warm, subtropical latitude of Site 205 it was expected that temperate elements would have been less conspicuous. Certain distinct equatorial planktonic foraminiferal forms have not been encountered.

Approximate sedimentation rates based on ages assigned to zonal boundaries (Berggren, 1969) are:

Plio-Pleistocene = 4 m/million years
late Miocene = 12 m/million years
middle Miocene = 50 m/million years
late Oligocene = 8 m/million years

Thus, the middle Miocene vitric tuff has the highest sedimentation rate. The interbedded glass-shard ash and nannofossil ooze of late Miocene age and the nannofossil chalk with zeolite-rich horizons of late Oligocene age have intermediate sedimentation rates, and the Plio-Pleistocene abyssal clay has the lowest sedimentation rate.

Benthonic foraminiferal faunas in the late Miocene and late Oligocene indicate deposition at abyssal depths above or close to the calcium carbonate compensation depth. In situ faunas are rare in the middle part of the sequence, but the available evidence in the upper part of the sequence suggests little change in depth since the late Oligocene. This conclusion is supported by the residual nature of all of the calcareous nannofossil assemblages obtained from this drill hole.

Reworked shallow-water benthonic foraminifera are persistent in the middle part of the sequence, indicating significant reworking of sediments from shallow water. This in turn may account for higher rates of sedimentation in this part of the sequence.

In summary, this site represents a moderately useful biostratigraphic sequence of calcareous nannofossils of middle and late Cenozoic age and of foraminifera of middle and late Miocene age.

Foraminifera

Planktonic Foraminifera

Planktonic foraminifera are almost entirely absent through Core 2 and most of Core 3 due to dissolution. They occur in varying frequencies, with moderate to good preservation, from the base of Core 3 to Core 22; are absent due to dissolution from Cores 23 to 28; and occur in very low frequencies in Core 29 immediately above the basal limestone overlying basement. Except for those intervals for which no core was recovered (Cores 2, 18, and 19), an apparently continuous planktonic foraminiferal sequence exists between latest Miocene Zone N18 (Blow, 1969) and earliest middle Miocene Zone N9 (Blow, 1969).

In Sample 205-3-3, 114-116 cm the presence of *Globigerina nepenthes, Globoquadrina dehiscens,* and *Sphaeroidinella subdehiscens paenidehiscens* is indicative of late Miocene age (N17-N18).

In Sample 205-6-2, 4-6 cm a rich fauna containing an association of *S. subdehiscens subdehiscens, S. seminulina, Globoquadrina dehiscens, Globorotalia conoidea, Globoquadrina acostaenisis,* and *Globigerinoides obliquus extremus* is indicative of Zone N16 (late Miocene).

The lowest occurrence of *G. nepenthes* in association with *Globigerina druryi* from Sample 205-11, CC to 205-12-1, 87-89 cm suggests an age at this level of late middle Miocene (N14).

Zone N10 is represented by a highly rich and diverse fauna in Samples 205-20-2, 45-47 cm, and 205-20-CC, as indicated by the level of development within the *Orbulina* bioseries. This group is dominated by *O. suturalis*, but also contains *O. universa* and *Praeorbulina glomerosa*. Other highly characteristic forms are *Globorotalia peripheroacuta, Globorotalia panda, Globorotalia continuosa, Globorotalia mayeri, Globerigerina woodi woodi*, and *Globigerina euapertura*.

Sample 205-22-CC of the *Orbulina* group is dominated by *O. suturalis*, contains forms intermediate between *Praeorbulina glomerosa circularis* and *P. glomerosa curva*, and contains no *O. universa* indicating a lower N9 age (lowest middle Miocene). *Globorotalia peripheronda* is also present.

The late Oligocene sequence, which has been dated almost entirely by calcareous nannofossils, is barren of planktonic foraminifera except at a few levels which contain uncommon specimens of *Catapsydrax dissimilis* and *Globoquadrina dehiscens praedehiscens*. In combination, these indicate a late Oligocene to early Miocene age for this core, although the dominance of *C. dissimilis* suggests an Oligocene age.

One surprising aspect of the Miocene assemblages of Site 205 is their relatively high affinities with the New Zealand temperate faunas despite the large latitudinal difference. For instance, the classical New Zealand temperate *Globorotalia miozea* lineage is quite well represented, and many tropical elements appear to be absent. It was expected that at this latitude, certain equatorial elements would have dominated over temperate forms.

Benthonic Foraminifera

Evidence for Depth

Late Oligocene Sample 205-29, CC contains a relatively abundant calcareous and arenaceous benthonic foraminiferal fauna which includes: *Stilostomella, Gyroidina, Cassidulina, Globocassidulina, Oridorsalis, Lenticulina, Pullenia quinqueloba, Eggerella, Dentalina, Cibicides* (rounded), and several species of *Pleurostomella*. Such an association is indicative of abyssal depths immediately above the calcium carbonate compensation depth. A small, sand-sized residue of fish teeth and bones is associated with these foraminifera. The oldest sediments recovered were deposited at abyssal depths above or close to the calcium carbonate compensation level (approximately 4000 m).

In middle and late Miocene, benthonic foraminifera that are assumed not to have been transported into the area of the drill site are mostly sporadic in occurrence and thus, little can be said at this time about depths of deposition of the sediments. However, Sample 205-3, CC and 205-7, CC do contain moderately abundant benthonic assemblages including the following forms:

7, CC: *Cyclammina, "Epistomina," Globocassidulina subglobosa, Pyrgo murrhyna*, and *Bulimina* (smooth)

3, CC: *Melonis pompilioides, Laticarinina halophora, Pullenia bulloides, Globocassidulina subglobosa, Oridorsalis tenera, Bulimina* (smooth), and *Pyrgo murrhyna*.

Both of these assemblages, which contain only deep-water forms and lack shallow-water forms, indicate deposition in abyssal depths above or close to the calcium carbonate compensation level. Therefore, strong evidence exists to show that at least the late Miocene sediments were deposited in abyssal depths like those of the late Oligocene.

Little change in depth appears to have occurred at least between the earliest and latest phases of sedimentation within this basin.

Evidence for Reworking of Sediments

The conspicuous presence of shallow-water benthonic foraminifera in varying frequencies in the middle part of the sequence (from Samples 205-8, CC to 205-22, CC) of early Middle to early late Miocene age represents strong evidence that reworking has been somewhat persistent during this phase of deposition. Benthic forms typical of continental shelf depths such as *Amphistegina* and *Elphidium* occur in varying frequencies in Samples 205-8, CC, 205-12, CC, 205-13, CC, 205-16, CC, 205-19, CC, and 205-22, CC. Several of these horizons also contain rare deeper-water forms. The most conspicuously reworked samples examined are Samples 205-8, CC and 205-22, CC which consist of coarse volcanic and quartz sands of which a small proportion of the grains are quite rounded. Furthermore, many of the benthonic foraminifera are highly battered, indicating either transportation over reasonably large distances or highly turbulent deposition. Sample 205-20, CC contains a reworked Cretaceous radiolarian.

The volcanic sediments that are important in the middle part of the sequence thus may, to a large extent, have been transported from shallow depths.

Calcareous Nannofossils

The biostratigraphy of Site 205, as deduced from the calcareous nannofossils, is summarized in Figure 4. For a detailed report on the floras, see the report by Edwards (Chapter 18).

Siliceous Microfossils

Most of the cores recovered at Site 205 except the upper eight cores (Table 3) are lacking siliceous debris.

In Cores 2 and 3, consisting lithologically of reddish brown clays, radiolarians are very rare and partly corroded. Several specimens of *Siphonosphaera* sp., *Hexacontium* sp., *Spongodiscus* sp., *Ommatartus* sp., and several orosphaerid fragments were the only forms encountered in Sample 205-2, CC. In Sample 205-3, CC, the organic remains are much rarer, consisting of a few orosphaerid fragments, sponge spicules, and fish teeth.

The richest siliceous microfossil assemblages occur in the interval from Sample 205-4, CC to 205-8, CC of late Miocene age (the *Stichocorys peregrina* radiolarian Zone and the *Dictyocha aspera* silicoflagellate Zone). The content of the assemblages is rather uniform through the entire interval, but the abundance varies from very rare to

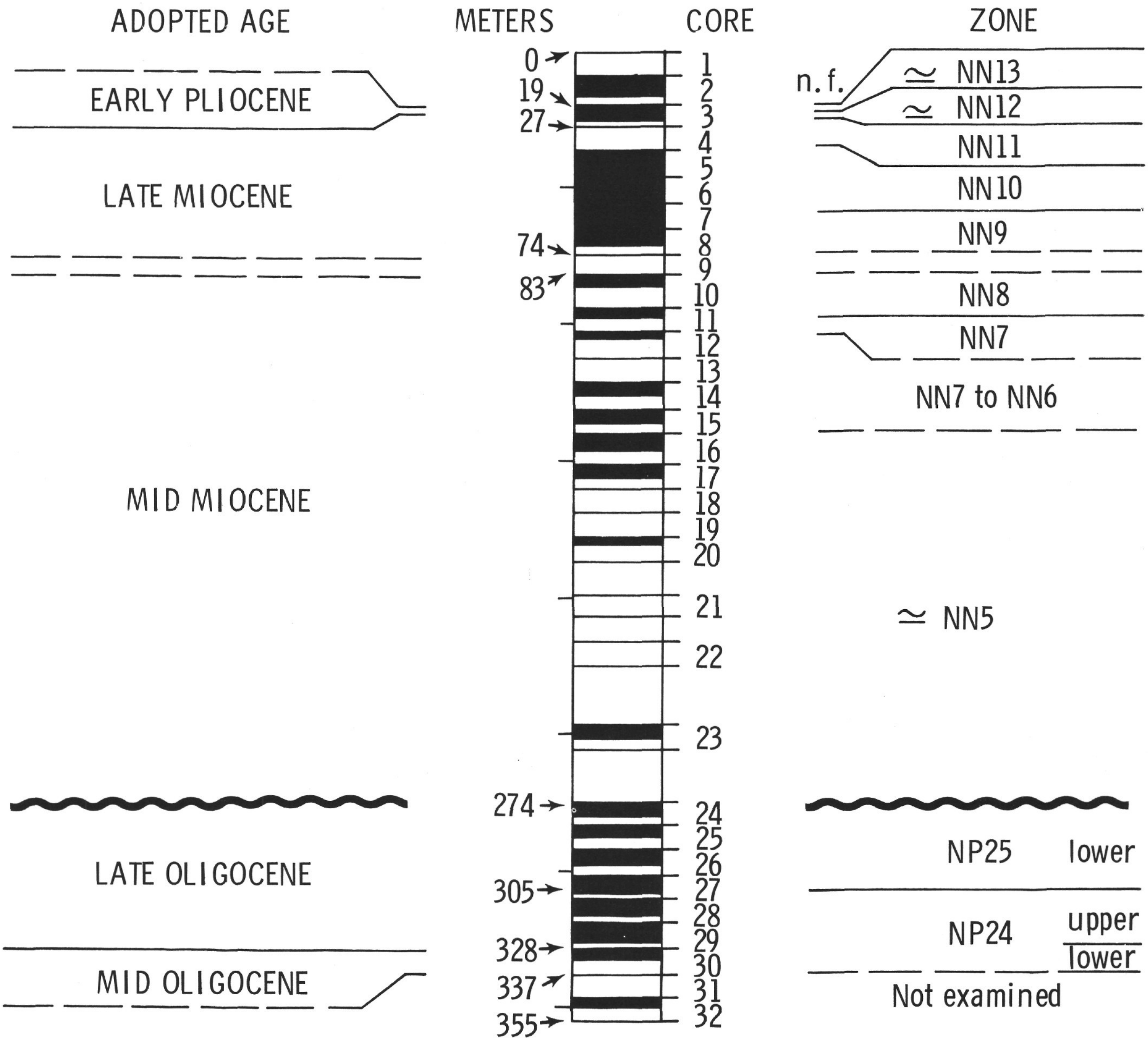


Figure 4. *Biostratigraphy of Site 205 as deduced from the calcareous nannofossils.*

common, depending upon the quantity of the volcanic glass.

The preservation of the radiolarians is moderately good, most skeletons being of dark color in transmitted light, probably due to crystallization of the initially opaline silica. It is worth noticing that some well-preserved phaeodarian skeletons have resisted this phenomenon.

Silicoflagellates and siliceous dinoflagellates (e.g., *Actiniscus*) are rare to common in these last five cores. Rare ebridian species also occur.

Cores 10 to 23 are barren, except for a few corroded orosphaerid fragments found in a few core-catcher samples and a reworked Cretaceous nassellarian encountered in Sample 205-20, CC.

Core 24 contains rare and corroded radiolarians. The presence of few specimens of *Dorcadospyris ateuchus* and *Liriospyris mutuaria* suggests an early Miocene or a latest Oligocene age.

Cores 24 to 29 are barren.

PHYSICAL PROPERTIES

Bulk Density

Bulk densities are low (about 1.2 to 1.3 gm/cc) in the upper 30 meters of the sequence cored (Cores 2 and 3). This reflects the high water content and unconsolidated nature of the sediments. Below this depth the sediments become noticeably more compacted, and the density rises to the range 1.46 to 1.58 gm/cc, remaining in this range right down to about 250 meters (Core 23). The lowest part of the sedimentary sequence, 250 to 330 meters (Cores 23 to 30), shows a progressive increase in density through the

TABLE 3
Distribution of Radiolaria and Silicoflagellates in Hole 205

Sample	Radiolarian zones	Silicoflagellate zones	Abundance	*Ommatartus* cf. *penultimus*	*Ommatartus antepenultimus*	*Ommatartus hughesi*	*Cannartus* aff. *prismaticus*	*Cannartus laticonus*	*Cannartus* ? *pettersoni*	*Spongaster klingi*	*Lithopera bacca*	*Stichocorys peregrina*	*Phormostichoartus corona*	*Acanthodesmia vinculata*	*Tholospyris acuminata*	*Tholospyris semantis*	*Lithocircus ovalis*	*Giraffospyris annulispina*	*Mesocena elliptica*	*Dictyocha aspera*	*Distephanus crux*	*Distephanus speculum*	*Distephanus polyactis*	*Paradictyocha apiculata*
205-2, CC	*Stichocorys peregrina*	*Dictyocha aspera*	R																					
205-3, CC			R																					
205-4, CC			R	R			F			+	C	C	F				F	R	R	C	R	R		+
205-5-1, 18-20 cm			F		R		F		R		C	C	C	F	C		F	F	+	C	R	R	R	+
205-5-2, 28-30 cm			R								C	C	C	R	F		F	R						
205-5-3, 70-72 cm			F			R	R				C	C	C		F		F	F		C				+
205-5-4, 70-72 cm			VR																					
205-5-6, 70-72 cm			F		R	+	F				C	C	C		R	+	F	+						
205-5, CC			R								R	R	+											
205-6-1, 80-82 cm			C		F	R	R				C	C	C	R		R	C	F		C	+	R	+	
205-6-3, 69-71 cm			VR				R				R	R	R											
205-6-5, 70-72 cm			R				R				C	C	F	R			C	R		C	R	R		R
205-6, CC			F		R		F	R			C	C	F	R		R	F	+						
205-7-1, 70-72 cm			F		+	R	C				C	C	F			R	F	R						
205-7-3, 70-72 cm			F		+	+	F	R			C	C	F	R			C	R		C	R	R	+	R
205-7-5, 70-72 cm			VR										+											
205-7, CC			R		+				R		R	R	F			+	R							
205-8-2, 70-72 cm			F		+						C	C	+			R	R							
205-8-3, 70-72 cm			VR								R													
205-8, CC			VR								R													

Legend: C = Common
F = Few
R = Rare
VR = Very rare
+ = 1 or 2 specimens in a slide

range 1.55 to 1.75 gm/cc downwards to the limestone at the contact with the underlying basalt.

The GRAPE device gives density values of 2.0 gm/cc and 2.2 gm/cc for the limestone and the basalt, respectively. These values are low because these cores consist of separate pieces of rock with air space between them and do not completely fill the core liner.

Sonic Velocity

Sonic velocity measurements were made on several samples from each core using the Hamilton frame method. A mean velocity of about 1.50 km/sec was obtained for the brown clays forming the top 30 meters or so of the sequence cored (Cores 2 and 3). Below this depth (Cores 5 to 7) the mean velocity rises to about 1.54 km/sec, presumably reflecting greater compaction of the sediments. From about 65 meters down to 250 meters (Cores 8 to 23) velocities average about 1.83 km/sec, but below this depth there is a drop in velocity to a mean of about 1.68 km/sec until the basalt at the bottom of the hole is reached.

Thermal Conductivity and Heat Flow

Thermal conductivity (K) was measured by the heated needle probe method on sediment cores recovered from 9 to 328 meters depth below bottom (Cores 2 through 29). Conductivity values ranged between 1.7 and 2.8 m cal/°C cm sec (TCU), uncorrected for ambient temperature and pressure at the sea floor. Although considerable variation occurs, values generally increase with depth. The hard limestones and basalts recovered between 328 and 355 meters below bottom (Cores 30 through 32) were not measurable by the needle probe method.

Because of various instrumental difficulties, including the loss of one instrument downhole, in situ temperatures were not measured at this site; hence, no heat-flow values were obtained.

SUMMARY AND CONCLUSIONS

Site 205 sampled a sequence of sediment that has accumulated from late Oligocene to Recent at abyssal depths relatively close to the calcium carbonate compensation depth. Although there is no evidence for any degree of tectonism locally, a possible trend of deepening of the basin relative to the calcium carbonate compensation depth may be inferred.

A strong reflector at 0.39 sec (355 m) marks the penetration, but although this is basalt, a deeper strong reflector at 0.49 sec (? 555 m) suggests a greater depth to the second layer. This would also be the case in applying the Sclater et al. (1972) interpretation of depth versus age to the basin crust so that a greater basement age is to be expected here.

The Oligocene was a period of deep-water accumulation of nannofossil ooze with intermittent showers of intermediate and acidic volcanic ash. During this accumulation, the basalt was extruded as a pillow flow at or near the sea floor.

A depositional hiatus in the early Miocene is represented by a disconformity which was sampled in Core 24. This could be the result of either a nondepositional interval (considered improbable in view of the lack of any other regional indications of uplift or lack of productivity) or a loss of sediment due to erosion.

During middle Miocene, the accumulation increased and the accumulation rate is the maximum indicated in the sequence. Although the sediment from this interval is predominantly volcanic detritus, calcareous sediments are common. The presence of shallow-water foraminifera, battered calcareous nannofossils, and rounded volcanic ash fragments indicates additional accumulation of transported sediment.

By late Miocene a change in sedimentary patterns is marked by a decrease in volcanic debris, and the supply of shallow-water foraminifera ceased. These changes may have been brought about by the development of north-south barrier ridges on the western flank of the Lau Ridge. One such structure occurs just east of the site. In the upper three cores of this interval there is a general decrease upward of calcareous fossils through dissolution due to lower sedimentation rates (i.e., less rapid burial). Some of the calcareous intervals here represent reworked sections.

Ladd and Hoffmeister (1945) describe a comparable pattern in the volcanic history of the Lau Group. Early Miocene volcanism was the dominant phase, with a smaller eruptive cycle in late Miocene, and a final gasp in Pliocene time.

From late Miocene to Recent, abyssal brown clays with minor amounts of nannofossil ooze have accumulated near the carbonate compensation depth with occasional showers of volcanic ash of intermediate composition.

REFERENCES

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

Blow, W. H., 1969. Late Middle Eocene to Recent planktonic foraminiferal biostratigraphy: Intern. Conf. Planktonic Microfossils, Geneva, p. 199.

Edwards, A. R., 1971. A calcareous nannoplankton zonation of the New Zealand Paleogene: Planktonic Conf. 2nd, Rome 1970, Proc., p. 381-419.

Hussong, D. M., 1972. Complex structure of the South Fiji Basin as shown by ASPER refraction data (abstract): Geol. Soc. Am. abstracts with progrons, v. 4, p. 175.

Ladd, H. S. and Hoffmeister, J. E., 1945. The Geology of Lau, Fiji: Bernice P. Bishop Mus. Bull., v. 181.

Martini, E., 1971. Standard Tertiary and Quaternary calcareous nannoplankton zonation: Planktonic Conf. 2nd, Rome 1970, Proc., p. 739-785.

Sclater, J. G., Hawkins, J. H., Mammerickx, J., and Chase, C. G. 1972. Crustal extension between the Tonga and Lau Ridges: petrologic and geophysical evidence: Geol. Soc. Am. Bull., v. 83, p. 505.

NOTE CONCERNING THE APPENDICES

The appendices consist of tables of shore laboratory determinations of grain size, carbon content, and mineralogical composition, summary visual descriptions of the cores recovered from the site, photographs of the cores and, finally, an overall summary of the results of drilling at the site. The symbols used to represent lithology in the core summary forms are explained in Chapter 2 of this volume. The lithologic description of each core contains typical results of shipboard examination of smear slides of each lithology. In order to make the lithologic descriptions more complete we have also included many of the shore laboratory results. These are identified by being placed in square brackets.

APPENDIX A
Grain Size Determinations, Site 205

Core, Section, Top of Interval (cm)	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Classification
3-7,0	27.0	0.5	34.5	65.0	Silty clay
5-1,90.0	38.9	36.3	50.2	13.5	Sandy silt
5-6,103.0	46.5	0.4	82.4	17.2	Silt
6-2,110.0	49.6	59.3	28.3	12.4	Silty sand
7-7,0	65.0	6.3	68.4	25.3	Clayey silt
8-3,13.0	68.1	84.9	9.3	5.8	Sand
8-7,0	74.0	79.0	15.6	5.4	Sand
15-7,0	140.0	0.1	69.5	30.3	Clayey silt
23-7,0	255.0	0.6	30.0	69.5	Silty clay
24-7,0	283.0	0.1	96.5	3.4	Silt
25-7,0	292.0	0.5	28.5	71.1	Silty clay
26-7,0	301.0	0.0	11.4	88.6	Clay
26-5,60.0	298.6	0.2	25.1	74.7	Silty clay
26-5,146.0	299.5	0.0	12.1	87.9	Clay
28-7,0	319.0	1.5	35.0	63.6	Silty clay

APPENDIX B
Carbon-Carbonate Determinations, Site 205

Core, Section, Top of Interval (cm)	Depth in Hole (m)	Carbon Total (%)	Organic Carbon (%)	$CaCO_3$ (%)
3-2,137.0	20.9	5.4	0.0	44
5-3,120.0	42.2	1.2	0.0	10
6-6,80.0	55.3	2.7	0.0	23
9-7,0	83.0	0.6	0.0	5
23-7,0	255.0	2.0	0.0	16
25-7,0	292.0	5.4	0.0	45
26-7,0	301.0	1.4	0.0	11
26-3,90.0	295.9	5.6	0.0	46
27-7,0	310.0	4.9	0.0	41
28-7,0	319.0	6.4	0.0	53
29-7,0	328.0	7.3	0.0	61

APPENDIX C
X-ray Mineralogy Determination, Site 205

Core	Cored Interval Below Sea Floor (m)	Sample Depth Below Sea Floor (m)	Diff.	Amor.	Calc.	Quar.	K-Fe.	Plag.	Mica	Chlo.	Mont.	Clin.	Phil.	Anal.	Augi.	Magn.	Goet.	U-1[a]	Kaol	Hema	U-2[b]
Bulk Sample																					
2	9-18	10.1	90.1	84.5	–	11.6	–	46.3	7.0	–	11.9	–	5.5	0.9	11.3	5.4	–	–	–	–	–
		14.3	91.2	86.3	1.7	9.4	–	39.8	12.8	–	3.7	–	23.2	1.1	3.8	4.5	–	–	–	–	–
3	18-27	27.0	79.3	67.7	–	2.5	–	31.7	–	–	12.5	–	48.5	–	–	4.8	–	–	–	–	–
5	38-47	42.1	93.0	89.0	63.4	1.8	12.4	16.1	–	–	–	–	–	–	–	6.3	–	–	–	–	–
7	56-65	56.5	76.3	63.0	60.3	2.0	–	26.4	–	–	–	–	–	–	9.4	2.0	–	–	–	–	–
8	65-74	67.4	90.9	85.9	34.4	5.8	–	41.8	–	–	5.8	–	–	–	7.9	4.3	–	–	–	–	–
		69.0	84.2	75.3	15.5	4.6	–	56.6	–	3.3	–	–	–	–	15.0	5.0	–	–	–	–	–
		74.0	79.7	68.3	8.4	5.2	–	62.9	–	–	2.7	–	–	–	16.7	4.1	–	–	–	–	–
11	95-104	97.6	89.8	84.0	18.3	5.6	–	38.2	–	–	12.5	2.1	5.4	–	12.8	5.1	–	–	–	–	–
12	104-113	113.0	91.7	87.1	8.6	3.8	–	49.9	–	–	11.4	–	–	0.9	20.5	4.9	–	–	–	–	–
15	131-140	133.6	92.7	88.6	7.2	6.9	–	45.8	–	–	21.8	–	–	2.0	11.9	4.3	–	–	–	–	–
		134.8	99.5	99.2	–	8.0	–	35.5	–	–	36.7	–	–	–	17.8	2.1	–	–	–	–	–
		140.0	91.8	87.5	4.0	7.9	–	–	–	–	31.3	–	–	5.1	45.4	6.3	–	–	–	–	–
16	142-151	145.8	91.9	87.4	29.1	4.1	–	47.3	–	–	7.0	–	–	–	6.9	5.6	–	Trace			
17	151-160	155.0	94.3	91.2	11.0	8.0	–	38.6	–	–	23.7	–	–	2.6	12.9	3.2	–	–	–	–	–
23	246-255	255.0	82.9	73.3	30.0	2.3	–	42.6	–	–	23.8	–	–	–	–	1.4	–	–	–	–	–
24	274-283	277.7	71.9	56.0	69.7	2.3	–	12.3	–	–	14.0	1.8	–	–	–	–	–	–	–	–	–
		283.0	64.2	44.1	90.7	1.9	–	5.5	–	–	2.0	–	–	–	–	–	–	–	–	–	–
25	283-292	292.0	71.9	56.1	55.6	1.4	–	25.5	–	–	17.5	–	–	–	–	–	–	–	–	–	–
26	292-301	295.6	73.2	58.1	69.9	4.2	–	7.3	2.3	–	15.1	1.1	–	–	–	–	–	–	–	–	–
		301.0	81.3	70.9	25.0	2.4	–	9.6	6.1	–	56.9	–	–	–	–	–	–	–	–	–	–
27	301-310	310.0	76.7	63.7	80.0	2.9	–	5.3	3.0	–	8.9	–	–	–	–	–	–	–	–	–	–
28	310-319	311.0	81.4	71.0	2.2	3.6	–	35.6	12.8	–	45.7	–	–	–	–	–	–	–	–	–	–
		311.4	81.6	71.2	26.1	1.6	–	7.9	–	–	64.3	–	–	–	–	–	–	–	–	–	–
		319.0	72.1	56.4	89.3	3.4	–	–	–	–	–	2.7	4.7	–	–	–	Trace	–	–	–	–
29	319-328	321.2	73.3	58.3	85.9	2.7	–	–	–	–	–	6.0	5.4	–	–	–	Trace	–	–	–	–
2-20μ Fraction																					
2	9-18	10.1	81.8	71.5	–	14.4	–	51.4	3.4	1.1	6.4	–	3.9	0.5	14.0	4.8	–	–	–	–	–
		14.3	83.1	73.6	–	9.5	–	47.8	3.9	–	14.6	–	14.9	0.7	4.3	4.3	–	–	–	–	–
3	18-27	27.0	79.5	67.9	–	2.8	–	29.4	–	–	17.6	–	46.4	–	–	3.8	–	–	–	–	–
5	38-47	42.1	97.2	95.6	–	5.3	26.4	50.9	–	–	–	–	–	–	8.6	8.8	–	–	–	–	–
7	56-65	56.5	91.0	85.9	–	3.6	–	62.2	–	–	–	–	–	–	27.0	7.1	–	–	–	–	–
8	65-74	67.4	90.9	85.8	–	11.7	–	60.8	–	–	–	–	–	–	21.3	6.3	–	–	–	–	–
		69.0	74.9	60.8	–	5.1	–	38.5	1.9	–	44.3	5.9	–	–	–	4.4	–	–	–	–	–
		74.0	87.5	80.4	–	5.6	–	69.4	–	–	–	–	–	–	19.1	5.9	–	–	–	–	–
11	95-104	97.6	90.1	84.5	–	6.3	–	47.7	2.2	–	12.1	1.2	6.3	–	19.9	4.3	–	–	–	–	–
12	104-113	113.0	93.1	89.2	–	6.5	–	56.1	–	–	9.4	–	–	1.9	21.0	5.0	–	–	–	–	–
15	131-140	133.6	91.5	86.7	–	10.3	–	52.6	–	–	13.0	–	–	1.0	18.4	4.8	–	–	–	–	–
		134.8	99.4	99.1	–	12.3	–	35.5	9.6	–	–	–	–	4.8	35.6	2.3	–	–	–	–	–
		140.0	88.8	82.5	–	4.7	–	51.7	–	–	17.8	1.5	–	1.9	18.8	3.5	–	–	–	–	–
16	142-151	145.8	93.1	89.2	–	7.1	–	68.3	–	–	–	–	–	–	20.3	4.4	–	–	–	–	–
17	151-160	155.0	92.9	88.9	–	10.5	–	48.5	–	–	16.8	1.5	–	2.6	18.1	2.0	–	–	–	–	–
23	246-255	255.0	80.0	68.8	–	3.3	–	47.8	–	–	44.3	–	–	–	0.7	3.9	–	–	–	–	–
24	274-283	283.0	89.6	83.7	–	10.2	–	28.0	–	–	50.8	–	–	–	9.1	1.9	–	–	–	–	–
25	283-292	292.0	77.4	64.6	–	5.0	–	58.9	–	–	32.6	–	–	–	–	3.5	–	–	–	–	–
26	292-301	295.6	77.0	64.0	–	10.4	–	38.8	2.4	–	45.7	2.1	–	–	–	0.6	–	–	–	–	–
		301.0	81.4	70.9	–	7.8	–	17.3	–	–	72.5	–	–	–	–	2.4	–	–	–	–	–

APPENDIX C – *Continued*

Bulk Sample – *Continued*																					
27	301-310	310.0	89.8	84.0	–	14.3	–	22.9	14.7	–	34.8	2.4	11.0	–	–	–	–	–	–	–	–
28	310-319	311.0	79.8	68.4	–	5.4	–	32.2	9.7	–	49.6	–	–	–	–	3.0	–	–	–	–	–
		311.4	81.1	70.4	–	2.5	–	8.9	–	–	88.5	–	–	–	–	–	–	–	–	–	–
		319.0	75.6	61.8	–	13.6	–	19.8	–	–	–	25.2	41.4	–	–	–	Trace	–	–	–	–
29	319-328	321.2	82.8	73.1	–	12.1	–	13.2	–	–	–	27.5	47.2	–	–	–	Trace	–	–	–	–
		323.0	79.5	67.9	–	1.2	–	10.1	–	–	81.3	–	7.3	–	–	–	–	–	–	–	–
<2μ Fraction																					
2	9-18	10.1	85.6	77.6	–	8.6	–	27.3	–	–	51.2	–	–	–	12.2	0.7	–	–	–	–	–
		14.3	85.5	77.3	–	5.3	–	15.3	5.5	–	47.7	–	26.3	–	–	–	–	–	–	–	–
3	18-27	27.0	81.9	71.7	–	1.6	–	11.8	–	–	54.4	–	29.2	–	–	3.0	–	–	–	–	–
5	38-47	42.1	94.7	91.7	–	1.6	15.3	23.7	–	–	45.8	–	–	–	7.2	6.5	–	–	–	–	–
7	56-65	56.5	97.4	96.0	–	3.8	–	42.6	–	–	45.7	–	–	–	–	8.0	–	–	–	–	–
8	65-74	67.4	87.6	80.6	–	6.0	–	36.5	–	–	43.8	–	–	–	–	6.8	–	–	6.9	–	–
		69.0	97.3	95.8	–	1.6	–	19.4	–	–	27.8	–	–	–	–	51.2	–	–	–	–	–
		74.0	86.0	78.2	–	1.9	–	16.3	–	–	77.1	–	–	–	–	–	–	–	4.7	–	–
11	95-104	97.6	87.5	80.5	–	1.2	–	19.4	–	–	61.8	–	9.1	–	7.2	1.4	–	–	–	–	–
12	104-113	118.0	88.4	81.9	–	2.1	–	14.8	–	–	79.5	–	–	–	–	3.7	–	–	–	–	–
15	131-140	133.6	87.2	80.1	–	1.6	–	14.3	5.7	–	75.8	–	–	–	–	2.7	–	–	–	–	–
		134.8	86.5	78.9	–	–	–	4.4	–	–	89.0	–	–	–	–	1.3	–	–	–	5.3	–
		140.0	87.4	80.3	–	1.1	–	16.3	–	–	76.5	–	–	2.6	–	3.4	–	–	–	–	–
16	142-151	145.8	87.8	80.9	–	1.2	–	14.9	–	–	72.7	–	–	1.6	8.9	0.8	–	–	–	–	–
17	151-160	155.0	86.8	79.4	–	1.5	–	8.9	–	–	78.7	–	–	–	5.6	1.2	–	–	4.1	–	–
23	246-255	255.0	78.9	67.1	–	2.1	–	18.0	–	–	77.0	–	–	–	–	2.8	–	–	–	–	–
24	274-283	277.7	70.5	54.0	–	2.7	–	7.0	2.4	–	82.8	1.2	–	–	3.9	–	–	–	–	–	–
		283.0	80.1	68.9	–	13.8	–	9.6	–	–	76.6	–	–	–	–	–	–	–	–	–	–
25	283-292	292.0	71.8	55.9	–	1.7	–	11.9	–	–	85.4	–	–	–	–	1.0	–	–	–	–	–
26	292-301	295.6	72.2	56.5	–	4.9	–	2.3	–	–	92.8	–	–	–	–	–	–	–	–	–	–
		301.0	75.9	62.3	–	–	–	–	–	–	100.0	–	–	–	–	–	–	–	–	–	Pres.
27	301-310	310.0	85.0	76.5	–	6.1	–	3.9	12.3	–	77.7	–	–	–	–	–	–	–	–	–	–
28	310-319	311.0	74.3	59.9	–	–	–	–	–	–	100.0	–	–	–	–	–	–	–	–	–	–
		311.4	68.2	50.4	–	–	–	–	–	–	100.0	–	–	–	–	–	–	–	–	–	–
		319.0	91.9	87.3	–	19.4	–	–	–	–	67.1	–	13.5	–	–	–	Pres.	–	–	–	–
29	319-328	321.2	87.7	80.8	–	15.5	–	–	–	–	76.6	7.9	–	–	–	–	Pres.	–	–	–	–
		323.0	76.0	62.5	–	0.7	–	10.4	–	–	83.2	–	5.7	–	–	–	–	–	–	–	–
Hole 206C <2μ Fraction																					
2	413-422	415.0	76.9	63.9	–	40.4	–	–	7.5	12.8	3.6	33.9	–	–	–	1.8	–	–			
3	422-431	424.1	76.4	63.2	–	53.9	–	–	8.1	6.8	3.0	27.6	–	–	–	0.8	–	–			
4	431-440	433.2	79.7	68.2	–	49.4	–	–	7.5	6.5	4.4	32.2	–	–	–	–	–	–			
5	440-449	442.3	78.8	66.9	–	54.8	–	–	7.8	7.5	2.4	27.5	–	–	–	–	–	–			
6	462-471	466.0	80.0	68.7	–	48.1	–	–	8.6	7.1	4.0	32.2	–	–	–	–	–	–			
7	480-489	481.1	82.0	71.9	–	41.5	–	–	9.1	5.0	2.9	39.8	–	–	–	1.7	–	–			
8	499-508	499.6	77.3	64.5	–	34.3	–	–	8.5	10.3	5.3	41.6	–	–	–	–	–	–			
10	531-540	533.8	79.6	68.2	–	17.9	–	–	3.8	2.1	1.0	73.9	–	–	–	1.4	–	–			
11	547-556	554.0	79.0	67.2	–	20.7	–	–	3.8	3.6	1.3	69.4	–	–	–	1.1	–	–			
12	565-574	567.7	72.5	57.1	–	14.3	–	–	2.4	2.7	1.3	77.6	–	–	–	1.7	–	–			
13	584-593	586.4	77.2	64.3	–	12.5	–	–	1.6	3.1	1.7	74.2	–	2.9	–	4.1	–	–			
		587.9	81.6	71.2	–	15.2	–	–	1.8	3.5	–	65.9	–	5.2	–	8.4	–	–			

APPENDIX C – *Continued*

Bulk Sample – *Continued*

14	603-612	605.4	76.9	63.9	–	14.6	–	–	1.6	6.8	1.4	64.2	–	5.9	–	5.5	–	–
15	612-621	614.1	87.4	80.4	–	11.3	–	–	3.0	2.4	–	79.7	–	1.3	–	1.4	–	–
16	630-639	631.4	84.0	75.0	–	10.4	–	–	4.4	4.6	1.9	78.7	–	–	–	–	–	–
		635.1	87.7	80.8	–	10.4	–	–	4.0	1.8	1.5	82.3	–	–	–	–	–	–
17	649-658	652.7	92.4	88.1	–	7.0	–	–	–	–	–	88.7	–	–	4.4	–	–	–
		657.7	96.3	94.2	–	14.6	–	–	8.7	–	–	76.6	–	–	–	–	–	–
18	668-677	670.7	93.5	89.9	–	12.0	–	–	5.7	–	–	77.6	–	–	4.7	–	–	–
19	687-696	688.3	84.8	76.3	–	3.5	–	–	–	4.9	–	82.2	–	4.4	5.0	–	–	–
20	706-715	706.9	78.5	66.4	–	9.7	7.5	4.4	2.8	12.3	–	42.4	–	19.1	1.9	–	–	–
21	725-734	725.7	87.8	80.9	–	3.2	74.8	–	0.8	2.1	–	9.9	9.2	–	–	–	–	–
		727.3	88.2	81.6	–	2.4	71.7	–	0.9	0.9	–	10.9	11.5	0.7	1.0	–	–	–

[a]U-1 peak at 12.1 Å.

[b]U-2 peaks at 2.83 Å and 2.00 Å.

APPENDIX D
Thermal Conductivity Measurements, Site 205

Core, Section, Interval Below Top (cm)	Thermal Conductivity (mcal/°C cm sec)	Standard Deviation	Ambient Core Tempera-ture (°C)	Remarks
2-2,78	0.001883	0.008811	20.36	
2-4,77	0.001773	0.009512	20.53	
2-5,77	0.001704	0.011842	21.17	
3-3,68	0.001706	0.009251	18.65	
3-4,66	0.001766	0.010352	19.42	
3-5,65	0.001717	0.010181	20.02	
5-1,61	0.002205	0.008058	21.10	
5-3,58	0.001992	0.010009	20.68	
5-5,58	0.001907	0.009756	19.99	
6-1,50	0.001979	0.007508	21.06	
6-3,50	0.002346	0.014266	21.76	
6-5,50	0.002083	0.004737	21.03	
7-1,75	0.002044	0.003473	20.85	
7-3,75	0.001973	0.008956	20.42	
7-5,75	0.001960	0.007375	20.30	
8-2,70	0.002398	0.013294	20.66	
8-4,70	0.002513	0.014478	20.97	
10-1,0	0.001921	0.008410	19.70	
10-2,0	0.001999	0.009959	19.57	
11-2,60	0.001995	0.008987	24.40	2nd meas.
11-3,57	0.002076	0.009153	24.26	2nd meas.
14-3,63	0.002030	0.011421	19.87	
14-4,72	0.001953	0.015970	20.34	
15-2,80	0.001966	0.009941	22.24	
15-3,70	0.001862	0.011038	23.00	
15-4,92	0.001922	0.012274	22.46	
16-3,79	0.002075	0.012460	21.43	Repeat
16-5,67	0.002189	0.008629	22.56	2nd meas.
16-5,3	0.001922	0.009798	21.67	2nd meas.
17-2,86	0.002010	0.010780	22.67	
17-3,132	0.002067	0.012676	22.78	
17-3,82	0.002065	0.008836	22.68	
26-4,70	0.003000	0.008442	22.93	Repeat 1
27-2,43	0.002305	0.008143	22.82	
27-4,32	0.002300	0.007596	23.79	
27-6,102	0.002670	0.006356	21.99	
28-2,90	0.002666	0.006296	21.47	
28-4,79	0.002634	0.004400	22.59	
28-5,74	0.001991	0.010495	21.89	
29-2,100	0.002738	0.007850	21.42	2nd meas.
29-4,50	0.002734	0.010513	22.44	2nd meas.
29-6,74	0.002816	0.006731	21.47	2nd meas.

Site 205 Hole Core 1 Cored Interval: 0-9 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					Core Catcher					IRON OXIDE BEARING GLASS SHARD RICH CLAY with pumice lapilli

Site 205 Hole Core 2 Cored Interval: 9-18 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLIO-PLEISTOCENE	?	F	-		1	0.5, 1.0	EMPTY	4	XM	5YR3/3 IRON OXIDE AND CLAY BEARING, GLASS SHARD ASH AND IRON OXIDE BEARING, GLASS SHARD BEARING OR RICH CLAY dark reddish brown, some brownish yellow (10YR6/8) and brown 7.5YR4/4) mixed in. Glass is colorless and intermediate in composition. 5 cm pumice, light gray (7.5YR N6). 10% Fe oxide; 10-75% clay; 85- 5% glass; 2-10% zeolites
					2			3, 1		X-ray - 85% amorphous, 15% crystalline: 13% quartz, 50% plag., 8% mica, 4% chlor., 9% mont., 13% augite, 6% magnetite
					3			4		
					4				XM	
					5					
		F N R	- - R	M	Core Catcher					ZEOLITE AND IRON OXIDE BEARING CLAY dark brown

Site 205 Hole Core 3 Cored Interval: 18-27 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5, 1.0	EMPTY			
PLIOCENE	? ≈NN13	F N	R A	P M	2			3	CC	5YR3/3 ZEOLITE RICH IRON OXIDE CLAY dark reddish brown — 50% clay, 40% Fe oxide, 10% zeolites. NYR6/4 IRON OXIDE AND FORAM BEARING NANNO OOZE light yellowish brown [44% $CaCO_3$]
LATE MIOCENE	N17-N18 ≈NN12(lower)	N F	F C	M M	3					5YR3/3-3/2 IRON OXIDE CLAY WITH VARYING AMOUNTS OF NANNO OOZE (30-85%). 10YR5/4 NANNO OOZE. FORAM AND IRON OXIDE BEARING NANNO OOZE (10YR5/4) yellowish brown (5YR3/2) mixed in
		F N	R F	P P	4					ZEOLITE BEARING NANNO RICH (25%)
	≈NN11(upper)	F N	C	M	5			4, 3, 4, 3		Small amounts of yellowish brown (10YR5/6) mixed in. ZEOLITE, IRON OXIDE, NANNO BEARING CLAY
	≈NN11 (lower)	N F N	C F C	M M P	6			4		5YR3/3 ZEOLITE IRON OXIDE RICH NANNO OOZE — 20% Fe oxide, 25% nannos, 40% clay, 15% zeolites. 5YR2/3 GLASS BEARING IRON OXIDE RICH NANNO OOZE — 85% nannos, 10% Fe oxide, 3% glass (colorless), 2% feldspar
		R F N	R F C	P M P	Core Catcher		EMPTY	4	GZ	7.5YR4/4 brown GLASS BEARING IRON OXIDE RICH NANNO CLAY [35% silt, 65% clay] Glass R.I. 1.55-1.58, therefore SiO_2 composition is intermediate.

Site 205 Hole Core 4 Cored Interval: 27-36 m

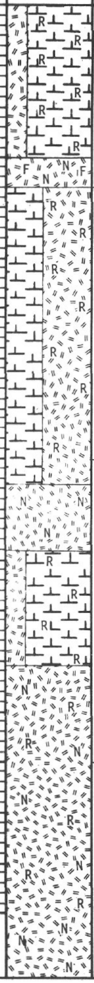
AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE MIOCENE	N17-N18 NN11	R F N	R F A	M M M	Core Catcher					15 gms GLASS SHARD FORAM RAD BEARING CLAY NANNO OOZE

Site 205 Hole Core 5 Cored Interval: 38-47 m

AGE: LATE MIOCENE
ZONE: N16, NN10

FOSSIL	ABUND.	PRES.	SECTION	METERS
R	F	M	1	0.5, 1.0
N	C	M		
N	A	M	2	
R	R	M		
N	A	M	3	
R	F	M		
R	VR	M	4	
N	A	P	5	
R	F	M	6	
R	R	M	Core Catcher	
F	A	G		
N	C	M		

LITHOLOGY



DEFORMATION: 3, 4, 3, 4

LITHO. SAMPLE: GZ, XM CC, GZ

LITHOLOGIC DESCRIPTION

Diatoms 2% IRON OXIDE CLAY, RAD BEARING GLASS SHARD RICH NANNO OOZE
10YR4/4
10YR3/1 very dark gray (glass clear and brown: clear R.I. <1.56, brown R.I. >1.56)
[36% sand, 50% silt, 14% clay]

25-53% nannos
2-90% glass
5-30% Fe oxide clay
5-20% rads

10YR5/4 dark yellowish brown

10YR3/1 very dark gray

10YR3/1
10YR5/3
SILICEOUS FORAM AND NANNO BEARING GLASS SHARD ASH, very dark gray, 60% glass

RAD BEARING, NANNO GLASS SHARD ASH, brown (mostly colorless glass R.I. <1.56)
10YR3/1 mixed with 10YR5/3

10YR5/4 yellowish brown swirled with 10YR3/1 very dark brown

RAD BEARING NANNO GLASS SHARD ASH
X-ray - 89% amorphous noncrystalline, 10% crystalline: 67% calcite, 2% quartz, 13% K-feldspar, 17% plag., 1% gypsum
[10% $CaCO_3$]

10YR4/2 FELDSPAR AND NANNO BEARING GLASS SHARD ASH
50% colorless glass 1.56
35% pale brown glass R.I. <>1.56
10% feldspar
5% nannos
10YR5/6

GLASS RICH SILICEOUS NANNO OOZE
yellow brown

10YR4/3
brown

10YR5/3 brown
NANNO RAD BEARING GLASS SHARD ASH
Most glass is colorless R.I. <1.56

10YR4/4
dark yellow brown

[82% silt, 17% clay]

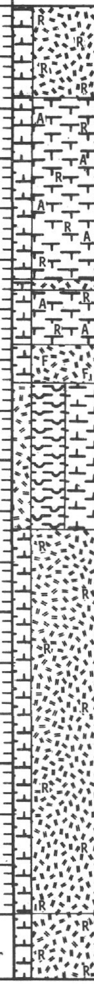
10YR4/2
dark gray brown
NANNO BEARING GLASS SHARD ASH
Most glass colorless and fresh R.I. <1.56
gray brown

Site 205 Hole Core 6 Cored Interval: 47-56 m

AGE: LATE MIOCENE
ZONE: N16, NN10

FOSSIL	ABUND.	PRES.	SECTION	METERS
N	A	G	1	0.5, 1.0
R	C	M		
F	A	G	2	
N	A	M	3	
R	VR	M		
			4	
N	A	M	5	
R	R	M		
			6	
R	F	M	Core Catcher	
F	F	M		
N	A	M		

LITHOLOGY



DEFORMATION: 4-3, 4, 3, 4, 3, 4, 3, 4, 3, 4

LITHO. SAMPLE: GZ, CC

LITHOLOGIC DESCRIPTION

10YR4/2-4/3 RAD BEARING NANNO RICH ASH
dark gray brown - brown
Glass colorless, mostly fresh, angular and with pipe shaped vesicles R.I. <1.56.
rhyolite pumice fragment 1 cm

50% glass
20% devitrified glass & clay
20% nannos
10% rads

10YR5/2-5/3 GLASS AND RAD BEARING NANNO RICH FORAM OOZE
grayish brown with very dark gray
10YR3/1 streaks of glass shard ash

10-20% nannos
30-58% forams
15-40% glass
1-10% rads

[60% sand, 28% silt, 12% clay]

10YR3/2-3/1 FORAM RICH GLASS SHARD ASH
very dark gray brown

10YR3/1 FORAM BEARING NANNO RICH GLASS SHARD ASH very dark

50% glass
10% nannos
10% forams
10% Fe oxide
20% feldspar & pyroxene

10YR5/2-6/3 GLASS SHARD RICH RAD NANNO OOZE
gray brown to pale brown
Glass is characteristic with long parallel vesicle tubes

34-40% nannos
30-40% glass
25-30% rads
5% Fe oxide

SILICEOUS NANNO RICH GLASS SHARD ASH
15% rads
15% diatoms

10YR4/3 brown

10YR5/2

10YR4/3 brown
Rhyolite fragment
10YR5/3 brown

NANNO BEARING TO NANNO RICH GLASS SHARD ASH

10YR4/2 dark gray brown

1 cm rhyolite pumice fragment

10YR5/3 [23% $CaCO_3$]

RAD BEARING NANNO RICH GLASS SHARD ASH
brown gray

Site 205 Hole Core 7 Cored Interval: 56-65 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
							EMPTY			
LATE MIOCENE	NN10	R N	F A	M M	1	0.5 1.0		3 4	XM	10YR3/1 GLASS RICH FORM NANNO OOZE very dark gray 10YR5/2 gray brown & 5/3 brown GLASS AND NANNO RICH FORAM OOZE AND NANNO RICH GLASS SHARD ASH
	NN9				2					10YR4/3 RAD RICH GLASS NANNO OOZE brown scattered pumice 40-52% nannos 20-30% glass 15-20% rads 1- 5% silicoflag.
		N R	C F	P M	3					10YR5/2 gray brown
					4			3		10YR5/2 RAD AND NANNO BEARING GLASS SHARD ASH gray brown
		N R	C VR	M M	5					
					6					10YR4/2 dark brown gray rare pumice fragments 10YR5/3 brown 10YR5/3 10YR4/2 10YR4/2 SILICEOUS NANNO BEARING GLASS SHARD ASH 60% glass 20% nannos 15% rads 5% diatoms
		R F N	R F A	M M P	Core Catcher				GZ	10YR4/2 RAD AND NANNO BEARING GLASS SHARD ASH dark yellow brown washed samples large up to 7 mm light gray pumice and glass subrounded to subangular. [6% sand, 70% silt]

Site 205 Hole Core 8 Cored Interval: 65-74 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5 1.0	EMPTY			
LATE MIOCENE	N15-N16	NN9	N	A	P	2				XM	10YR4/3 NANNO BEARING GLASS SHARD ASH brown 50-60% glass 35-40% nannos 5% rads Pebble of white pumice, (rhyolitic pitchstone)
			N	A	M	3				GZ XM	2.5Y4/2 dark gray brown [85% sand, 9% silt, 5% clay] Many lapilli size pumice fragments (subrounded to angular) 10YR3/1 very dark gray
						4					10YR4/1 dark gray 10YR4/2 gray brown sand to small pebble size glass and tuff fragments form 1/3 of Sections 4-5
			N	A	P	5					2.5Y3/2 very dark gray brown 10YR5/2 gray brown
			R F N	VR A C	M M P	Core Catcher				GZ	10YR2/2 NANNO GLASS SHARD ASH dusky yellow brown wash sample; granule to sand size - pumice, plagioclase, pyroxene, black vesic. glass [80% sand, 16% silt, 5% clay]

Site 205 Hole Core 10 Cored Interval: 83-92 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N14-N16	NN8	N	A	M	1	0.5, 1.0		3 to 4			CORE 9: NO RECOVERY
											5Y3/2	NANNO RICH GLASS SHARD ASH — dark olive gray. Varying hardness probably due to drilling. Glass mostly colorless and with R.I. <1.56 <5% brown glass with R.I. >1.56. 85% glass, 15% nannos
											5Y2/2, 5Y3/2, 5Y2/2	black. Much of the glass is devitrified and coated by iron oxides. black indurated
						2					5Y3/2	Alternating hard and soft intervals.
			F N	R C	G M	Core Catcher						NANNO RICH GLASS SHARD ASH — 67% colorless glass, 10% brown glass, 20% nannos, 1% rads, 1% forams. 17% $CaCO_3$ using shipboard HCl treatment.

Site 205 Hole Core 11 Cored Interval: 95-104 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
						1	0.5, 1.0	EMPTY	4			Downhole contamination, white pumice and dark olive tuff. sediments.
MIDDLE MIOCENE		NN8							3 to 4		5Y3/2	NANNO BEARING GLASS SHARD ASH — semilithified hard intervals; much of glass is devitrified
						2				XM	5Y2/2 black to 5Y3/1	NANNO AND ZEOLITE BEARING GLASS SHARD ASH — 75% colorless glass, 10% brown glass, 10% nannos, 5% zeolites. X-ray - 84% amorphous, 16% crystalline: 17% calcite, 24% plag., 5% quartz, 12% mont., 22% K-feldspar, 3% phillipsite, 10% augite, 5% magnetite
			N	A	M	3						3 cm fragment vitric lapilli tuff 5Y3/1
											5G4/1, 5Y3/1	Devitrified vitric tuff; worm? casts.
	N14	NN7	R F N	- R C	- M P*	Core Catcher						NANNO BEARING GLASS SHARD ASH — gray, semi-indurated, olive gray (5Y4/1)

*From base of core catcher.

Site 205 Hole Core 12 Cored Interval: 104-113 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE		LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N14	NN6 to NN7	F N	F R	M P	1	0.5, 1.0	EMPTY	4 to 3			Downhole contamination white rhyolite and dark tuff.
											5Y3/2	ZEOLITE AND NANNO BEARING GLASS SHARD ASH — dark olive gray. 85% glass, 5% nannos, 15% zeolites
	N13		R F N	R R	M P*	Core Catcher						NANNO BEARING GLASS SHARD ASH — gray semilithified, olive black (5Y4/1)

*From base of core catcher.

Site 205 Hole Core 13 Cored Interval: 113-122 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N12-N13	NN6 to NN7	N F	R C	P G	Core Catcher					NANNO BEARING GLASS SHARD ASH — washed sample; mainly sand and granules of pumice, glass, quartz

Site 205 Hole Core 14 Cored Interval: 122-131 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5 1.0	EMPTY			
MIDDLE MIOCENE	N12-N13	NN6 to NN7	N	R	P	2			3 to 4		Downhole contamination. 10YR3/1 VITRIC TUFF, very dark gray. Much of glass is devitrified. Almost all is colorless glass with R.I. <1.56. Feldspar and pyriboles 5%. Mottled by burrowing organisms. Induration is sufficient to require sawing cores to split them. Hardness, however, varies cyclically along core.
			N	R	P	3					10YR4/1 dark gray — Zeolite rich
						4					10YR3/1 very dark gray
MIDDLE MIOCENE			N F R	F - -	M	Core Catcher					NANNO BEARING VITRIC TUFF olive gray (5Y4/1) — 52% colorless glass, 40% devitrified glass, 3% brown glass, 5% nannos

Site 205 Hole Core 15 Cored Interval: 131-140 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0.5	EMPTY			
MIDDLE MIOCENE	NN6 to NN7	N	C	P	1	1.0		Mostly 4 25% ~1		NANNO BEARING VITRIC TUFF. 10YR4/1 dark gray to 10YR3/1 very dark gray — same as 14-3. Alternating hard and soft intervals. much devitrified glass
					2				XM	
		N	F	P	3				XM	NANNO AND ZEOLITE BEARING GLASS SHARD ASH, 10YR3/2 + 10YR4/2 dark gray brown — cross laminated; 80-90% glass, 5-15% zeolites, 2-15% nannos, 5% plag. and pyriboles. Alternating hard and soft intervals. 10YR5/2 gray brown
					4			60% 1 40% 4		10YR4/1 dark gray to 10YR3/1 very dark gray — VITRIC TUFF. Moderately mottled by burrowing organisms. 96% + glass, 2% feldspar
		R N F	- C R	P G	Core Catcher				GZ	ZEOLITE BEARING VITRIC TUFF gray partially lithified [70% silt, 30% clay] olive gray (5Y4/1) to olive glack (5Y2/1)

Explanatory notes in Chapter 1

Site 205 Hole Core 16 Cored Interval: 142-151 m

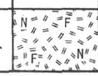
AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5 1.0	EMPTY			10YR4/2 dark brown gray — Downhole contamination.
MIDDLE MIOCENE	N11-N12	≈NN5	N	A	M	1–5			Almost all 4 except for few hard int.	XM	10YR4/1 dark gray — VITRIC TUFF similar to 14-3 — 90% glass R.I. <1.56 Alternating hard and soft intervals. Little or no mottling. 10% nannos Scattered lapilli size fragments of vitric tuff. 2% nannos Moderately mottled. 5% nannos 90% clear glass R.I. <1.56 3% brown glass 2% plag. and pyriboles
	N10-N11		R N F	- C C	P M	Core Catcher					NANNO BEARING VITRIC TUFF 14% $CaCO_3$ using shipboard HCl treatment olive gray to olive black

Site 205 Hole Core 17 Cored Interval: 151-160 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5 1.0	EMPTY	1 and 4		10YR4/1 dark gray — ZEOLITE AND NANNO BEARING VITRIC TUFF similar to 14-3, moderately mottled
MIDDLE MIOCENE	≈NN5	N	C	P	2–4		EMPTY	1 and 4	XM	10YR4/1 dark gray — NANNO BEARING VITRIC TUFF, moderately mottled. Most glass is devitrified. — 90-98% glass, 0-10% nannos, <5% zeolites
							EMPTY			
		N	C	P	5					VITRIC TUFF 5Y4/1 dark gray — VITRIC LAPILLI TUFF, poorly sorted pumice fragments up to 2 cm
		N R	C -	P	Core Catcher					NANNO-FORAM BEARING VITRIC TUFF olive gray (5Y4/1)

Site 205 Hole Core 19 Cored Interval: 169-178 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N10-N11	≈NN5	R N F	- F F	P M	Core Catcher					1 vial NANNO BEARING VITRIC ASH 83% glass - much of it devitrified pumice R.I. 1.56 10% plag. & pyrobole crystals 5% nannos 2% forams



Site 205 Hole Core 20 Cored Interval: 178-187 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N10	≈NN5	N F	C C	M G	1	0.5 1.0		4		10YR3/1 VITRIC ASH very dark gray not lithified
						2		F	1 and 4		10YR4/1 FORAM BEARING NANNO RICH VITRIC TUFF dark gray 4 cm piece of vitric tuff x-bedded, slightly mottled 10YR5/1 gray Alternating soft (25%) and hard (75%) intervals. 10YR3/1 VITRIC ASH 67% glass 20% nannos 10% forams 3% plag. & pyroboles
MIDDLE MIOCENE	N10		R N F	- C C	 M G	Core Catcher		F			FORAM AND NANNO BEARING VITRIC ASH olive gray (5Y4/1 to olive black (5Y2/1)

Site 205 Hole Core 21 Cored Interval: 198-207 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	≈NN5	R N F	- F -	P	Core Catcher		N			NANNO BEARING VITRIC ASH olive gray (5Y4/1)

Site 205 Hole Core 22 Cored Interval: 216-225 m

AGE	ZONE		FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N9	≈NN5	N F R	C F -	M -	Core Catcher					NANNO-RICH ASH washed sample; same as in CC8

Site 205 Hole Core 23 Cored Interval: 246-255 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	≈NN5				1	0.5 1.0	EMPTY			
		N F	R -	P	2					10YR6/1 gray to 10YR4/1 VITRIC TUFF AND VITRIC LAPILLI TUFF Moderately mottled; graded? bedding inclined 5-10°; pumice lapilli angular to subrounded; up to 4 cm in diameter; penecontemporaneous deformation of vitric ash matrix around lapilli; glass mainly devitrified R.I. <1.56
		N	C	P	3			1		2.5Y4/2 gray brown Intensely mottled. ZOOPHYCOS type burrows; intensely mottled. Several stages of burrowing. Bedding inclined <5°.
					4					
		F	-		5			1 and 4		Intensely mottled by several stages of organic burrowing. 5G6/1 greenish gray to 5G4/1 dark green gray
		R N F	- A -	M*	Core Catcher		N		CC GZ XM	NANNO VITRIC ASH [30% silt, 70% clay] [16% $CaCO_3$] X-ray shows significant amount of montmorillonite developed after glass.

*From top of core catcher.

Site 205 Hole Core 24 Cored Interval: 274-283 m

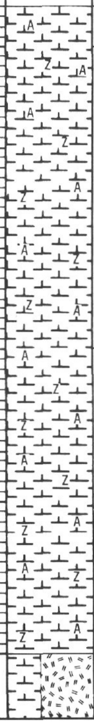
AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5	EMPTY			
MIDDLE MIOCENE	≈NN5					1.0		1		10YR6/4 to 10YR4/4 NANNO VITRIC TUFF 70% glass, 10-30% nannos. Intensely burrowed yellowish brown. Glass mostly devitrified.
LATE OLIGOCENE	NP25 (lower)	N	C	M	2					olive gray piece with sandy layer
		N	A	P				2		10YR4/2 ZEOLITE AND DEVITRIFIED GLASS BEARING NANNO OOZE stiff, transitional to chalk; mottled by burrows
		N	A	P						5G8/1 sharp color change oblique to core, burrows continue undisturbed across boundary, therefore post-depositional
		N	A	P				3		10YR4/2 & 10YR1/4 very pale brown
		N	A	M	3			1 and 2		ZEOLITE RICH NANNO OOZE; 10YR5/3 brown & 10YR7/4 pale brown mottling NANNO BEARING GLASS SHARD ASH Intensely mottled.
		N F	A R	M P					XM	X-ray - 56% amorphous, 44% crystalline: 57% calc., 2% qtz., 10% plag., 14% mont., 2% gyps., 4% augite
		N	A	M						5YR8/1 ZEOLITE GLASS SHARD BEARING NANNO OOZE 91% nannos, 5% glass, 3% zeolite; 5YR3/1 pinkish gray
										very dark gray NANNO ZEOLITE BEARING VITRIC ASH AND VOLCANIC GLASS BEARING NANNO OOZE
		N	C	M	4					variegated colors grays & browns: Thinly interlayered nanno rich layers are yellowish and pinkish gray. Glass rich layers light to dark gray.
		R N F	R A -	M M*	Core Catcher					GLASS BEARING NANNO OOZE AND NANNO VITRIC ASH [97% silt, 3% clay] 74% $CaCO_3$ using shipboard Insol. Resid. light olive gray (5Y6/1) and pale yellow brown (10YR6/2)

*From base of core catcher.

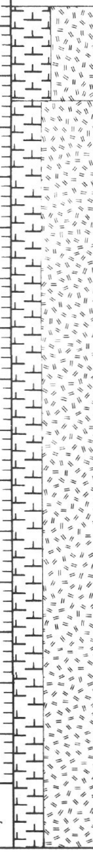
Site 205 Hole Core 25 Cored Interval: 283-292 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5	EMPTY			
LATE OLIGOCENE	NP25 (lower)	N	A	M		1.0		4, 3		10YR7/3 very pale brown & 10YR5/2 gray brown GLASS SHARD BEARING NANNO CHALK 87-94% nannos, 5-10% glass. Semilithified transitional to ooze. Moderately mottled throughout. Glass largely devitrified.
					2			3 and 1		5GY8/1 light green gray to 5GY6/1 green gray (Greenish layers richest in glass.)
		N	A	M	3					5YR5/2 reddish gray; 5GY8/1 light green gray to 5Y8/1 yellowish gray; 5YR5/2 shades of reddish gray slightly mottled; 10YR7/3 & 10YR5/2
										dark gray (2.5Y3/1) NANNO BEARING VITRIC TUFF; light green gray (5GY8/1)
		N F R	A - -	G	Core Catcher				CC GZ	light gray (N7) NANNO CHALK; olive gray (5Y4/1) VITRIC ASH; GLASS RICH NANNO CHALK AND NANNO BITRIC ASH gray semilithified; contact in CC between dark gray (more burrowed) and light gray [45% $CaCO_3$] [29% silt, 71% clay]

Site 205 Hole Core 26 Cored Interval: 292-301 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5 – 1.0	EMPTY			
LATE OLIGOCENE	NP25 (lower)	N	C	P	2			1, 2		5Y6/4 light red brown & 10YR6/3 pale brown mostly — GLASS SHARD ZEOLITE BEARING NANNO CHALK. Moderately mottled (burrowed) to intensively mottled. Semilithified. 5-15% glass, 2% zeolites 10YR4/2 dark gray brown
					3				XM CC	5YR7/3 pink & 10YR4/2 dark gray brown interbedded — pink layers 95% nannos, 2% zeolites, 2% glass; gray layers with iron oxide 10YR4/2
		N	A	G	4			1 to 2		pink mottled (5YR7/3) reddish brown (5YR6/4) & pink (5YR8/3) grayish brown (10YR5/2) to pale & dark brown (10YR6/3-4/3) — glass rich, feldspar rich, darker layers; pink layers nearly pure nannos pink (5YR7/4)
					5				GZ	dark gray brown (10YR4/2) to very dark gray (10YR3/1) [25% silt, 74% clay]
									GZ	pink (7.5YR7/4) [12% silt, 88% clay]
		N	A	C	Core Catcher				GZ CC	pink NANNO DEVITRIFIED VITRIC ASH. Most glass devitrified. [11% silt, 89% clay] [11% $CaCO_3$]

Site 205 Hole Core 27 Cored Interval: 301-310 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
					1	0.5 – 1.0	EMPTY			
LATE OLIGOCENE	NP25 (lower)				2			4		Pink, brown and green lithologies. Mostly downhole contamination.
					2, 3					10YR3/1 NANNO RICH DEVITRIFIED VITRIC ASH. Slightly mottled. pink (10YR2.5/1) black iron oxide rich (25%) glass bearing (2%) Interlayered and mottled very dark gray brown (10YR3/2) to dark gray brown (10YR4/2) and pink (5YR7/3) or pinkish gray (7.5YR7/2). Dark layers iron oxide and clay rich.
		N	A	M	4					very dark gray (10YR3/1) pink (5YR7/4) and pink gray (5YR7/2) NANNO RICH GLASS SHARD ASH
	NP24 (upper)				5			2		
		N	A	M	6					
		R N F	- A -	M	Core Catcher				CC	Top dark NANNO BEARING TO NANNO VITRIC ASH [41% $CaCO_3$] Bottom white layer richer in nannos. Most glass devitrified.

Site 205 Hole Core 28 Cored Interval: 310-319 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LATE OLIGOCENE	NP24 (upper)	N	A	M	1	0.5, 1.0	EMPTY		XM XM
					2				
					3				
		N	A	M	4				
					5				
		N F R	A - -	P	Core Catcher				GZ CC

LITHOLOGIC DESCRIPTION

downhole cavings

very dark gray brown (10YR3/2)
&
pinkish gray (5YR6/2)
to pink (5YR8/3)

dark red brown
(5YR2.5/2
slightly to moderately mottled

30% Fe oxide, 70% nannos

ZEOLITE AND NANNO BEARING AND NANNO RICH VITRIC ASH

mottled with pale yellow (2.5Y8/4)

light gray (2.5Y7/2) NANNO BEARING ASH BEDS
Most of volcanic glass is devitrified.

whitish bands

10YR6/3 pale brown

Slightly devitrified R.I. <<1.56
variegated
light gray to brown
Semilithified ash rich layer

Ash rich layer
95% glass
5% nannos

IRON OXIDE RICH GLASS SHARD NANNO OOZE
[35% silt, 64% clay] [53% $CaCO_3$]

Explanatory notes in Chapter 1

Site 205 Hole Core 29 Cored Interval: 319-329 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LATE OLIGOCENE	NP24 (upper)	N	A	M	1	0.5, 1.0	EMPTY		
					2				XM
					3				XM
		N	A	M	4				
					5				
		N	A	P	6				
	N3	N F	A C	P M	Core Catcher				CC

LITHOLOGIC DESCRIPTION

dark red brown (5YR3/2) NANNO VITRIC ASH
slightly mottled
stiff to semilithified

Brown (7.5YR3/2) Glass mostly devitrified
yellowish brown palagonite?

X-ray - 58% amorphous, 92% crystalline:
85% calc., 2% qtz., 6% clin.(clay),
5% phillips.

yellow brown (10YR5/4)
Ash rich layer.

brown
(7.5YR3/2)

pale yellow (5Y7/3) FE OXIDE NANNO BEARING VITRIC ASH
pink ash layers glass almost completely devitrified
81% glass
4% feldspar & pyroboles
5% Fe oxide
10% nannos

pale yellow
(2.5Y7/4) moderately
mottled with dark
gray brown (10YR4/2) Ash rich

yellow and dark brown layers

brown (10YR4/3)

pale brown (10YR6/3) ash rich layer

5YR2.5/2 dark red brown

slightly mottled
dark brown (7.5YR3/2)

IRON OXIDE RICH GLASS SHARD NANNO OOZE
grayish brown (5YR3/2)
most glass is devitrified
[61% $CaCO_3$]

Site 205 Hole Core 30 Cored Interval: 328-337 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
MIDDLE OLIGOCENE	NP24 (lower)	N	A	P	1	0.5, 1.0	EMPTY		
		F	R	P	2				
		N	A	M	3		EMPTY		1
		N	R	P	Core Catcher				

LITHOLOGIC DESCRIPTION

dark brown (7.5YR3/2) — DEVITRIFIED VOLCANIC GLASS NANNO OOZE
slightly mottled
stiff to very stiff

dark red brown (5YR2.5/2 — yellowish brown non-birefringent (R.I. ~1.56) grains probably palagonite

5YR3/2 dark red brown — DEVITRIFIED VOLCANIC GLASS NANNO OOZE
slightly mottled
very stiff

5YR2.5/2
2.5Y6/2 light brown gray — LIMESTONE
lithified

NANNO LIMESTONE AND BASALT
Limestone fine grained, nannos partially recrystallized vugs and veinlets with calcite; in direct contact with basalt. Minor volcanic glass probably masked by highly birefringent nannos.

Site 205 Hole Core 31 Cored Interval: 337-346 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
						0.5			
					Core Catcher				

LITHOLOGIC DESCRIPTION

NANNO LIMESTONE CUT BY BASALT
Limestone - fine green, light brown gray (2.5Y6/2); bugs and veinlets filled with calcite crystals. Fe? dendrites (black) extend from contact with basalt into limestone.

Basalt - fine green, dark gray (10YR4/1), slightly vesicular (vesicules up to 3 mm) calcite veined. Feldspar phenocrysts from diabasic texture visible in thin section; feldspars altered. Black and yellowish orange. Fresh glass rims 3-6 mm of basalt in contact with limestone. Fresh olivine and labradorite phenocrysts in outer rim.

BASALT
Dark gray fine grained, highly vesicular, feldspar phenocrysts form matted (subdiabasic) texture. Radiating crystals of amphibole; glass and plagioclase clearly altered.

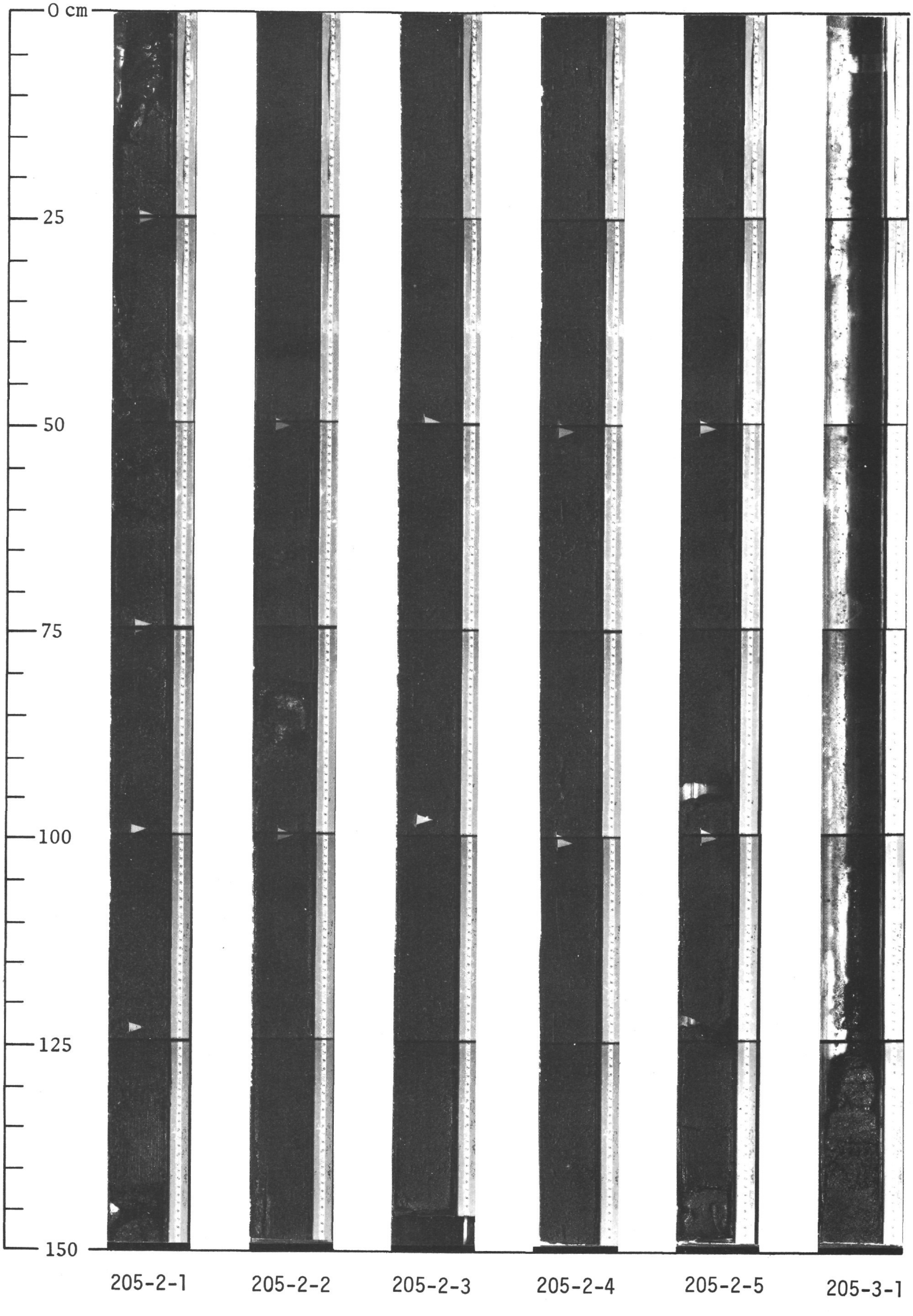
Site 205 Hole Core 32 Cored Interval. 346-355 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
					1	0.5, 1.0			
					2				
					3				
					Core Catcher				

LITHOLOGIC DESCRIPTION

BASALT
Fine-grained, olive gray (5Y4/1), highly vesicular (vesicles 1-2 mm in diameter), in places up to 25% vesicles; rare calcite veinlets stained in most places by iron. Plagioclase phenocrysts (labradorite) altered and iron stained. In places diabasic texture is visible. Rock is massive and structureless. No obvious change in composition or texture between core sections.

BASALT
same as above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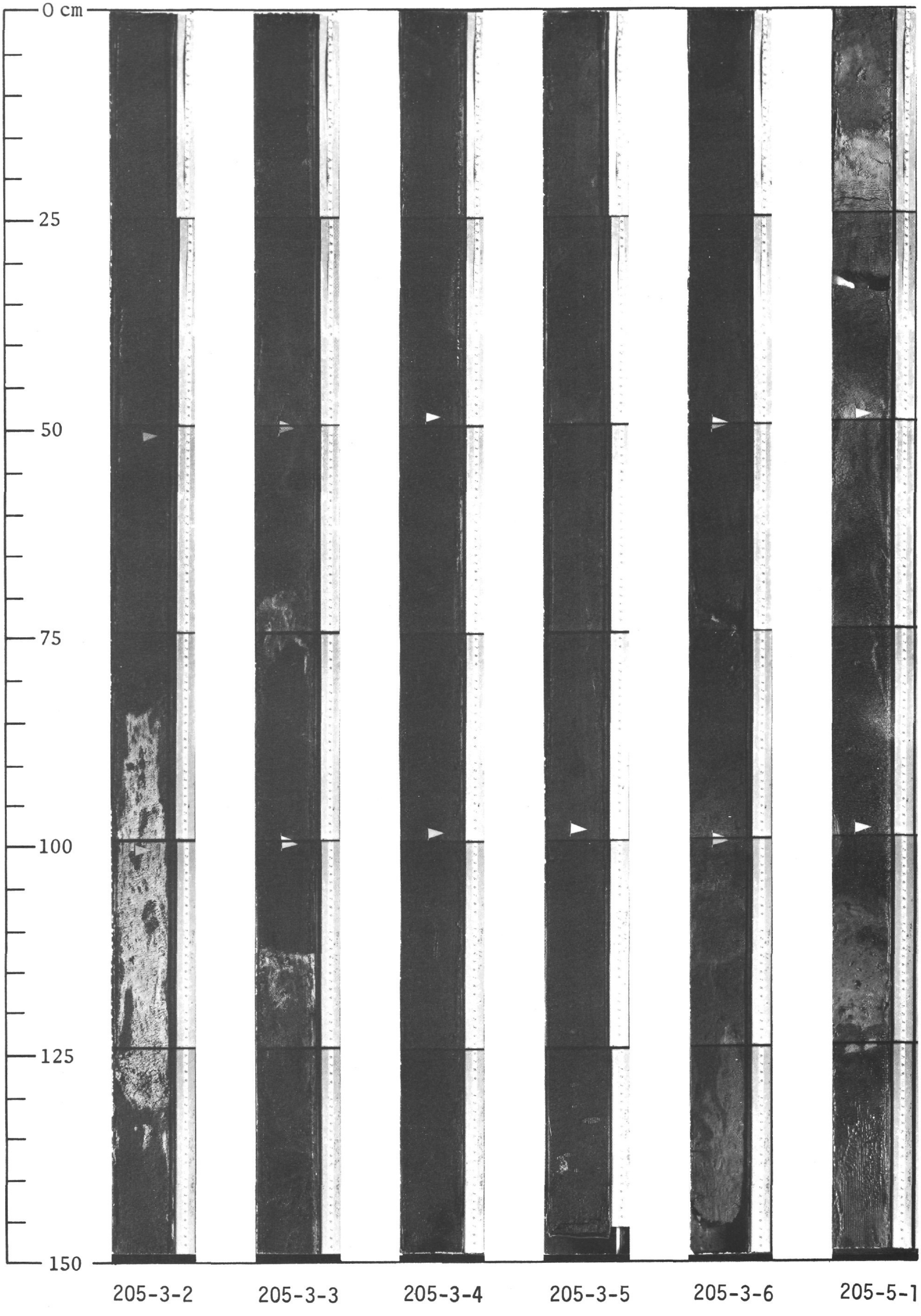
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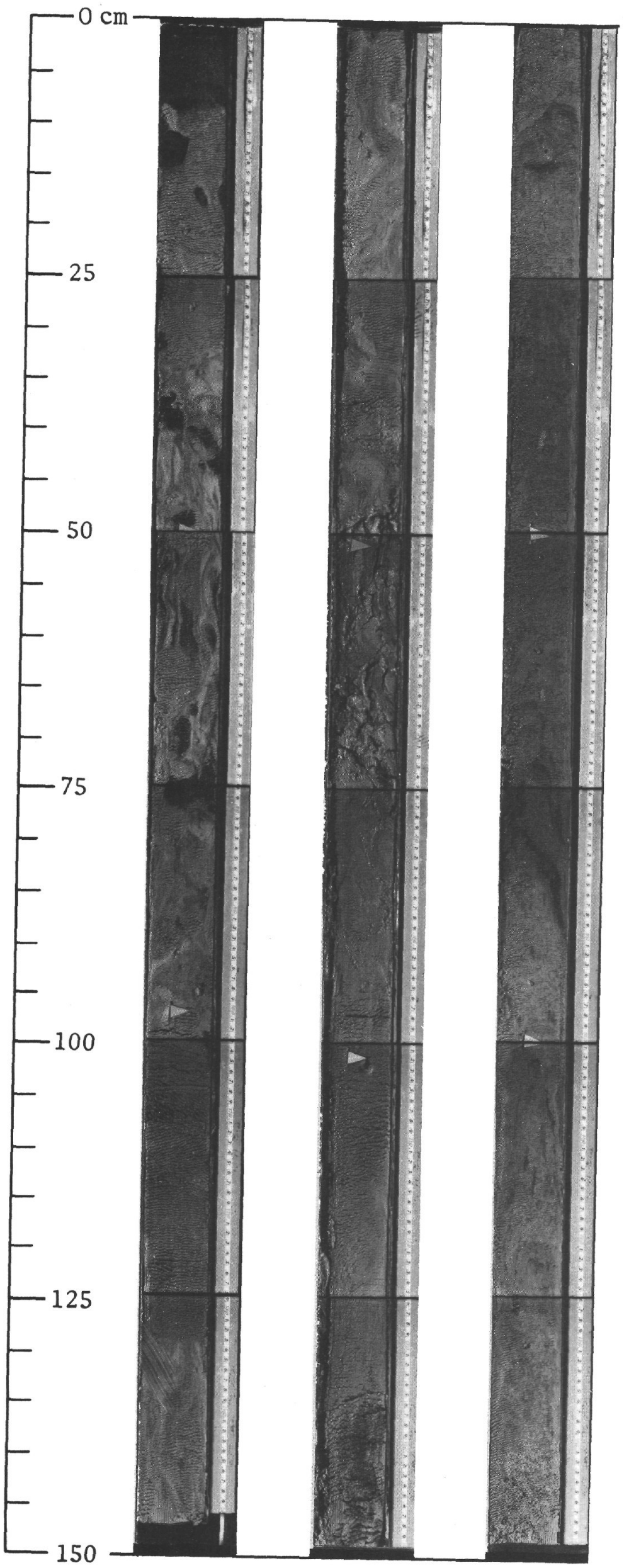

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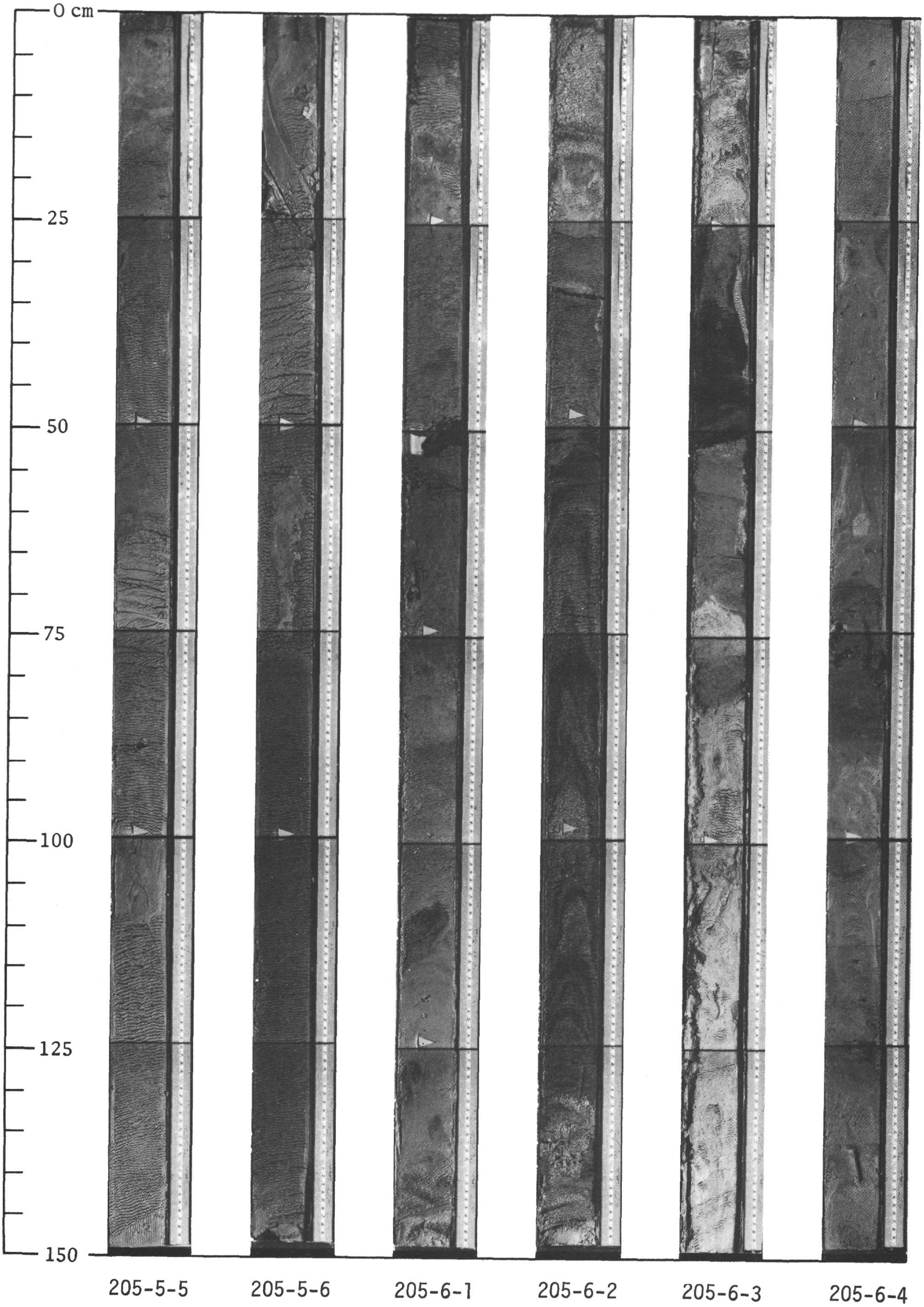
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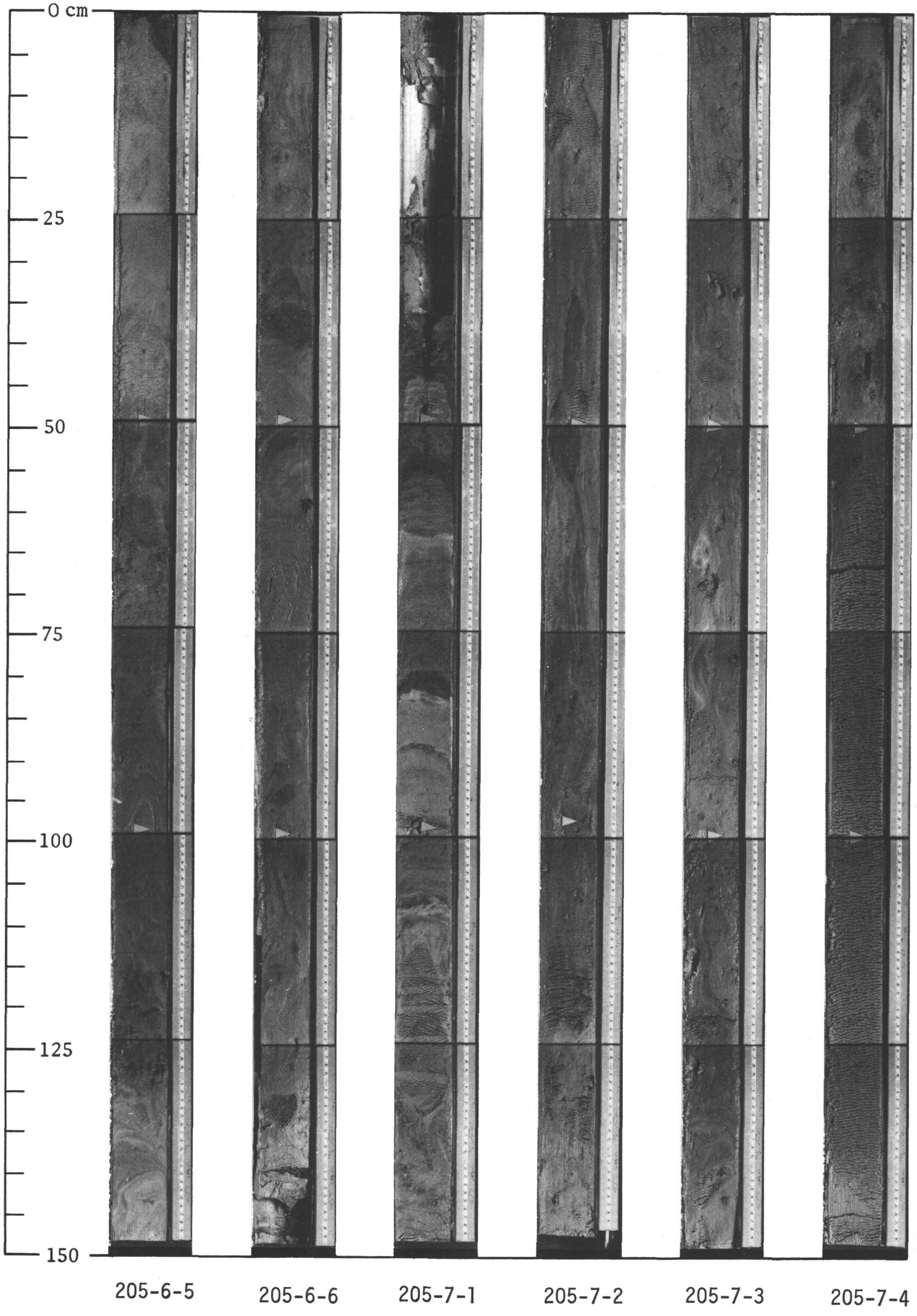
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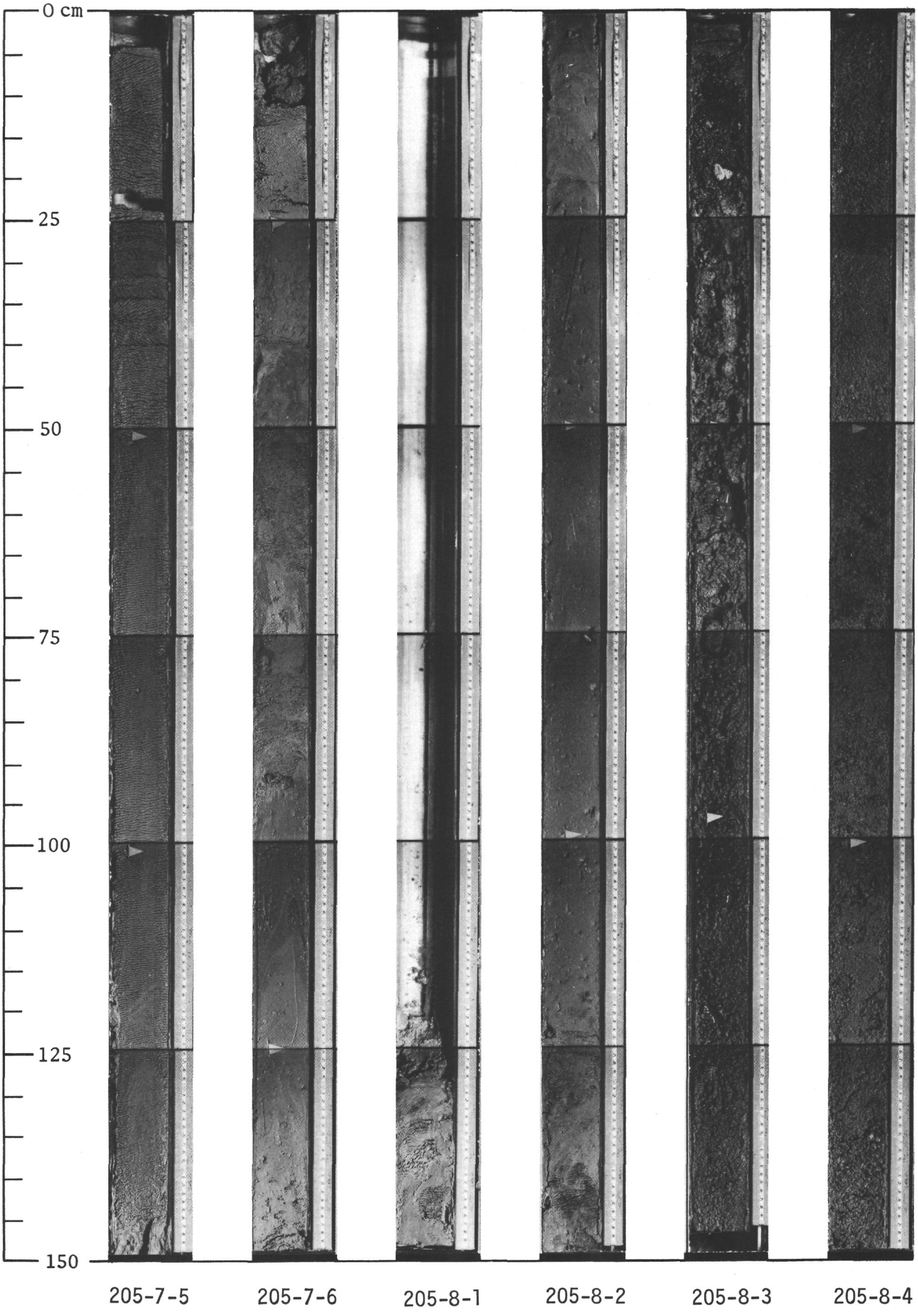
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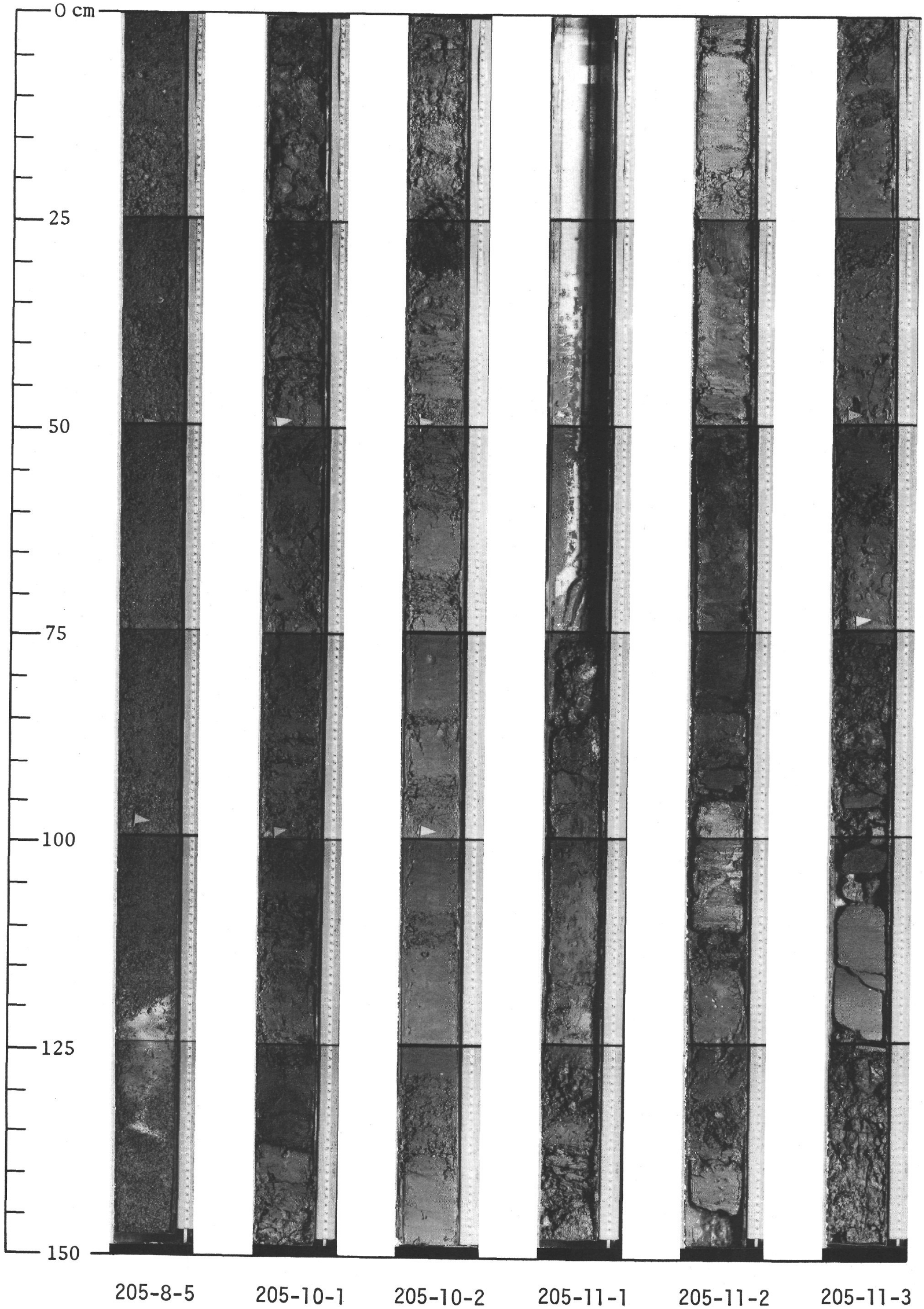
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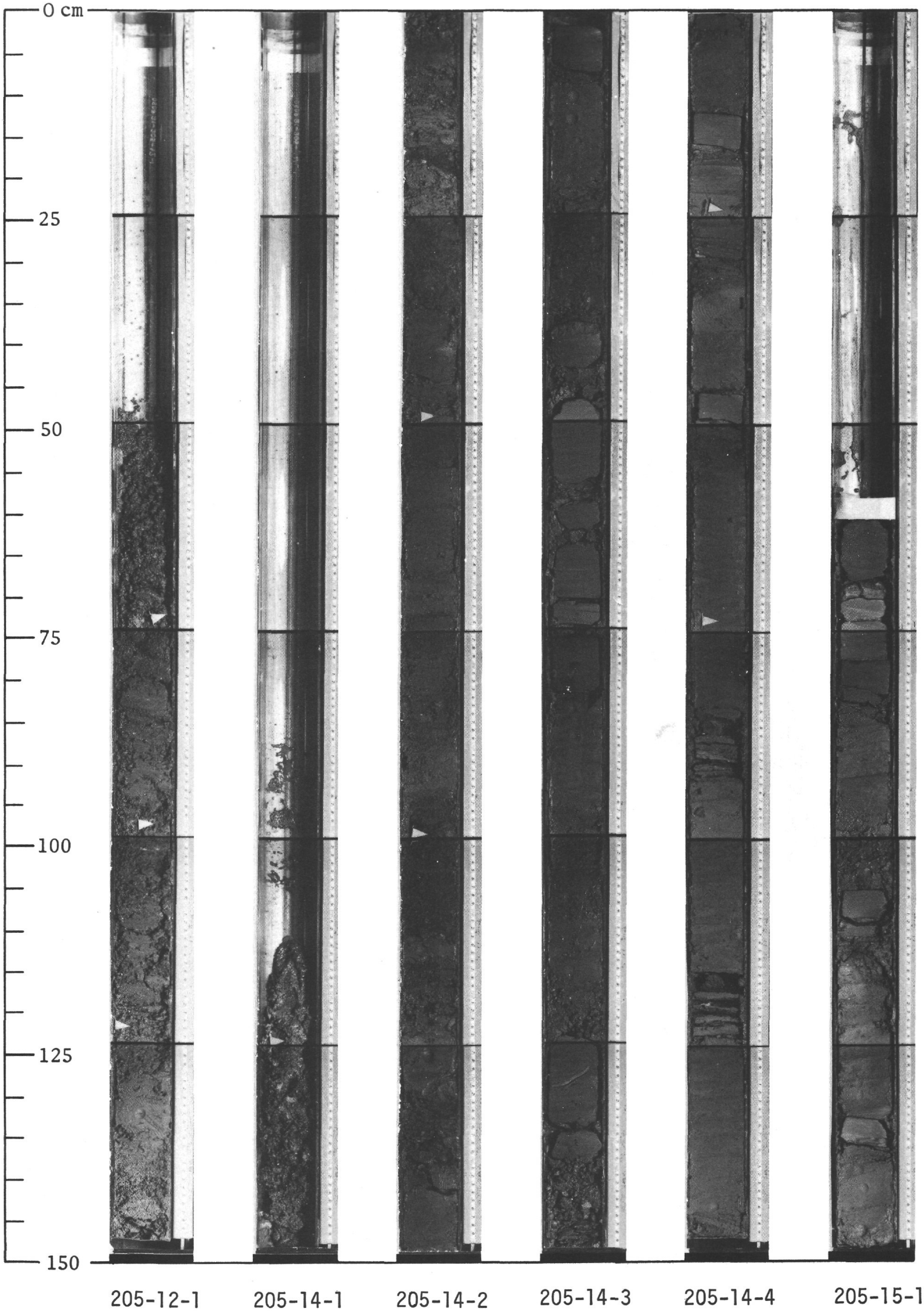
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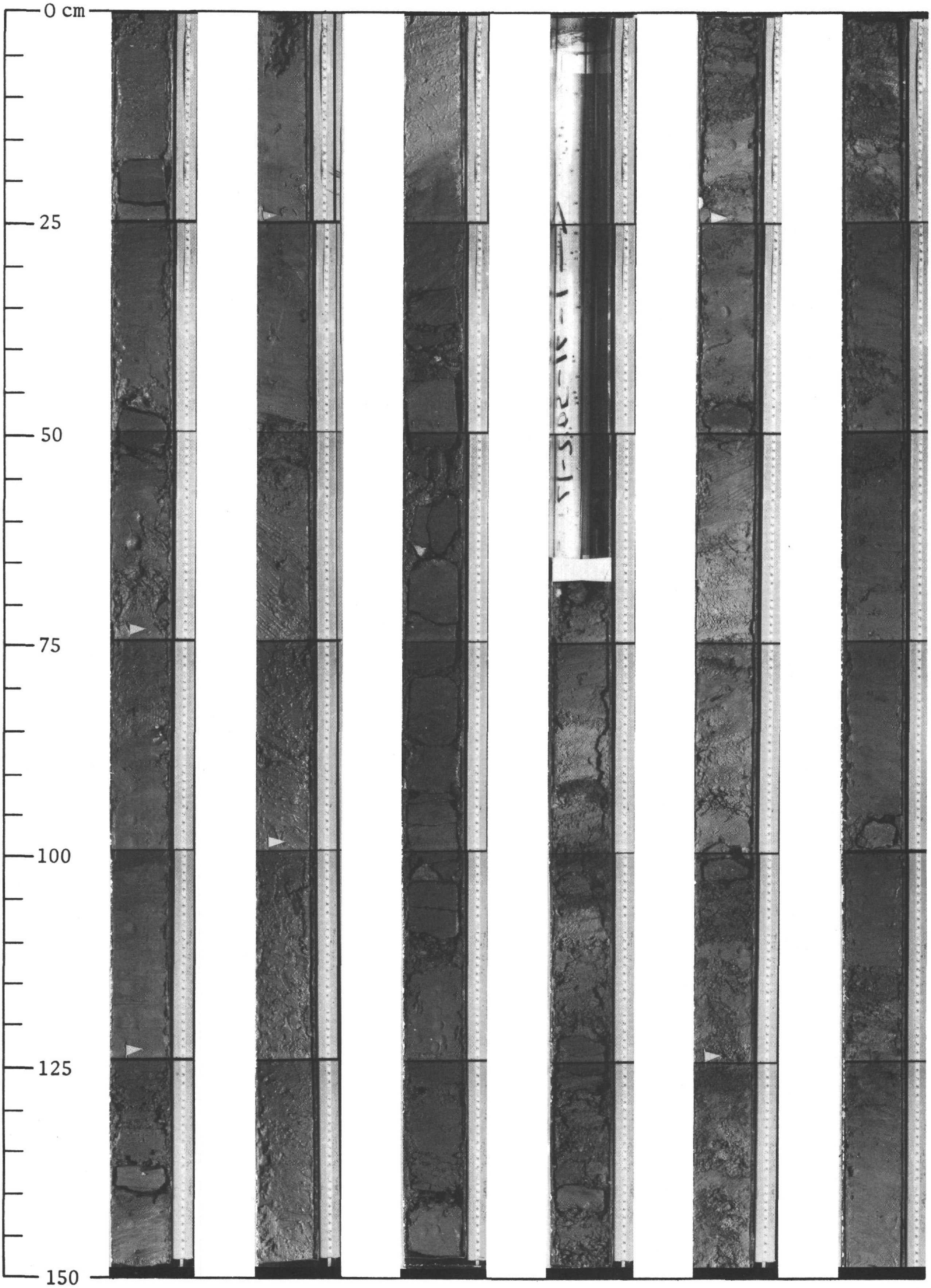

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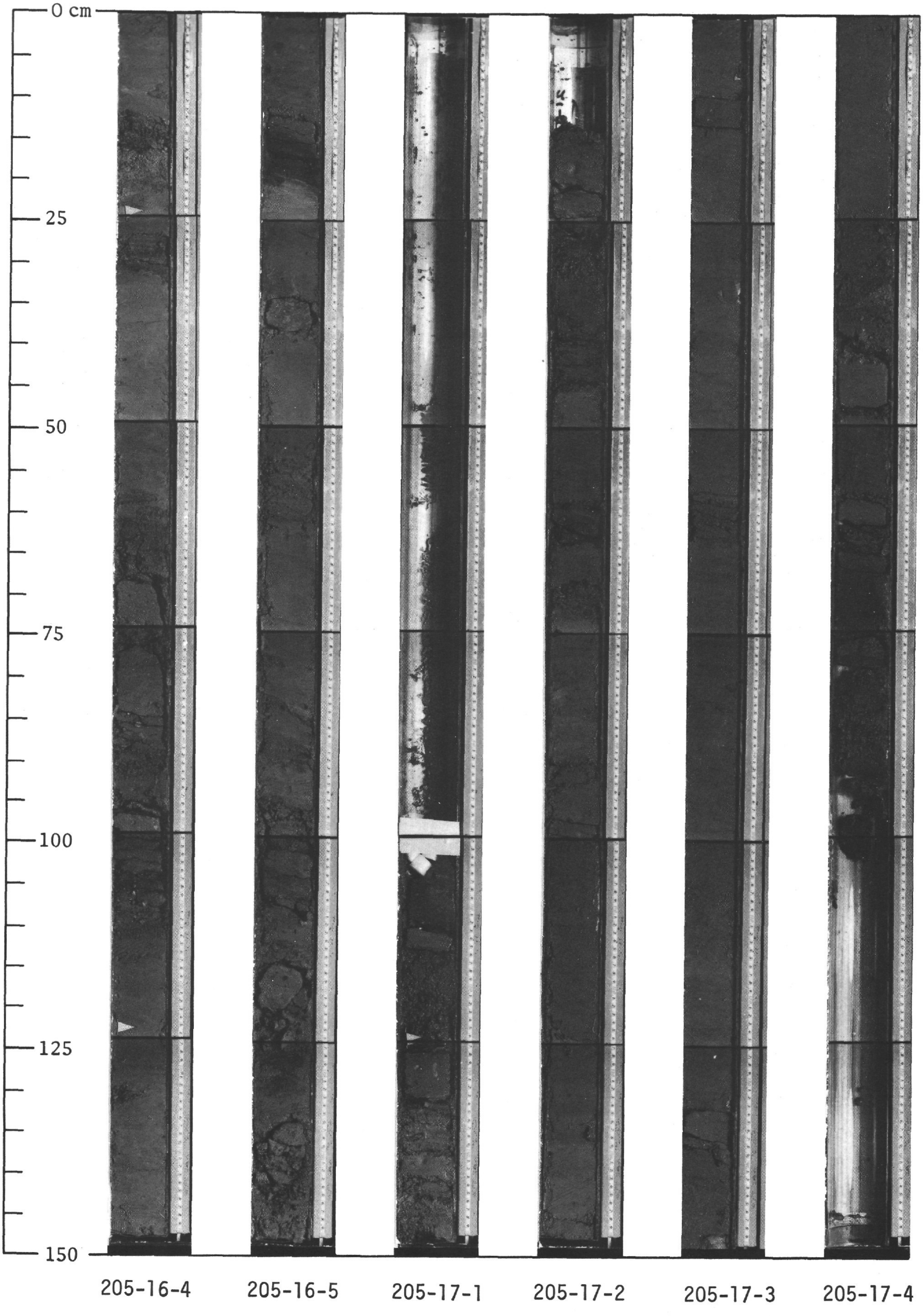
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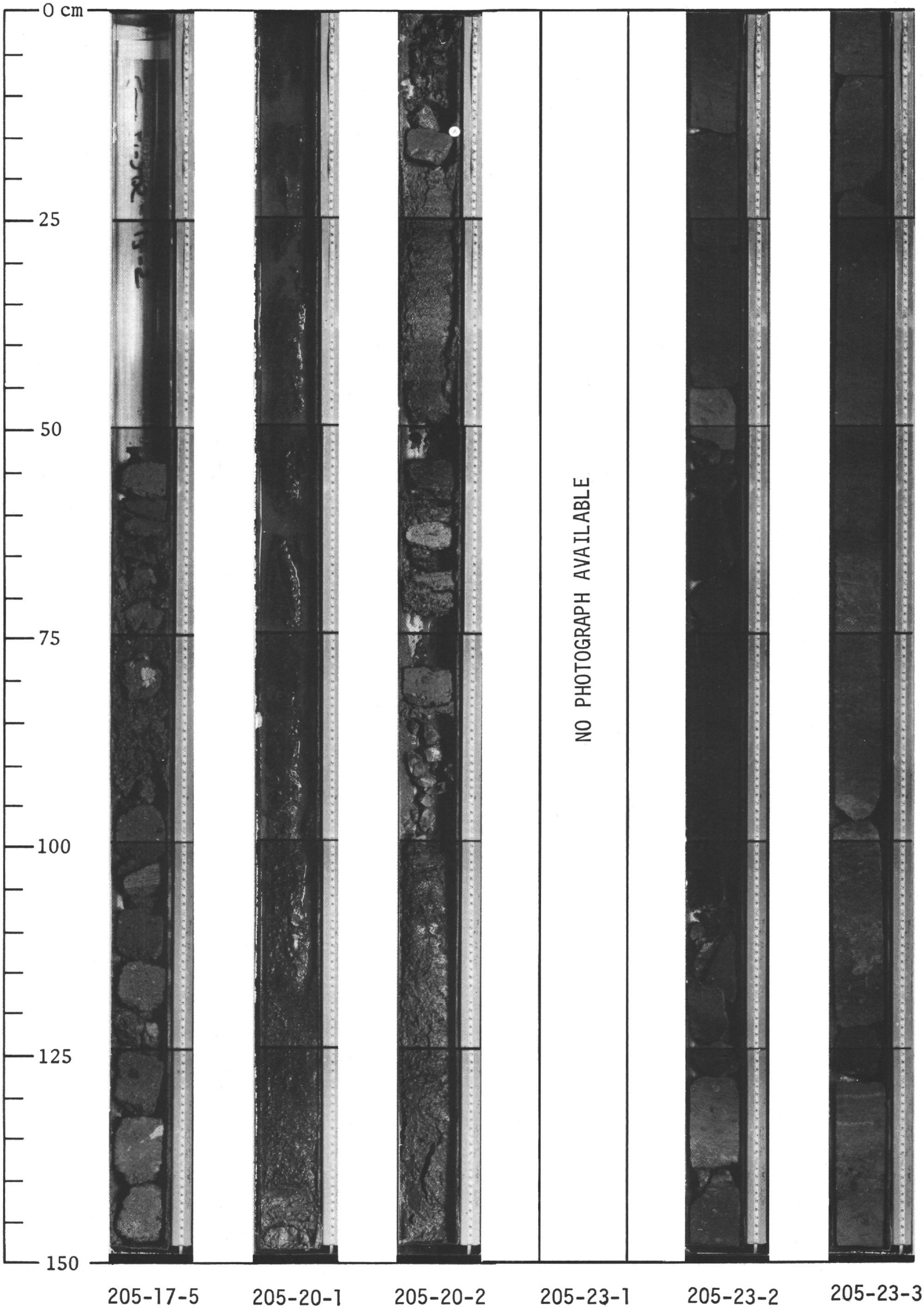
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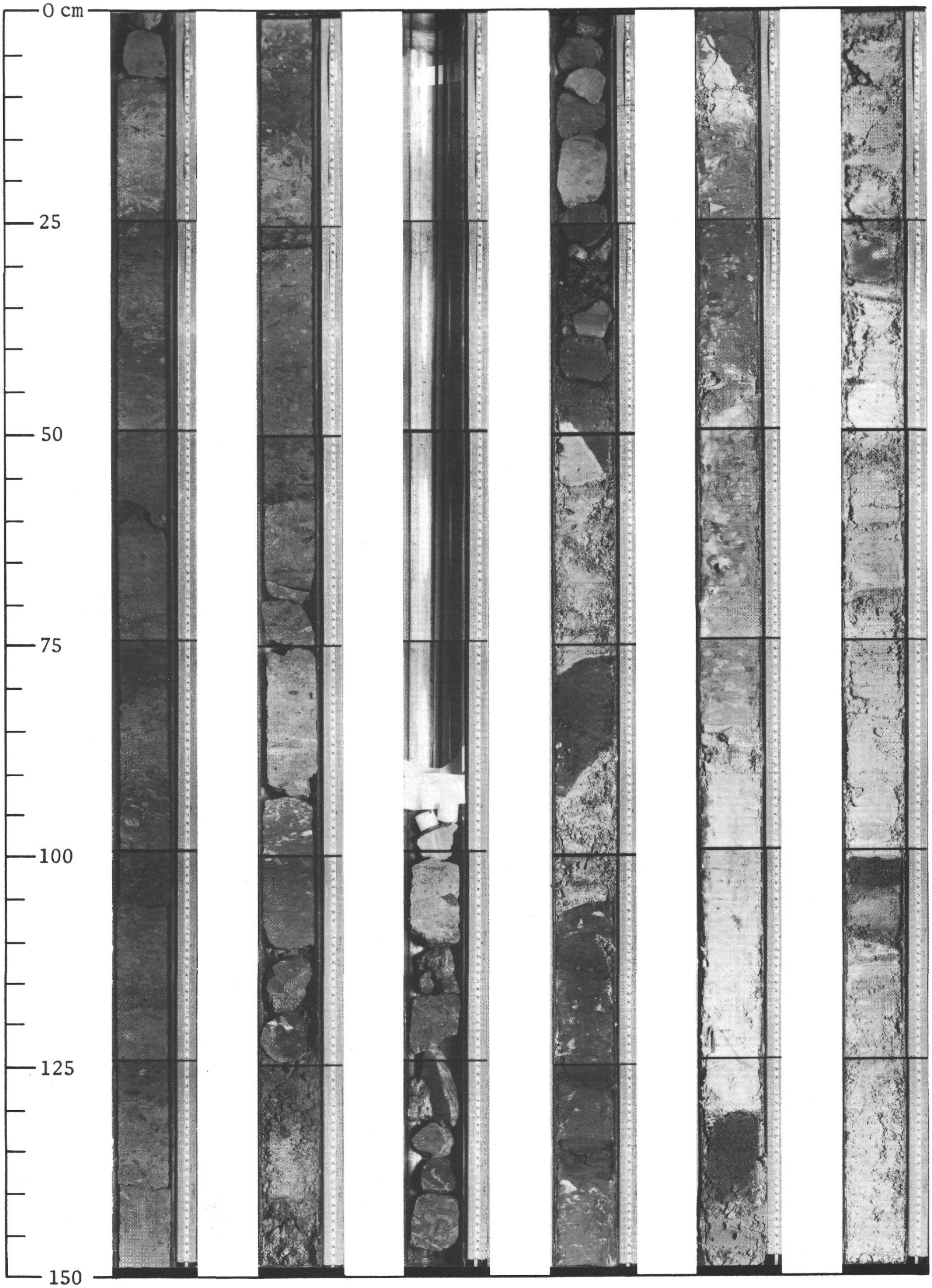
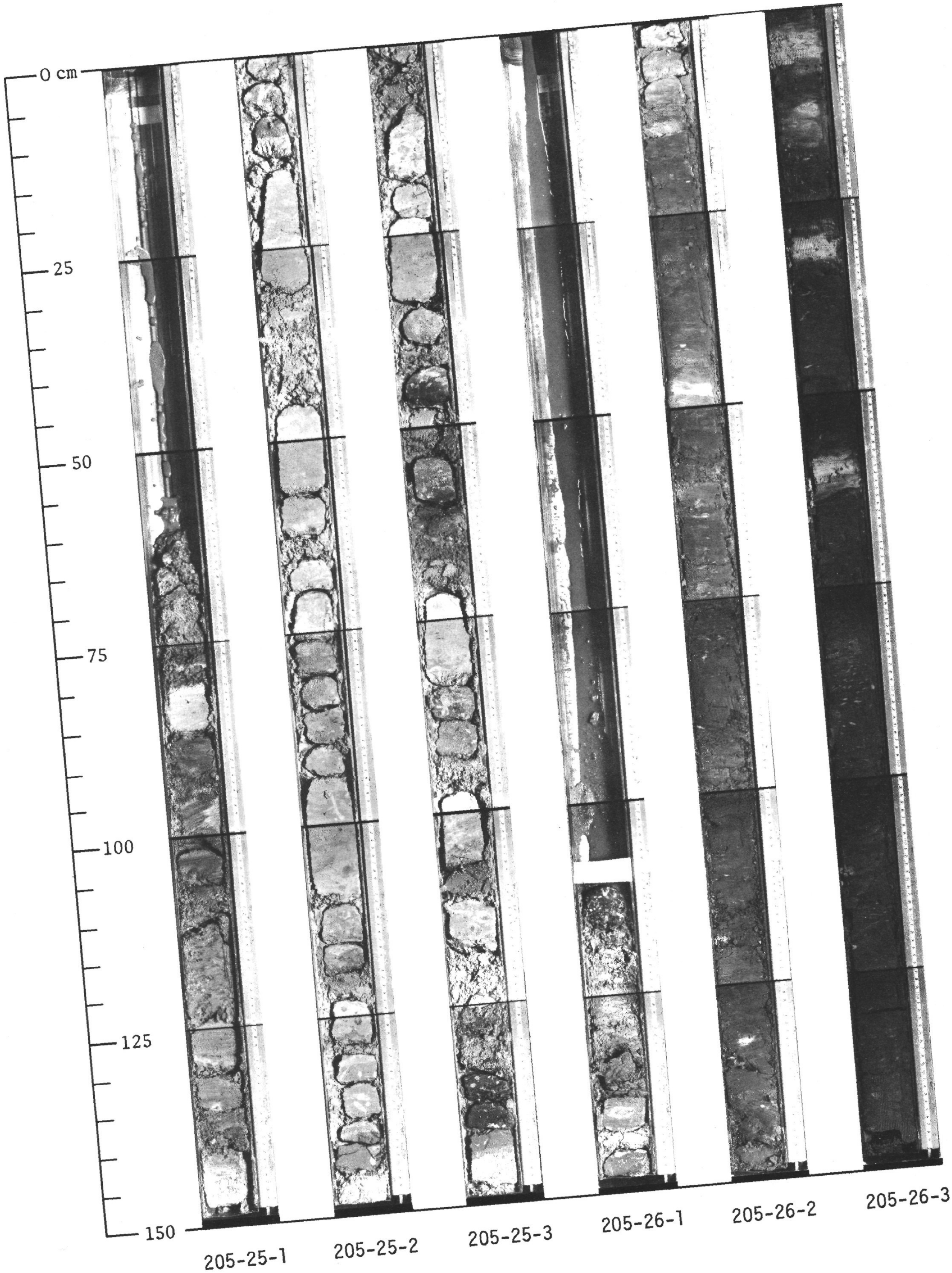
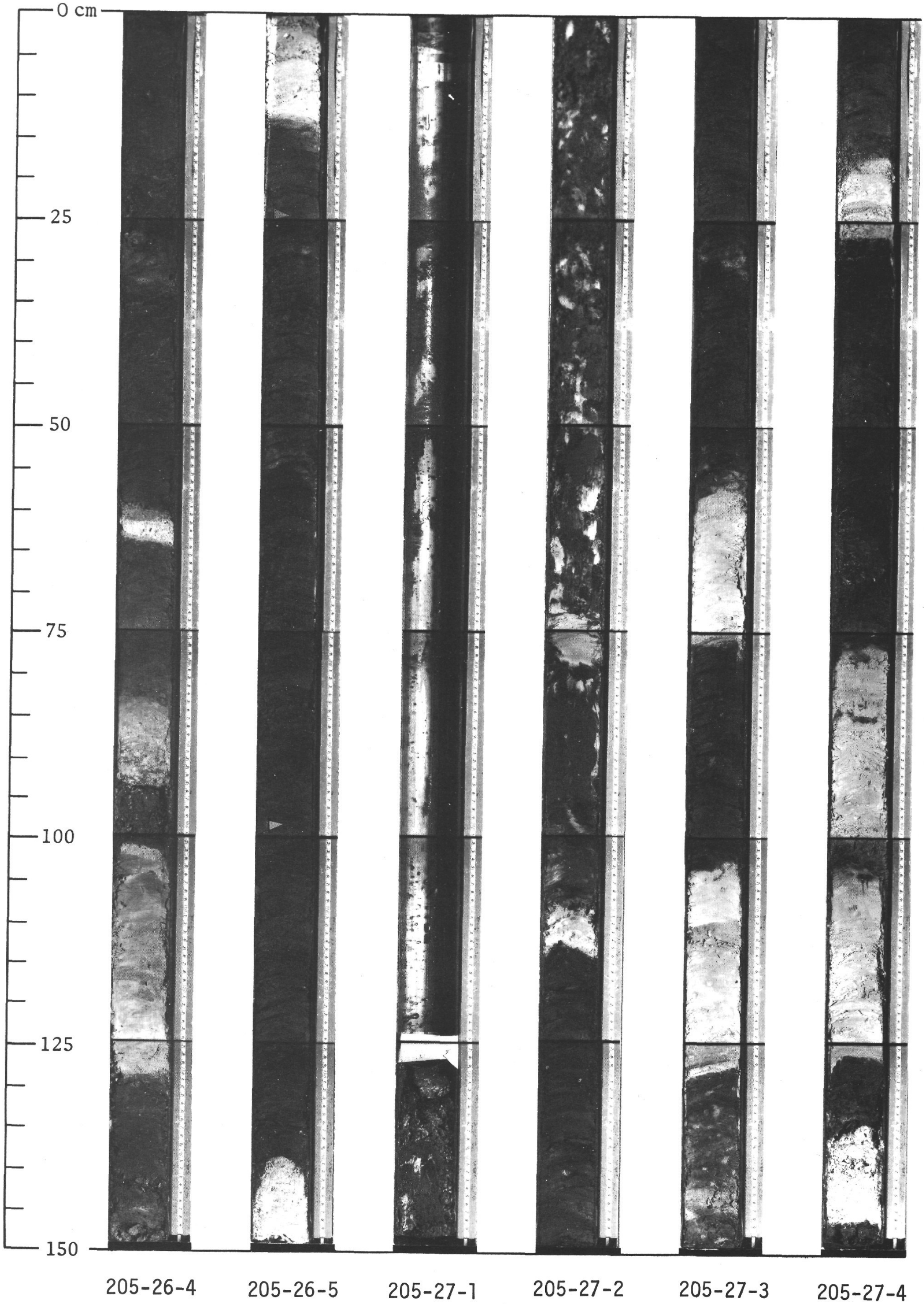
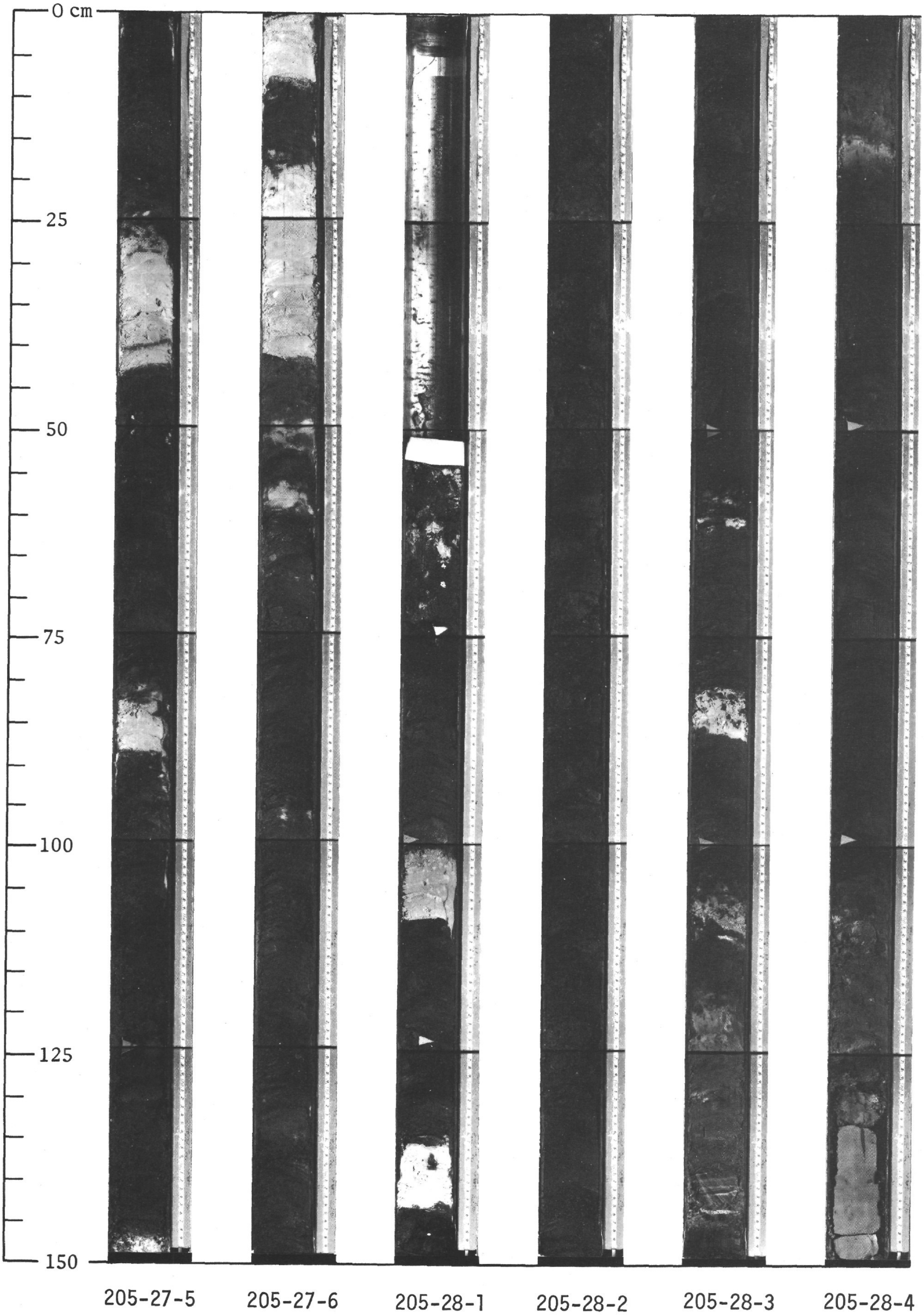
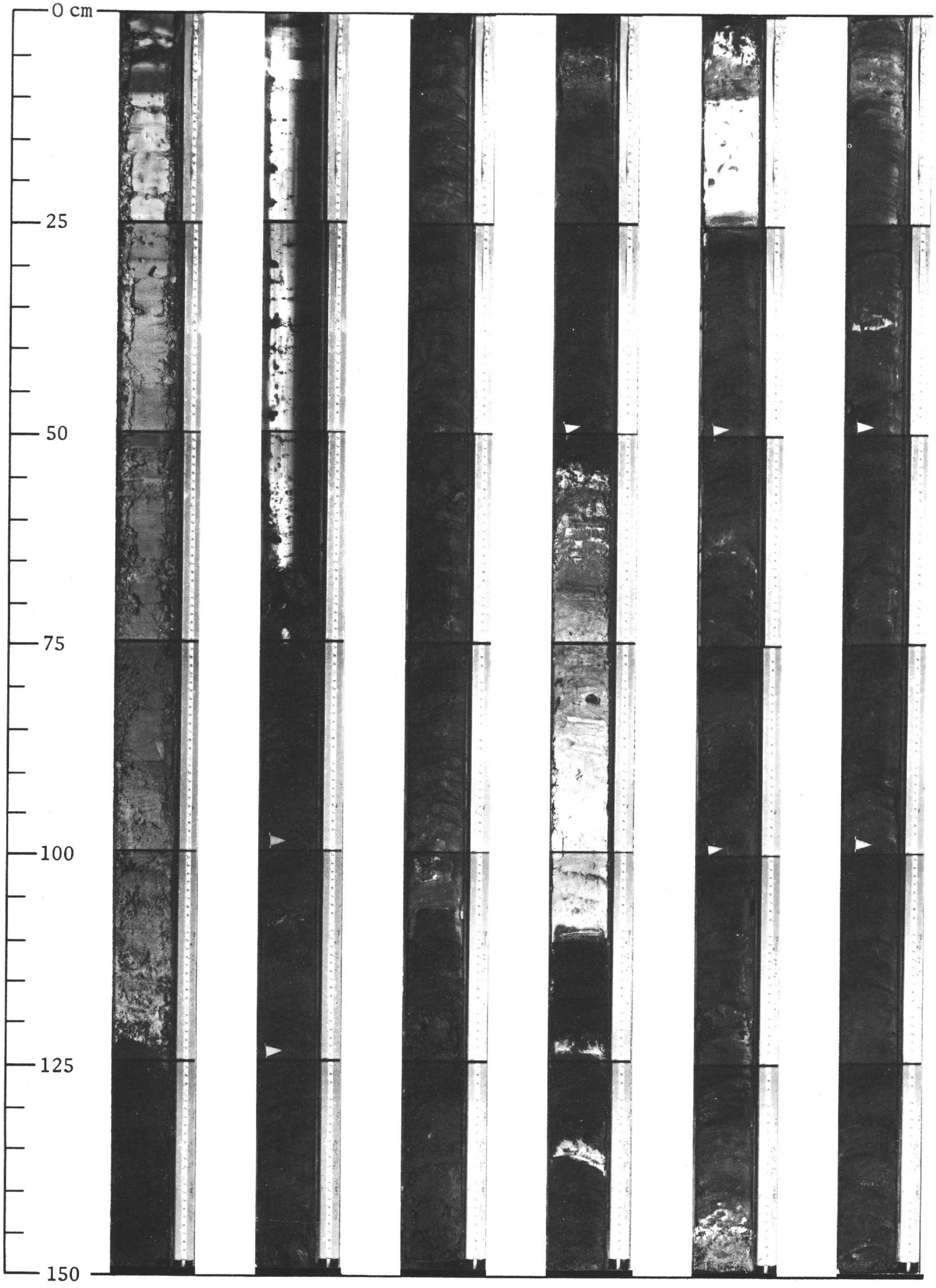
205-20-2
205-23-1
205-23-2
205-23-3

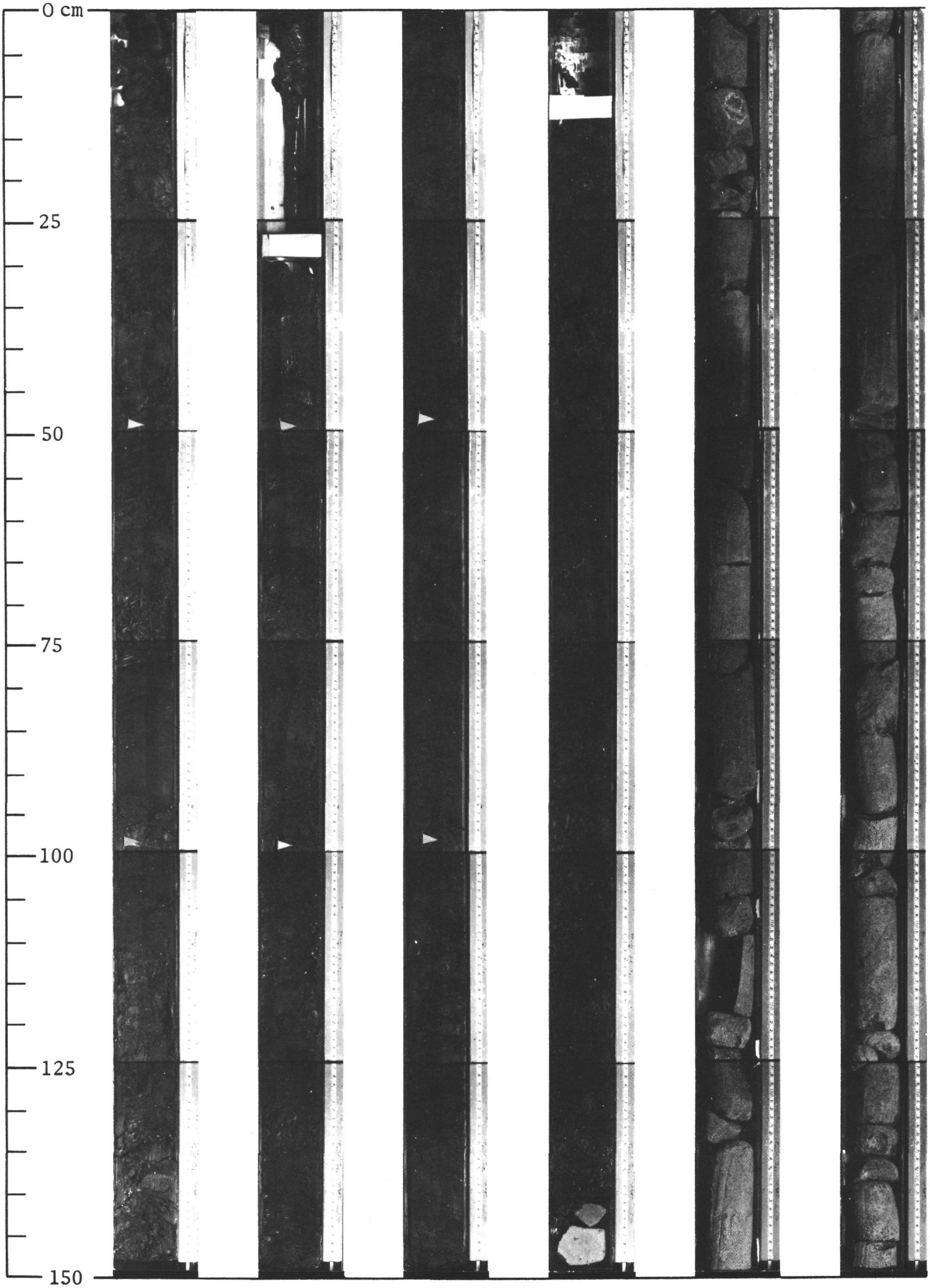

0 cm
25
50
75
100
125
150
205-23-4
205-23-5
205-24-1
205-24-2
205-24-3
205-24-4


0 cm
25
50
75
100
125
150
205-25-1
205-25-2
205-25-3
205-26-1
205-26-2
205-26-3

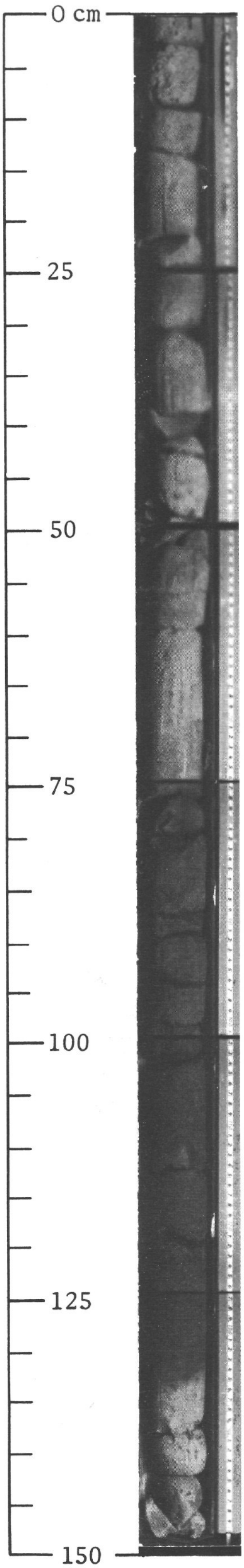

0 cm
25
50
75
100
125
150
205-26-4
205-26-5
205-27-1
205-27-2
205-27-3
205-27-4


0 cm
25
50
75
100
125
150
205-27-5
205-27-6
205-28-1
205-28-2
205-28-3
205-28-4

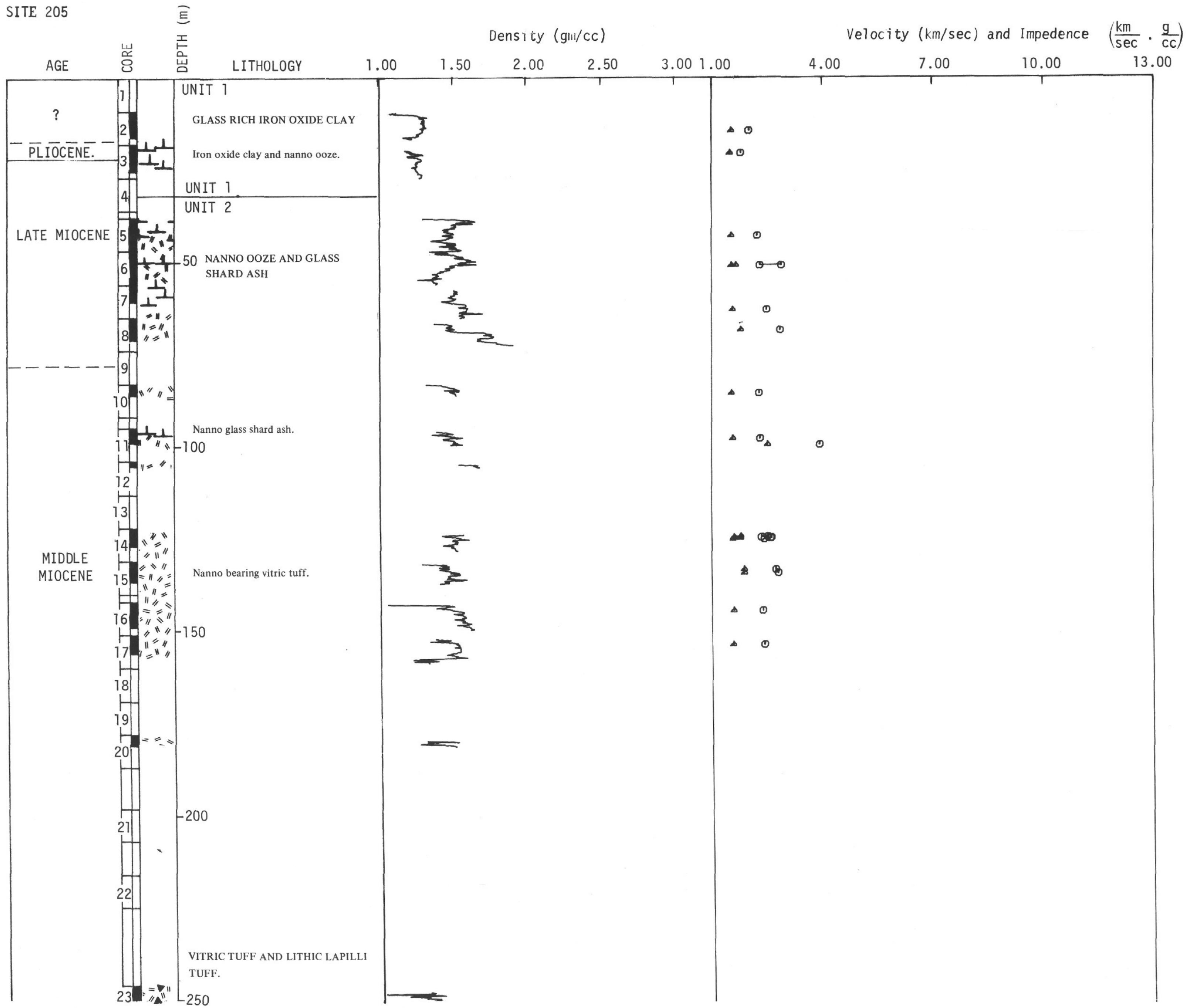

0 cm
25
50
75
100
125
150
205-28-5
205-29-1
205-29-2
205-29-3
205-29-4
205-29-5



205-29-6 205-30-1 205-30-2 205-30-3 205-32-1 205-32-2



205-32-3


SITE 205
AGE
CORE
DEPTH (m)
LITHOLOGY
Density (gm/cc)
1.00
1.50
2.00
2.50
3.00
Velocity (km/sec) and Impedence (km/sec · g/cc)
1.00
4.00
7.00
10.00
13.00
UNIT 1
?
GLASS RICH IRON OXIDE CLAY
PLIOCENE.
Iron oxide clay and nanno ooze.
UNIT 1
UNIT 2
LATE MIOCENE
50
NANNO OOZE AND GLASS SHARD ASH
Nanno glass shard ash.
100
MIDDLE MIOCENE
Nanno bearing vitric tuff.
150
200
VITRIC TUFF AND LITHIC LAPILLI TUFF.
250
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

SITE 205 cont.