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Some Geological Results of the Bottom Sampling from the Sea off Kwanto District Western Margin of the Northern Pacific (Report of the Cruise GDP-1, 1972)

By

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Abstract

The first cruise of the Japanese Geodynamics Project (GDP–1), which aimed at a combined geophysical and geological survey, was carried out in August, 1972.

There were five corings with heat flow measuring at the position along the line of 33°30′ N, across the Izu-Ogasawara Trench. One of the sediment columns was olive-brown clay, and one collected on the east slope of the Izu-Ogasawara Trench was sandy deposit containing many glasses and scoria fragments.

Angular sandstone gravels were obtained at a station on the wall of a submarine canyon of the Ogasawara Ridge. The age of the rocks is most probably Middle Pliocene from the evidence of foraminifers and nannofossils.

Bottom materials were collected at the top plane of the Takuyo Seamount II. Nannofossils were found from the pieces of phosphate rocks coated with ferro-manganese compounds in the materials, and were correlated to Late Cretaceous (Turonian~Maastrichtian) in age. Many spines and tubercles of sea-urchins, which indicate the Mesozoic age, were collected from the materials.

The occurrence of these fossils offers additional data for the study of the history and movement of the seamounts and ocean floor around the seamounts of northwestern Pacific.

1. Introduction

A preliminary survey for the Japanese Geodynamics Project in the West Pacific was initiated in the middle of 1972. Two research cruises were carried out in this year. One of them (GDP–1) by the Tokaidaigaku-Maru II aimed at a combined survey of the northwestern Pacific across the northern end of the Izu-Ogasawara (Izu-Bonin) Trench.

Various kinds of geological and geophysical observation and sampling were carried out. That is, continuous echo sounding, continuous seismic reflection profiling, magnetic anomaly investigation, recording of submarine seismicity, measurement of heat flow conductivity, and bottom sampling. A brief report of the cruise

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has been made by K. KOBAYASHI (1972). In the present paper, we deal with the results of the bottom sampling. Sampling devices were a gravity corer for heat flow measurement and dredges of bucket type. The details of the results will be presented by the research members in near future.

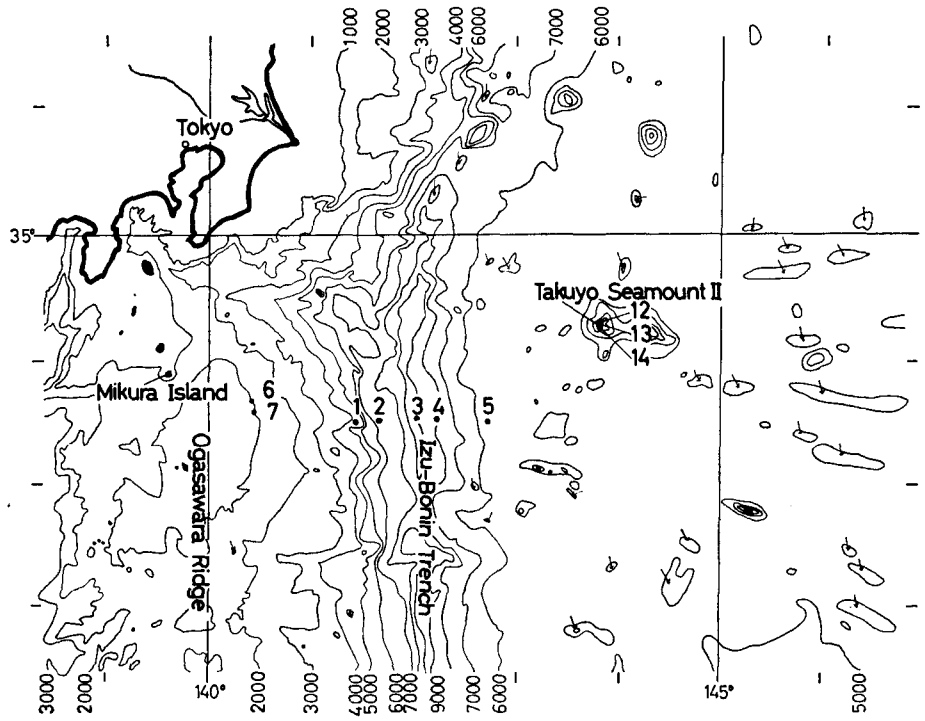

Fig. 1. Sampling locations. Bathymetry in metres derived from Japanese bathymetric chart 6302. 1~7, 12~14: GDP-1-1~GDP-1-7, GDP-1-12~GDP-1-14.

2. Submarine Configuration

The surveyed area is situated to the southeast of the Kwanto District, Japan. It extends from 138° E to 147° E, and from 32° N to 36° N. The area can be divided topographically into three parts, i) the Izu-Ogasawara (Izu-Bonin) Trench, ii) the continental slope of the Izu Islands, iii) the ocean bottom of the northwest Pacific Basin, and seamounts in the basin. The track of the ship has been presented by KOBAYASHI (1972). The depths described in the present paper are uncorrected ones read from the echograms of the Precise Depth Recorder.

3. Sediments

The bottom samplings were made by a gravity corer attached to a heat flow measuring apparatus, and two dredges of bucket type. Table 1 shows the sampling position, depth, date, type of apparatus used, and materials obtained at each location. The results are briefly discussed in the followings.

(1) Izu-Ogasawara Trench

There were five corings with heat flow measuring at the positions along the line of 33°30′ N, across the Izu-Ogasawara Trench; two of them were on the west slope of the trench, one at the trench bottom, and the other two on the east slope. Two of the sediment columns were greenish gray mud, one was greenish olive mud, one

Table 1. Research stations and obtained materials.

Sta. No.	Position	Depth* (m)	Observation	Core length	Dredged materials	Date
GDP-1- 1	33°30.0′N, 141°26.5′E	5470	Gravity corer	43	Greenish gray ~olive gray mud	July 27
GDP-1- 2	33°30.0′N, 141°40.0′E	6750	〃	35.5	Greenish gray ~olive gray mud	〃
GDP-1- 3	33°30.0′N, 142°00.5′E	9020	〃	28	Greenish gray ~greenish olive mud	Aug. 1
GDP-1- 4	33°31.3′N, 142°15.4′E	7610	〃	35.8	Dark brown ~olive brown mud	Aug. 2
GDP-1- 5	33°28.5′N, 142°42.5′E	5940	〃	10	Gray muddy sand	〃
GDP-1- 6	33°40.9′N, 140°25.4′E ~33°40.5′N, 140°26.1′E	1260 ~1160	Dredge haul		Med sand with foram., a few gravels of ss	Aug. 6
GDP-1- 7	33°36.0′N, 140°27.0′E	980 ~1045	〃		Sand with foram, scolia, angul. gravels of ss	〃
GDP-1-12	34°18.0′N, 143°50.7′E ~34°18.5′N, 143°50.5′E	1440	〃		Sand with granules	Aug. 12
GDP-1-13	34°19.2′N, 143°50.5′E ~34°17.2′N, 143°50.6′E	1420 ~1430	〃		Sand with 3 Mn nodules, 1 scoria, 1 coral frag., 1 phos. rock	〃
GDP-1-14	34°18.6′N, 143°50.0′E	1540	〃		Sand with Mn nodules, scorias, phos. rocks, spines of urchins, gastropods, teeth of shark, 1 pelecypod	〃

* Uncorrected water depth

Note angul.: angular foram.: foraminifers frag.: fragment med: medium Mn: (ferro-) manganese ss: sandstone phos.: phosphate

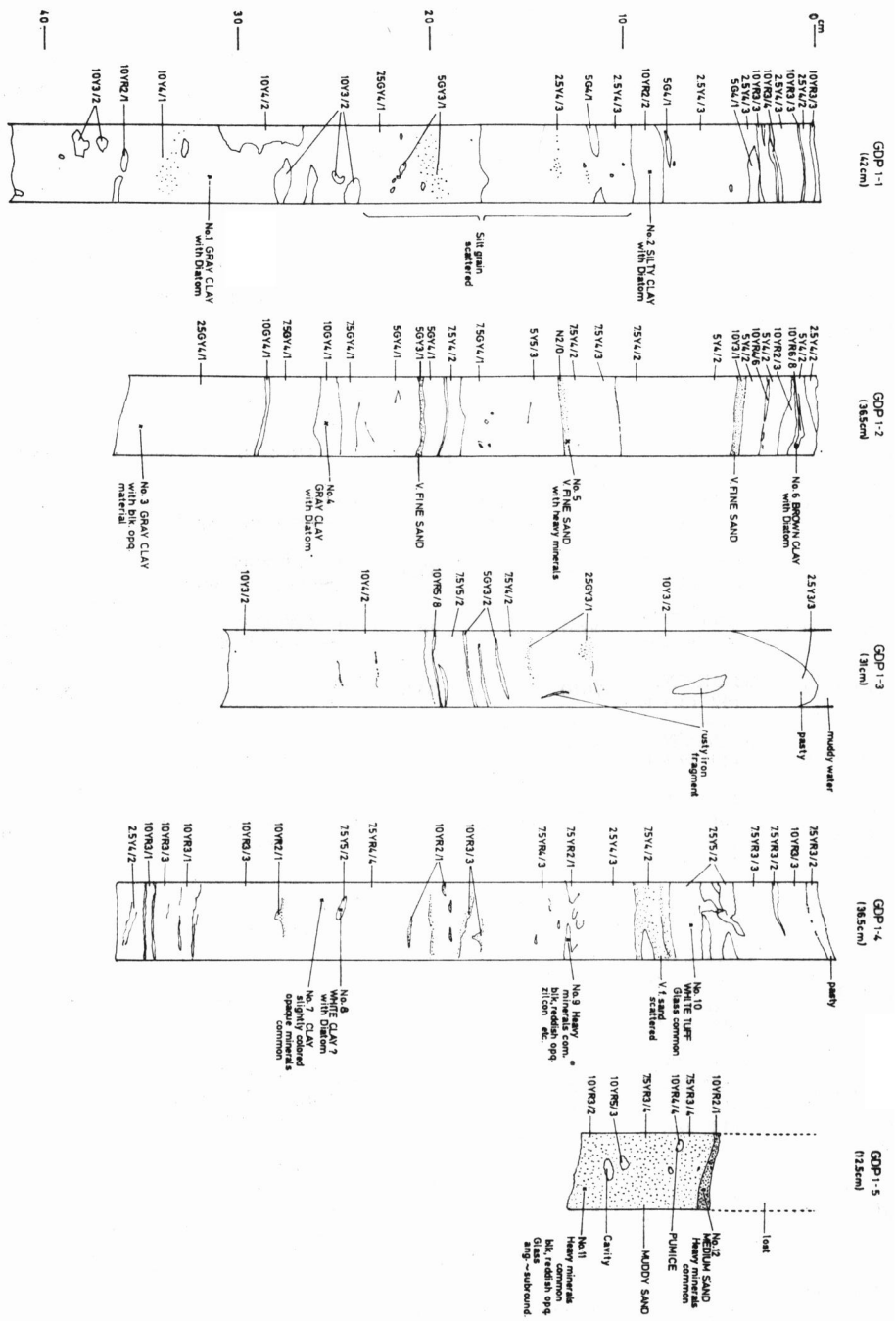

Fig. 2. Columnar sections of the core samples.

was olive brown clay, and one was muddy sand. Foraminifers and diatoms were contained in these sediments, but any nannofossil was not preserved.

These sediment columns are short but significant. A few bottom samples have been obtained from the deep bottom of the Izu-Ogasawara Trench. Ryofu-Maru collected a column from the bottom of the Ramapo Deep in the Southern Japan Trench, down to 8,450 m in depth (NASU *et al.* 1960). GDP-1-3 of the present report is greater in water depth of core sampling than that of Ryofu-Maru.

It is remarkable that sandy deposit (Fig. 3) was found on the east slope of the trench in this cruise. It might be interesting if the sandy deposit of GDP-1-5 shows some possibility of supply to the present position from the west, prior to the subsidence of the trench axis. Such possibility has been suggested by NASU (1964) as one of the explanations for the occurrence of the coarse sediments on the east slope of the Japan Trench. A great number of sand grains of the present sediment of GDP-1-5, however, seem to be glass and scoria fragments. Since data are insufficient, we cannot describe the deposit in detail as yet. Further investigation is necessary.

(2) Continental slope of the Izu Islands

It was found from the seismic reflection survey by MURAUCHI and ASANUMA during this cruise that some basement rock is exposed at the wall of the submarine canyon which exists to the east of the Mikura Island. For the purpose of obtaining samples from the exposure, dredging was carried out at three stations. Materials were obtained at two stations (GDP-1-6, -7) as shown in Table 1. Angular gravels of calcareous sandstone collected at Station GDP-1-7 are most likely of the fragments of the wall rock of the canyon, their maximum size being 4 cm in diameter.

These gravels comprise many microfossils such as foraminifer and nannofossil. The species of planktonic foraminifers significant in the age-consideration from these gravels are as follows:

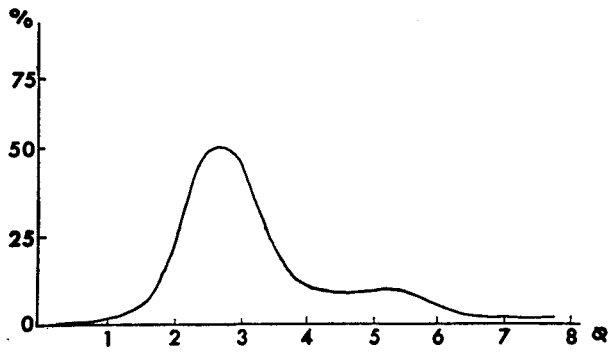

Fig. 3. Weight-percentage frequency curve of grain size of the muddy sand of GDP-1-5.

Globigerina bulloides apertula, G. dutertrei, G. eggeri eggeri, G. rubescens, Globorotalia obliquus extremus, G. pseudomiocenica, Pulleniatina primalis, Sphaeroidinellopsis subdehiscens paenedehiscens, S. subdehiscens subdehiscens, S. cf. *seminulina seminulina* etc.

Remarkable calcareous nannofossil species which occurred from the stones are *Discoaster brouweri, D. pentaradiatus, D. surculus, Cyclococcolithus macintyrei* and *Reticulofenestra pseudoumbilica.*

From the evidence of the above-mentioned foraminifers and nannofossils, it seems probable that the geological age of the sandstone gravels is Middle Pliocene.

(3) Takuyo Seamount II

Bottom materials were collected by dredge hauls at the top plane of the Takuyo Seamount II (GDP–1–12, –13) and on the slope near the top of the seamount (GDP–1–14). The samples obtained are listed in Table 1.

A large amount of pieces of phosphate rocks coated with ferro-manganese compounds were collected from the samples of GDP–1–13, –14 by water sieving. The size of the largest piece was 37 cm in diameter. Nannofossils were found from these pieces and were correlated to Late Cretaceous (Turonian~Maastrichtian) in age. They are *Watznaueria barnesae, Cretarhabdus crenulatus crenulatus, Chiastozygus* aff. *C. disgregatus, Cribrosphaera* aff. *C. ehrenbergi* and *Zygodiscus* aff. *Z. deflandrei.* These nannofossils were replaced by phosphate.

Phosphate rocks also contain small gastropod shells and foraminiferal tests that are phosphatized. These phosphate rocks might have been produced in warm shallow sea-water, where calcareous sediments were altered to phosphorite. They are collected, however, at a relatively higher latitude than in the case of those ever described.

Many spines and tubercles of sea-urchins were collected from the dredged samples. They are like those of *Balanocidaris* sp. and *Pseudocidaris* sp. and indicate Mesozoic age.

One bivalve fossil was obtained at GDP–1–14, but was not preserved well. Definite identification was impossible.

It is needless to say that the occurrence of these fossils is very important for the study of the history and movement of the seamount and ocean floor around the seamount.

The size and weight of the large ferro-manganese nodules obtained at GDP–1–13, –14 are as shown in Table 2.

Manganese nodules and slabs have been discovered at a few seamounts (Kashima II: 36°02.8′ N, 143°32.7′ E and "Mizunagi": 37°07.3′ N, 145°18.6′ E) during the research cruise of the Hakuho-Maru KH–69–2, 1969 (TOMODA and NASU, 1971). Manganese nodules and manganese-coated pumice fragments were also recovered at E6 (38°06.4′–38°11.2′ N, 148°01.0′–147°59.0′ E), at the middle of the flat Northwest Pacific Basin, during the Japanese Deep Sea Expedition of 1961 (NASU and SATO,

1962). The discovery of manganese nodules at the Takuyo Seamount II should offer an interesting additional datum for the problem of distribution and depositional environment of the nodules.

Table 2. Ferro-manganese nodules obtained at GDP-1-13, 14.

Sample No.	Size (cm) a b c	Weight (kg)	Remarks
GDP-1-13 1	27×23×20	8	Black
2	18×17×12	3	One side of the surface is remarkably rough.
3	13×11× 9	1.5	Surface is rough.
GDP-1-14 1	30×20×15	9	Granules and a sponge are attached to the surface.
2	37×22×17	9	Sponge is attached to the surface.
3	17×11.5×6.5	1.5	Pumice thickly coated by manganese oxides.
A large number of nodules		4 (in all)	

4. Acknowledgments

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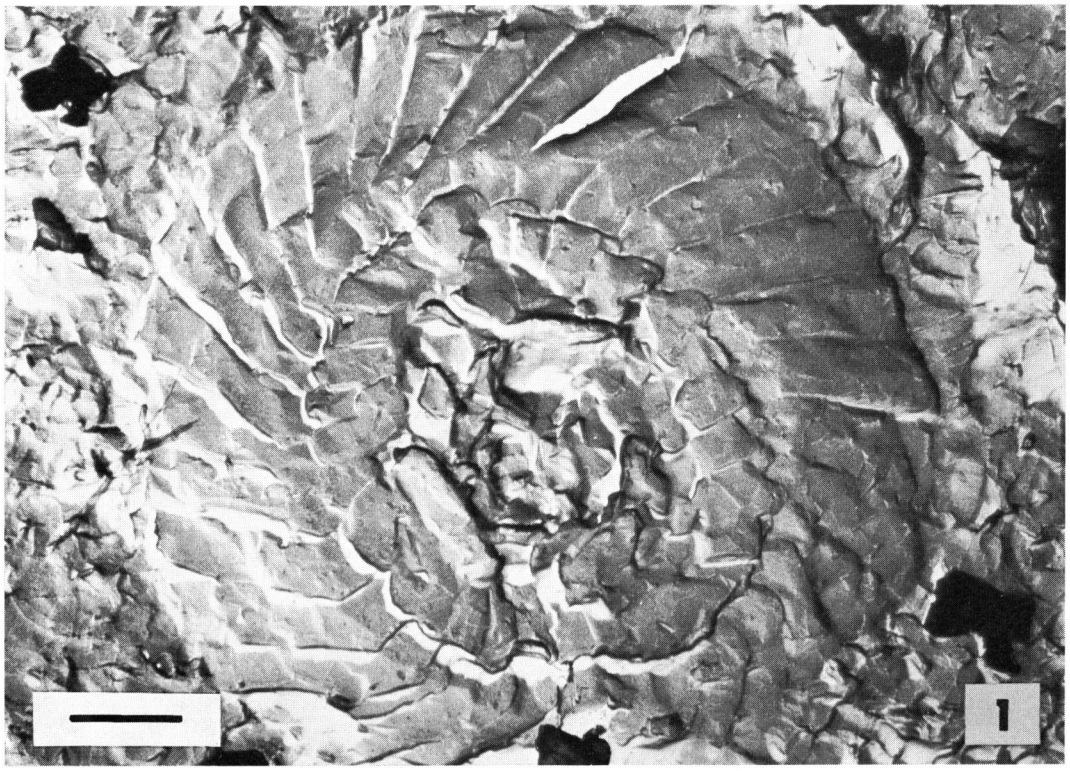
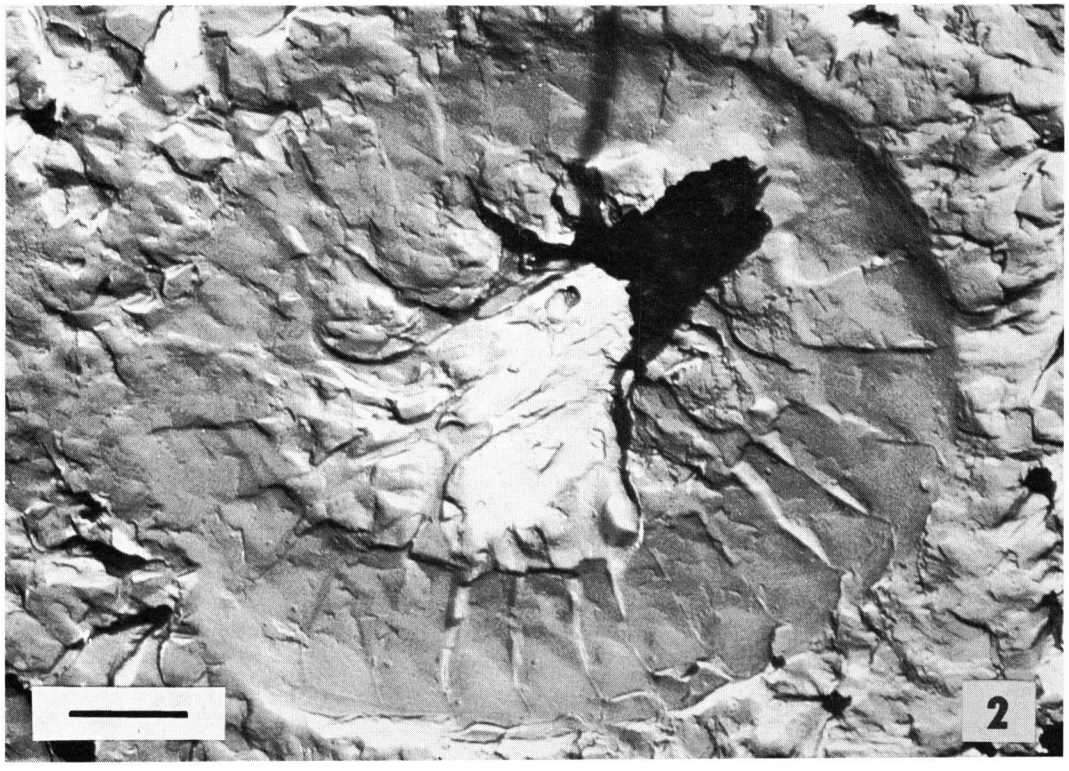
Explanation of Plate 10

Late Cretaceous Nannofossils from the Takuyo Seamount II
Electronmicrographs of carbon replica.
Bar scale on each figure represents 1 micron.
Figure 1. *Watznaueria barnesae* (BLACK) BUKRY, 1969
Figure 2. *Cretarhabdus crenulatus crenulatus* BRAMLETTE & MARTINI, 1964

Explanation of Plate 11

Figure 1. Spines of echinoid: Type 1
Figure 2. Spines of echinoid: Type 2
Figure 3. Spines of echinoid: Type 3
Figure 4. Tubercles of echinoid.
Figure 5. Phosphate rock with manganese coating.
Figure 6. Cross section of manganese nodule, of which core is phosphate.
Figures 1–6 are in natural size.
Figure 7. Sandstone fragments at St. GDP–1–7. ×1/3.
Figure 8. Thin section of one of the sandstone fragments. ×30.





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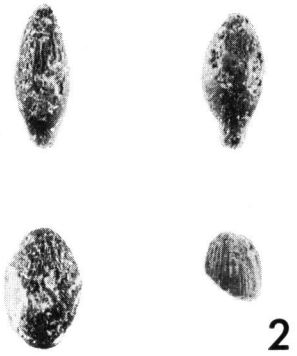

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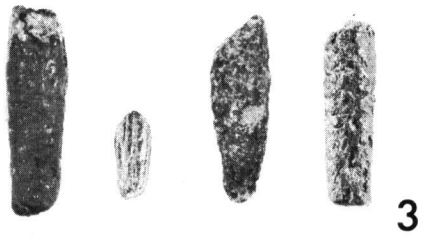

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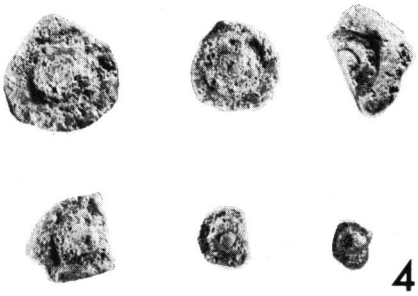

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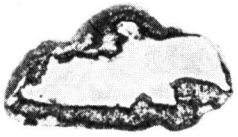

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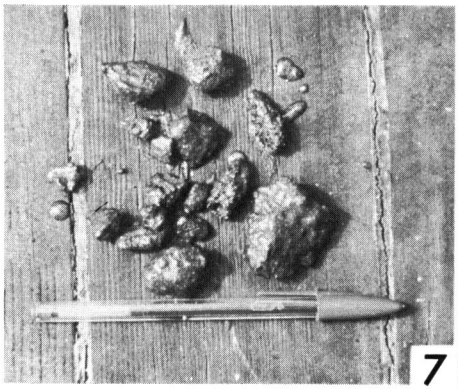

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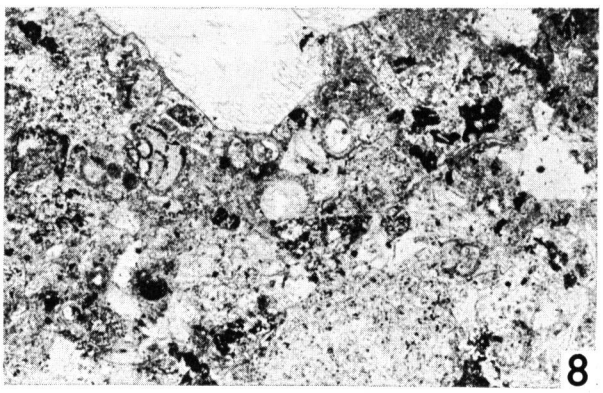

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