RECONSIDERATION OF THE SO-CALLED OLIGOCENE FAUNA IN THE ASPHALTIC DEPOSITS OF BUTON (MALAY ARCHIPELAGO)

3. REPORT ON DIATOMS

BY

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Several samples of asphaltic marls from the Island of Buton have been analysed on diatoms. These samples after their treatment with solvents to eliminate the asphalt content appeared to consist of greyish or yellowish white marls. Despite the vigorous treatment with several solvents, by which the asphalt content was reduced to a small fraction of a percent, it proved to be impossible to prepare and wash the samples in the usual way. Only after heating them to about 800° F. for several hours, they could with much care be washed and cleaned adequately for final examination.

The samples were labelled: Waisioe and Kaboengka.

I owe many thanks to Dr. NELLENSTEYN and Mr. KUIPER of the "Rijkswegenbouwlaboratorium" for one set of samples and to Dr. BEETS for another set. The fossil content of both sets appeared to be similar.

In the course of a careful examination of many slides, the following species were observed:

Actinocyclus ellipticus GRUN.
„ *allinearius* HANNA & GRANT
Actinoptychus cf. *aster* BRUN.
Cestodiscus ovalis GREV.
Coscinodiscus excentricus EHR.
„ *radiatus* EHR. var. *nodulifer* REINHOLD
„ *vetustissimus* PANT. var. *javanica* REINHOLD
Hemidiscus cuneiformis WALL.
Melosira sulcata (EHR.) KÜTZ.
Navicula cf. *aspera* EHR.
Triceratium cuspidatum JAN.
„ *radioso-reticulatum* GRUN.

ACTINOCYCLUS ELLIPTICUS GRUN.

HEURCK, H. v. — Synopsis, pl. 124, fig. 14.
DE TONI — Sylloloqe, p. 1186.
MILLS, F. W. — Index, p. 85.

The difference between the typical form and the variety *javanica* is vague and based on the presence of a varyingly broad border. Many variations are present, ranging from those with a normal border to those with a very broad border, which are mixed together.

ACTINOPTYCHUS cf. ASTER BRUN

BRUN, J. — A. SCHMIDT — Atlas, pl. 153, fig. 2.
REINHOLD, TH. — Fossil diatoms of the Neogene of Java. Verh. Geol. Mijnbk. Gen., XII, 1, p. 76, pl. 3, fig. 6; 1937.
MILLS, F. W. — Index, p. 105.

BRUN has described *A. aster* from the Sendai Limestone which is regarded as Upper Miocene. It has also been recorded from the "*Globigerina* Marls" of Java. The species is unknown from older formations.

CESTODISCUS OVALIS GREV.

GREVILLE, R. K. — Trans. Micr. Soc. 1865, p. 49, pl. 5, fig. 9.
REINHOLD, TH. — Fossil diatoms of the Neogene of Java. Verh. Geol. Mijnbk. Gen., XII, 1, p. 89, pl. 7, fig. 9; 1937.
MILLS, F. W. — Index, p. 368.
RATTRAY, J. — Revision of the Genus *Coscinodiscus* [*C. ovalis* RATTR.].

Cestodiscus ovalis is similar to *Actinocyclus ellipticus* but has a row of very distinct spines, inserted at the inner edge of the marginal band. It is known from the Miocene of Spain and from both the Middle Miocene and the Upper Miocene "*Globigerina* Marls" of Java.

COSCINODISCUS EXCENTRICUS EHR.

EHRENBERG, CH. G. — Abh. Akad. Wiss. Berlin, 1839, p. 146.
HILLS, F. W. — Index, p. 471.

This is one of the commonest diatoms found in almost any marine deposit from Eocene to recent. Its presence in the samples from Buton is therefore quite natural but this record has no particular stratigraphic significance.

COSCINODISCUS RADIATUS EHR. var. NODULIFER REINHOLD

Pl. I, fig. 3.

REINHOLD, TH. — Fossil diatoms of the Neogene of Java. Verh. Geol. Mijnbk. Gen., XII, 1, p. 100, pl. 8, fig. 6; 1937.

This large and striking diatom is fairly common in the samples from Buton. It has so far been recorded exclusively from the Upper Miocene "*Globigerina* Marls" of Java. It is probably a good marker for this formation.

COSCINODISCUS VETUSTISSIMUS PANT. var. JAVANICA REINHOLD

Pl. I, fig. 1.

REINHOLD, TH. — Fossil diatoms of the Neogene of Java. Verh. Geol. Mijnbk. Gen., XII, 1, p. 102, pl. 8, figs. 7, 8; 1937.

This diatom is stratigraphically important, because its range is strictly limited to the "*Globigerina* Marls" of Java (Upper Miocene). In other regions, the species has been recorded from the Young Tertiary deposits of Kekkö (Hungary) and Mejillones (Chili), which are of a "Mediterranean" Miocene age. Its presence in the samples from Buton in good quantities is a strong indication for a Young Miocene age of the sediments concerned.

HEMIDISCUS CUNEIFORMIS WALL.

(= *H. niveus* — HANNA & GRANT, Maria Madre Islands. Proc. Calif. Ac. Sci., Ser. IV, vol. 15, nr. 2, p. 146, pl. 17, fig. 1; 1926).
WALLICH — Trans. Micr. Soc., Ser. II, vol. 8, p. 42, pl. 2, fig. 3; 1860.
MILLS, F. W. — Index, p. 849.

Diatoms supposedly representing this species are rather abundant in the samples from Buton. Many variations are present, ranging from those which are almost exactly semicircular to forms with a convex and a concave connecting line between the ends of the semicircular segment. An adequate means of separation of these variations has not yet been found; they may all be forms of one plastic species. They are widely recorded from Miocene to recent deposits.

MELOSIRA SULCATA (EHR.) KÜTZ.

KÜTZING, F. T. — Baccillarien, Nordhausen 1844, p. 55, pl. 2, fig. 7.
MILLS, F. W. — Index, p. 951.

This species is omnipresent in recent and fossil sediments ranging from the Eocene to the present day.

NAVICULA cf. ASPERA EHR.

EHRENBERG, CH. G. — Mikrogeologie, 35 A, fig. 5.
MILLS, F. W. — Index, p. 951.

Navicula aspera has been recorded from many deposits and is found living in many seas. Its value for geological correlation is nil.

TRICERATIUM CUSPIDATUM JAN.

Pl. I, fig. 2.

SCHMIDT, A. — Atlas, pl. 84, fig. 2; 1885.
DE TONI — Syllologe, p. 910.
MANN — Philippine Islands. Smiths. Inst. U. S. Nat. Mus., Bull. 100, vol. 6, prt. 1, pl. 1, fig. 39; 1925 [*Biddulphia cuspidata* (JAN.)].
REINHOLD, TH. — Fossil diatoms of the Neogene of Java. Verh. Geol. Mijnbk. Gen., XII, 1, p. 125; 1937.
MILLS, F. W. — Index, p. 1627.

This remarkable fossil occurs abundantly in the samples from Buton.

Triceratium cuspidatum may perhaps be united with *T. favus* f. *quadrata*. However, MANN (Philippine Islands) shows himself adverse of this idea, because *T. cuspidatum* is flat when seen in girdle view. Many specimens of *T. favus* in recent material from the North Sea, however, are at least as flat as *T. cuspidatum*. The arrangement of the beads varies considerably in *T. favus*. A. SCHMIDT bases the distinction between *T. favus* f. *quadrata* and *T. cuspidatum* on the differences in arrangement of the beads and the different border structure, which is also variable. The close examination of many specimens shows the very considerable variation of these characters.

If we may regard both forms as belonging to the same species, we may quote here the interesting observation made by MANN (Diatoms of the Albatross Voyages. Contributions U. S. Nat. Herbarium, vol. 10 (1906—1908), p. 225, 303) that the quadrate form of *T. favus* is the dominant form of stations 2915 H—2921 H, 3008 H, 3010 H, 3013 H, 4430 H, 4502 H and 4571 H,

where it occurs in immense quantities and without any of the triangular varieties being present. H. L. SMITH type 599 is a similar case. He marks it "Tuscora Sounding, S. of Sandwich Isle, 1468 fathoms", the locality therefore corresponding almost exactly with station 3008 H.

MANN remarks: " These localities constitute a practically unbroken series beginning with station 2921 H in latitude 155°58'30" W, longitude 22°18'00" N, running westward to the Hawaian islands and on the return voyage eastward ending at about the starting point, namely at station 3018 H in latitude 155°57'30" W, longitude 21°56'00" N."

From the anagraph we gather that the bottom temperature were low, i. e. about 34°—37° F.

The presence of these diatoms in large quantities in the samples from Buton is both interesting and remarkable. Therefore, the Buton marls may have been deposited in water of a low temperature.

TRICERATIUM RADIOSO-RETICULATUM GRUN.

HEURCK, H. v. — Synopsis, pl. 112, fig. 5.
DE TONI — Syllologe, p. 925.
REINHOLD, TH. — Fossil diatoms of the Neogene of Java. Verh. Geol. Mijnbk. Gen., XII, 1, p. 128, pl. 19, fig. 8; 1937.
MILLS, F. W. — Index, p. 1651.
Jour. Q. M. C., Ser. II, vol. 2, p. 327, pl. 19, fig. 13 [*Triceratium coscinoides* GR. & ST.].
MANN — Diatoms of the Albatross Voyages, p. 292 [*Trigonium coscinoides* (GR. & ST.].

This distinct species is known from Barbados (Chalky Mount) and from Java, as well as from Oamaru. This diatom may perhaps be considered a marker for deposits older than Upper Miocene.

The stratigraphic relationships between some of the deposits on the Island of Buton are not clear yet. The list of species of diatoms observed in the samples from Waisioe and Kaboengka is at present still short and incomplete but it contains on the whole species which indicate equivalence with the Upper Miocene "*Globigerina* Marls" of Java.

All the species recorded from the Buton samples are known from the "*Globigerina* Marls". Some, among which *Triceratium radioso-reticulatum* is the most important one, are known from the Oligocene Oamaru formation but the typical Oamaru flora is entirely absent. Several species are widely found in deposits ranging from Eocene or Oligocene to the present day, like *Melosira sulcata, Actinocyclus ellipticus, Coscinodiscus excentricus, Navicula aspera* a. o., and are useless for correlation. Forms like *Coscinodiscus vetustissimus* var. *javanica* and *C. radiatus* var. *nodulifer,* however, combined with *Cestodiscus ovalis,* are typical for the Upper Miocene in *Globigerina*-marl facies. It seems not premature, therefore, to conclude that the samples of asphaltic marl from W a i s i o e and K a b o e n g k a represent the equivalent of the "*Globigerina* Marls" of Java which are regarded as Upper Miocene.

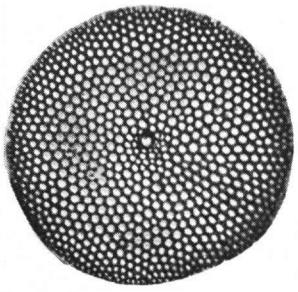

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Fig. 1. *Coscinodiscus vetustissimus* (PANT.) var. *javanica* REINHOLD.

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Fig. 2. *Triceratium cuspidatum* JAN.

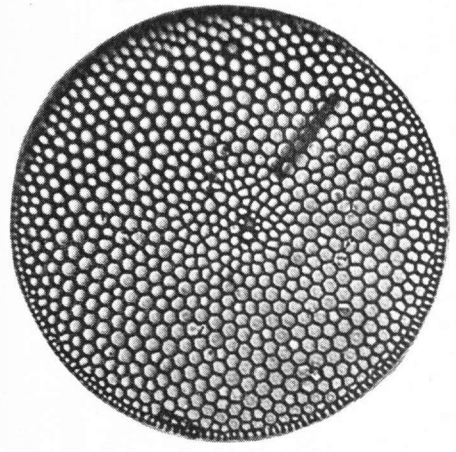

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Fig. 3. *Coscinodiscus radiatus* (EHR.) var. *nodulifer* REINHOLD.