Calcareous Nannofossils from the Miocene Formations in Yuya and Iki, Southwest Japan

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山口県油谷地域および長崎県壱岐島中新統からの石灰質ナンノ化石

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(要　旨)

長崎県壱岐島芦辺町和合浜の勝本層および山口県油谷町森末の油谷湾層群川尻累層からの2試料に含まれる石灰質ナンノ化石の検討が試みられた．勝本層の試料には時代決定に有効な種が含まれないが，NN3の最上部からNN5までに認められる *Sphenolithus heteromorphus* が発見された．他方川尻累層の試料には，NN5の下限から出現する *Calcidiscus macintyrei* およびNN5の上限で消滅する *Sphenolithus heteromorphus* が発見された．従って試料採集層準はNN5に位置づけられ，浮遊性有孔虫検討の結果のN10と一致する．なお勝本層は底生有孔虫 *Eggerella nishisonogiensis* の発見により前期中新世芦屋層群に対比される．

In the present investigation two samples which have proved to be coccolith-bearing during the study of the Miocene formations from Yuya and Iki, were examined by using calcareous nannofossils to determine their biostratigraphic position. One of the samples (Sample A) is from the Katsumoto Formation on Wagôhama coast, Ashibe-chô, Iki Island, Nagasaki Prefecture (Figs. 1 and 2) and the other (Sample B) is from the Kawashiri Formation of the Yuya-wan Group in Morisue, Yuya-chô, Yamaguchi Prefecture (Figs. 1 and 3).

The echinoid *Pericosmus* cf. *spatangoides* (DESOR) (OKAMOTO, MORISHITA, *et al.*, 1973) and some benthonic foraminifera, *i.e.*, *Cyclammina incisa* (STACHE) (Rare), *Haplophragmoides* sp. (Rare), and *Eggerella nishisonogiensis* MURATA (Very Abundant) were from the Katsumoto Formation at the locality of Sample A on Wagôhama coast. Occurrence of *Eggerella nishisonogiensis* indicates that the Katsumoto Formation can

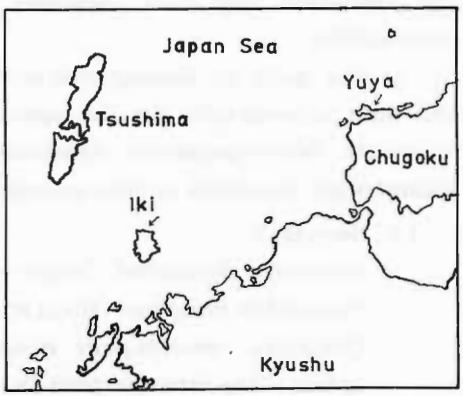


Fig. 1. Index map.

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Fig. 2. Locality map of Sample A
Cliff on Wagôhama coast, Ashibe-chô, Iki Island, Nagasaki Prefecture (Lat. 33°50'47"N, Long. 129°43'43"E).
(Cited from the 1/25,000 Quadrangle Katsumoto)

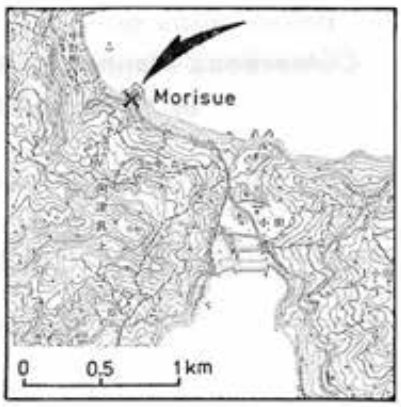


Fig. 3. Locality map of Sample B
North side exposure of road-cut at Ryujin-yama, Morisue, Yuya-chô, Yamaguchi Prefecture (Lat. 34°24' 41"N, Long. 131°0'31"E).
(Cited from the 1/25,000 Quadrangle Nagato-Furuichi)

be correlated with the Early Miocene Ashiya Group in North Kyushu (MURATA, 1961). Sample B from the Kawashiri Formation in Morisue contains planktonic foraminifera including *Globorotalia adamantea* SAITO, which is age-diagnostic of the planktonic foraminiferal zone N10 (HUANG, T. and OKAMOTO, 1979).

Study of the smear slides in the light microscope suggests that preservation of the nannofossils in both samples is not generally good, poorer in Sample A than in Sample B. It seems rather clear from our observation that the materials in concern might have subjected to moderate (in Sample B) to strong (in Sample A) degree of carbonate dissolution after deposition. In the latter sample, most of the specimens lose their identities and the discoaster becomes broken and/or overcalcified.

In this study an attempt was made to recover as many species as possible, and the light micrographs for the age-diagnostic or common species were prepared whenever better-preserved specimens were observed (Pl. 4). The nannofloral assemblages examined in two samples can be listed as follows:

(I) Sample A
- *Discoaster deflandrei* Group ..... (Rare)
- *Coccolithus pelagicus* (WALLICH) ..... (Rare)
- *Coccolithus miopelagicus* BUKRY ..... (Rare)
- *Sphenolithus heteromorphus* DEFLANDRE ..... (Very Rare)
- *Cyclicargolithus floridanus* (ROTH & HAY) ..... (Very Rare)
- *Sphenolithus moriformis* (BRÖNNMIANN & STRADNER) ..... (Very Rare)
- *Reticulofenestra* sp. ..... (Very Rare)

(II) Sample B
- *Sphenolithus heteromorphus* DEFLANDRE ..... (Few)

Reticulofenestra sp.·····(Few)
Coccolithus pelagicus (WALLICH)·····(Few)
Coccolithus miopelagicus BUKRY·····(Few)
Cyclicargolithus floridanus (ROTH & HAY)·····(Rare)
Discoaster variabilis MARTINI & BRAMLETTE·····(Rare)
Discoaster deflandrei BRAMLETTE & RIEDEL·····(Rare)
Sphenolithus moriformis (BRÖNNIMANN & STRADNER)·····(Very Rare)
Helicosphaera carteri (WALLICH)·····(Very Rare)
Calcidiscus macintyrei (BUKRY & BRAMLETTE)·····(Very Rare)

Although the foregoing lists indicate difference in both number of species and number of individuals, they share many taxa in common. Important among them are *Sphenolithus heteromorphus* and *Cyclicargolithus floridanus*. *Cyclicargolithus floridanus*, being a long ranging species in the Tertiary, has the last occurrence level approximating the upper limit of the Middle Miocene zone NN6 (BUKRY, 1978).

Sphenolithus heteromorphus is a cosmopolitan taxon occurring most commonly in the Late Early to Early Middle Miocene deposits. Its last occurrence was employed to define the upper limit of the *Sphenolithus heteromorphus* Zone or zone NN5 of the standard nannofossil zonation (MARTINI, 1971). This marker species has been recorded to have first occurrence level in the upper part of zone NN3, co-occurring with *Sphenolithus belemnos* according to MARTINI (1971). Evidence from many other works (ROTH *et al.*, 1971; BUKRY, 1971, 1973; GARTNER, 1977) and the senior writer's observations (HUANG T.C., 1980) suggests that the first appearance of *Sphenolithus heteromorphus* corresponds approximately to the same stratigaraphic level as the extinction of *Sphenolithus belemnos*; an overlap of the ranges of the two species occurs in a very narrow belt of strata in cases the two do co-exist.

Calcidiscus macintyrei, poor in preservation state, occurs sparsely in Sample B. In view that the first occurrence of the taxon has been used by BUKRY (1975) to define the base of his *Sphenolithus heteromorphus* Zone, which in turn can be equated with the base of zone NN5 (BUKRY, 1978), the host rock, in which *Sphenolithus heteromorphus* is also recorded, can be assigned to the Middle Miocene zone NN5. The indicated age concurs with the planktonic foraminiferal zone N10 recently determined by HUANG, T. and OKAMOTO (1979).

Except for *Sphenolithus heteromorphus* the nannoflora recovered in Sample A contains no other age markers for precise age determination. The age of the sample can be settled only in an age interval ranging from the uppermost part of zone NN3 to zone NN5 on the occurrence of *Sphenolithus heteromorphus*. We provide herein an age constraint for further detailed study.

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Explanation of Plate 4

Figs. 1a, b. *Coccolithus miopelagicus* BUKRY
from Sample B; a. polarized light;b. transmitted light.

Fig. 2. *Cyclicargolithus floridanus* (ROTH & HAY)
from Sample B; polarized light.

Fig. 3. *Discoaster variabilis* MARTINI & BRAMLETTE
from Sample A; transmitted light.

Fig. 4. *Discoaster deflandrei* BRAMLETTE & RIEDEL
from Sample B; transmitted light.

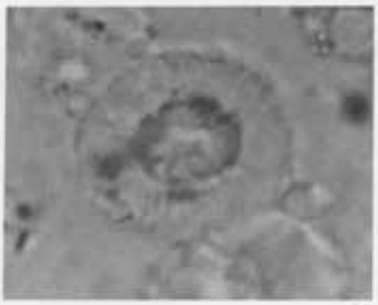
Figs. 5a, b. *Sphenolithus moriformis* (BRÖNNIMANN & STRADNER)
from Sample A; a. polarized light; b. transmitted light.

Figs. 6a, b. *Sphenolithus heteromorphus* DEFLANDRE
from Sample A; polarized light, a. long axis 45 degrees to cross nicols; b. long axis 0 degree to cross nicols.

Figs. 7a–c. *Sphenolithus heteromorphus* DEFLANDRE
from Sample B; a, c. polarized light, a. long axis 45 degrees to cross nicols; c. long axis 0 degree to cross nicols; b. transmitted light.



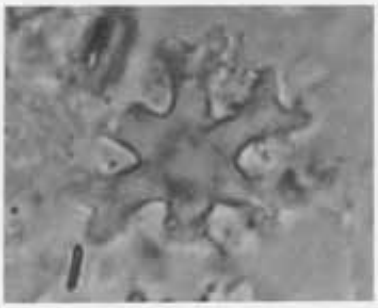
1a



1b



2



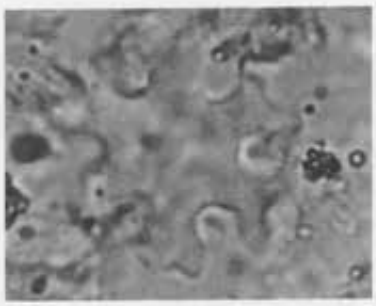
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6a



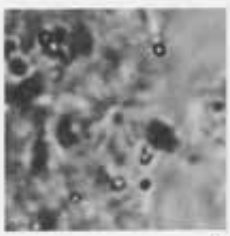
5a



4



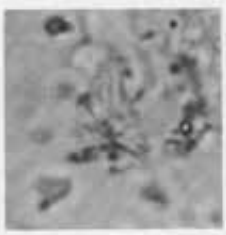
6b



5b



7a



7b



7c

12.5μ