

On *Discocyclina* (Foraminifera) occurrence problem in the Tsukeng Formation, Nantou, Taiwan

Kuniteru MATSUMARU*, Jyaku-Chang CIU** and Ting-Maw CHUNG***

Abstract

Discocyclina (Foraminifera) from the limestone cobble in Tsukeng Village, Nantou, Taiwan is described briefly, and the cobble may be carried out from the Eocene Hakurei Formation, Taichung County, of the Backbone Range of Taiwan.

Introduction

The occurrence problem of the discovery of *Discocyclina* (Foraminifera) from the Tsukeng Formation, Nantou, central Taiwan is caused by the geological results of the *in situ* or reworking, concerning to the *Discocyclina*-bearing limestone. Ho et al. (1956) found the *Discocyclina* and *Nummulites* from the middle part of the Neogene Tsukeng Formation, Tsukeng, Nantou and they regarded these larger foraminifera to be reworked from the Eocene strata. Moreover they considered the cause of the reworking to be the Puli Orogenic Phase at the end of the Early Miocene. Chiu (1972) supported Ho et al.'s interpretation of the reworking of the *Discocyclina*, because the *Discocyclina* occurred from the lower part of the Miocene foraminifera carrying Tsukeng Formation. However Hashimoto and Kurihara (1974) concluded that the age of the *Discocyclina* bearing calcareous sandstone of the middle part of the Tsukeng Formation is assigned to be the late Eocene. Because the preservation of the *Discocyclina* is good condition and the lithofacies of the middle part of the Tsukeng Formation is similar to the effusive facies of the Eocene strata, exposed on the west side of the Kuanshan Pass of the Southern Cross-Mountain Highway. The authors visited Tsukeng area, eastern Nantou during September 6 to 12, 2006 and found the *Discocyclina* bearing limestone cobble, which will be rolling down from Taipin or northern Taipin (Figs. 1, 2). The authors describe the *Discocyclina*, and consider the geological meaning. This work was supported by a Fund of the International research project of the Saitama University.

* Department of Geology, Faculty of Education, Saitama University, Saitama 338-8570, Japan; E-mail: matsumar@post.saitama-u.ac.jp

** Division of Japanese literature, Providence University, Shalu, Taichung, Taiwan, R. O. C.

*** Department of Ecology, Providence University, Shalu, Taichung, Taiwan, R. O. C.

Fossil locality

The *Discocyclusina* bearing limestone cobble for study is found in a small branch of the Tsuken

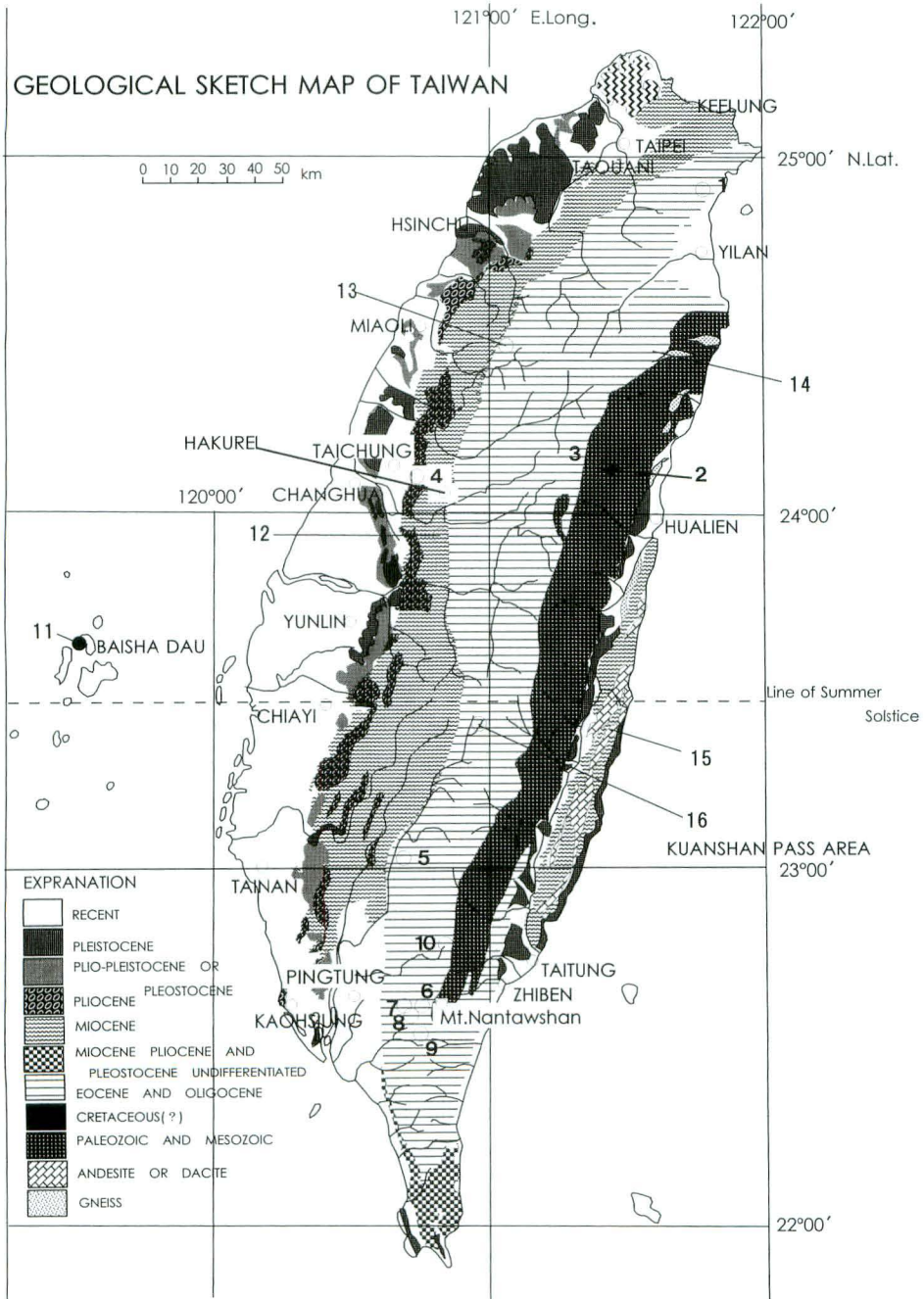


Fig. 1 Map showing the geological sketch map of Taiwan. Number 12 is the studied locality.

Si (river) at Tsukeng Village (Fig. 2-12). The exact location is situated 300 m NE from the Tsukeng Chiau (bridge) and a small river bed in front of the Tsukeng Filtration Plant and old Yunglo Fun Shiau (Yunglo Fun closed school) (Fig. 2). This location seems to be the Location 2 or Location 3 of Hashimoto and Kurihara (1974, Fig. 2). The authors discovered the similar *Discocyclus* bearing limestone, which Hashimoto and Kurihara (op. cit., pl. 1, fig. 2) has showed the surface of *Discocyclus* bearing limestone. The authors couldn't, however, find any free *Discocyclus* specimens from the calcareous sandstone of the Tsukeng Formation which is rarely exposed from the surface soil of a small trail along the small river near the Tsukeng Village.

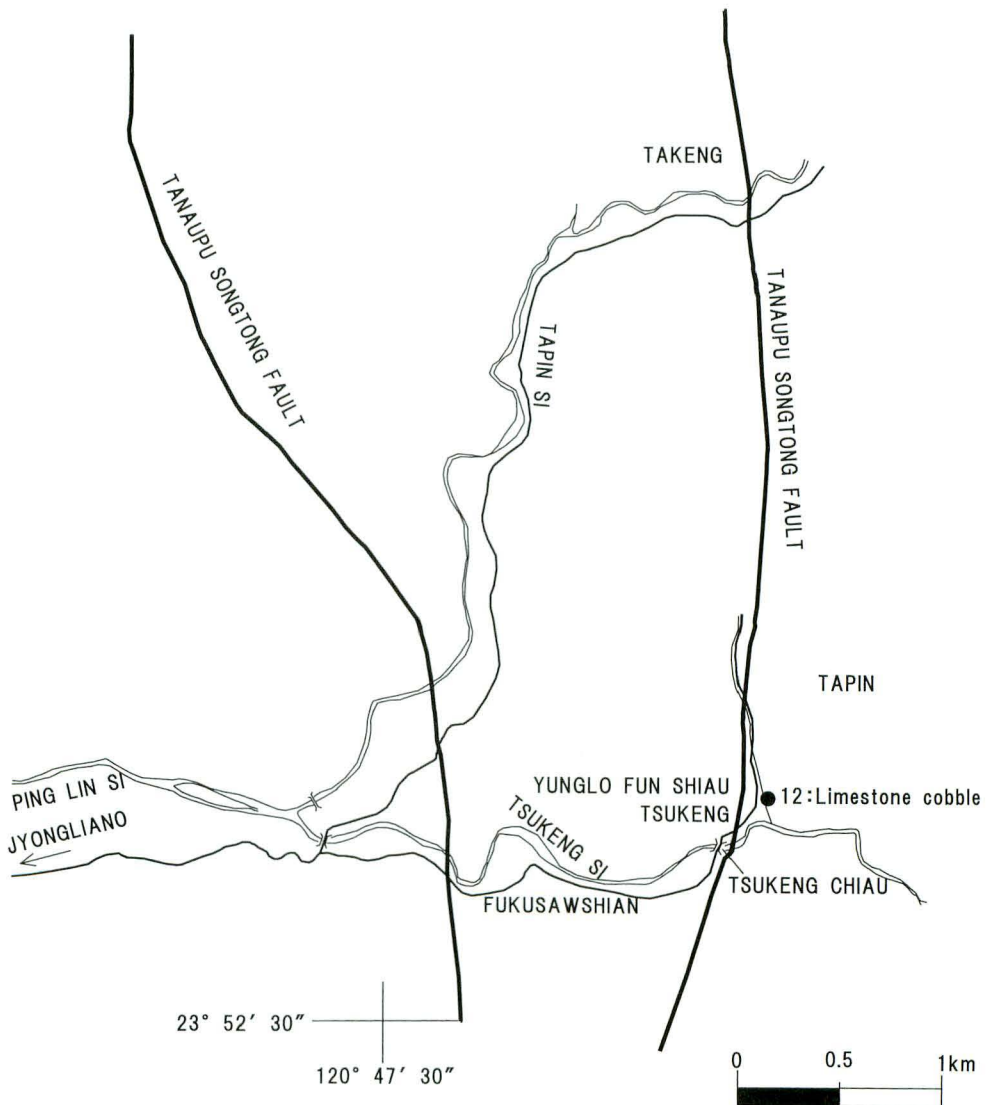


Fig. 2 Map showing the *Discocyclus* bearing limestone cobble of the fossil locality (12).

Description of species

Family Discocyclinidae Galloway, 1928

Genus *Discocyclina* Gumbel, 1870

Discocyclina dispansa (Sowerby, 1840)

Plate 1, figures 1-3; plate 2, figures 1a-1c; plate 3, figures 1-3

Lycophris dispansa Sowerby, 1840, p. 327, pl. 24, figs. 16a-b.

Discocyclina dispansa (Sowerby) . Nuttall, 1926, p. 145-147, pl. 7, figs. 1-3, 5; Nagappa, 1959, pl. 10, figs. 6-8; Samanta, 1965, p. 422, pl. 1, figs. 9-11; Less, 1987, p. 163-164, pl. 13, figs. 9, 12; pl. 14, figs. 3, 6, text-fig. 27q; Matsumaru, 1996, p. 138-140, pl. 40, fig. 7; pl. 48, figs. 1-3.

Discocyclina (*Discocyclina*) *changi* Hashimoto and Kurihara, 1974, p. 38-40, pl. 1, figs. 1-6; pl. 2, figs. 1-6.

Description: Test thin lenticular to lenticular, with or without central umbo; megalospheric embryonic chambers, trybliolepidine type; periembrionic and embryonic chambers, rectangular and *archiachii* type arrangements; lateral chambers, arranged mostly in regular tiers and chamber cavities low to moderately open cavities between roofs and floors; pillars thin and enclosed by lateral chambers.

Dimension: Diameter of test = 7.0 to 15.0 mm, Thickness of test = 0.75 to 1.55 mm, Form ratio of diameter/thickness = 9.36 to 20.00; Diameter of protoconch = 124 and 208 micron in two specimens, Diameter of deutoconch = 364 and 541 micron, Distance across both protoconch and deutoconch = 333 and 545 micron; Dimension of equatorial chambers (i.e. tangential diameter x radial diameter) = 36 x 40 to 40 x 70 micron; Dimension of lateral chambers (i.e. length x height) = 60 x 11 to 90 x 7 micron; Number of lateral chambers in a tier over embryonic chambers = 13 to 29; Number of lateral chambers enclosed around pillars = 7 ; Diameter of pillars = 140 to 146 micron.

Remarks: The present form is similar to *Discocyclina changi* Hashimoto and Kurihara, 1974, based on the external and internal characters. Hashimoto and Kurihara mentioned that *Discocyclina changi* is similar to *D. sella* (d'Archiac, 1850), but is different from the latter in having the thinner test. However both the present form and *D. changi* is identified as *Discocyclina dispansa* (Sowerby), because of having trybliolepidine type of embryonic chambers and *archiachii* type arrangement of periembrionic and equatorial chambers. The present form is assigned to *D. dispansa*. This species is associated rarely with *Lenticulina* sp. and *Asterigerina* sp., but doesn't associate with other diagnostic species. Then the age of the *Discocyclina* bearing limestone cobble is difficult to decide critically, but *D. dispansa* is known as the range of Middle to Late Eocene.

Stratigraphic horizon: Unknown. However, the limestone cobble for study could be at least carried from the Eocene Hakurei Formation, which is known widely in Taichung County (Ho et al., 1956, Chiu, 1972, and Matsumaru, 2005).

Geological age: Middle to Late Eocene or probably Late Eocene, because of the previous works to some Eocene larger foraminifera in Taiwan (Matsumaru, 2005).

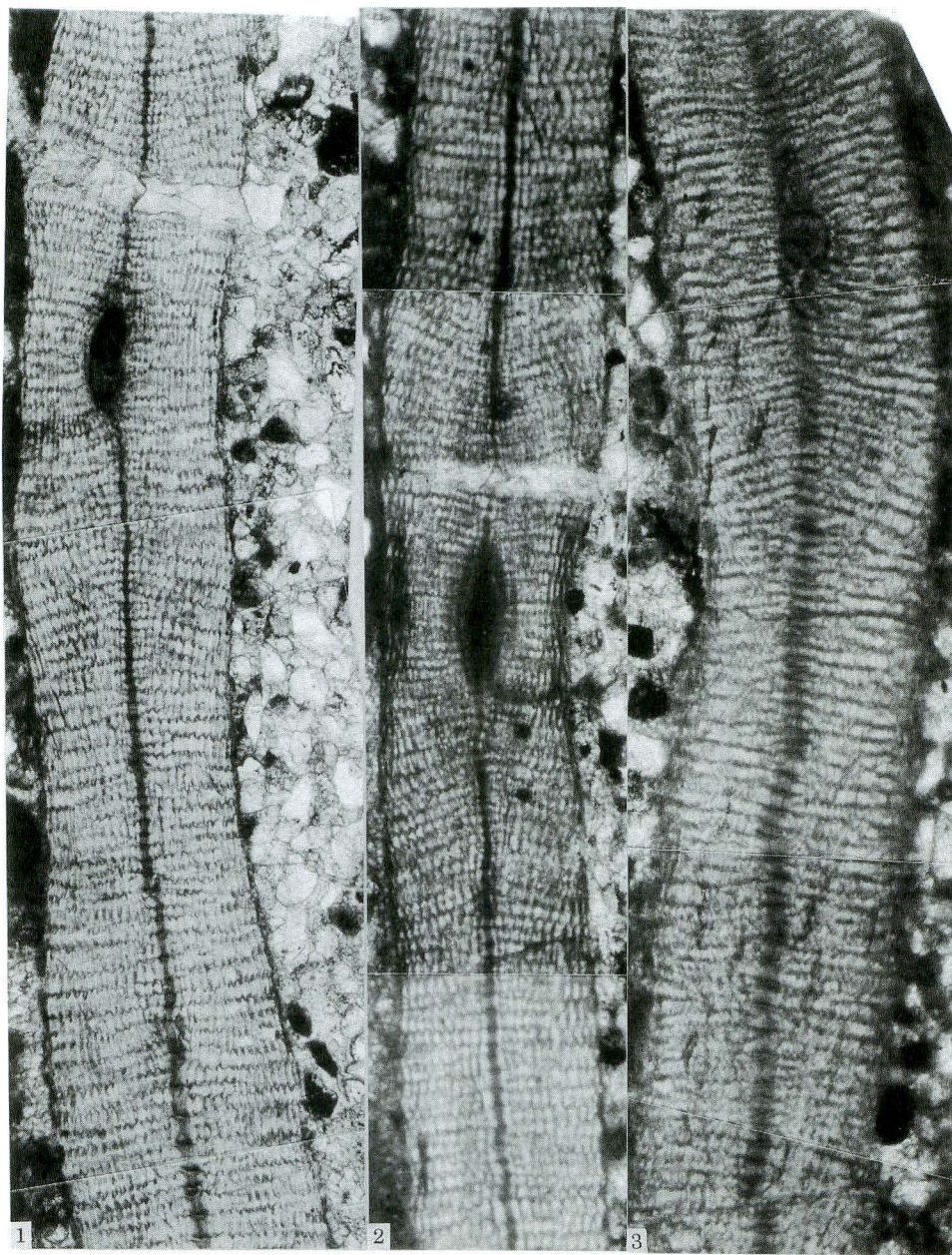


Plate 1

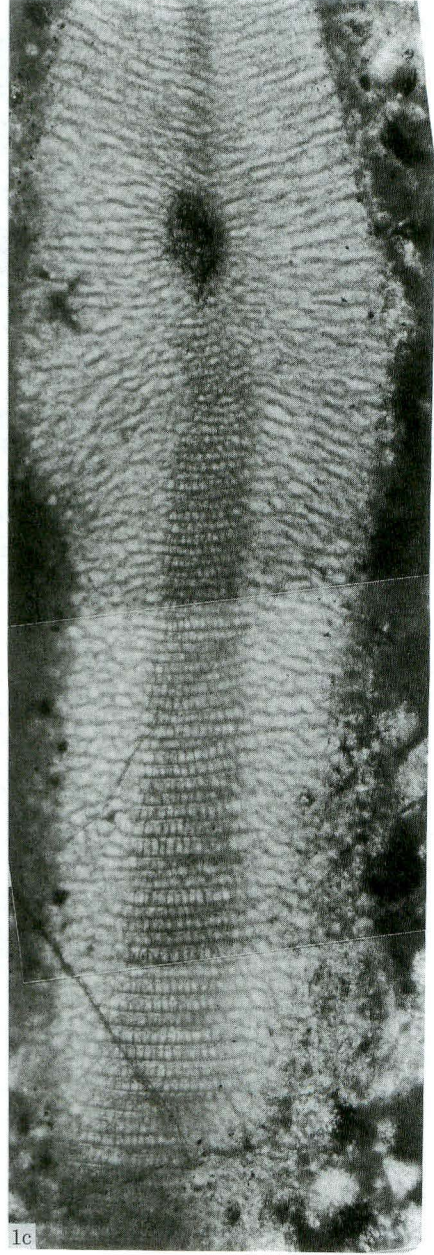
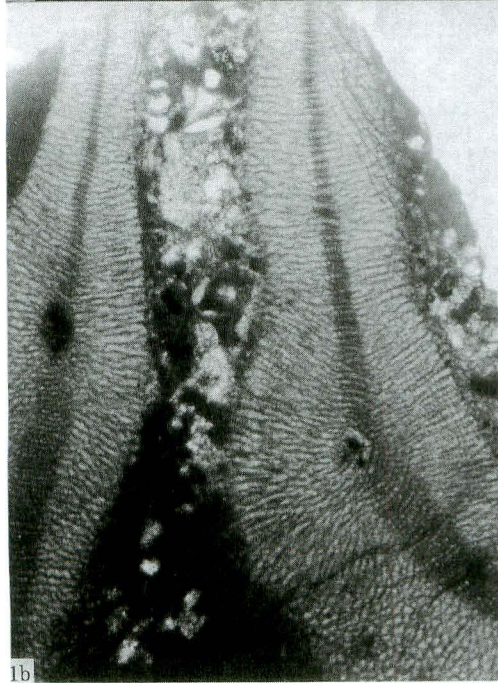
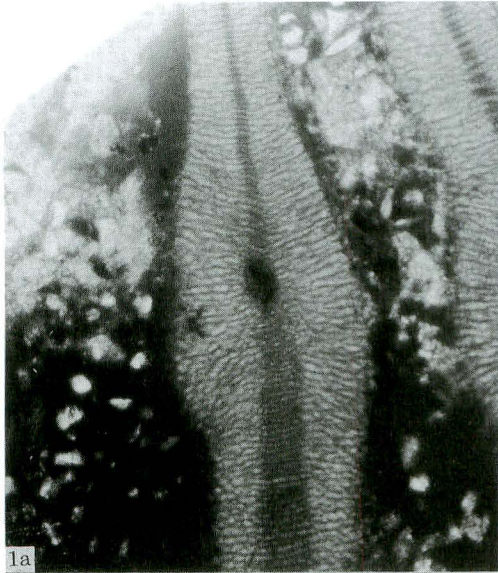


Plate 2

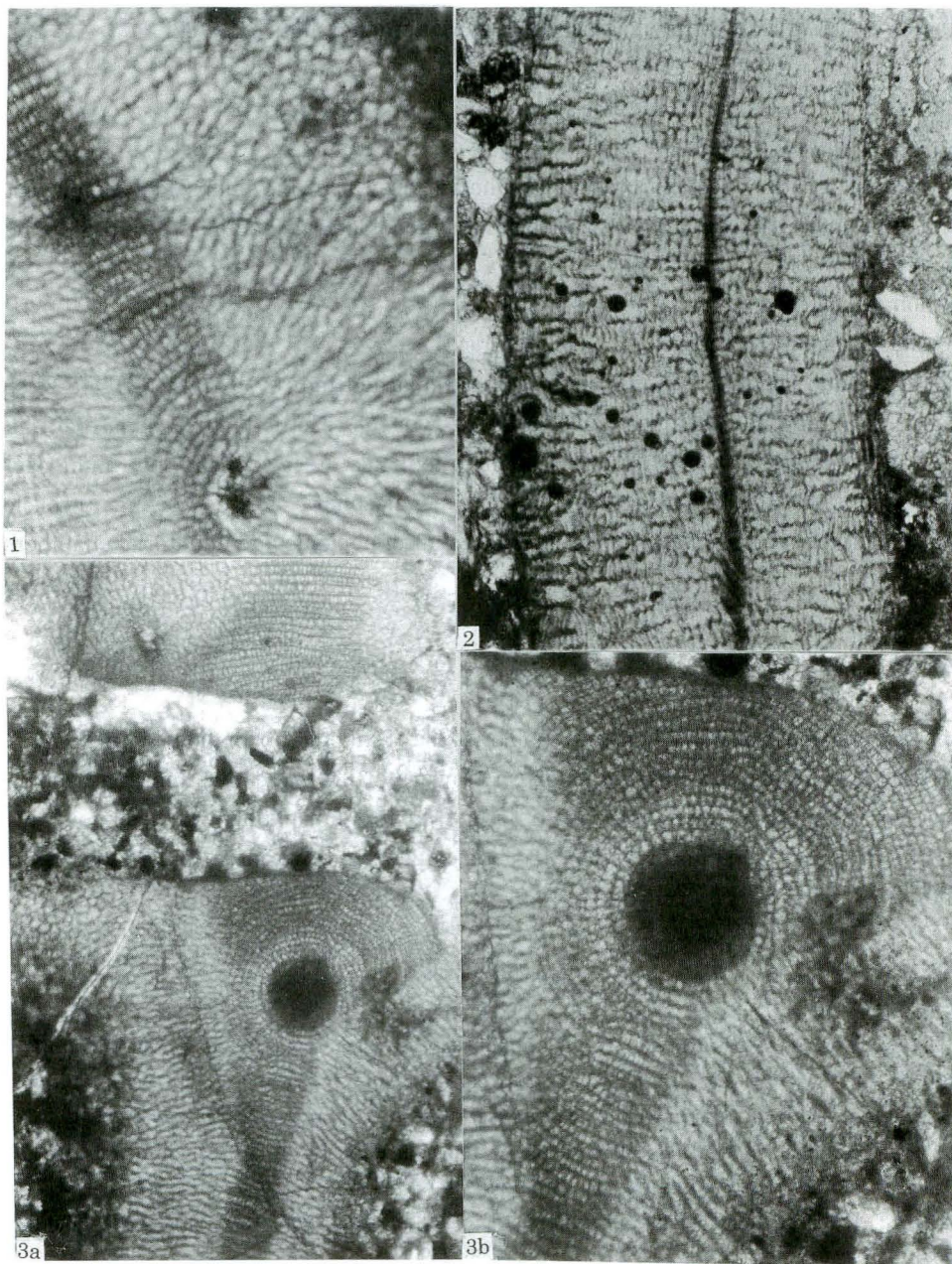


Plate 3

Explanation of Plate 1

Discocyclusina dispansa (Sowerby)

1-3. Axial sections of megalospheric form. 1. The orientation is cut across both protoconch and deutoconch. 2. The orientation is cut near the embryonic chambers. 3.

The orientation is cut near perpendicular for the orientation of figure 1. x 32.

Explanation of Plate 2

Discocyclusina dispansa (Sowerby)

1a-1c. Centered oblique section of megalospheric form showing ellipsoidal embryonic, sub-*rectangular nepionic*, *rectangular* equatorial and polygonal lateral chambers. 1a, 1b. x 16, 1c. x 32.

Explanation of Plate 3

Discocyclusina dispansa (Sowerby)

1. Centered oblique section of megalospheric form (enlarged figure 1b right of Plate 2) showing trybliolepidine embryonic chambers and *archiaci* type of rosette feature of lateral chambers exposed around pillars. 2. Vertical section of thick lenticular test showing low high cavities of lateral chambers. 3a-3b. Equatorial sections of megalospheric form showing trybliolepidine embryonic chambers and *archiaci* type of arrangement of nepionic and equatorial chambers. 1-2, 3 b. x 32. 3a. x 16.

Conclusions

The *Discocyclusina*-bearing limestone cobble of the Tsukeng Formation in Tsukeng Village, Nantou, Taiwan contains *Discocyclusina dispansa* (Sowerby, 1840), and this limestone cobble could be at least carried out from the middle to late Eocene Hakurei Formation, which is known widely in Taichung County as Matsumaru (2005) has indicated the reworking of *Nummulites*-bearing limestone

References

- Chiu, H. T., 1972: Miocene stratigraphy of the Nantou area, central Taiwan. *Petrol. Geol. Taiwan* **10**: 159-177.
- Hashimoto, W. and Kurihara, K., 1974: *Discocyclusina* from the Tsukeng Formation, Tsukeng, Nantou, central Taiwan, and its geological significance. *Bulltin of the Geological Survey of Taiwan* **24**: 35-49.
- Ho, C. S., Tsan, S. F. and Tan, L. P., 1956: Geology and coal deposits of the Chichitashan area, Nantou, Taiwan. *Bulltin of the Geological Survey of Taiwan* **9**: 1-43.
- Matsumaru, K., 1996: Tertiary larger foraminifera (Foraminiferida) from the Ogasawara Islands, Japan. *Palaeontological Society of Japan, Special Papers* **36**: 239 pp.
- Matsumaru, K., 2005: *Nummulites junbarensis* and *Assilina formosensis* (late Early to early Middle Eocene) from Taiwan (Formosa). *Revue de Paléobiologie, Genève* **24** (2): 551-561.
- Nagappa, Y., 1959: Foraminiferal biostratigraphy of the Cretaceous-Eocene succession in the India-pakistan-Burma region. *Micropaleontology* **5**: 145-192.

- Nuttall, W. L. F., 1926: The zonal distribution of the larger foraminifera of Middle and lower Kirthar Series (Middle Eocene) of parts of western India. *Record of the Geological Survey of India* 59: 115-164.
- Samanta, B. K., 1965: *Discocyclina* from the upper Eocene of Assam, India. *Micropaleontology* 11: 415-430.
- Sowerby, J. de C., 1840: Systematic list of organic remains. Appendix to Grant C. W.: Memoir to illustrate a geological map of Cutch. *Transaction of the Geological Society of London* 5: 327-329.

(Received September 25, 2006)

(Accepted October 13, 2006)