

ART. VII.—*Rare Foraminifera from Deep Borings—Part III.*

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(With Plates XI-XIII.)

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In continuation of former papers on "Rare Foraminifera from Deep Borings," we here describe some new and rare foraminifera obtained from various borings in Victoria and New Guinea, and also from outcrops in Papua and New Guinea.

Included in this paper are *Spiroclypeus margaritatus* (Schlumberger) from the Hamilton Bore, the first definite record in Australia; two new species of *Lepidocyclina*, *L. hamiltonensis* and *L. howchini* from the bore at Hamilton, Western Victoria; *L. martini* from borings in Gippsland, Victoria; *L. radiata* from borings in Western Victoria and Gippsland, previously known only from Java; also the occurrence of *L. sumatrensis* (Brady) var. *mirabilis* Yabe and Hanzawa for the first time in Australian Tertiaries; *Miogypsina mamillata* Yabe and Hanzawa, and *M. saitoi* Yabe and Hanzawa from borings and outcrops at Matapau, New Guinea, previously described only from the Island of Formosa (Taiwan).

Genus *Spiroclypeus* H. Douvillé, 1905.

*SPIROCLYPEUS MARGARITATUS* (Schlumberger).

(Plate XI, Figs. 4. 5.)

*Heterostegina margaritata* Schlumberger, 1902, p. 252-3, pl. vii, fig. 4.

*Spiroclypeus margaritatus* (Schl.), Boussac, 1906, p. 94.

*Heterostegina margaritata* (Schl.), Chapman, 1914, p. 293, pl. ix, fig. 11.

*Spiroclypeus margaritatus* (Schl.), Yabe and Hanzawa, 1928, p. 187, pl. xxiii, figs. 1-4, pl. xxiv, figs. 1-5.

Observations.—We are enabled to place on record the first undoubted occurrence of *Spiroclypeus margaritatus* in the Australian Tertiaries. This specimen occurred in the bore at Muddy Creek, near the junction of the Grange Burn about six miles west of Hamilton. It was found in a thin section of the ochreous limestone in association with the Nephrolepidines (*Lepidocyclina sumatrensis*, *L. tournoueri*, and *L. hamiltonensis*) described below. In the same section of limestone there also occur nume-

rous species of polyzoa common to the Tertiary. The section, which is cut through the equatorial zone, represents a typical specimen of the species earlier described by Schlumberger as *Heterostegina margaritata*. The condition of preservation is fairly good for these ironstained limestones, and the disposition of the pillars in the lateral zones is well shown, together with the unequal arrangement of the central chambers.

A doubtful reference to the species by one of us (F.C.) previously was made from a limestone at Batesford near Geelong, Victoria, though this has not been confirmed by additional specimens. We also figure here a limestone from Tumleo Island, Aitape, New Guinea, which is extremely rich in *Spiroclypeus margaritatus*.

Dimensions of Hamilton Specimens.—Diameter of test, 2.47 mm. Thickness of test, 0.9 mm.

Occurrence.—*Spiroclypeus margaritatus* occurs at the following localities:—In Victoria, Hamilton Bore, at 36-38 feet, ? and Batesford; in Papua, at Bootless Inlet, Boira and Red Scar Head, Lagaba Island; and in New Guinea in the Aitape Area, at Tumleo Island, Wanfela Creek, Mene River, Nofula Creek, Upper Bliri Creek and Pinbim Creek, and in the Wanimo Area at Umoni Creek, Pimpri Hill, Pluro Creek and Mapri-Kipri Hills; in the New Hebrides at Santo.

Age.—The original type specimen, described by Schlumberger as *Heterostegina margaritata*, came from the Miocene of Borneo. The genus *Spiroclypeus* is regarded by Umbgrove, (1930), p. 4, as one of the principal guide fossils of Tertiary "e," which is regarded by Van der Vlerk as Lower Miocene. This genus is usually associated with the Eulepidines and certain Nephrolepidines, in the East Indies, New Guinea and Papua. In the Hamilton Bore it is found with large and small Nephrolepidines. From the above associations we may conclude that *Spiroclypeus margaritatus* in Victoria distinctly points to a Lower Miocene horizon.

#### Genus *Lepidocyclina* Gümbel, 1868.

LEPIDOCYCLINA (NEPHROLEPIDINA) HAMILTONENSIS, sp. nov.

(Plate XII, Figs. 8, 9, 10.)

*Lepidocyclina martini* Chapman (non Schlumberger), 1910, p. 297, pl. liv, figs. 3, 4.

Description of Holotype (from Hamilton Bore, 48-53 feet).—Test small, surface moderately and evenly convex, periphery angulate, with 7 blunt processes, papillae small, generally scattered on the whole surface, with a few larger ones near the centre.

Description of Tectotypes.—(a) Transverse section, from 68-80 feet. Centrosphere nephrolepidine, moderately thick-walled.

Median chambers, short, spatulate, arranged in about 20 annulations. (b) Vertical section from 26-38 feet. Lateral chambers arranged in 7 layers on either side of the centrosphere; 8 strong pillars distributed through the lateral series of chambers.

Dimensions.—Diameter of test, 2.88 mm.; thickness of test, 0.76 mm. Diameter of centrosphere, 0.17 mm.; longest diameter of nucleoconch, 0.35 mm.

Observations.—The form to which *Lepidocyclina hamiltonensis* is most nearly allied is *L. tournoueri*. The points of difference are the more regular and compact characters of the equatorial chambers in the present series. Externally it shows a more even outline with regular angulation. This angulation is seen to some extent in the equatorial sections just near the margin, and by the more compressed character of the chamberlets at the points. Some specimens which are more variable in character, but which we refer to this species, occur in the Batesford Limestone, recorded by one of us (F.C.), under the name *L. martini*, which, however, is not referable to Schlumberger's species.

Occurrence.—In the Hamilton Bore, Western Victoria, at 35-53 feet, 68-85 feet, 86-91 feet, 135-137 feet, 159-160 feet, 181-187 feet; and Batesford, near Geelong.

Age.—Lower Miocene. It is associated with *L. marginata*, *L. radiata*, *L. howchini*, and *Spiroclypeus margaritatus*.

#### LEPIDOCYCLINA (NEPHROLEPIDINA) HOWCHINI, sp. nov.

(Pl. XIII, Figs. 18, 19.)

? *Orbitoides stellata*, Howchin (*non* d'Archiac), 1889, p. 17, pl. i, figs. 9, 10 a,b.

Description of Holotype (from Hamilton Bore, 80-85 feet).—Test small, discoidal with 8 blunt marginal prolongations. Surface strongly convex, central part of test with a group of strong papillae, smaller on the surrounding area.

Description of Tectotype.—Vertical section from 68-80 feet. Equatorial series narrow, lateral, chamberlets forming 6 layers superimposed on centrosphere, 5 vertical pillars shown in cross section in the central region.

Dimensions.—Diameter of test, 2.9 mm.; thickness of test, 1.17 mm. Diameter of centrosphere, 0.14 mm.; longest diameter of nucleoconch, 0.41 mm.

Observations.—It is possible that the specimen referred to by Howchin as *Orbitoides stellata* (1889) is specifically the same as the present species, judging from the figure of the external surface which Howchin gives, but a small measure of doubt is thrown upon it by the transverse section accompanying *O. stellata* (pl. I, fig. 10a), for this figure of a vertical section appears to belong to the outline of the species we have here named as *Lepidocyclina hamiltonensis*, or an allied form. On the other hand,

the comparison between the external view of Howchin's specimen and our species is strengthened by a fragment of a vertical section of a specimen from Muddy Creek, showing a strong pillar, which he figures on pl. I, fig. 10*b*.

Occurrence.—Western Victoria, in Hamilton Bore, at 36-38 feet, 43-53 feet, 68-85 feet, 86-91 feet, 109-114 feet, 135-137 feet, 157-159 feet, 160-161 feet, 166-171 feet, 181-187 feet; Gippsland in No. 16 Bore, Parish of Stradbroke, at 610 feet.

Age.—Lower Miocene. *L. howchini* is associated with *L. radiata*, *L. hamiltonensis*, *L. sumatrensis* and *L. marginata*.

#### LEPIDOCYCLINA (NEPHROLEPIDINA) MARTINI Schlumberger.

(Pl. XII, Figs. 11, 12, 13.)

*Lepidocyclus martini*, Schlumberger, 1900, p. 131, pl. vi, figs. 5-8; Douvillé, H. 1916, p. 28, pl. iv, figs. 3-7; Crespin, 1926, p. 115, pl. viii, fig. 8.

Observations.—*Lepidocyclus martini* is a very variable species which in the more regularly rayed forms approaches *L. radiata*. The distinguishing features are the pustule-bearing rays, the rays themselves being of a more irregular character than those met with in *L. radiata*. The original type specimen given by Schlumberger was afterwards supplemented by a fine series, figured by H. Douvillé from Rembang, Java, and by means of which we were enabled more definitely to assign the Australian species to their proper position. Although *L. martini* is met with at Batesford, the figures given by one of us (F.C.) rightly belong to *L. hamiltonensis*. The feature of irregularity in the rays of *L. martini* is well shown in the equatorial section which is here figured.

Occurrence.—Western Victoria. In Hamilton Bore at 36-48 feet, 53-63 feet, 68-85 feet, 89-96 feet, 104-114 feet, 119-129 feet, 135-142 feet, 152-157 feet, 159-160 feet, 161-171 feet, 176-187 feet. In Gippsland, Parish of Stradbroke, Bore No. 15, at 45 feet; in No. 16 Bore, at 640 feet; No. 5 Bore, Parish of Glencoe, at 40-80 feet; in No. 1 Bore, Parish of Bumberrah (Metung) at 872 feet; at Batesford, near Geelong, and Green Gully, Keilor.

Age.—Almost the whole of the recorded examples of *L. martini* from the Australian Tertiaries are in the Lower Miocene (stage "e"), although in the East Indies and New Guinea it has been recorded in the stages of "e" and "f."

#### LEPIDOCYCLINA (NEPHROLEPIDINA) RADIATA (Martin).

(Pl. XIII, Figs. 15, 16, 17.)

*Orbitoides radiata* Martin, 1880, p. 163, pl. xxviii, fig. 4.

*Lepidocyclus radiata* (Martin), Douvillé, H. 1916, p. 22, pl. v, fig. 4, Van der Vlerk, 1928, p. 35, fig. 25.

Observations.—*Lepidocyclina radiata* was first described from the Miocene of Java associated with *Cycloclypeus communis*. There is no doubt that our specimens, which were met with in the Metung Bore, are conspecific with Martin's species. This is an important discovery in regard to the Australian Tertiaries since *L. radiata* is typically referable to stage "e" in the Dutch East Indies, and so helps to fix the exact horizon in the Miocene of South-eastern Australia. The most typical specimens of *L. radiata* occur in the East Gippsland borings, but the species is also met with, in a less developed condition, in Western Victoria, where on account of its variability it may easily be mistaken for the smaller or less regular form *L. martini*. The figure of the transverse section here given is apparently the first that has been published of this species. In addition to the typical test of *L. radiata* a figure is included of the juvenile stage. In this it will be seen that the radii of the test of the adult stage, which are within the circumference, in the early stages are represented by spur-like processes beyond the margin.

Dimensions.—Diameter of test of figured specimen from No. 5 Bore, Parish of Glencoe, 4.7 mm. Average diameter of examples from Hamilton Bore, about 2.5 mm.

Occurrence.—Western Victoria. In Hamilton Bore, at 38-43 feet, 48-53 feet, 58-63 feet, 68-96 feet, 104-114 feet, 119-124 feet, 135-137 feet, 152-161 feet. In Gippsland, in No. 1 Bore, Parish of Bumberrah (Metung), at 872 feet; No. 5 Bore, Parish of Glencoe, 50-80 feet; No. 15 Bore, Parish of Stradbroke, at 45 feet.

Age.—Lower Miocene. *L. radiata* is associated with *L. martini*, *L. sumatrensis*, *L. hamiltonensis*, *L. marginata*, *L. howchini*, and *Cycloclypeus communis*.

LEPIDOCYCLINA SUMATRENSIS (Brady) var. MIRABILIS  
Yabe and Hanzawa.

(Pl. XI, Figs. 1, 2.)

*Orbitoides stellata* Howchin *pars.* (non d'Archiac), 1889, p. 17, pl. i, figs. 11, a, b.

*Lepidocyclina murrayana* Crespin (non Chapman), 1926, p. 116, pl. xiii, fig. 9.

*Lepidocyclina sumatrensis* (Brady) forma *mirabilis* Yabe and Hanzawa, 1930, p. 31, pl. vi, figs. 1-7; pl. vii, figs. 1-11.

Observations.—Howchin has figured and described an exactly similar form of the above variety of *L. sumatrensis* under the name of *Orbitoides stellata*, and coming from the lower beds at Muddy Creek, Hamilton, was probably obtained from the red limestone of that locality, washed down or in situ. We have found identical examples in the Hamilton Bore at Muddy Creek, at 91-98 feet, as well as at the Batesford Quarry, near Geelong.

Figures of this variety from both localities are here given. The form referred to as *L. murrayana* from Keilor is now seen to be also similar. Yabe and Hanzawa, in the work above quoted, suggested that these "Trigonolepidine" forms may be found, as monstrous varieties, in other species. They also state their belief that these are not produced by an accidental lobe-formation of test, because the same nucleoconch lies at the centre of the test. On the other hand, the section of one of the trigonal forms which we here figure appears to show definitely that this trigonolepidine habit in some individuals is due to the duplicated budding of the second or kidney-shaped chamber.

Further than this we have met with other species of *Lepidocyclina* which have shown the same tendency to produce monstrous forms through prolific budding of the second chamber.

Thus, the monstrous form of *L. martini*, which occurs at 45 feet in No. 15 Bore, Parish of Stradbroke, Victoria, shows an even more aberrant condition and a section showing four rays to the test is here figured under the name of *L. martini* var. *mirabilis*.

Occurrence.—In Hamilton Bore, Western Victoria, at 38-48 feet, 80-85 feet, and 91-98 feet.

Age.—Lower Miocene. *L. sumatrensis* var. *mirabilis* is associated with *L. radiata*, *L. martini*, *L. marginata*, *L. hamiltonensis* and *L. howchini*.

#### Genus *Miogypsina* Sacco, 1893.

##### *MIOGYPSINA MAMILLATA* Yabe and Hanzawa.

(Pl. XI, Fig. 6.)

*Miogypsina mamillata* Yabe and Hanzawa, 1930, p. 34, pl. i, fig. i, pl. iii, figs. 7, 8, pl. iv, fig. 6, pl. vi, fig. 13, pl. xi, figs. 7, 8, pl. xii, fig. 1, pl. xiii, fig. 8.

Observations.—The above species was recently described by H. Yabe and S. Hanzawa, from the island of Taiwan (Formosa). During our examination of bore material and outcrop samples from Matapau, New Guinea, obtained by the officers of Oil Search Ltd., we have found the same species in the limestones of that area, and associated similarly with other genera, as recorded by these Japanese authors. This is the only occurrence of *M. mamillata* at present known, beyond the island of Taiwan (Formosa). The Matapau examples are beautifully preserved, and many of them have the tests so thickened that they appear almost subspherical.

Occurrence.—Bore No. 7, Matapau, at 1200-1210, and at Mabam River, Matapau, New Guinea.

Age.—Middle Miocene, Tertiary "f." *M. mamillata* is found associated with *Operculina*, *Lepidocyclina* (N.) *angulosa*, *L.* (N.) *sumatrensis*, *L.* (N.) *ferreroi*, *L.* (N.) *verbeeki* and *Miogypsina saitoi*.

## MIOGYPSINA SAITOI Yabe and Hanzawa.

(Pl. XI, Fig. 7.)

*Miogypsina saitoi* Yabe and Hanzawa, 1930, p. 34, pl. v, fig. 8, pl. xii, fig. 3, pl. xiv, fig. 7.

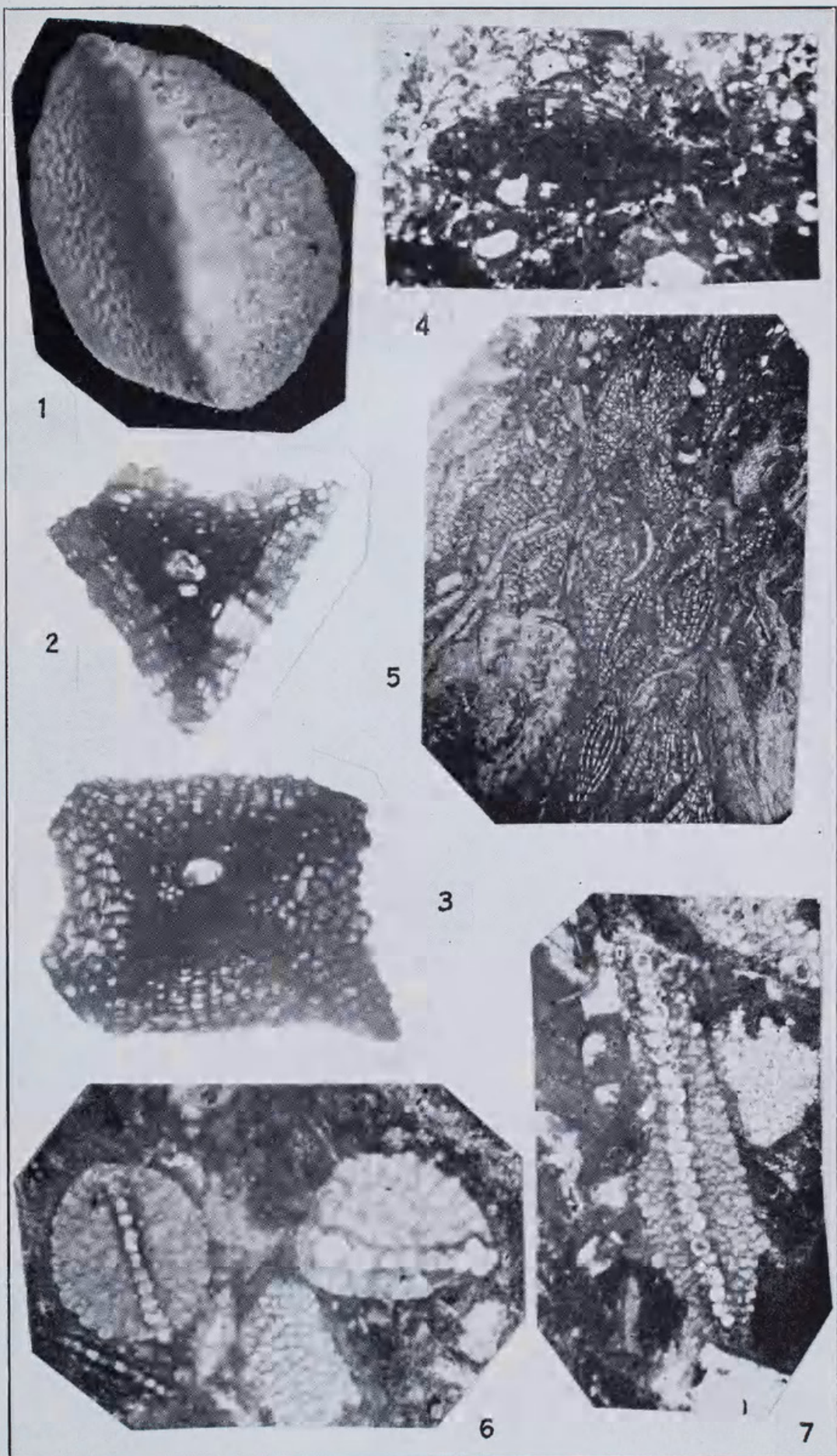
Observations.—This species, like the one above mentioned, was first described by Yabe and Hanzawa, from Taiwan (Formosa). It may be distinguished from *M. irregularis* by the more compressed form and regular median series. In vertical section the test shows a greater inflation on one side than the other.

Occurrence.—At Mabam River, Atob River, and Head of Mindik Creek (Atob R.), Matapau, New Guinea.

Age.—Middle Miocene, Tertiary "f." *M. saitoi* is associated with *Lepidocyclina sumatrensis* and *L. angulosa* and *Miogypsina mamillata*.

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F.C. Photo

**Lepidocyclina, Spiroclypeus and Miogypsina from Victoria and New Guinea.**



Chapman, Frederick and Crespín, Irene. 1932. "Rare Foraminifera from deep borings. Part III." *Proceedings of the Royal Society of Victoria. New series* 44(1), 92–99.

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