FORAMINIFERA OF THE GENERA *FABIANIA* AND *EORUPERTIA* FROM THE SYLHET LIMESTONE OF ASSAM*

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ABSTRACT—The calcareous facies of the Eocene of Assam is well developed along the southern foothills of the Shillong plateau and includes rocks of Ranikot (Palaeocene), Laki (Lower Eocene), and Kirthar (Middle to Upper Eocene) ages. Among the numerous fossils occurring in the Prang Limestone member of this facies there are two genera—*Fabiania* and *Eorupertia*—which have not so far been recorded from the Indian subcontinent. The species of *Fabiania* is considered new while that of *Eorupertia* is considered to be the same as *E. boninensis* (Yabe & Hanzawa) from Japan.

INTRODUCTION

THE Eocene rocks of Assam are developed in two different facies, one predominantly calcareous and the other argillaceous. The calcareous facies known as the Jaintia Series (Evans 1932) is developed in a narrow strip running through the southern foothills of the Shillong plateau and extending through the North Cachar and Mikir Hills to near Golaghat. The argillaceous facies known as the Disang Series is developed southeast of the Haflong Disang fault and covers an extensive area in North Cachar, the Naga Hills, the Patkai Range and Manipur State. Both the Jaintia Series and the Disang Series pass gradually into the overlying Barail Series.

The Sylhet Limestone forms a part of the Jaintia Series and is known from the Garo Hills on the west to as far east as the Mikir Hills. In the Garo Hills the limestone is thin and impure, but further east thick massive beds of limestone are developed. Near Therriaghat the thickness of this limestone is 900 ft. (Evans 1932, p. 171). In the Hari, the Lubha and the Prang rivers the limestone is again well developed. In the Mikir Hills its thickness is variable. Where it is well developed, as in the Khasi and Jaintia Hills the Sylhet Limestone includes representatives of the Ranikot (Palaeocene), the Laki (Lower Eocene), and also the Kirthar (Middle to Upper Eocene). The succession in the Khasi and Jaintia Hills can be summarized as under (Wilson & Metre 1953) :—

Kopili Alternations (1500 ft.) Alternations of shales and sandstones with bands of fossiliferous limestone.	Kirthar (U. Eocene)
Sylhet Limestone (up to 1740 ft.)	
PRANG LIMESTONE (400-900 ft.) : Grey foraminiferal and algal limestone with numerous *Nummulites*, *Assilina*, *Discocyclina*, *Operculina* and calcareous algae (Corallinaceae).	Kirthar (M.-U. Eocene)
NARPUH SANDSTONE (60 ft.) : Sandstone with occasional calcareous bands containing *Alveolina* and Miliolids.	Laki (L. Eocene)
UMLATDOH LIMESTONE (200 ft.) : Light grey compact limestone with *Alveolina*, Miliolids, *Discocyclina* and calcareous algae.	

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LAKADONG SANDSTONE (80 ft.): Sandstone with occasional coal. LAKADONG LIMESTONE (up to 500 ft.): Grey compact hard foraminiferal limestone with *Alveolina*, *Lockhartia haimei*, *Miscellanea*, *Discocyclina* and calcareous algae	Ranikot (Palaeocene)
Tura (*Cherra*) *Beds* (up to 325 ft.) Very hard sandstone underlain by limestone, calcareous sandstones and soft sandstones with few determinable fossils.	? Palaeocene

The Prang Limestone is one of the most fossiliferous groups in this succession and contains a rich and varied foraminiferal fauna of typical Khirthar affinities. Amongst these foraminifera are represented two genera, *Fabiania* and *Eorupertia*, which have not so far been recorded from this subcontinent. In this short note a description of these two new forms, as far as can be made out from a study of random sections in rock slides, is given. As the limestone is hard and compact, it has not been possible to isolate individual whole specimens but sufficient of their characters is seen in the slides which has led to their identification.

DESCRIPTION OF SPECIES

Family CYMBALOPORIDAE

Genus FABIANIA A. Silvestri 1926

Genotype PATELLA CASSIS Oppenheim

FABIANIA INDICA sp. nov.

Pl. 30, figs. 1-9; Pl. 31, figs. 1-3.

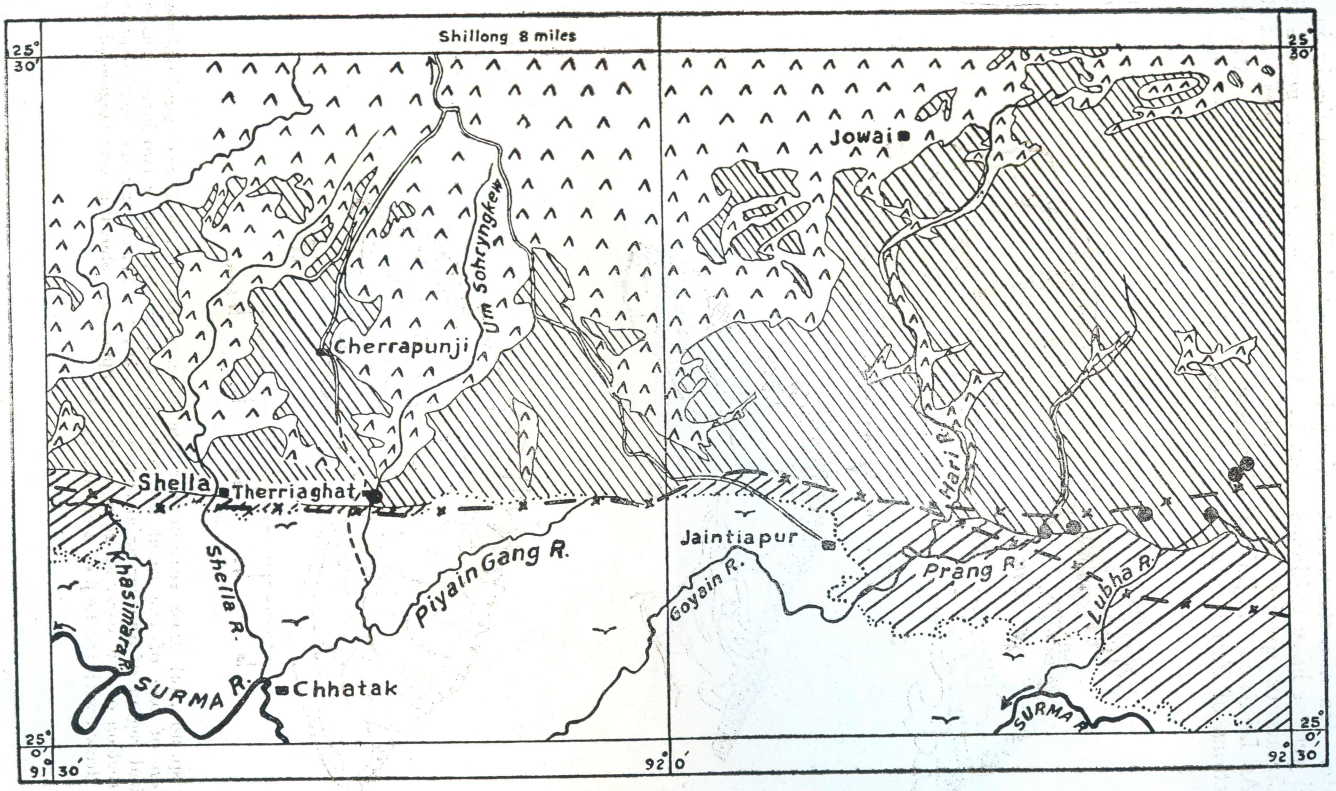
Test irregularly conical, generally broader than high and with a deeply excavated umbilicus. Some of the sections show that the umbilical cavity is very irregular and even partially filled by a loose network of chamberlets. Chambers probably biserial in the early stage later becoming annular, subdivided; chamberlets appear to be in a double row especially in the later stage. In axial sections chambers are arranged in layers parallel to the base; they are longer than high, often with a horizontal partition (plate or lamella) extending from the outer wall some distance into the chamber. Short vertical partitions are also present. Most of the septa have a fine, dark, median line, probably of chitinous matter, traversing almost the entire length. Near the base the chambers are on the average 0.55 mm. long by 0.1 to 0.16 mm. high. The middle lemella is about 0.11 mm. long.

The outer wall of the test is traversed by numerous fine perforations whose terminations on the surface give it a finely pitted appearance

The embryonic stage consists of three megalospheres only one or two of which are generally seen in axial sections. One oriented section prepared to give a cross section of the test near the apex shows clearly the three large initial chambers. One section (Pl. 31, fig. 1) is a cross section nearly parallel to the base and shows the loose network of chamberlets irregularly filling the umbilical area. Among the axial sections some show a wide deep umbilicus without any infilling while others show that the umbilical area is partially filled by chamberlets. The sections examined indicate that the base in adult specimens is not quite circular but is oval in cross section.

Cushman (1936) describes the wall of the test in *Fabiania cubensis* (Cushman & Bermudez) as finely arenaceous, though in his generic description (Cushman 1950) he does not mention anything regarding the nature of the wall. Bermudez(1952) on the other hand states in his generic description of *Fabiania* that the wall is calcareous and perforate. In discussing the characters of the family Cymbaloporidae however Cushman states that the wall of the test is cal-

GEOLOGICAL MAP OF PART OF KHASI AND JAINTIA HILLS SHOWING FOSSIL LOCALITIES



Scale 0 4 8 16 Miles

LEGEND

Alluvium

Post-Eoc. Tert.

Eoc. & Cret.

Granites & Metamorphics

Fossil Localities : ●

careous and perforate. He also states that in the early stage all genera have chitinous walls while the Cretaceous species have agglutinated wall. As far as can be judged from the various sections of *Fabiania indica* that have been examined the wall appears to be calcareous.

The impression gained as to the form of the test from a study of the available sections is presented diagrammatically in text fig. 2. It is intended to give a general idea of the shape of the test and does not take into account the irregularities in the shape of the test which certainly are present.

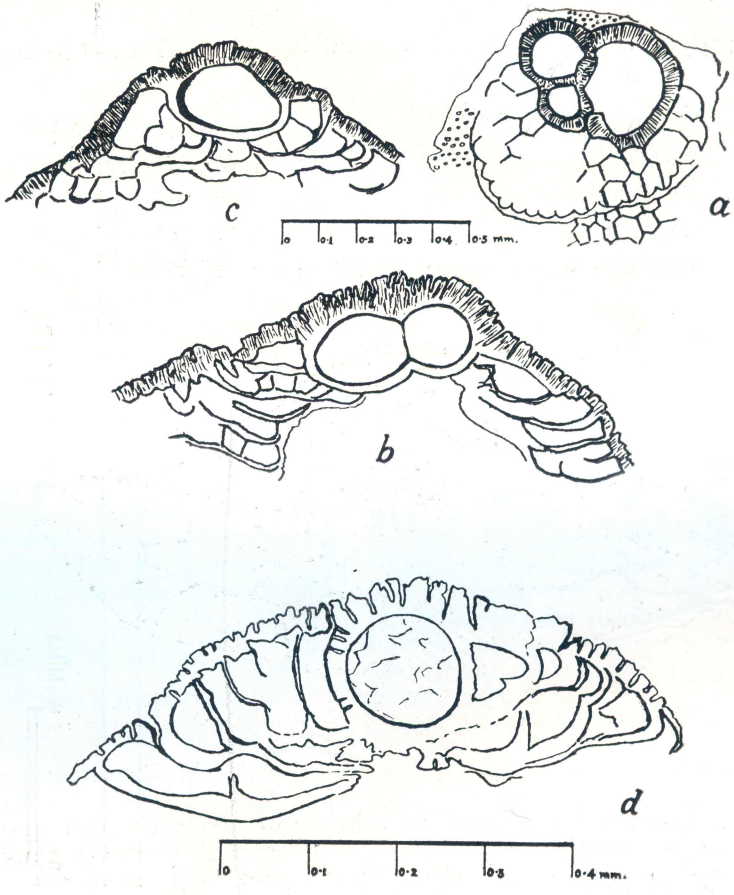


FIG. 1—*Fabiania indica* sp. nov. (a) Cross section near the apex showing the three megalospheres. (b) apical region of one of the axial sections (Pl. 30, fig. 6) showing two large megalospheres; (c) apical region of another axial section (Pl. 30, fig. 2) showing one megalosphere and (d) axial section of the early stage of a smaller specimen showing one megalosphere. All figures were drawn with the help of a camera lucida.

Some sections were measured for height and width of base ; though only the results of true axial sections are of value, these results give some idea of the variations in size.

	Test		Umbilicus	
	width	height	width	height
1	2.96 mm.	1.22 mm.	2.22 mm.	0.93 mm.
2	2.22 mm.	0.67 mm.	1.55 mm.	0.52 mm.
3	3.10 mm.	1.70 mm.		
4	3.77 mm.	1.85 mm.		
5	1.96 mm.	1.48 mm.		

Sections 1 and 2 are near axial sections and all the others are more or less oblique sections.

Occurrences.— Therriaghat (25° 11′ : 91° 45′—78 O/16*)
Wah Lariang (25° 9′ : 92° 20′—83 C/8)
Narpuh (25° 9½′ : 92° 23′— ”)
Lubha River (25° 9′ : 92° 26′— ”)
Sakwa (Deserted village) (25° 11′ : 92° 27′— ”)

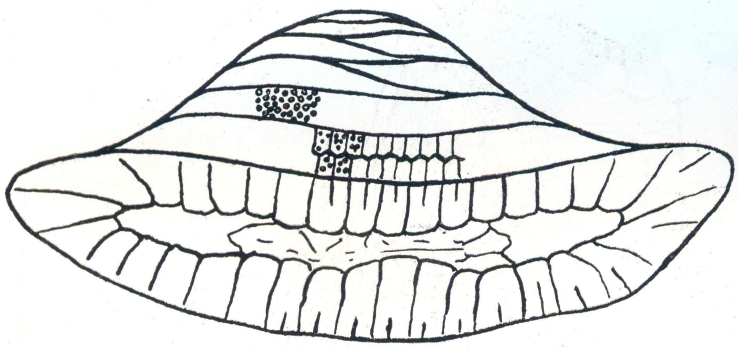


FIG. 2—*Fabiania indica* sp. nov. Diagrammatic reconstruction to show the general shape of the test.

Horizon.—Prang Limestone; common in the lower part, rare in the upper part.

This species resembles to some extent *F. cubensis* (Cushman & Bermudez). Cole (1944) reports the occurrence of a plate with irregular perforations sometimes covering the umbilicus of *F. cubensis*. In some examples of the Assam species the umbilical area is partially filled by a loose network of chamberlets and there does not seem to be any "plate" answering to the description given by Cole. Compared with *F. cubensis* the Assam species seems to have a relatively lower test with a deeper umbilicus. Compared with the type species of the genus, *F. cassis* (Oppenheim), the Assam form is smaller; *F. cassis* is from 4-7 mm. in diameter by 2-4 mm. high while the largest Assam specimen is not more than 4 mm. in diameter by about 2 mm. high. *F. cassis* shows on the average 3 lamellae (horizontal partitions as seen in axial sections) andr arely even 4 while in *F. indica* usually, there are one or two and rarely three such lamellae.

* Survey of India, 1 inch map references.

Family RUPERTIIDAE

Genus EORUPERTIA Yabe & Hanzawa 1925

Genotype : UHLIGINA BONINENSIS Yabe and Hanzawa 1922

EORUPERTIA BONINENSIS (Yabe & Hanzawa)
Pl. 31, figs 4-7; Text-fig 4, a-c.

Uhligina Boninensis Yabe and Hanzawa 1922
Japan Journ. Geol. Vol. 1 (2) p. 72,
Text-figs. 1-4; Pl. 12, figs. 1-17.

Eorupertia Boninensis (Yabe and Hanzawa) 1925.
Sci. Rept. Tohoku Imp. Univ. Ser. 2, Vol. 7, p. 77.

Test calcareous, conical, elongate-spiral; chambers inflated, coiled over a narrow, hollow centre. Whorl sutures deep and directed ventrally. Apex is slightly truncated in some specimens suggesting that the test was probably attached in the early stage. Some of the specimens show two or three short pointed spines at the apex. Septa thick, straight and solid; whorl wall finely perforate, thick and with round tubercles rather irregularly disposed on the outer surface. Perforations do not generally pierce the tubercles. The whorl wall is about 0.1 mm. thick; septa are 0.03—0.04 mm. thick and the perforations are from 0.005—0.009 mm. in diameter. The largest specimen present measures just over 4.5 mm. in length with a maximum width of 2.28 mm. Two cross

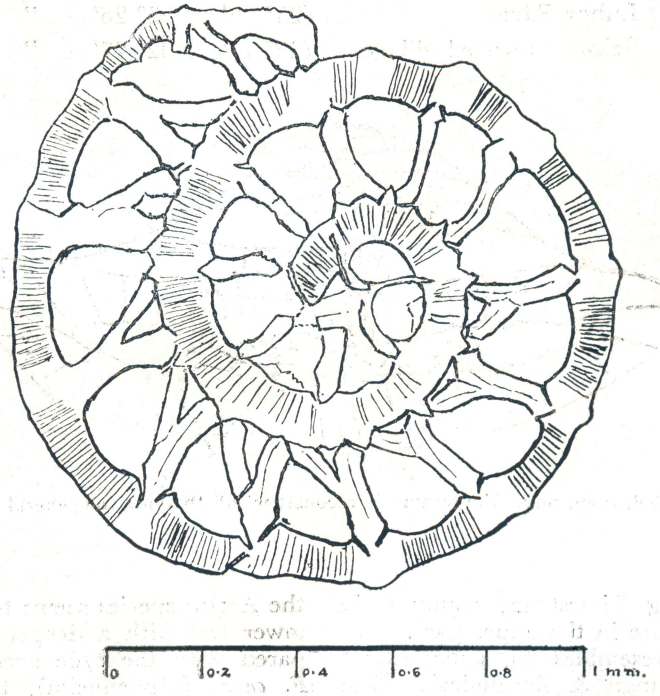


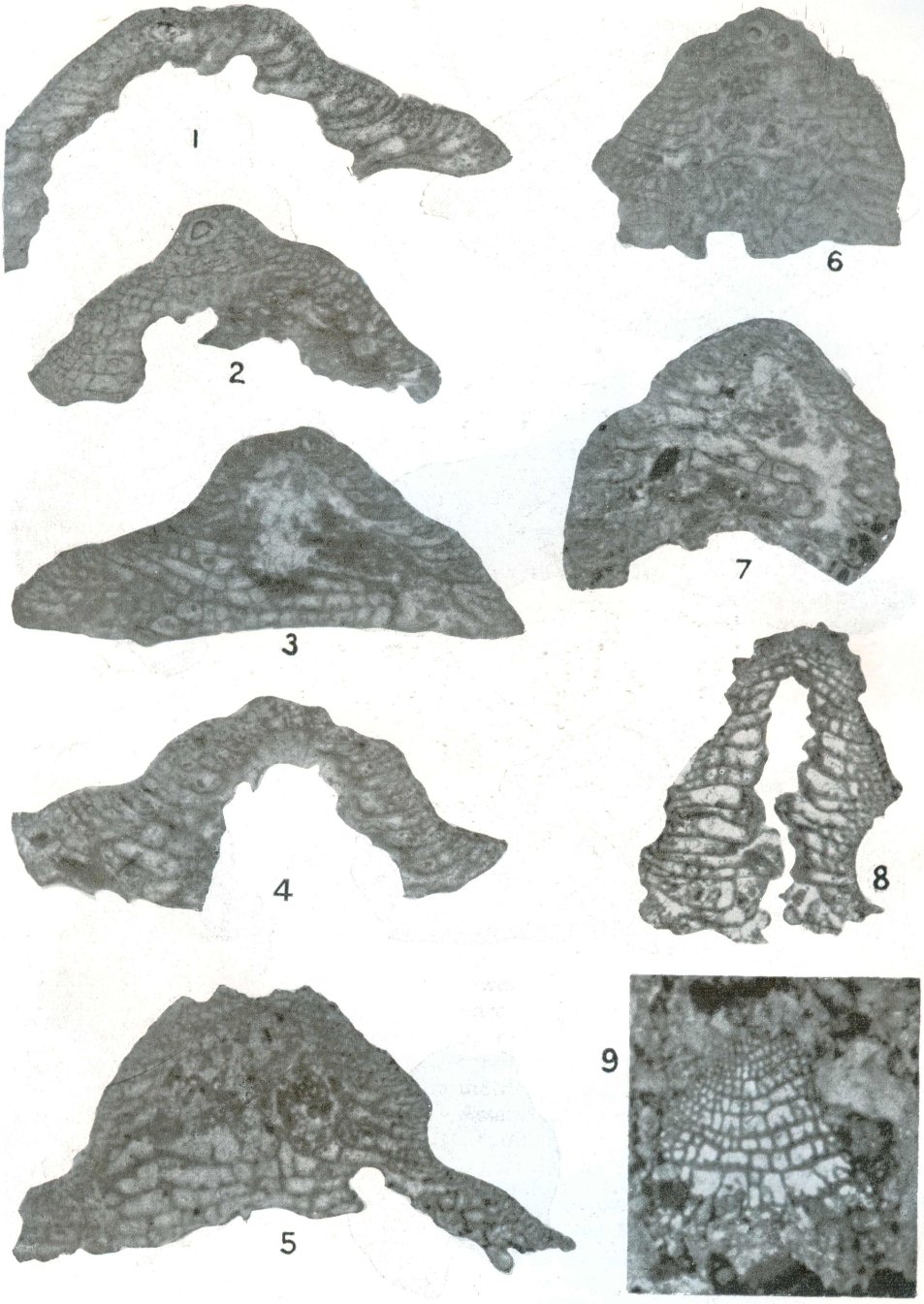
FIG. 3—*Eorupertia boninensis* Yabe and Hanzawa. A cross section showing chambers and septa. Camera lucida drawing.

EXPLANATION OF PLATE 30

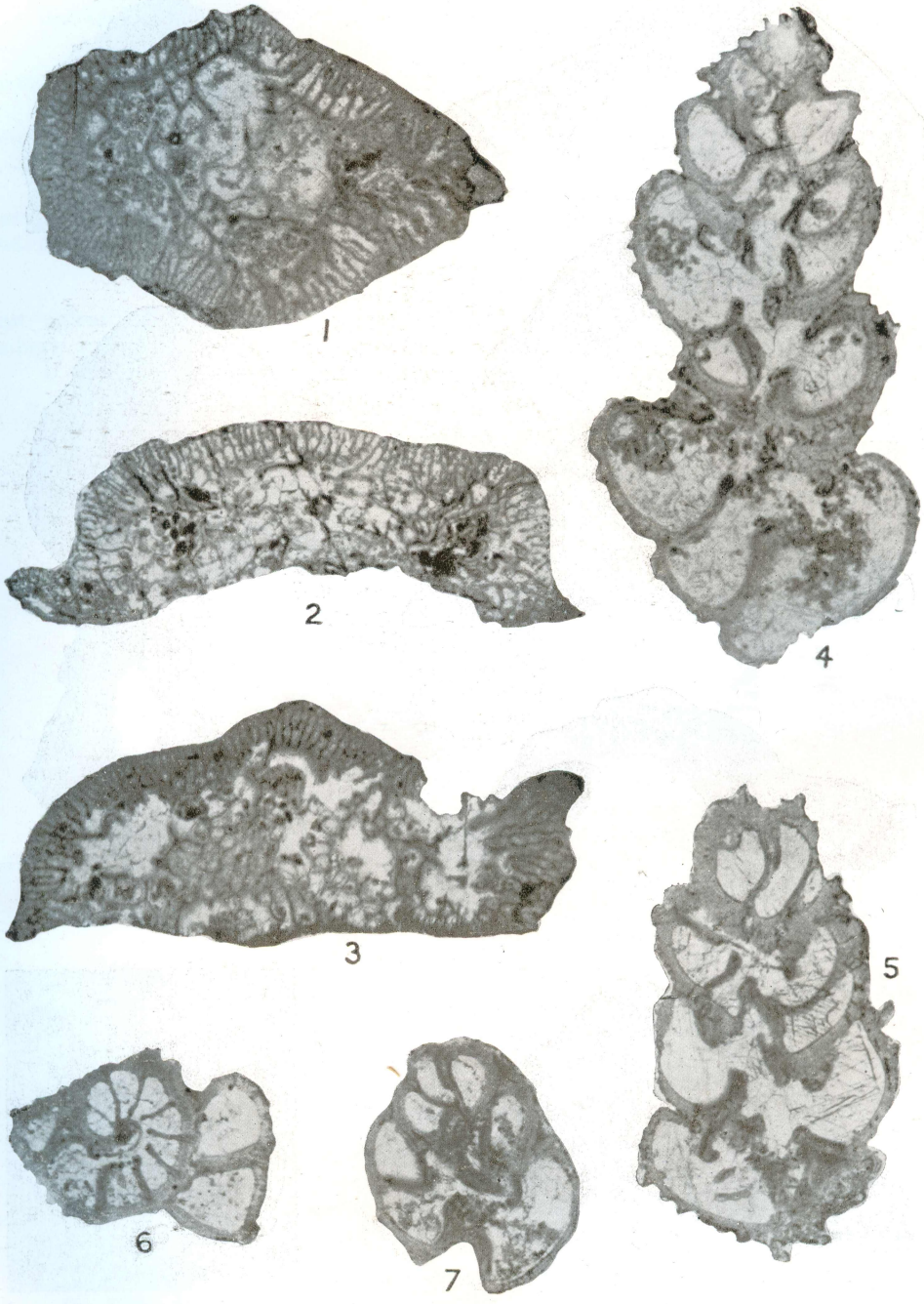
FABIANIA INDICA sp. nov.

FIG. 1—Axial section showing one of the megalospheres and deep umbilicus. Loc. Lubha River.
2—Another axial section showing one megalosphere; the umbilical area is partially filled by chamberlets. Loc. Therriaghat.
3—An oblique section showing two megalospheres (one incomplete) and partially filled umbillical area. Loc. Therriaghat. Holotype.
4—Another oblique section showing moderately deep umbilicus. Loc. Lubha River.
5—Another section showing clearly the loose network of chamberlets in the umbilical area. Loc. Lubha River.

(*Contd. on next page*)



NAGAPPA : FORAMINIFERA FROM THE SYLHET LIMESTONE, ASSAM.



NAGAPPA : FORAMINIFERA FROM THE SYLHET LIMESTONE, ASSAM.

sections show from 9 to 10 chambers in a coil of about 1.3 mm. diameter.

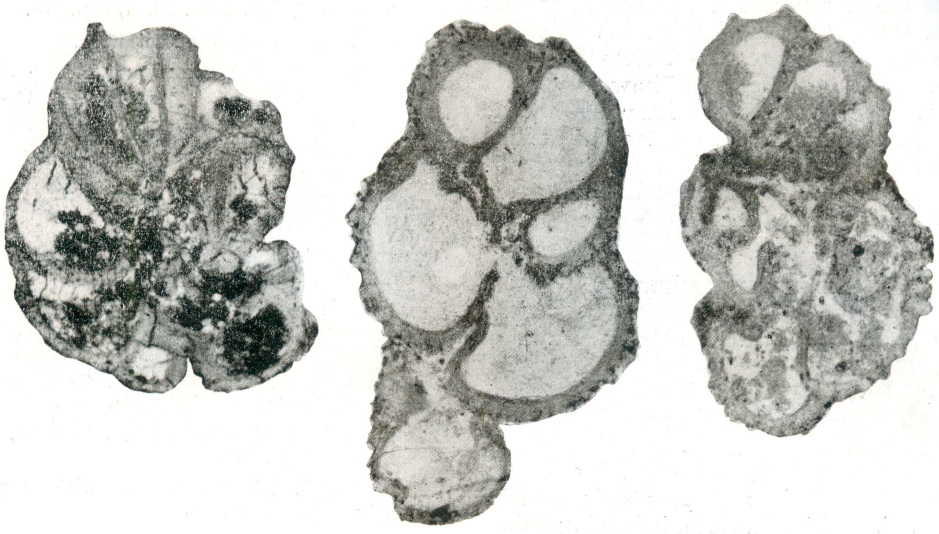
Occurrences.—As for *Fabiania indica.*

Horizon.—Prang Limestone; common in the lower part and rare in the upper part.

THE AGE OF THE PRANG LIMESTONE

The hard, often massive, limestones of this group contain some of the most fossiliferous beds in this area. Some of the limestone bands are made up almost entirely of tests of foraminifera and some have such a high algal content that they can be called algal limestones. Amongst the foraminifera identified from the Prang Limestone are :

Alveolina spp.
Assilina cancellata Nuttall
Assilina subcancellata Nuttall
Assilina papillata Nuttall
Assilina subpapillata Nuttall
Asterocyclina sp.
Baculogypsinoides sp.



a *b* *c*

Eorupertia boninensis (Yabe and Hanzawa).

FIG. 4a—Section more oblique than figure 5 (Plate 31) Loc. Therriaghat.
b–c—Longitudinal sections away from the axis of coiling. Tubercles on the outer wall are clearly seen. Loc. Wah Lariang.
Magnification of all figures ×20.

EXPLANATION OF PLATE 30 (*contd.*)

FIG. 6—A section showing two of the three megalospheres distinctly; umbilical area partially filled. Loc. Therriaghat.
7—Section similar to fig. 6 but without passing through the apex. Loc. Therriaghat.
8—Another section showing deep narrow and irregular umbilical cavity. Loc. Lubha River.
9—A lateral section near the surface showing sutures and the network produced by the partitions. Loc. Lubha River.
Magnification of all the figures ×20 except fig. 1 which is ×30.

EXPLANATION OF PLATE 31

FABIANIA INDICA sp. nov.

FIG. 1—Section across the cone showing partially filled umbilicus. Loc. Therriaghat.
2–3—Skew sections through the lower part of the cone; umbilical area partially filled. Loc. Therriaghat

EORUPERTIA BONINENSIS (Yabe and Hanzawa).

4—Longitudinal section nearly through the centre of the test. Loc. Lubha River.
5—Slightly oblique longitudinal section through the test. Loc. Lubha River.
6—Cross section of test showing disposition of the septa. Loc. Lubha River.
7—Section more oblique than figure 5. Loc. Therriaghat.
Magnification of all figures ×20.

Discocyclina undulata Nuttall
Eorupertia boninensis Yabe and Hanzawa
Fabiania indica sp. nov.
Halkyardia sp.
Linderina sp.
Nummulites acutus Sowerby
Nummulites beaumonti D'Archiac & Haime
Nummulites nanggoelanensis Verbeek
Nummulites obtusus Sowerby var.
Operculinoides sp.
Pellatispira orbitoidea (Provale)

This fauna contains a number of species known from the Kirthar of W. Pakistan and some species are also known from the Pondaung Sandstone and Yaw stages of Burma. A few species are known from the Palaeogene of Indonesia. On the basis of the above fauna the Prang Limestone may be regarded as Middle Eocene probably ranging into the Upper Eocene.

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