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"Triassic of the Tethys Realm"

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Triassic foraminifers from the Malay Peninsula

ABSTRACT: The Middle to Upper Triassic foraminifer assemblages were found for the first time in Malaysia. Fifty two foraminifer taxa (including the new species *Endothyra malayensis* Gaździcki, sp. n.) are recognized in the Kodiang Limestone Formation. The assemblages include stratigraphically important forms: *Glomospira densa* (Pantić), *Glomospirella grandis* (Salaj), *Meandrospira pusilla* (Ho), *M. dinarica* Kochansky-Devidé & Pantić, *Earlandia gracilis* (Pantić), *Earlandinita soussii* Salaj, *Agathammina? iranica* Zaninetti & al. and some representatives of the family Involutinidae Bütschli. The studied foraminifer assemblages are almost identical to those of the contemporaneous deposits of various sections of the Tethys Realm.

INTRODUCTION

This is the first study of Triassic foraminifers from the Malay Peninsula. Their presence was previously stated in the Kodiang Limestone Formation in Kedah, North-West Malaysia by de Coo & Smit (1975).

The Kodiang Limestone Formation[1] crops out in seven isolated mogotes amidst Quaternary sediments (Text-figs 1 and *2A*), and was formally described as a new lithostratigraphic unit in the Malay Peninsula by de Coo & Smit (1975). The Triassic age of the Formation based on conodonts was proposed by Ishii & Nogami (1966), Nogami (1968) and Koike (1973; *see* also Tamura & al. 1975).

[1] The name "Kodiang limestone" was first informally used by Jones & al. (1966); a short description of the "Kodiang limestones" was provided by Burton (1973).

The type locality of the Formation is situated 2.5 kilometers south of the village Kodiang, and 30 kilometers north of the town Alor Star. The stratotype of the Formation was determined in the mogotes Bukit Kecil (*1*) and Bukit Kalong (Text-figs 1, 3*A* and 4). Other exposures of the Kodiang Limestone Formation are in the mogotes Bt. Kepelu, Bt. Mulong, Bt. Kecil (*2*), Bt. Kodiang and Bt. Hantu (*cf.* Text-figs 1, 2*AB* and 3*B*). The foraminifers were studied primarily in some 120 thin sections. Almost all the described forms come from light grey, graded limestone beds (unit *10*) from Bt. Kecil (*1*) and Bt. Kalong (Text-fig. 4), and from loose rock samples which most probably also belong to these limestones.

The material described in this paper is housed in the Institute of Geology and Mineralogy of the University of Leiden (*coll.* O. E. Smit).

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DISTRIBUTION OF FORAMINIFERS IN THE BT. KALONG PROFILE

The foraminifers were found in unit *10* (grey, graded limestone beds of diverse microfacies — *cf.* Pl. 1, Figs 3—4) and occasionally in unit *12* (black lime mudstone with chert nodules — *cf.* Pl. 1, Figs

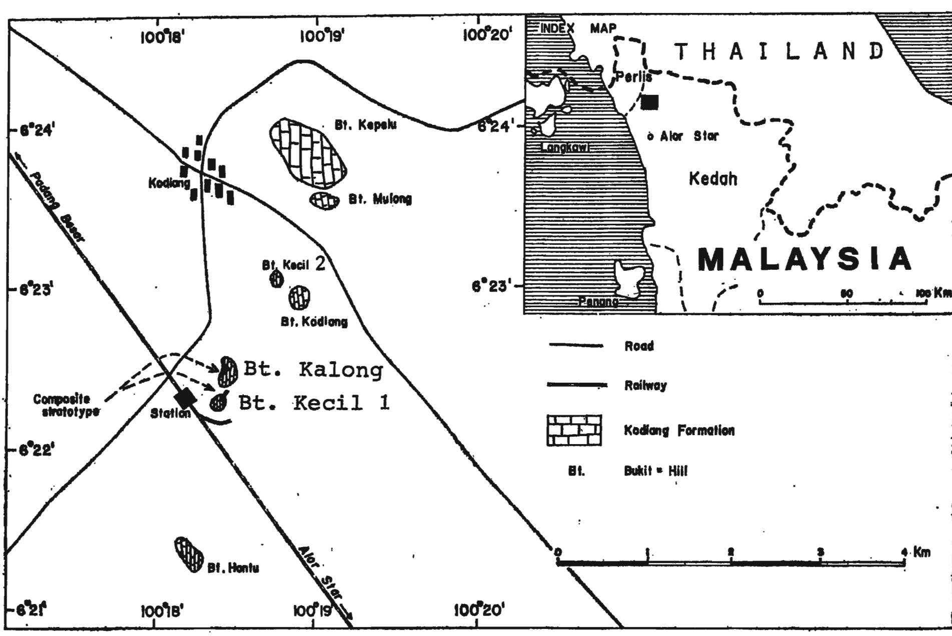
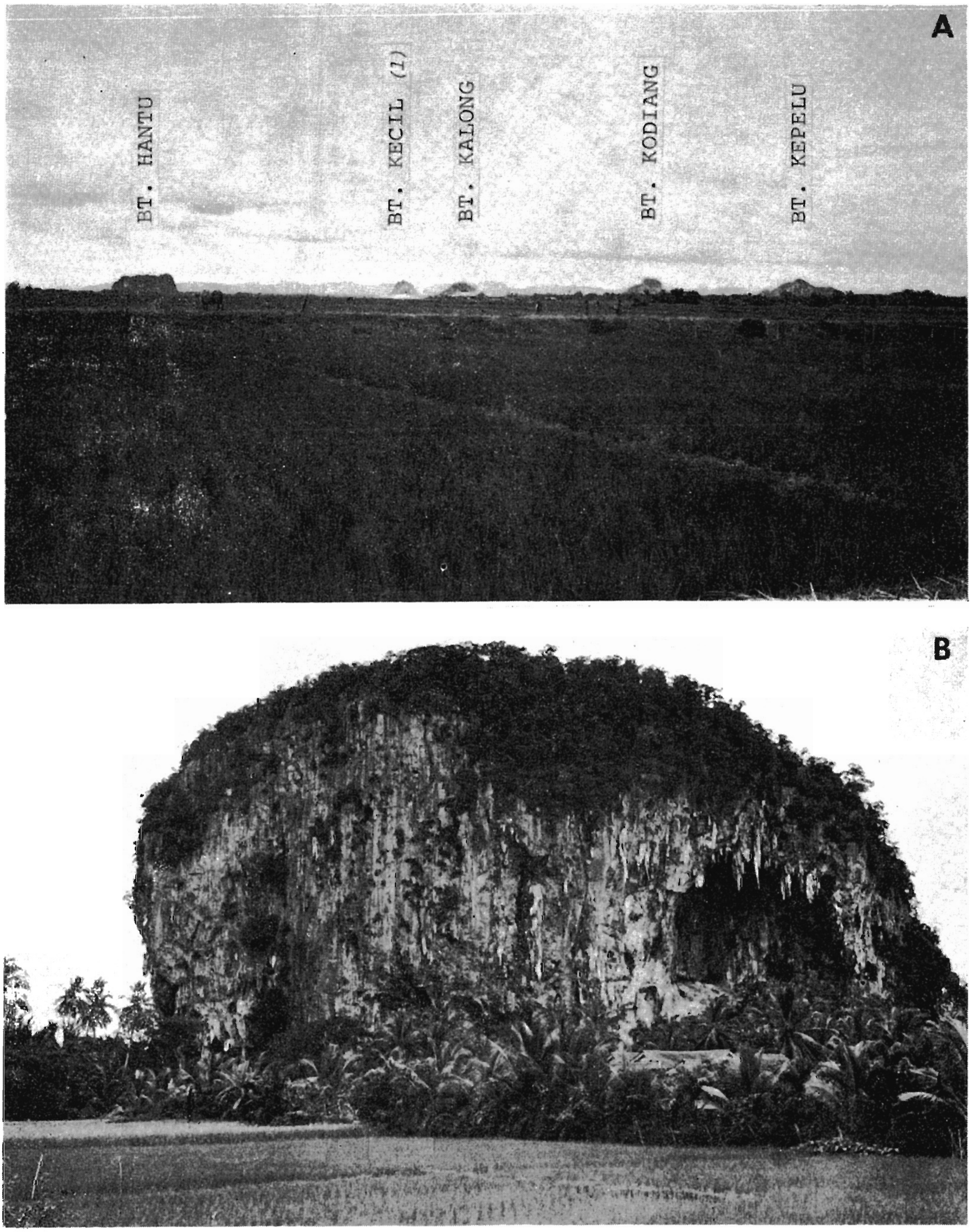
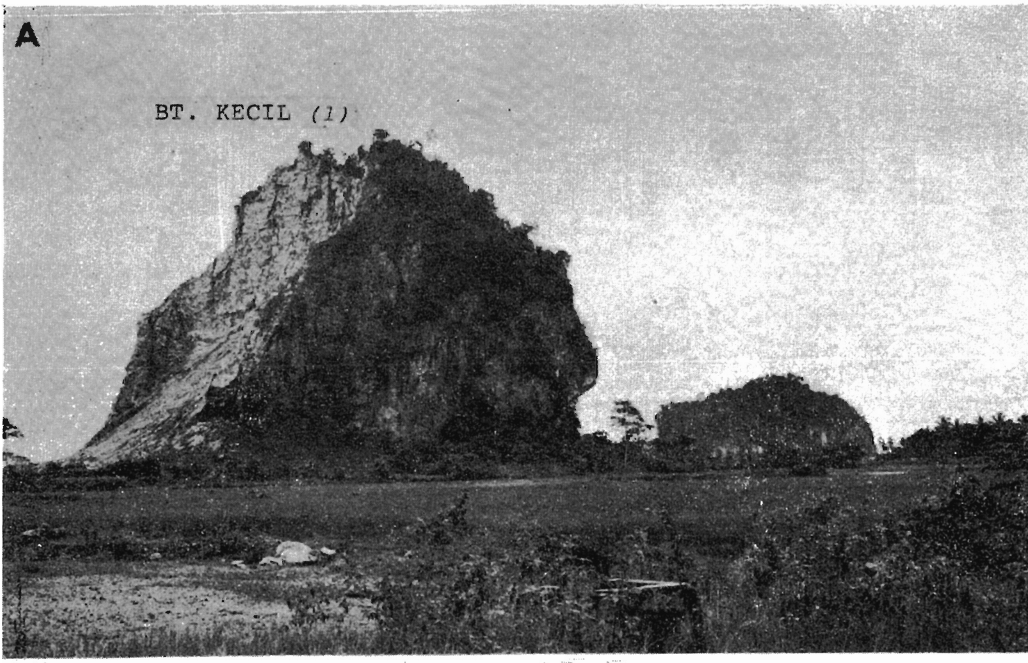


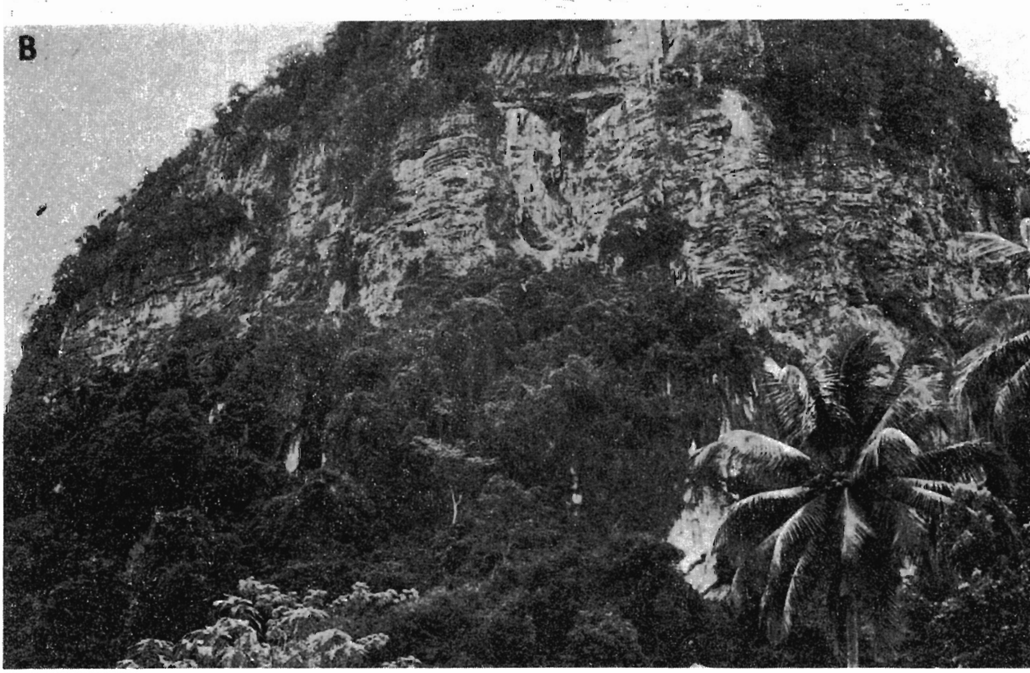
Fig. 1. Outcrop and index map of the Kodiang Limestone Formation (*after* de Coo & Smit, 1975)



A Panoramic view of the Kodiang Limestone Formation type locality: the limestones exposed in a series of the mogotes. View from the east (*cf.* Text-fig. 1); taken in November 1974

B Close-up view of the Bukit Kepelu mogote; a collapse cavern is developed





A Bukit Kecil (*1*) mogote: the lower component stratotype of the Kodiang Limestone Formation. The Bukit Hantu mogote visible in the background
B Bukit Kodiang mogote; the slump interval of the sequence is visible (such as in Bukit Kalong; *cf.* unit *13* in Text-fig. 4)

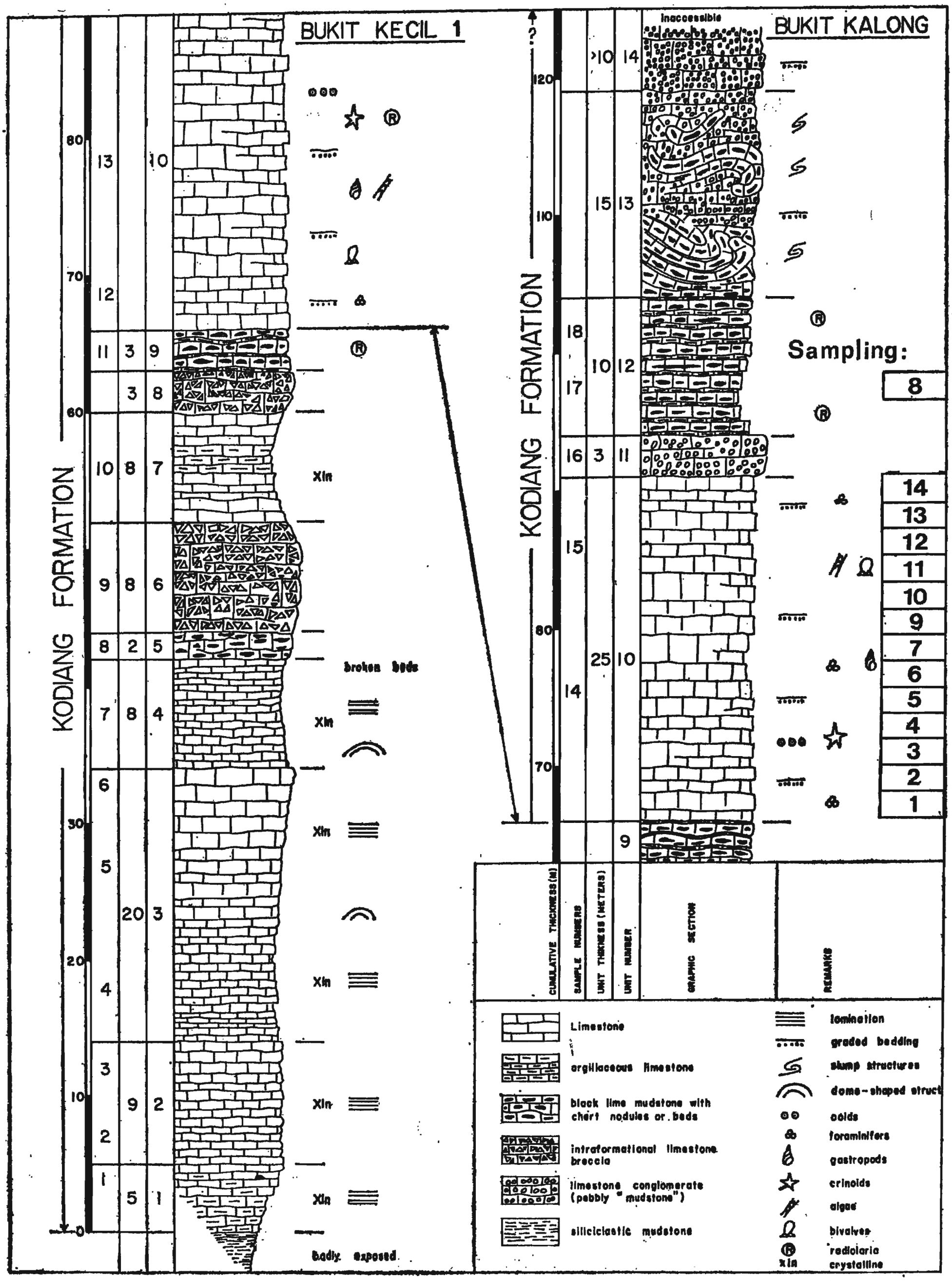


Fig. 4. Detailed profiles of the stratotype of the Kodiang Limestone Formation at Bukit Kecil (*1*) and Bukit Kalong (*after* de Coo & Smit, 1975); sampling sites (*BKA 1 — BKA 14*) for foraminifers *in situ* are indicated

1—2), as well as in loose rock samples from the scree[2]. Sampled was primarily unit *10* (samples *BKA 1—14*, except *BKA 8*), and unit *12* (sample *BKA 8*). The foraminifers fairly common in these rocks are represented by over 50 taxa.

The following samples taken *in situ* from Bt. Kalong profile contained foraminifers (*see* Text-fig. 4):

Unit 10

BKA-1: Crinoid-algal (*Tubiphites*) biosparite with foraminifers, the most common of which is *Meandrospira pusilla* (Pl. 4, Fig. 9); associated are *Glomospirella* sp. (Pl. 4, Fig. 1), as well as *Endothyra* sp., ?*Diplotremina* sp., *Agathammina* sp., *Planiinvoluta carinata*, *Tolypammina gregaria*, *Ammobaculites* sp., and ?*Meandrospiranella* sp.;

BKA-2: Crinoid-pelecypod biosparite with the alga, *Tubiphites obscurus*, and ostracodes; the foraminifers are represented by *Glomospirella grandis* (Pl. 4, Fig. 2), *Textularia sp.* (Pl. 6, Fig. 1), as well as *Glomospira sp.*, *Tolypammina gregaria*, *Earlandia* sp., *Meandrospira pusilla*, and *Diplotremina* sp.;

BKA-3: Algal (*Tubiphites*) — crinoid biosparite with foraminifers ?*Earlandinita* sp. (Pl. 7, Fig. 6), ?*Diplotremina* sp. (Pl. 10, Fig. 12); moreover, *Tolypammina gregaria*, *Planiinvoluta carinata*, *Endothyra* sp. and *Involutina* sp. are present; sparsely associated is a polychaete *Spirorbis* sp.;

BKA-4: Pelecypod-crinoid biosparite with *Tubiphites obscurus*, and foraminifers *Ophthalmidium* sp. (Pl. 5, Fig. 9), *Tolypammina gregaria*, and *Planiinvoluta carinata;*

BKA-5: Pelecypod-crinoid biosparite with ?*Planiinvoluta* sp. (Pl. 6, Fig. 5), *Tolypammina gregaria* and *Ophthalmidium* sp.;

BKA-7: Biopelsparite composed of crinoid ossicles, ostracodes, alga *Tubiphites obscurus* and pellets; abundant foraminifers are mostly represented by *E. amplimuralis* (Pl. 7, Fig. 1), *Earlandia gracilis* (Pl. 7, Fig. 2), *Agathammina*? *iranica* (Pl. 5, Fig. 3), *Ophthalmidium* sp. (Pl. 5, Figs 5—6), whereas *Tolypammina gregaria*, *Ammobaculites* sp., *Diplotremina* sp., and *Nodosaria* sp. are subordinate;

BKA-9: Crinoid biosparite with *Tubiphites obscurus* and pelecypods; the foraminifers are scarce, represented mostly by *Tolypammina gregaria;*

BKA-10: Crinoid-pelecypod biosparite with abundant foraminifers represented by ?*Diplotremina* sp. (Pl. 10, Fig. 11), *Tolypammina gregaria*, *Endothyra* sp., *Endothyranella* sp., and *Involutina sinuosa* cf. *pragsoides;*

BKA-12: Biosparite composed of crinoid and pelecypod debris with algal encrustings; besides the alga *Tubiphites obscurus*, such foraminifers are present as *Endothyra malayensis* sp. n. (Pl. 8, Figs 1—2), *E. salaji*, *Glomospira* sp., *Tolypammina gregaria*, *Textularia* sp., *Diplotremina* sp., *Variostoma* sp., and *Involutina* sp.;

BKA-13: Algal (*Girvanella* and *Solenopora*) biosparite with ?*Agathammina* sp. (Pl. 5, Fig. 2), and *Ophthalmidium* sp.;

[2] BKA-1 to BKA-14 are samples taken *in situ* from the Bt. Kalong outcrop (*see* Text-fig. 4). All the other thin sections are from loose rock samples. The "BKA-series" are from Bt. Kalong and the "BKE-series" are from Bt. Kecil (*1*) profiles. The loose rock samples originate most probably from the limestone interval of unit *10*, as indicated by their fossil content and lithologic resemblance.

BKA-14: Crinoid-pelecypod biosparite with algal encrustings, partially dolomitized; scarce foraminifers represented by *Tolypammina gregaria*, and ?*Involutina* sp.

Unit 12

BKA-8: Foraminifer-ostracode-radiolarian biosparite (*cf.* Pl. 1, Figs 1—2). Yielding commonly scattered foraminifers, primarily *Nodosaria* sp. (Pl. 10, Fig. 1), *Austrocolomia* sp. (Pl. 10, Fig. 7), *Dentalina* sp. (Pl. 10, Fig. 4), and ?*Pseudonodosaria* sp. (Pl. 10, Fig. 9).

The complete list of the recognized foraminifer taxa from the Kodiang Limestone Formation comprises:

Glomospira densa (Pantić, 1965) — Pl. 3, Figs 4—9
Glomospira gemerica (Salaj, 1969) — Pl. 4, Fig. 4
Glomospira sp. — Pl. 3, Figs 1—3
Glomospirella spirillinoides (Grozdilova & Glebovskaya, 1948) — Pl. 4, Fig. 5
Glomospirella grandis (Salaj, 1967) — Pl. 4, Fig. 2
Glomospirella sp. — Pl. 4, Figs 1 and 3
„*Turritellella*" cf. *mesotriasica* Koehn-Zaninetti, 1968
Tolypammina gregaria Wendt, 1969 — Pl. 6, Figs 6—10
Ammobaculites sp.
Textularia sp. — Pl. 6, Fig. 1
Trochammina almtalensis Koehn-Zaninetti, 1968
?*Trochammina* sp. — Pl. 6, Figs 2—3
Earlandia amplimuralis (Pantić, 1972) — Pl. 7, Fig. 1
Earlandia gracilis (Pantić, 1972) — Pl. 7, Fig. 2
Earlandinita soussii Salaj, 1974 — Pl. 7, Fig 8
Earlandinita cf. *soussii* Salaj, 1974 — Pl. 7, Fig. 7
?*Earlandinita* sp. — Pl. 7, Figs 6 and 9
Tetrataxis sp.
Endothyra kuepperi Oberhauser, 1960 — Pl. 8, Figs 7—8
Endothyra salaji Gaździcki, 1975
Endothyra malayensis Gaździcki, sp. n. — Pl. 8, Figs 1—3
Endothyra sp.
Endothyranella wirzi (Koehn-Zaninetti, 1968) — Pl. 7, Fig. 10
Endothyranella lombardi Zaninetti & Brönnimann, 1972 — Pl. 8, Fig. 6
Endothyranella sp. — Pl. 8, Fig. 9
?*Endothyranella* sp. — Pl. 8, Figs 4—5
Agathammina austroalpina Kristan-Tollmann & Tollmann, 1964 — Pl. 5, Fig. 1
Agathammina? *iranica* Zaninetti, Brönnimann, Bozorgnia & Huber, 1972 — Pl. 5, Fig. 3
Agathammina sp.
?*Agathammina* sp. — Pl. 5, Fig. 2
Meandrospira pusilla (Ho, 1959) — Pl. 4, Figs 8—10
Meandrospira dinarica Kochansky-Devidé & Pantić, 1966 — Pl. 4, Fig. 7
„*Meandrospira*" *deformata* Salaj, 1967 — Pl. 4, Fig. 6
?*Meandrospiranella* sp.
Planiinvoluta carinata Leischner, 1961, Pl. 6, Fig. 4
?*Planiinvoluta* sp. — Pl. 6, Fig. 5
Ophthalmidium sp. — Pl. 5, Figs 4—9
Nodosaria sp. — Pl. 10, Fig. 1
?*Nodosaria* sp. — Pl. 10, Figs 2 and 6
Austrocolomia sp. — Pl. 10, Figs 3 and 7
Dentalina sp. — Pl. 10, Fig. 4
?*Pseudonodosaria* sp. — Pl. 10, Fig. 5
Diplotremina astrofimbriata Kristan-Tollmann, 1960 — Pl. 10, Fig. 9
Diplotremina sp. — Pl. 10, Fig. 8
?*Diplotremina* sp. — Pl. 10, Figs 11—12
Variostoma sp. — Pl. 10, Fig. 10
Involutina communis (Kristan, 1957) — Pl. 9, Fig. 1
Involutina gaschei (Koehn-Zaninetti & Brönnimann, 1968) — Pl. 9, Figs 6—8

Involutina sinuosa sinuosa (Weynschenk, 1956)
Involutina sinuosa cf. *pragsoides* (Oberhauser, 1964) — Pl. 9, Figs 2—3 and 5
Involutina sp. — Pl. 9, Fig. 4
?*Triasina* sp. — Pl. 9, Fig. 9

The above listed foraminifers are represented by 52 taxa, a majority of which are well known (*cf.* Zaninetti 1976), and therefore are not systematically characterized herein. Only one new species, *Endothyra malayensis* Gaździcki, sp. n., is described. Almost all the foraminifers are however illustrated (Pls 3—10) to show their variability and facilitate any further discussion.

SYSTEMATIC DESCRIPTION

Family **Endothyridae** Brady, 1884
Subfamily **Endothyrinae** Brady, 1884
Genus *ENDOTHYRA* Phillips, 1846
Endothyra malayensis Gaździcki, sp. n. (Pl. 8, Figs 1—3)

Holotype: the specimen presented in Pl. 8, Fig. 1 (thin section *BKA-12*).
Type horizon: upper part of the unit *10* in Bt. Kalong, Ladinian?
Type locality: Bt. Kalong in Kedah (North-West Malaysia).
Derivation of the name: malayensis — from Malaysia.
Diagnosis: Test medium-sized, of an oval outline in the equatorial section. Proloculus large and spherical. The final whorl incomplete, planispiral; composed of three chambers that display a tendency to uncoiling.
Material: Five specimens.
Association: Diplotremina sp., *Endothyra salaji*, *Endothyra* sp., *Glomospira* sp., *Tolypammina gregaria*, *Variostoma* sp., and *Textularia* sp.

Description. — The test medium in size (as for this genus), consisting of spherical and large initial chamber, and an incomplete planispiral whorl. The final whorl evolute in equatorial section (Pl. 8, Figs 1—3); composed of three chambers increasing gradually in size. Septa thick, short and slightly inclined in the direction of coiling. The single-layered wall thick and dark, finely microgranular.

Dimensions of the test *(in microns)*: maximum diameter — 250—330, diameter of the proloculus — c 60, thickness of the wall — 25—30.

Remarks. — The new species *Endothyra malayensis* Gaździcki, sp. n. differs from the hitherto known species of the endothyras by its slightly elongated test (in equatorial section), reduced number, equalling three, of chambers in the last whorl, and by a distinct tendency to uncoil this whorl. This tendency causes that the species, although assigned to the genus *Endothyra* Phillips, is very close to the genus *Endothyranella* Galloway & Harlton. Some analogies to this new species are dislayed by the form determined as *Endothyra* sp. by Jendrejáková (*in* Kochanová, Mello & Siblik 1975, Pl. 11, Fig. 6) from the Wetterstein Limestones (Ladinian) at the locality Silička (Slovak Karst, West Carpathians, Czechoslovakia).

Occurrence. — Known from the type locality only (sample *BKA-12* from the upper part of unit *10* in Bt. Kalong; *see* Text-fig. 4).

REMARKS ON FORAMINIFERS

Among 52 taxa of the recognized foraminifers, the most commonly represented (both in number of taxa and of individuals) are such families as: Fischerinidae (11 taxa), Ammodiscidae and Endothyridae (8 taxa of each), as well as Involutinidae (6 taxa), Moravamminidae and Nodosariidae (5 taxa of each), and Variostomatidae (4 taxa). The families Lituolidae, Textulariidae, Trochamminidae and Tetrataxidae are represented by single genera.

A remarkable frequency of the foraminifers in the investigated thin sections and therefore a great number of diversified sections of the tests, enables identification of particular species. The state of preservation of the tests is generally satisfactory, although a more or less advanced sparitization makes difficulties in recognition of the detailed structure of some specimens. A part of the tests was damaged by synsedimentary agents, and underwent onkolitization or oolitization.

The new established species, *Endothyra malayensis* Gaździcki, sp. n., from sample No. *12* was recognized within the assemblage with *E. salaji* Gaździcki, the latter species being known in the same stratigraphic position in the epicontinental (Muschelkalk) basin of southern Poland (*see* Gaździcki & al. 1975). Such forms, featured with an advanced reduction of chambers in the ultimate planispiral whorl and with a tendency to uncoiling, have not hitherto been reported within the Endothyridae.

Important is also an assemblage of the involutinids, which comprises *Involutina communis* (Kristan), *I. gaschei* (Koehn-Zaninetti & Brönnimann), *I. sinuosa sinuosa* (Weynschenk), and *I. sinuosa* cf. *pragsoides* (Oberhauser), and which is very close to Upper Triassic involutinid assemblages from the Nayband Formation, Iran (*see* Zaninetti & Brönnimann 1974), and from the Namyan Group of Burma (Brönnimann & al. 1975.* An associated form, determined as ?*Triasina* sp. (Pl. 9, Fig. 9), and coming from a loose sample at Bt. Kalong is the only, although supposed *Triasina* in the investigated deposits; it is poorly preserved, but it may represent a hitherto unknown species of this genus.

The representatives of families occurring the most commonly in the investigated deposits, i.e. Fischerinidae, Ammodiscidae and Involutinidae, are widely distributed within the Triassic sequences of the Tethys Realm (*cf.* Zaninetti 1976). Their bearing upon the paleogeographic reconstructions becomes therefore considerable, the same as their stratigraphic importance. The latter is due to a well pronounced and rather fast evolution of these families in the Middle and Upper

* See also some specimens from Hoang Mai Limestone, North Vietnam (Liem 1966, Pl. 1).

Triassic (*cf.* Koehn-Zaninetti 1969, Salaj 1977), and the resulting appearance of the well defined, short-lasting guide fossils (*see* Salaj 1969a, b, 1974, 1977; Gaździcki 1974a, b; Gaździcki & al. 1975).

STRATIGRAPHY

The analysis of the succession of foraminifer assemblages in the Kodiang Limestone Formation indicates that the unit *10* of Bt. Kalong (*see* Text-fig. 4) represents the time interval ranging from the Lower Anisian through at least the Ladinian.

The base of unit *10* (sample No. *1* — *see* Text-fig. 4) is characterized by the common occurrence of *Meandrospira pusilla* (Ho), the presence of which (Pl. 4, Fig. 9), but the lack of *Glomospira densa* (Pantić), *Glomospirella grandis* (Salaj) and *Meandrospira dinarica* Kochansky-Devidé & Pantić is typical of Upper Scythian — Lower Anisian age (*cf.* Premoli Silva 1964; Kochansky-Devidé & Pantić 1966; Ramovš 1968; Salaj 1969a, b, 1974, 1977; Zaninetti & Brönnimann 1975). The position of the sampling place in the sequence (*cf.* Text-fig. 4), just beneath the first occurrence of *Glomospirella grandis* (Salaj) suggests however Lower Anisian age for this interval. This very age is confirmed (*cf.* Gaździcki & al. 1975) by the presence of *"Meandrospira" deformata* Salaj recognized in a loose sample from Bt. Kalong (*see* Pl. 4, Fig. 6).

The Pelsonian and Illyrian age is indicated (*cf.* Salaj 1969a, 1974; Gaździcki & Zawidzka 1973; Głazek & al. 1973; Gaździcki & al. 1975; Bełka & Gaździcki 1976) by the occurrence of *Glomospirella grandis* (Salaj) in sample No. *2* (*see* Pl. 4, Fig. 2), as well as by the presence, in loose samples, of such forms as *Glomospira densa* (Pantić) — Pl. 3, Figs 4—9; *Meandrospira dinarica* Kochansky-Devidé & Pantić — Pl. 4, Fig. 7; *Trochammina almtalensis* Koehn-Zaninetti; *"Turritellella"* cf. *mesotriasica* Koehn-Zaninetti, *Endothyranella wirzi* (Koehn-Zaninetti) — Pl. 7, Fig. 10; and *E. lombardi* Zaninetti & Brönnimann — Pl. 8, Fig. 6.

The Ladinian age is documented (*cf.* Salaj 1969b, 1974; Pantić 1972; Gaździcki & al. 1975; Zaninetti 1976) by the occurrence of *Earlandia amplimuralis* (Pantić) — Pl. 7, Fig. 1; *E. gracilis* (Pantić) — Pl. 7, Fig. 2; *Agathammina? iranica* Zaninetti & al. — Pl. 5, Fig. 3 (all from sample No. 7) and *Endothyra salaji* Gaździcki (from sample No. *12*), as well as of *Glomospira gemerica* (Salaj) — Pl. 4, Fig. 4; and *Earlandinita soussii* Salaj — Pl. 7, Fig. 8; the latter both species being stated in loose samples.

The investigated deposits of the Kodiang Limestone Formation yield some conodonts, the presence of which is substantial for the correlation of the foraminifer and conodont subdivisions of the Triassic column (*cf.* Budurov & Trifonova 1974, Gaździcki & al. 1975). The conodonts from the limestones of Bt. Kalong were investigated by Ishii & Nogami (1966), and Nogami (1968), who reported from the lower part of the section [3] *Gondolella navicula* Huckriede, *Gladigondolella tethydis* (Huckriede), and *Neospathodus newpassensis* Mosher. Later investigations revealed that one of the illustrated specimens of *Gondolella navicula* Huckriede seems to be related to *Neogondolella aegaea* Bender; an Early or Middle Anisian age was therefore assumed for the above fauna (*see* Tamura & al. 1975, p. 139), and this is confirmed by the here presented foraminifer dating.

Late Ladinian or Early Carnian conodont faunas are known (*cf.* Ishii & Nogami 1966, Nogami 1968, Koike 1973, Tamura & al. 1975) from Bt. Kecil (*1*), and they contain *Gladigondolella malayensis* Nogami, *G. tethydis* (Huckriede), *Paragondolella polygnathiformis* (Budurov & Stefanov), *Carinella mungoensis* (Diebel), and *Gondolella navicula* Huckriede. Contemporaneous conodont assemblages have been reported from the upper part of the section of Bt. Kalong (*cf.* Nogami 1968, *see* also Tamura & al. 1975).

The discussed conodont faunas indicate an Early or Middle Anisian age in the lower part of Bt. Kalong, and a Late Ladinian or Early Carnian in Bt. Kecil and in the upper part of Bt. Kalong (*see* Tamura & al. 1975). As the same age results from the foraminifer zonation, it may be suggested that the foraminifers are not less important than the conodonts in recognition of the Triassic stratigraphy.

In loose samples, mostly from Bt. Kecil (*1*), which lithologically correspond to unit *10*, important is the presence of such forms as *Involutina communis* (Kristan) — Pl. 9, Fig. 1; *I. gaschei* (Koehn-Zaninetti & Brönnimann) — Pl. 9, Figs 6—8; *I. sinuosa sinuosa* (Weynschenk); *I. sinuosa* cf. *pragsoides* (Oberhauser) — Pl. 9, Figs 2—3 and 5; and *?Triasina* sp. — Pl. 9, Fig. 9. All these forms suggest an Upper Triassic, presumably Carnian-Norian age (*cf.* Zaninetti & Brönnimann 1974, Brönnimann & al. 1975, Zaninetti 1976), and this is the first approach to the Carnian-Norian dating of the upper part of the Kodiang Limestone Formation. The foraminifers from unit *12* of Bt. Kalong (*see* Text-fig. 4), represented mostly by Nodosariidae, do not contain any forms diagnostic of the age of their parent deposits.

FINAL REMARKS

The foraminifer assemblages recognized in the Kodiang Limestone Formation contain some stratigraphically important species which

[3] This interval coincides with unit No. *10* of the Kodiang Limestone Formation, that consists of graded limestone beds (Text-fig. 4; *see* also de Coo & Smit 1975, Fig. 2).

evidence the time interval ranging from the Lower Anisian till the Ladinian, and suggest even Carnian-Norian age for the topmost part of the investigated sequence.

The foraminifers are often associated by diverse algae, the most common of which are such forms as: *Macroporella alpina* Pia, 1912 — Pl. 2, Fig. 5; *Oligoporella* sp. — Pl. 2, Fig. 6; *Acicularia* sp.; *Girvanella* sp.; *Solenopora* sp.; *Globochaete alpina* Lombard, 1945 — Pl. 2, Figs 7—8; *Clypeina besici* Pantić, 1965; *Tubiphites obscurus* Maslov, 1956 — Pl. 2, Figs 2—3; and by scarce miroproblematics *Ladinella porata* Ott, 1968; *Baccanella floriformis* Pantić, 1971 — Pl. 2, Fig. 4; and *Probolocuspis espahkensis* Brönnimann & al., 1974 — Pl. 2, Fig. 1. Many of these taxa, if not displaying their stratigraphic ranges almost identical with that of the foraminifers, are at least typical of the contemporaneous deposits from various areas of the Tethys Realm (*cf.* Bystrický 1964; Pantić 1965, 1971; Flügel 1972; Jablonský 1973; Brönnimann & al. 1974; Ott 1974; Borza 1975; Kochanová & al. 1975; Mello 1975).

The Anisian-Ladinian foraminifer assemblages of the Kodiang Limestone Formation bear close analogies to the other contemporaneous assemblages of the Tethys Realm. This is indicated both by the taxonomic composition of the assemblages, by the sequence of particular assemblages, and by the microfacies of the deposits, both developed in the neighboring regions in Burma (*cf.* Gramann & al. 1972), Pakistan (*cf.* Zaninetti & Brönnimann 1975), and Iran (*cf.* Brönnimann & al. (1974), as well as in the Caucasus (Efimova 1974) and in various regions of Europe (*cf.* Salaj & al. 1967; Premoli Silva 1971; Zaninetti & al. 1972; Pantić 1972, 1974; Jendrejáková 1973; Gaździcki & Zawidzka 1973; Brönnimann & Čatalov 1975; *see* also Zaninetti 1976). Moreover, the investigated assemblages are also related to those from the epicontinental Muschelkalk sequence of southern Poland (*cf.* Głazek & al. 1973, Gaździcki & al. 1975).

The Carnian-Norian involitinid assemblage with *Involutina communis*, *I. gaschei*, *I. sinuosa sinuosa*, *I. sinuosa* cf. *pragsoides*, and *?Triasina* sp., which has been recognized in loose samples from Bt. Kecil (*1*) and Bt. Kalong is evidently related to the assemblages known from the base of the Namyan Group of Burma (*cf.* Brönnimann & al. 1975), the Nayband Formation of Iran (*cf.* Zaninetti & Brönnimann 1974), and from some localities in Europe (*cf.* Zaninetti 1976).

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A. GAŹDZICKI i O. E. SMIT

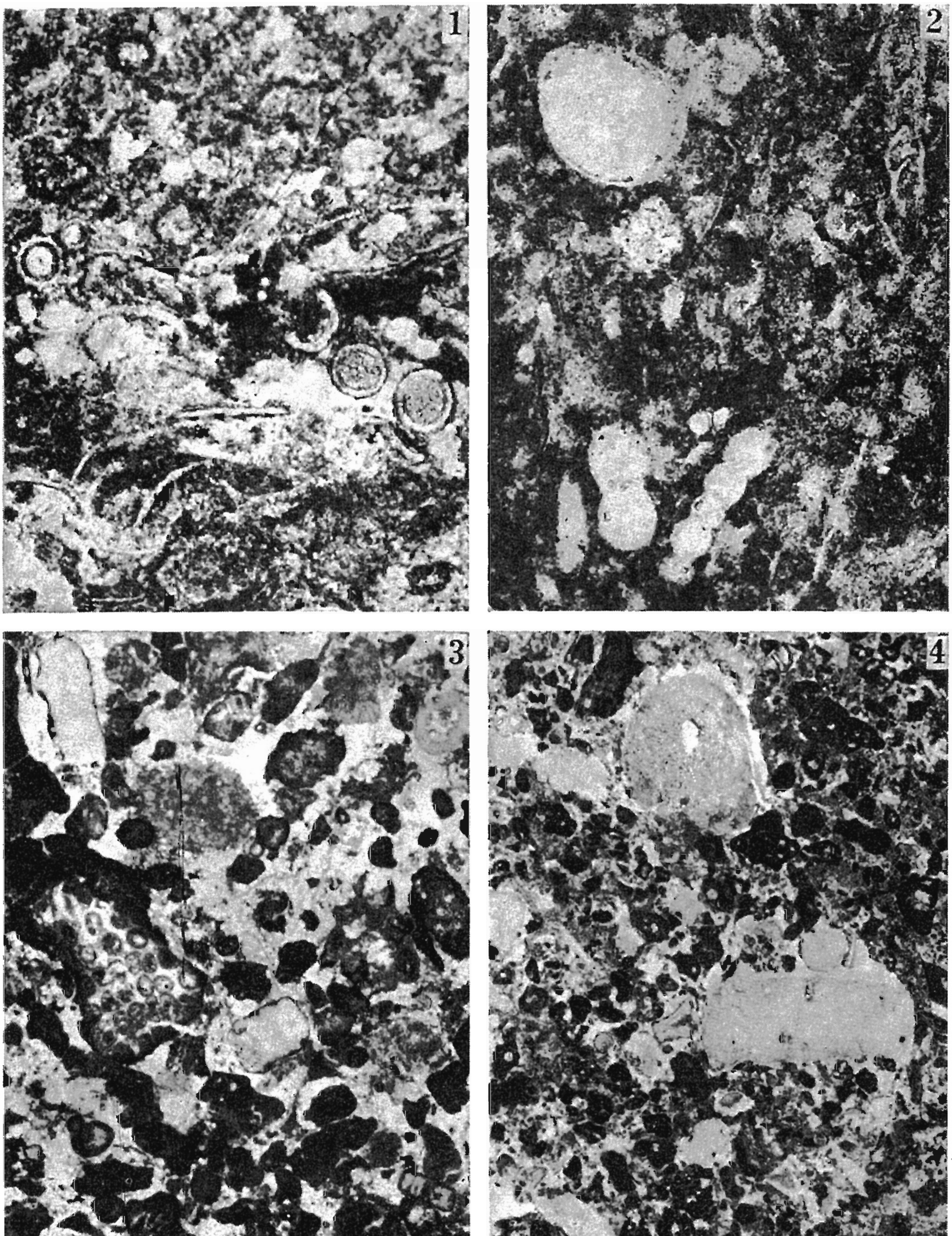
TRIASOWE OTWORNICE Z PÓŁWYSPU MALAJSKIEGO

(Streszczenie)

W utworach triasowych formacji wapieni z Kodiang, północno-zachodnia Malazja (fig. 1—4) stwierdzono obecność bogatych zespołów otwornicowych, wśród których rozpoznano 52 taksony (pl. 1—10) w tym jeden nowy, *Endothyra malayensis* Gaździcki, sp. n. Analizowane zespoły obejmują szereg form o znaczeniu stratygraficznym, m.in.: *Meandrospira pusilla* (Ho), *Glomospira densa* (Pantić), *Glomospirella grandis* (Salaj), *Meandrospira dinarica* Kochansky-Devidé & Pantić, *Earlandia gracilis* (Pantić), *Earlandinita soussii* Salaj, *Endothyra salaji* Gaździcki, *Agathammina? iranica* Zaninetti & al., oraz kilku przedstawicieli rodziny Involutinidae Bütschli.

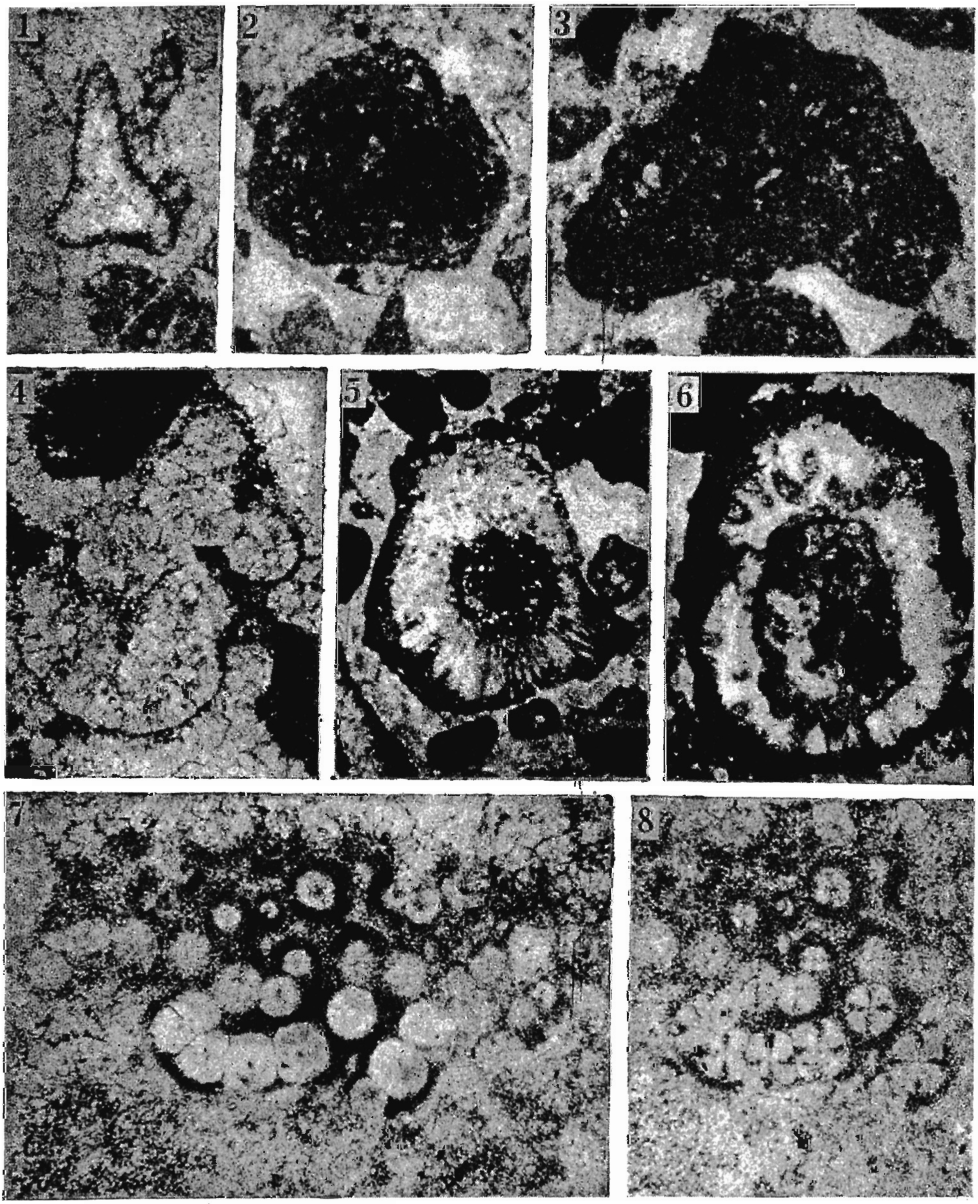
Rozpoznane poszczególne zespoły otwornic określają wiek zawierających je osadów począwszy od najniższego anizyku po ladyn, a niektóre z nich obejmują również karnik i noryk.

Wykazano, że triasowe zespoły otwornic z Półwyspu Malajskiego nie różnią się od równowiekowych zespołów z innych rejonów Tetydy tak pod względem składu taksonomicznego jak również rozprzestrzenienia stratygraficznego.



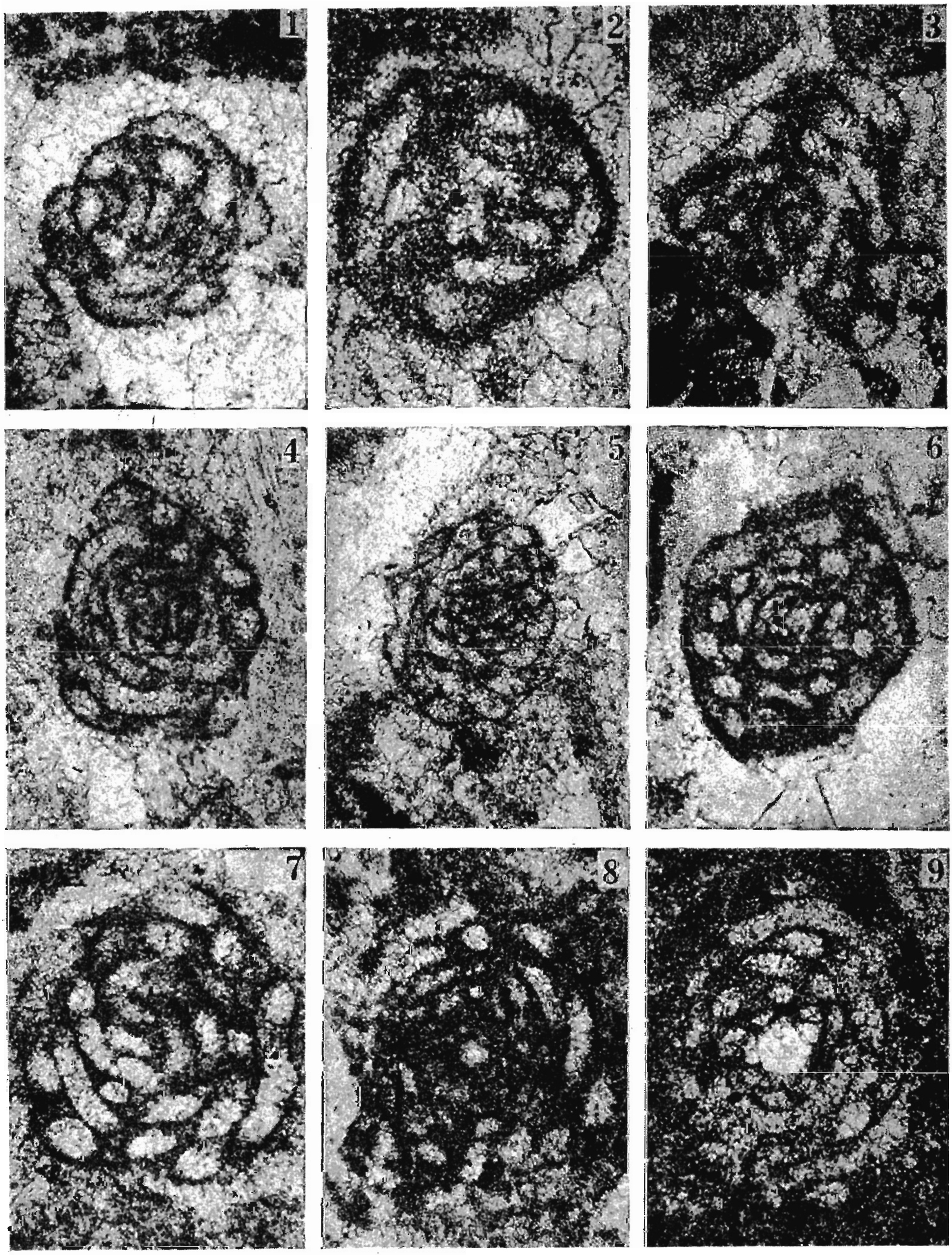
1—2 Microfacies with Nodosariidae in ostracode-radiolarian biosparite, × 60; unit 12; **3** Biointrasparite composed of algal (Dasycladaceae and Solenoporaceae) and crinoid debris with intraclasts, × 8; unit 10; **4** Crinoid-algal biopelsparite, × 8; unit 10

All from Bt. Kalong



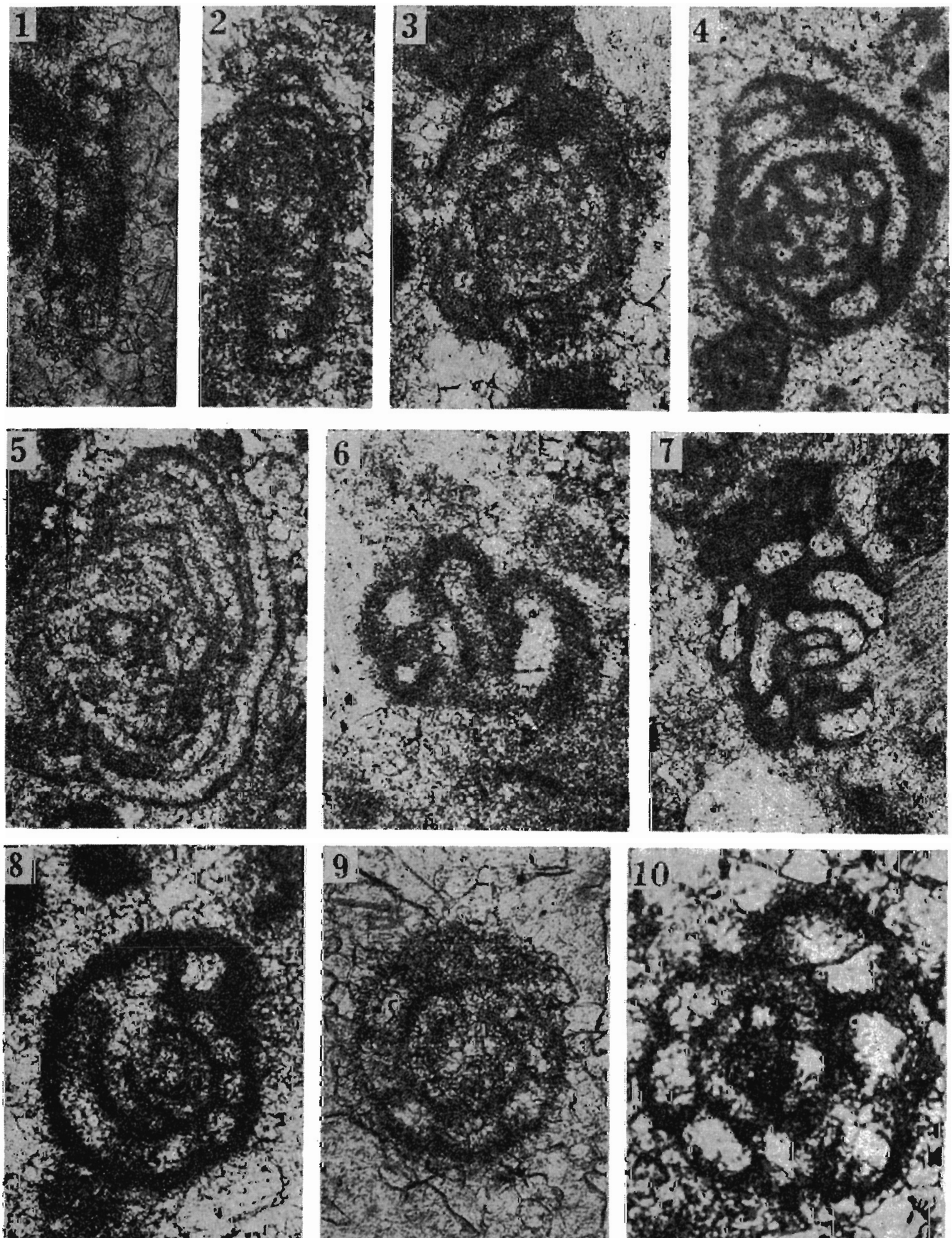
1 *Probolocuspis espahkensis* Brönnimann, Zaninetti, Moshtaghian & Huber; × 45; **2—3** *Tubiphytes obscurus* Maslov; × 35; **4** *Baccanella floriformis* Pantić; × 55; **5** *Macroporella alpina* Pia; × 15; **6** *Oligoporella* sp.; × 30; **7—8** *Globochaete alpina* Lombard (7 parallel, 8 crossed nicols); × 110

1, 4 from Bt. Kecil (*1*); others from Bt. Kalong



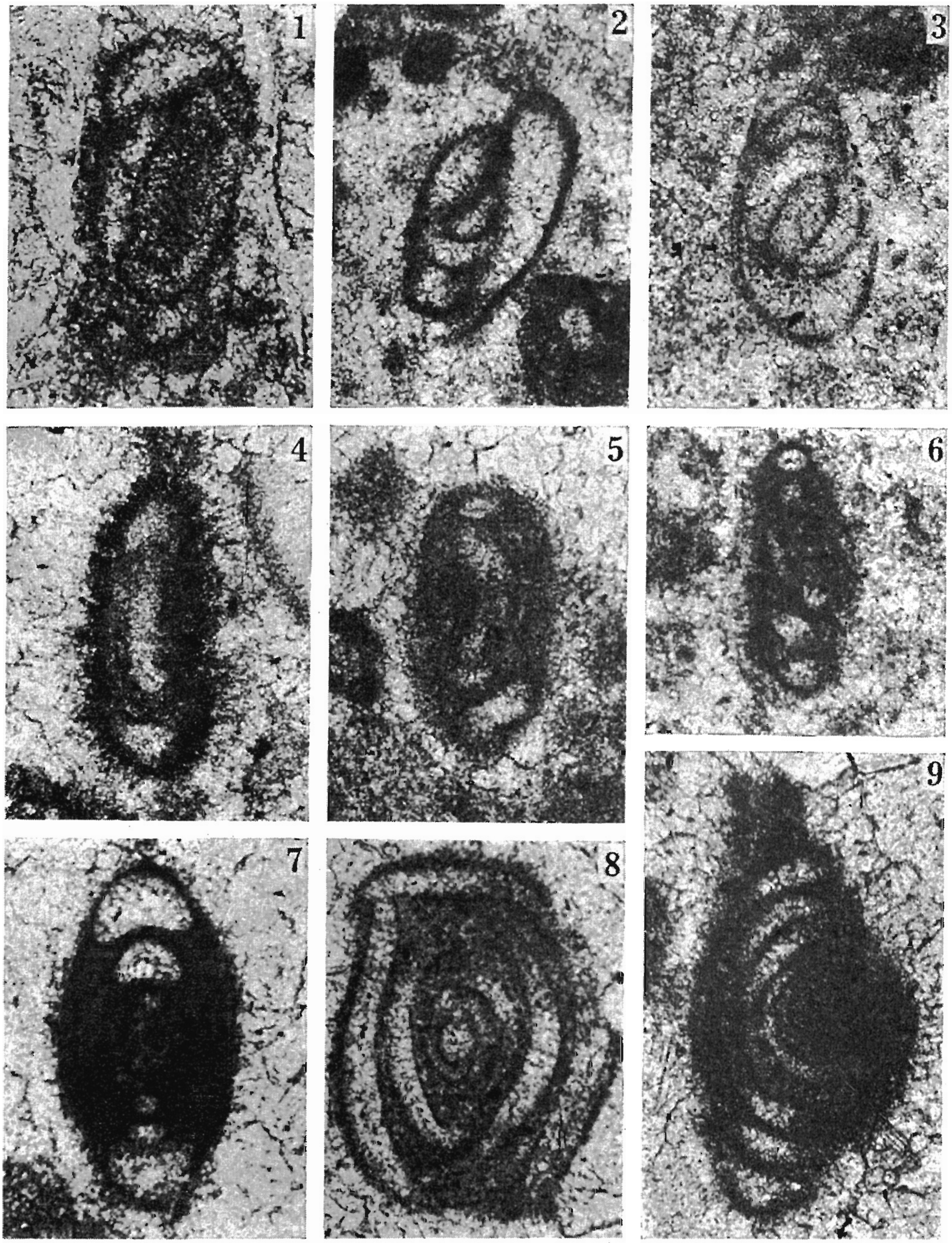
1—3 *Glomospira* sp.; *1* and *3* × 70, *2* × 150; **4—9** *Glomospira densa* (Pantić); *5* and *8* × 80, *4* and *6—7* × 100, *9* × 140

1, 4 from Bt. Kecil (*1*); others from Bt. Kalong



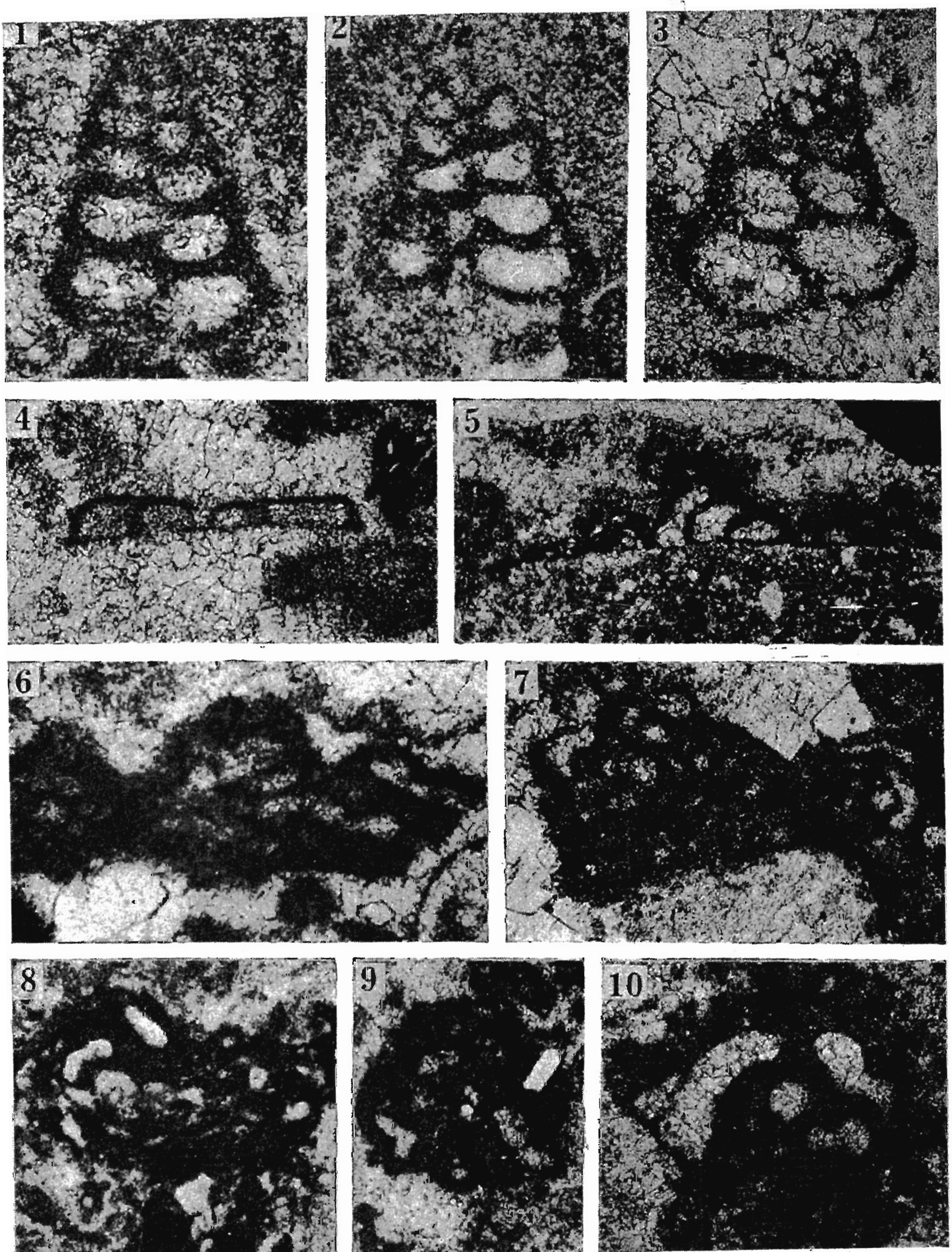
1, 3 *Glomospirella* sp.; × 100; *1* from sample No. 1; **2** *Glomospirella grandis* (Salaj); × 150; sample No. 2; **4** *Glomospira gemerica* (Salaj); × 100; **5** *Glomospirella spirillinoides* (Grozdilova & Glebovskaya); × 60; **6** „*Meandrospira*" *deformata* Salaj; × 150; **7** *Meandrospira dinarica* Kochansky-Devidé & Pantić; × 85; **8—10** *Meandrospira pusilla* (Ho); *8—9* × 150, *10* × 400; *9* from sample No. 1

From Bt. Kalong, except 4 from Bt. Kecil (*1*)



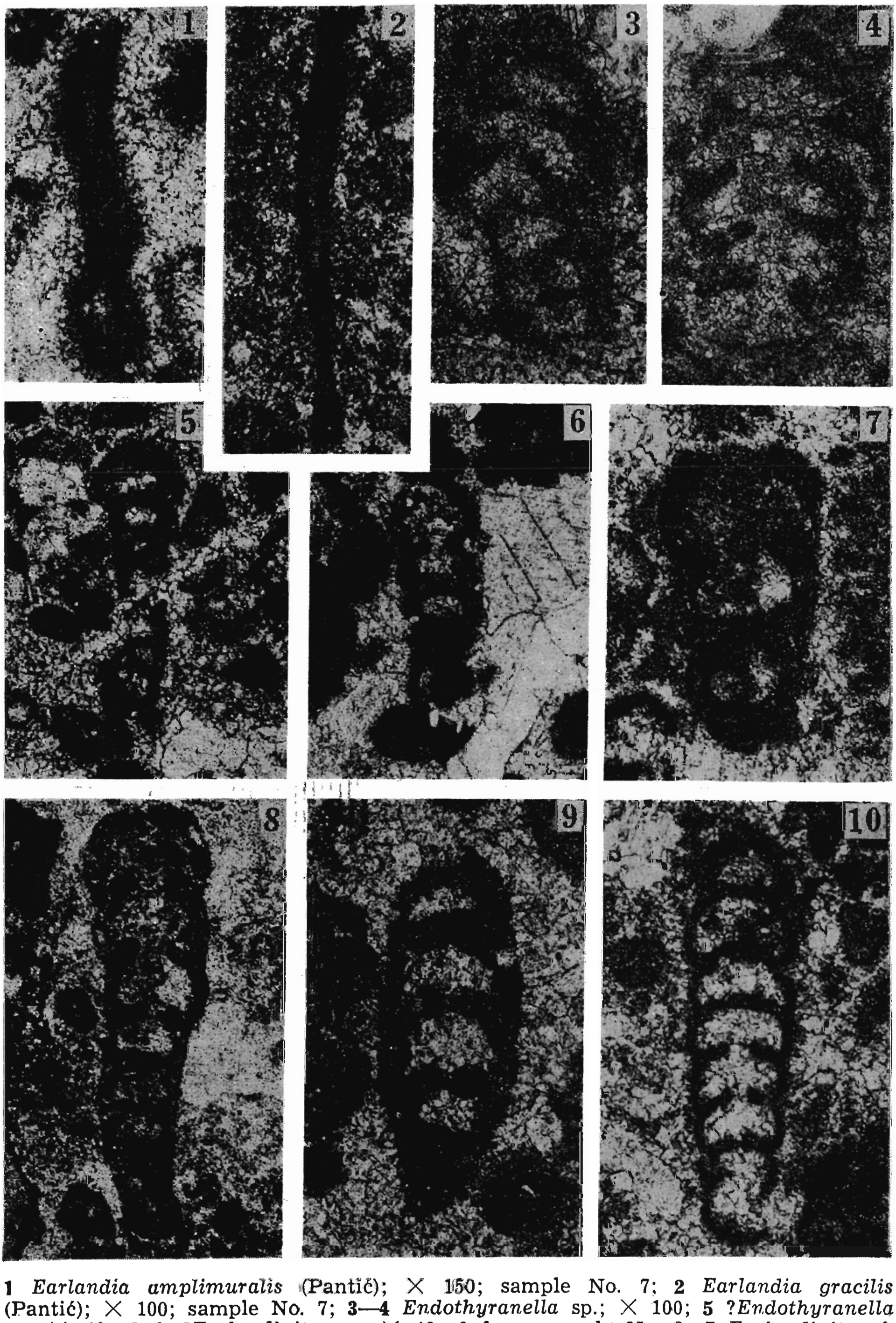
1 *Agathammina austroalpina* Kristan-Tollmann & Tollmann; × 100; 2 ?*Agathammina* sp.; × 150; sample No. 13; 3 *Agathammina*? *iranica* Zaninetti, Brönnimann, Bozorgnia & Huber; × 150; 4—9 *Ophthalmidium* sp.; *4—7, 9* × 150, *8* × 100; *5—6* from sample No. 7, *9* from sample No. 4

1, 7—8 from Bt. Kecil (*1*); others from Bt. Kalong



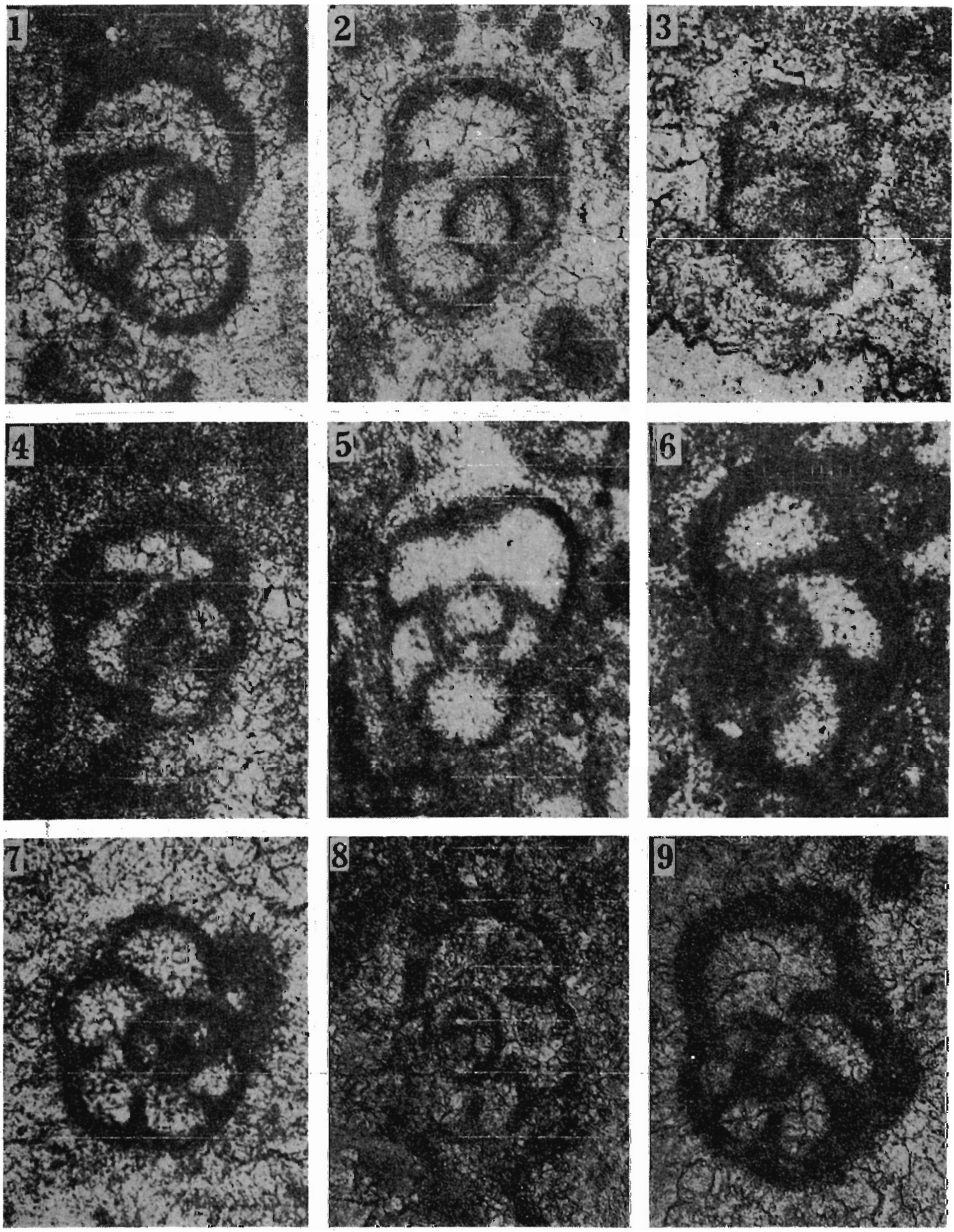
1 *Textularia* sp.; × 150; sample No. 2; 2—3 ?*Trochammina* sp.; × 150; 4 *Planiinvoluta carinata* Leischner; × 100; sample No. 4; 5 ?*Planiinvoluta* sp.; × 50; sample No. 5; 6—10 *Tolypammina gregaria* Wendt; *6—7, 10* × 100, *8—9* × 50; *9* from sample No. 10

From Bt. Kalong, except *6* from Bt. Kecil (*1*)



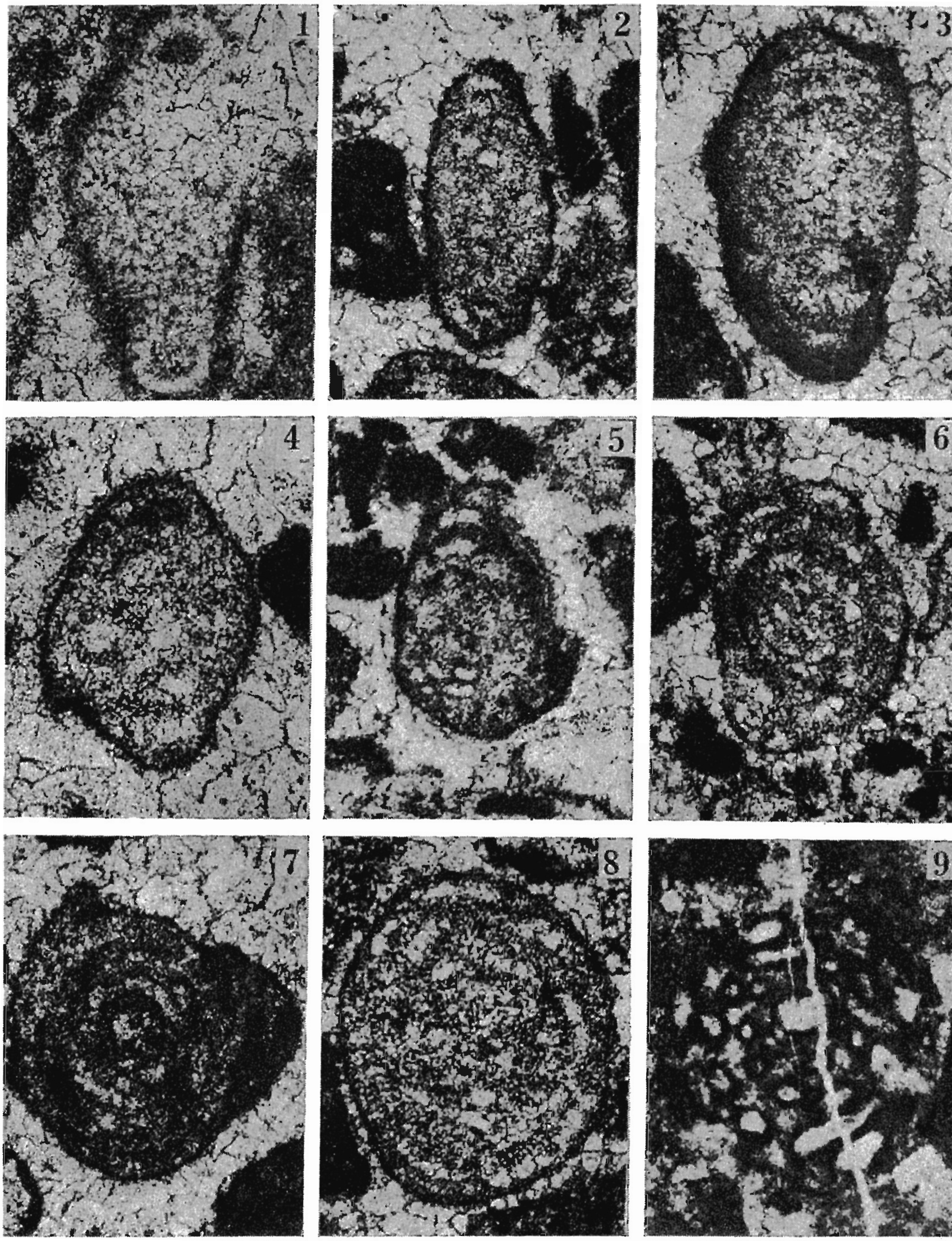
1 *Earlandia amplimuralis* (Pantič); × 150; sample No. 7; **2** *Earlandia gracilis* (Pantić); × 100; sample No. 7; **3—4** *Endothyranella* sp.; × 100; **5** ?*Endothyranella* sp.; × 40; **6, 9** ?*Earlandinita* sp.; × 40; *6* from sample No. 3; **7** *Earlandinita* cf. *soussii* Salaj; × 60; **8** *Earlandinita soussii* Salaj; × 40; **10** *Endothyranella wirzi* (Koehn-Zaninetti; × 60

From Bt. Kalong, except 9 from Bt. Kecil (1)



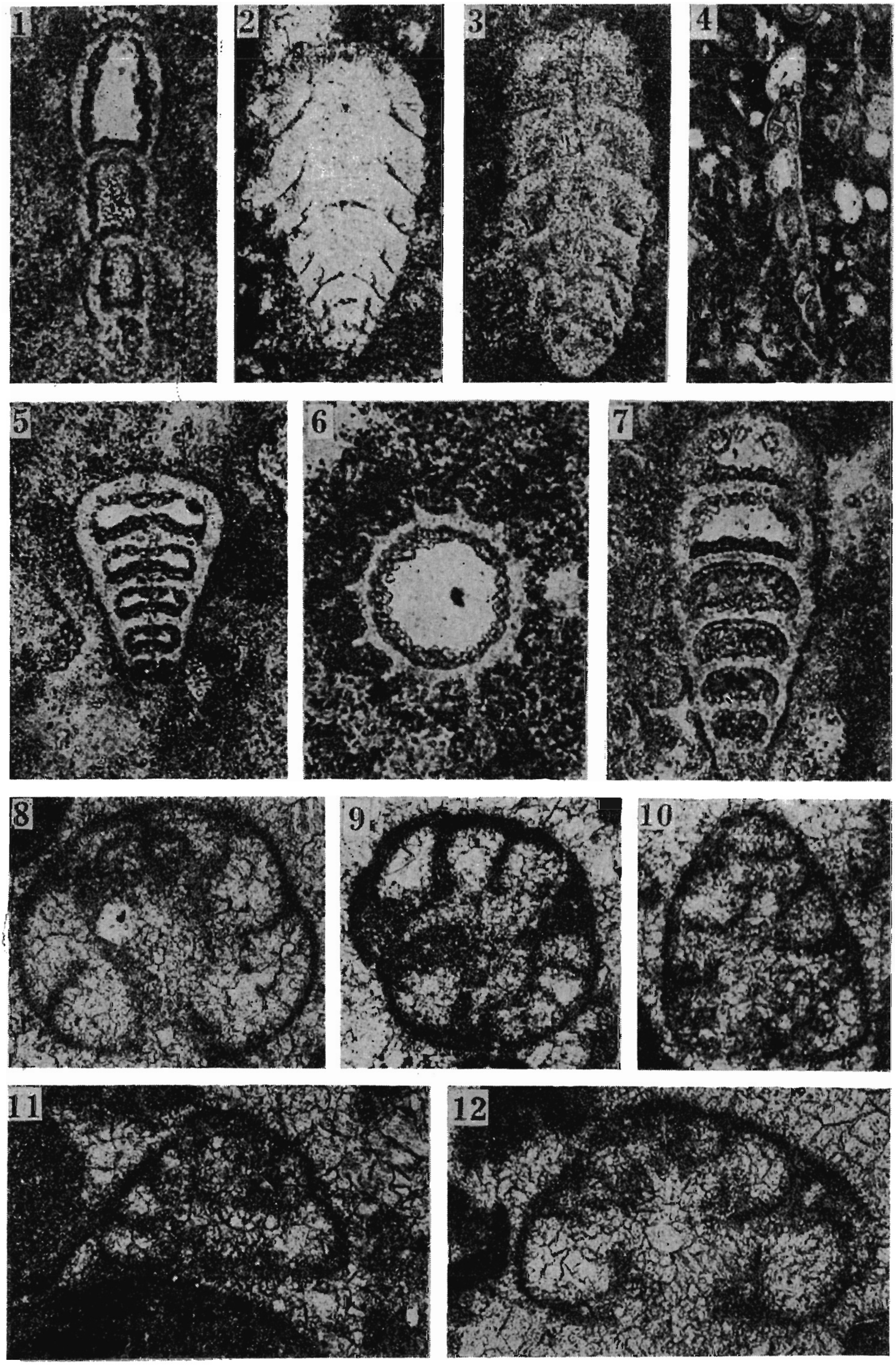
1—3 *Endothyra malayensis* Gaździcki, sp. n.; × 100, *1—2* from sample No. 12; **4—5** ?*Endothyranella* sp.; × 150; **6** *Endothyranella lombardi* Zaninetti & Brönnimann; × 100; **7—8** *Endothyra kuepperi* Oberhauser; × 100; **9** *Endothyranella* sp.; × 100

6—7, 9 from Bt. Kecil (*1*); other from Bt. Kalong



1 *Involutina communis* (Kristan); × 100; **2—3, 5** *Involutina sinuosa* cf. *pragsoides* (Oberhauser); × 60; **4** *Involutina* sp.; × 100; **6—8** *Involutina gaschei* Koehn-Zaninetti & Brönnimann; × 60; **9** ?*Triasina* sp.; × 60

From Bt. Kecil (*1*), except *9* from Bt. Kalong



1 *Nodosaria* sp.; × 150; sample No. 8; 2 ?*Nodosaria* sp.; × 100; 3, 7 *Austrocolomia* sp.; × 150; 7 from sample No. 8; 4 *Dentalina* sp.; × 40; sample No. 8; 5 ?*Pseudonodosaria* sp.; × 150; sample No. 8; 6 ?*Nodosaria* sp.; transverse section, × 150; sample No. 8; 8 *Diplotremina* sp.; × 100; 9 *Diplotremina astrofimbriata* Kristan-Tollmann; × 60; 10 *Variostoma* sp.; × 60; 11--12 ?*Diplotremina* sp.; × 100; *11* from sample No. 10, *12* from sample No. 3
From Bt. Kalong, except *10* from Bt. Kecil (*1*)