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 irinica* 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).

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\(^1\) 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, 3A 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, 2AB and 3B). 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 (I) mogote: the lower component stratotype of the Kodian 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. 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 pasilla* (Pl. 4, Fig. 9); associated are *Glomospirella* sp. (Pl. 4, Fig. 1), as well as *Endothyra* sp., ?Diplotrema sp., *Agathammina* sp., *Planitinvoluta 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 pasilla*, and *Diplotrema* sp.;

**BKA-3:** Algal (Tubiphites) — crinoid biosparite with foraminifers *?Earlandinata* sp. (Pl. 7, Fig. 6), ?Diplotrema sp. (Pl. 10, Fig. 12); moreover, *Tolypammina gregaria*, *Planitinvoluta 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 *Planitinvoluta carinata*;

**BKA-5:** Pelecypod-crinoid biosparite with *?Planitinvoluta* 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. 6, Figs 5—6), whereas *Tolypammina gregaria*, *Ammobaculites* sp., *Diplotrema* 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 ?*Diplotrema* sp. (Pl. 10, Fig. 11), *Tolypammina gregaria*, *Endothyra* sp., *Endothyranella* sp., and *Involutina sinuosa* cf. *pragosoides*;

**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., *Diplotrema* sp., *Variostoma* sp., and *Involutina* sp.;

**BKA-18:** Algal (Girvanella and Solenopora) biosparite with *?Agathammina* sp. (Pl. 5, Fig. 2), and *Ophthalmidium* sp.;

*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 *Tolympamina 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:

- *Gtomospira densa* (Pantic, 1985) — Pl. 3, Figs 4—9
- *Gtomospira gemertca* (Salaj, 1989) — Pl. 4, Fig. 4
- *Gtomospira* sp. — Pl. 3, Figs 1—3
- *Gtomospirella* sp. (Grozdilova & Glebovskaya, 1948) — Pl. 4, Fig. 3
- *Gtomospirella grandis* (Salaj, 1967) — Pl. 4, Fig. 2
- *Gtomospirella* sp. — Pl. 4, Figs 1 and 3
- *Tolympamina gregaria* Wendt, 1969 — Pl. 6, Figs 8—10
- *Ammobaculites* sp.
- *Textularia* sp. — Pl. 6, Fig. 1
- *Trocchammina* almalaensis Koehn-Zaninetti, 1968
- *?Trocchammina* sp. — Pl. 6, Fig. 3
- *Earlandia* amplimuralis (Pantić, 1972) — Pl. 7, Fig. 1
- *Earlandia* gracilis (Pantić, 1972) — Pl. 7, Fig. 2
- *Earlandinina* sousSite Salaj, 1974 — Pl. 7, Fig. 8
- *Earlandinina* cf. *sousSite* Salaj, 1974(1) — Pl. 7, Fig. 7
- *?Earlandinina* sp. — Pl. 7, Figs 6 and 9
- *Tetradactis* sp.
- *Endothyra* kuepperi Oberhauser, 1980 — Pl. 8, Figs 7—8
- *Endothyra* malayensis Gazdzicki, 1973
- *Endothyra* sp.
- *Endothyranella* utri (Koehn-Zaninetti, 1969) — 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—6
- *Agathammina* austrostipina Kristan-Tollmann & Tollmann, 1984 — Pl. 5, Fig. 1
- *Agathammina* sp. 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.
- *Planinovoluta* carinata Leischner, 1961, Pl. 6, Fig. 4
- *?Planinovoluta* 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
- *Diptotrema* astrotrumbrata Kristan-Tollmann, 1980 — Pl. 10, Fig. 9
- *Diptotrema* sp. — Pl. 10, Fig. 8
- *?Diptotrema* sp. — Pl. 10, Figs 11—12
- *Variostoma* sp. — Pl. 10, Fig. 10
- *Involutina communis* (Kristan, 1957) — Pl. 9, Fig. 1
- *Involutina* gaschel (Koehn-Zaninetti & Brönnimann, 1980) — Pl. 9, Figs 8—9
Involutina sinuosa sinuosa (Weynschenk, 1956)
Involutina sinuosa cf. progoides (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* Gażdzicki, 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 Endothydrinae Brady, 1884**

**Genus ENDOTHyRA Phillips, 1846**

*Endothyra malayensis* Gażdzicki, 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 salafi, Endothyra sp., Clamospira sp., Tolypaminina gregaria, Varistoma 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* Gażdzicki, 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 *Endothyraclia* Galloway & Harlton. Some analogies to this new species are dislayed by the form determined as *Endothyra* sp. by Jendrjáková (in Kochanová, Mello & Siblik 1975, Pl. 11, Fig. 6) from the Wetterstein Limestones (Ladinian) at the locality Šilíčka (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 sporitization makes difficulties in recognition of the detailed structure of some specimens. A part of the tests was damaged by syneeedmentary agents, and underwent onkolitization or oolitization.

The new established species, Endothyra malayensis Gażdzicki, sp. n., from sample No. 12 was recognized within the assemblage with E. salaji Gażdzicki, the latter species being known in the same stratigraphic position in the epicontinental (Muschelkalk) basin of southern Poland (see Gażdzicki & 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; Glazek & 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 co-
nodos 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 & Brömnnmann) — Pl. 9, Figs 6—8; *I. sinuosa sinuosa* (Weynschenk); *I. sinuosa cf. pragosoides* (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 & Brömnnmann 1974, Brömnnmann & 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; Chypeina 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 esphkkensis 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. Bystricky 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 & Catalov 1975; see also Zaninetti 1976). Moreover, the investigated assemblages are also related to those from the epicontinental Muschelkalk sequence of southern Poland (cf. Glazek & al. 1973, Gaździcki & al. 1975).

The Carnian–Norian involitinid assemblage with Involutina communis, I. gaschei, I. sinuosa sinuosa, I. sinuosa cf. pragsoide, and ?Triasina sp., which has been recognized in loose samples from Bt. Kecil (I) 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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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 Gażdzicki, 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, Earlania gracilis (Pantić), Earlania soussii Salaj, Endothyra salajii Gażdzicki, Agathammina? iranica Zaninetti & al., oraz kilku przedstawicieli rodziny Involuitinidae Bütschli.

Rozpoznane poszczególne zespoły otwornic określają wiek zawierających je osadów począwszy od najniższego anizyku po ladyn, a niektóre z nich obejmują również kar nik 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 bioparite, × 60; unit 12; 3 Biointrasparrite 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 esphakensis Brönnimann, Zaninetti, Moshtaghian & Huber; × -5;
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. Kecl (I); 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 & Glebovska); × 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 Planorivoluta carinata Leischner; × 100; sample No. 4; 5 ?Planorivoluta 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 (i)
1 Earlandia amplimuralis (Pantić); × 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 St. Kalont, except 9 from St. 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 St. Kecl (J); other from St. Kalong
1 Involutina communis (Kristan); × 100; 2–3, 5 Involutina sinuosa cf. pragsoiides (Oberhauser); × 60; 4 Involutina sp.; × 100; 6–8 Involutina gaschei Koehn-Zaninetti & Brönnmann; × 60; 9 Triasina sp.; × 60

From Bt. Kecil (1), except 9 from Bt. Kalong.
1 Nodosaria sp.; X 150; sample No. 8; 2 ?Nodosaria sp.; X 100; 3, 7 Austrocolomia sp.; X 150; 7 from sample No. 8; 4 Denticulina sp.; X 40; sample No. 8; 5 ?Pseudonodosaria sp.; X 150; sample No. 8; 6 ?Nodosaria sp.; transverse section, X 150; sample No. 8; 8 Diplopremata sp.; X 100; 9 Diplopremata astrofimbriata Kristan-Toliman; X 60; 10 Xartostoma sp.; X 60; 11–12 ?Diplopremata sp.; X 100; 11 from sample No. 10, 12 from sample No. 3

From Bt. Kalong, except 10 from Bt. Kecil (1)