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GEOLOGICAL AND MICROPALEONTOLOGICAL INVESTIGATIONS IN THE UPPER TRIASSIC (ASINEPE LIMESTONE) OF SERAM, OUTER BANDA ARC, INDONESIA

BY

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RÉSUMÉ

Le Trias supérieur en facies carbonaté récifal de Seram présente deux associations distinctes de Foraminifères, l'une essentiellement faite d'Involutinidae, avec pour espèce dominante *Triasina hantkeni* MAJZON, l'autre de Foraminifères porcelanés dont les principaux représentants sont *Planiinvoluta*, *Ophthalmidium* et les Milioliporidae *Miliolipora* et *Galeanella*. Une nouvelle espèce, *Galeanella? laticarinata*, n. sp., est attribuée avec doute à ce dernier genre.

La microfaune d'accompagnement des Involutinidae et des Foraminifères porcelanés comprend des Ammodiscidae, des Lituolidae (ou Endothyridae), des Trochamminidae (?), des Duostominidae, des Nodosariidae, etc., qui seront décrits dans une note ultérieure (AL-SHAIBANI, CARTER et ZANINETTI, en préparation).

INTRODUCTION

The materials described here were collected from the Asinepe Limestone (the "massive Triassic limestone" of VALK, 1945) in 1975 by members of the London University and B.P. Expedition to Seram, Eastern Indonesia. This rock unit, named informally after Mt. Asinepe in the Lamoemoete Mountain range of N. central Seram, outcrops in the main central ranges of the island, extending from the Manusela mountains of S. Seram to the Lamoemoete mountains in the N. and N.W. It also occurs in parts of eastern and western Seram as much smaller outcrops. It is present also as large exotic blocks and boulder and pebble sized clasts in the Salas Block Clay olistostrome of N. Seram.

The Asinepe Limestone forms a thrust sheet and, with the Salas Block Clay olistostrome and other thrust sheets (Kaibobo Complex, Tehoru Formation, etc.)

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constitutes an allochthonous stratigraphical-structural element overthrust on to the entirely marine, Triassic to Miocene, imbricated para-autochthon in the earliest Pliocene (N.18). In the N.W. of the island outcrops of Asinepe Limestone have been strongly affected by steep, post-thrusting faults and appear as small klippen. Autochthonous Plio-Pleistocene sediments were deposited in basins produced by the post-thrusting faults. A detailed discussion of the various stratigraphic-structural units making up the island of Seram is given by AUDLEY-CHARLES *et al.* (1979).

The para-autochthon forming the basal exposed portion of the island, was deposited on the Australian shelf, slope and rise and includes both Triassic siliciclastics (lower part of the Wakuku beds) containing palynomorphs (PRICE, 1976) and Triassic marls and calcilutites containing chert, radiolaria and *Halobia.* These deposits differ markedly both in lithology and biofacies from the tropical or subtropical, reefal-subreefal Asinepe Limestone, which is usually a grey, sometimes crystalline, oolitic and bioclastic grainstone containing calcareous algae, foraminifera, sponges, corals, crinoid ossicles, echinoids and brachiopods. The age of this limestone is shown here to be Norian/Rhaetian, substantiating the views of VALK (1945) and of AUDLEY-CHARLES *et al.* (1979) who considered it to be late Triassic by analogy with the Triassic part of the Maubisse Limestone of Timor (CARTER *et al.* 1976), dated by YAMAGAWA (1963) on corals and the associated fauna, and contradicting those of VAN DER SLUIS (1950) who supposed it to be Jurassic because the deposit contains *Lovcenipora.* Like the Maubisse Limestone, the Asinepe Limestone is considered to habe been deposited on the margin of Sundaland (see also KANMERA and NAKAZAWA, 1973) and to have been thrust on to the margin of the Australian plate in the earliest Pliocene.

II. MICROPALEONTOLOGY

The Upper Triassic of Seram contains a rich foraminiferal fauna. It will be described in 2 papers. The present first paper contains the description of the Involutinidae and the Miliolina [Fischerinidae, Nubeculariidae (Nubeculariinae and Ophthalmidiinae), Miliolidae (?) and Milioliporidae].

Involutinids and porcelaneous foraminifera represent two facies controlled associations which we did not find intermixed. However there are a number of forms common to both associations, such as *Duotaxis birmanica* ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, WHITTAKER and ZANINETTI, 1975, Ammodiscidae, Trochamminidae (?), Nodosariidae, etc., which will be described in the second paper (AL-SHAIBANI, CARTER and ZANINETTI, in preparation).

The foraminiferal fauna of the Upper Triassic of Seram shows a distinct relationship with that from the Upper Triassic of the Shan Plateau, Burma (BRÖNNIMANN, WHITTAKER and ZANINETTI, 1975), however the dominant species of Seram, *Triasina hantkeni* MAJZON, 1954, is absent in the Burmese material (AL-SHAIBANI, ALTINER, BRÖNNIMANN, CARTER and ZANINETTI, 1982), as well as the representatives of the Milioliporidae.

In the following we are listing all the species which have been used for paleoecological interpretation of the Upper Triassic sediments of Seram.

1. *Association of involutinids*

This group, which is mostly found in samples 12-9 and CER 20, is characterized by the abundantly occurring *Triasina hantkeni* MAJZON. Other involutinids [*Aulotortus* spp., pl. 1, Fig. 1-8, 12, 15; *Auloconus permodiscoides* (OBERHAUSER), not illustrated)] are rare.

The involutinids and associated forms are listed below:

Triasina hantkeni MAJZON, 1954 (pl. 1, Fig. 1-3, 5, 6)
Aulotortus sinuosus sinuosus WEYNSCHENK, 1956 (pl. 1, Fig. 1)
Aulotortus ex gr. *sinuosus* WEYNSCHENK, 1956 (pl. 1, Fig. 23)
Aulotortus sinuosus pragsoides (OBERHAUSER, 1964) (pl. 1, Fig. 4, 7?, 8?, 13?)
Aulotortus communis (KRISTAN, 1957) (pl. 1, Fig. 9, 10, 14)
Aulotortus tumidus (KRISTAN-TOLLMANN, 1964) (pl. 1, Fig. 11, 12)
Aulotortus ex gr. *impressus* (KRISTAN-TOLLMANN, 1964) or *tenuis* (KRISTAN, 1957) (pl. 1, Fig. 15, 16)
Aulotortus gaschei (KOEHN-ZANINETTI and BRÖNNIMANN, 1968) (or *Glomospirella friedli* KRISTAN-TOLLMANN, 1964) (pl. 1, Fig. 17-22)
Auloconus permodiscoides (OBERHAUSER, 1964) (not illustrated)
Agathammina austroalpina KRISTAN-TOLLMANN and TOLLMANN, 1964 (pl. 3, Fig. 9, 10, 11?, 14, 15?, 16?)
Duotaxis birmanica ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, WHITTAKER and ZANINETTI, 1975

In addition species of the families Ammodiscidae, Trochamminidae (?), Lituolidae (or Endothyridae), Nodosariidae, etc., are also present.

The microfacies of the sediments with involutinids and other small foraminifera is a biosparite (grainstone). The involutinids are always strongly recrystallized.

2. *Porcelaneous foraminifera*

They occur mostly in samples CC 10, CC 13 and 13-1 (pl. 2, Fig. 1-25; pl. 3, Fig. 1-3, 5, 7-13, 15, 17-26, 28-31). The porcelaneous foraminifera and associated forms are listed below:

Agathammina austroalpina KRISTAN-TOLLMANN and TOLLMANN, 1964 (pl. 3, Fig. 9, 10, 11?, 15?)
Planiinvoluta carinata LEISCHNER, 1961 (pl. 2, Fig. 15-19, 21-24; pl. 3, Fig. 31)

Nubecularia sp. (AL-SHAIBANI, CARTER and ZANINETTI, in preparation, pl. 1, Fig. 14, 15)
Ophthalmidium spp. (pl. 2, Fig. 25; pl. 3, Fig. 3, 5, 7, 28-30)
Spiriamphorella ? sp. (pl. 3, Fig. 1, 2)
Galeanella ? *laticarinata*, n. sp. (pl. 3, Fig. 17-20, 21 ?)
Galeanella panticae ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, CADET, RICOU and ZANINETTI, 1973 (pl. 3, Fig. 22-24, 25 ?)
Galeanella sp. 1 or overgrown *Galeanella panticae* ZANINETTI and BRÖNNIMANN, 1973 (pl. 2, Fig. 5, 6, 9, 10)
Galeanella ? sp. (pl. 2, Fig. 11)
Miliolipora cuvillieri BRÖNNIMANN and ZANINETTI *in* BRÖNNIMANN, ZANINETTI, BOZORGNIA, DASHTI and MOSHTAGHIAN, 1971 (pl. 2, Fig. 1-4, 7, 8, 14; pl. 3, Fig. 8 ?, 12 ?, 13 ?)
"*Sigmoilina*" *schaeferae* ZANINETTI, ALTINER, DAGER and DUCRET, 1982 (pl. 2, Fig. 12, 13, 20; pl. 3, Fig. 26 ?)
Duotaxis birmanica ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, WHITTAKER and ZANINETTI, 1975

In addition species of the families Duostominidae, Trochamminidae (?), Lituolidae (or Endothyridae), "Textulariidae", Nodosariidae, etc., are also present.

Associated with these foraminifers we also find the *incertae sedis Muranella sphaerica* BORZA, 1975, and *Globochaete gregaria* SCHÄFER and SENOWBARI-DARYAN, 1980.

The microfacies of the sediments in which the above listed species have been found is a biosparite (grainstone).

Paleoecological interpretation

With reference to SADATI's (1981, Fig. 8) interpretation of the distribution of the foraminifera in the reefal environment of the Upper Triassic, the following conclusions can be made:

1. *Association of involutinids*

This association is dominated by *Triasina hantkeni*. The involutine *Aulotortus* is less common and the trocholine *Auloconus* very rare. The facies of the involutinid association does not correspond with any of the 3 facies types (biolithite-grapestone-mud facies) recognized by SADATI (1981) in the reefal development of the Upper Triassic of the Hohe Wand, Eastern Austria.

The abundant occurrence of *Triasina hantkeni* is quite similar to that observed by one of us (L.Z.) in the Upper Triassic of the southern Appennine mountains. It is here interpreted to suggest a shallow water, low energy lagoonal environment, protected from the open sea by a reefal barrier. In fact, the accumulation of the sub-globular tests of the triasines without involutines and trocholines has to be envisaged to occur in an environment away from immediate reefal influences. In this case the "mud facies" of SADATI (1981, Fig. 8) would best represent this type of environment and sedimentation.

2. *Association of porcelaneous foraminifera*

The dominant genera of this association are *Agathammina*, *Planiinvoluta*, *Nubecularia*, *Ophthalmidium*, "*Sigmoilina*", *Galeanella* and *Miliolipora*. Duostominidae, Trochamminidae (?), Lituolidae (or Endothyridae), Nodosariidae), etc., may also be present. This association characterizes quite well the limit of the reefal facies "biolithite" and "grapestone" which occurs precisely in the subdivision I D of SADATI, 1981, Fig. 8.

Occasionally, there occurs in this association of porcelaneous foraminifera also *Globochaete gregaria* SCHÄFER and SENOWBARI-DARYAN, 1980, which might place the sediments with this species in a quiet back reef environment corresponding to the "mud facies" (= Schlamm-Fazies of SCHÄFER and SENOWBARI-DARYAN, 1980, p. 101).

In conclusion, the samples from the beds 12-9, CER 20, CC 10, CC 13 and 13-1 can be interpreted paleoecologically as follows:

— the samples 12-9 and CER 20, with *Triasina hantkeni*, *Aulotortus* spp., *Glomospira*, *Glomospirella*, *Duotaxis* (= *Tetrataxis in* SADATI, 1980?), trochamminids (?) and nodosariids are considered to represent the "mud facies", subdivision III B of SADATI, 1981, Fig. 8;

— the samples CC 10, CC 13 and 13-1 with *Agathammina*, *Planiinvoluta*, *Nubecularia*, *Ophthalmidium*, "*Sigmoilina*", *Spiriamphorella* ?, *Galeanella*, *Miliolipora*, *Duotaxis*, ammodiscids, trochamminids (?), lituolids (or endothyrids), attached agglutinated forms, etc., are believed to represent the "biolithite" and "grapestone" facies, subdivisions I B to I D of SADATI, 1981, Fig. 8.

Systematic description of the more important species

Miliolina DELAGE and HEROUARD, 1896, emend. BRÖNNIMANN and ZANINETTI *in* BRÖNNIMANN, ZANINETTI, BOZORGNIA, DASHTI and MOSHTAGHIAN, 1971

Miliolacea EHRENBERG, 1839, emend. BRÖNNIMANN and ZANINETTI, 1971

Fischerinidae MILLETT, 1838

This family is represented in the Upper Triassic of Seram by the genera *Agathammina* NEUMAYR, 1887, and *Planiinvoluta* LEISCHNER, 1961. We have identified *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN, 1964 (pl. 3, Fig. 9, 10, 11?, 14, 15?, 16?), *Agathammina* sp. (pl. 3, Fig. 27) and *Planiinvoluta carinata* LEISCHNER, 1961 (pl. 2, Fig. 15-19, 21-24; pl. 3, Fig. 31). The last cited species shows occasionaly in axial section irregularities in the enrollment (pl. 2, Fig. 16, 21) and agglutination of the wall (pl. 2, Fig. 17). Further we have observed in some forms that the proloculus is not attached to the substratum (pl. 2, Fig. 17, 21, 24).

Nubeculariidae JONES, 1875
Ophthalmidiinae WIESNER, 1920

The Ophthalmidiinae are not well represented in the Upper Triassic of Seram and taxonomically it seems best to list them under the name of *Ophthalmidium* spp. (pl. 2, Fig. 25; pl. 3, Fig. 3-7, 28-30).

Nubeculariidae (Ophthalmidiinae) or Milioliporidae BRÖNNIMANN and ZANINETTI, 1971
Spiriamphorella BORZA and SAMUEL, 1977

Two specimens have been placed with reservation into the genus *Spiriamphorella* BORZA and SAMUEL, 1977 (*Spiriamphorella* ? sp., pl. 3, Fig. 1, 2).

Miliolidae EHRENBERG, 1839?
Quinqueloculininae CUSHMAN, 1917?

Sigmoilina SCHLUMBERGER, 1887?

"*Sigmoilina*" *schaeferae* ZANINETTI, ALTINER, DAGER and DUCRET, 1982, Pl. 2, Fig. 12, 13, 20; pl. 3, Fig. 26?

1978? "*Sigmoilina*" sp.
SCHÄFER and SENOWBARI-DARYAN, pl. 1, Fig. 4.

1979? "*Sigmoilina*" sp.
SCHÄFER, pl. 19, Fig. 9.

1980. "*Sigmoilina*" sp.
SENOWBARI-DARYAN, pl. 19, Fig. 10.

1980. *Sigmoilina* sp.
DULLO, pl. 12, Fig. 7.

1981. "*Sigmoilina*" sp.
FLÜGEL, Fig. 14 B.

1982. "*Sigmoilina*" sp.

1982. "*Sigmoilina*" *schaeferae*
ZANINETTI, ALTINER, DAGER and DUCRET, pl. 8, Fig. 3, 6, 9, 12, 13.

This species is characteristic of the late Triassic reefal facies of the Alps and the Taurus. Three specimens are illustrated (pl. 2, Fig. 12, 13, 20).

Milioliporidae BRÖNNIMANN and ZANINETTI *in* BRÖNNIMANN, ZANINETTI, BOZORGNIA, DASHTI and MOSHTAGHIAN, 1971

Galeanellinae ZANINETTI, ALTINER, DAGER and DUCRET, 1982

Galeanella KRISTAN, 1958, emend. ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, CADET, RICOU and ZANINETTI, 1973

Galeanella ? *laticarinata*, n. sp.
Pl. 3, Fig. 17-20, 21 ?; holotype, pl. 3, Fig. 18

1978. *Galeanella* sp. 1
SCHÄFER and SENOWBARI-DARYAN, pl. 1, Fig. 5; pl. 2, Fig. 4.

1979. *Galeanella* sp. 1
SCHÄFER, pl. 19, Fig. 19.

1980. *Galeanella* sp. 1
SENOWBARI-DARYAN, pl. 17, Fig. 2.

This new foraminifer, which seems to be the same form as that illustrated by SCHÄFER and SENOWBARI-DARYAN (1978, pl. 1, Fig. 5; pl. 2, Fig. 4), by SCHÄFER (1979, pl. 19, Fig. 19) and by SENOWBARI-DARYAN (1980, pl. 17, Fig. 2) is here only with doubt placed in *Galeanella* KRISTAN, 1958, because the reticulate perforation characteristic of the genus could not be clearly recognized. The new species is named for the well developed keels.

Material

Five individuals in thin sections from the samples CC 10 (type level), CC 13 and 13-1. The material will be deposited in the Imperial College, micropaleontological research Collection.

Holotype

The specimen illustrated by pl. 3, Fig. 18, from sample CC 10.

Paratypes

Two paratypes are illustrated by pl. 3, Fig. 20, 21 ?

Type-locality

Lola Kechil River, 1.3 km from its mouth, in float.

Type-level

Upper Triassic, Norian/Rhetian.

Morphological description

The strongly keeled test of *Galeanella* ? *laticarinata*, n. sp., with 350 μ maximum diameter, falls in the medium range of dimensions of the genus. The total number of chambers cannot be determined. Their basal parts are thickened and their apertural parts thinned out. The early enrollment is irregular, in the adult it seems to be rather regular with 2 chambers per whorl. The chambers carry an elongate and sharp keel which is apparently the continuation of the "foot". This keel differs from that of *Galeanella tollmanni* (KRISTAN, 1957) which is proximal in respect to the "foot" and characterized by a less sharp border.

The calcareous wall is opaque in transmitted light, probably originally of porcelaneous microstructure. The perforations, typical for the family Milioliporidae and the genus *Galeanella* are not well recognizable in our material.

The aperture was not seen. It is probably a simple terminal opening.

Stratigraphic range and environment

Norian/Rhetian, reefal facies.

Remarks

Galeanella ? laticarinata, n. sp., differs from all other species of the genus [*Galeanella expansa* ZANINETTI, ALTINER, DAGER and DUCRET, 1982; *Galeanella irregularis* (BORZA and SAMUEL, 1977) (synonyme: *Urnulinella andrusovi* BORZA and SAMUEL, 1977); *Galeanella ? minuta* ZANINETTI, ALTINER, DAGER and DUCRET, 1982; *Galeanella ovata* (SAMUEL, SALAJ and BORZA, 1981) (synonyme: *Galeanella bronnimanni* ALTINER and ZANINETTI, 1981); *Galeanella panticae* ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, CADET, RICOU and ZANINETTI, 1973); *Galeanella ? salaji* (SAMUEL and BORZA, 1981); *Galeanella tollmanni* (KRISTAN, 1957); *Galeanella variablis* ZANINETTI, ALTINER, DAGER and DUCRET, 1982] by its strongly keeled periphery which seems to be the result of a differentiation of the "foot".

Association

In the type-sample CC 10, *Galeanella ? laticarinata*, n. sp., is associated with *Galeanella panticae*, *Ophthalmidium* spp., *Nubecularia* sp., *Duotaxis birmanica* ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, WHITTAKER and ZANINETTI, 1975, the families Ammodiscidae, Lituolidae (or Endothyridae), "Textulariidae", Trochamminidae (?), etc. In the other samples (CC 13 and 13-1), *Galeanella ? laticarinata*, n. sp., is accompanied by *Agathammina austroalpina*, *Planiinvoluta carinata*, *Spiriamphorella* ? sp., *Galeanella panticae*, *Miliolipora cuvillieri*, *Ophthalmidium* spp., *Nubecularia* sp., "*Sigmoilina*" *schaeferae*, *Duotaxis birmanica*, *Aulotortus* ex gr. *impressus* or *tenuis*, the families Ammodiscidae, Lituolidae (or Endothyridae), Trochamminidae (?), Duostominidae, etc., and the *Incertae sedis Muranella sphaerica* BORZA, 1975, and *Globochaete gregaria* SCHÄFER and SENOWBARI-DARYAN, 1980.

Galeanella panticae ZANINETTI and BRÖNNIMANN *in* BRÖNNIMANN, CADET, RICOU and ZANINETTI, 1973
Pl. 3, Fig. 22-24, 25?

See synonymy *in* ZANINETTI, ALTINER, DAGER and DUCRET, 1982, and add

1980? *Galeanella* sp.
DULLO, pl. 12, Fig. 1.

1982. *Galeanella panticae.*
ZANINETTI, ALTINER, DAGER and DUCRET, pl. 1, Fig. 1-3, 4?, 5-11.

1982. *Galeanella panticae.*
SENOWBARI-DARYAN, SCHÄFER and ABATE, pl. 24, Fig. 15, 21.

In the Seram material, sample CC 10, occur specimens of a *Galeanella* which we identified as *Galeanella panticae*, the type of which is from the Upper Triassic of the Dinarids. The thin sections show an early streptospiral enrollment and a complex type of perforations (pl. 3, Fig. 22-24).

Galeanella sp. 1
or overgrown *Galeanella panticae* ZANINETTI and BRÖNNIMANN, 1973
Pl. 2, Fig. 5, 6, 9, 10

The specimens occurring in sample CC 10 and illustrated by pl. 2, Fig. 5, 6, 9, 10 have been separated from *Galeanella panticae* (see pl. 3, Fig. 22-24, 25?) from which they differ by the thick wall, the small chamber lumen and possibly by the uncoiling of the test.

However, it is possible that the thick wall and the small lumina are the result of calcite overgrowth. Such a secondary thickening cannot be excluded in view of the strong recrystallization of the test. As also in *Galeanella panticae* some sort of uncoiling was observed (BRÖNNIMANN, CADET, RICOU and ZANINETTI, 1973, pl. 2, Fig. 6, 21), the above mentioned differences might be of secondary nature. In this case *Galeanella* sp. 1 would have to be placed into *Galeanella panticae.*

Milioliporinae BRÖNNIMANN and ZANINETTI *in* BRÖNNIMANN, ZANINETTI, BOZORGNIA, DASHTI and MOSHTAGHIAN, 1971

Miliolipora BRÖNNIMANN and ZANINETTI, 1971

Miliolipora cuvillieri BRÖNNIMANN and ZANINETTI, 1971
Pl. 2, Fig. 1-4, 7, 8, 14; pl. 3, Fig. 8?, 12?, 13?

See synonymy *in* ZANINETTI, ALTINER, DAGER and DUCRET, 1982, and add

1982. *Miliolipora cuvillieri.*
ZANINETTI, ALTINER, DAGER and DUCRET, pl. 4, Fig. 14; pl. 6, Fig. 16?, 20-22.

The sections of *Miliolipora cuvillieri* illustrated by pl. 2, Fig. 1-4, 7, 8, 14 are identical with those of the type of the species which is from the Upper Triassic of Iran (BRÖNNIMANN, ZANINETTI, BOZORGNIA, DASHTI and MOSHTAGHIAN, 1971). The species is remarkable for its large size, by which it is clearly distinguishable from species of *Agathammina*, the thickness of the wall, and the perforations. The latter are well exhibited by the individual shown by pl. 2, Fig. 1.

Rotaliina Delage et Herouard, 1896
Involutinacea Bütschli, 1880
Involutinidae Bütschli, 1880

This family is well represented in the Seram material. The Involutinids form an association distinct from that of the porcelaneous foraminifera. The most common species is *Triasina hantkeni* which may be associated with other involutinids. (*Aulotortus communis*, *A. sinuosus sinuosus*, *A. sinuosus pragsoides*, A. *tumidus*, *A. gaschei*, *A.* ex gr. *impressus* or *tenuis*), or other foraminifera, such as *Agathammina austroalpina*, *Duotaxis birmanica*, ammodiscids, trochamminids (?), nodosariids, etc.

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PLATE 1

Association of Involutinidae in the Upper Triassic of Seram.

1-3, 5, 6	*Triasina hantkeni* MAJZON, 1954; 1, with *Aulotortus sinuosus sinuosus* WEYNSCHENK, 1956.
4, 7?, 8?, 13?	*Aulotortus sinuosus pragsoides* (OBERHAUSER, 1964).
9, 10, 14	*Aulotortus communis* (KRISTAN, 1957); 14, eroded specimen.
11, 12	*Aulotortus tumidus* (KRISTAN-TOLLMANN, 1964).
15, 16	*Aulotortus* ex gr. *impressus* (KRISTAN-TOLLMANN, 1964), or *tenuis* (KRISTAN, 1957).
17-22	*Aulotortus gaschei* (KOEHN-ZANINETTI and BRÖNNIMANN, 1968) or *Glomospirella friedli* KRISTAN-TOLLMANN, 1964.
23	*Aulotortus* ex gr. *sinuosus* WEYNSCHENK, 1956.

1, 2, 5-8, 12, 15, 22, sample 12-9; 3, 4, 20, sample CER 20; 9, 14, 17, 23, sample CC 85; 10, sample 21-1; 11, sample CER 45; 13, sample CER 19; 16, sample 13-1; 18, 19, 21, sample 12-4.
1, 2, 5-8, 13, 14, 25 ×; 3, 4, 15 ×; 9, 45 ×; 10, 75 ×; 11, 15, 16, 35 ×; 12, 70 ×; 17, 18, 22, 40 ×; 19, 20 ×; 20, 21, 30 ×; 23, 10 ×.

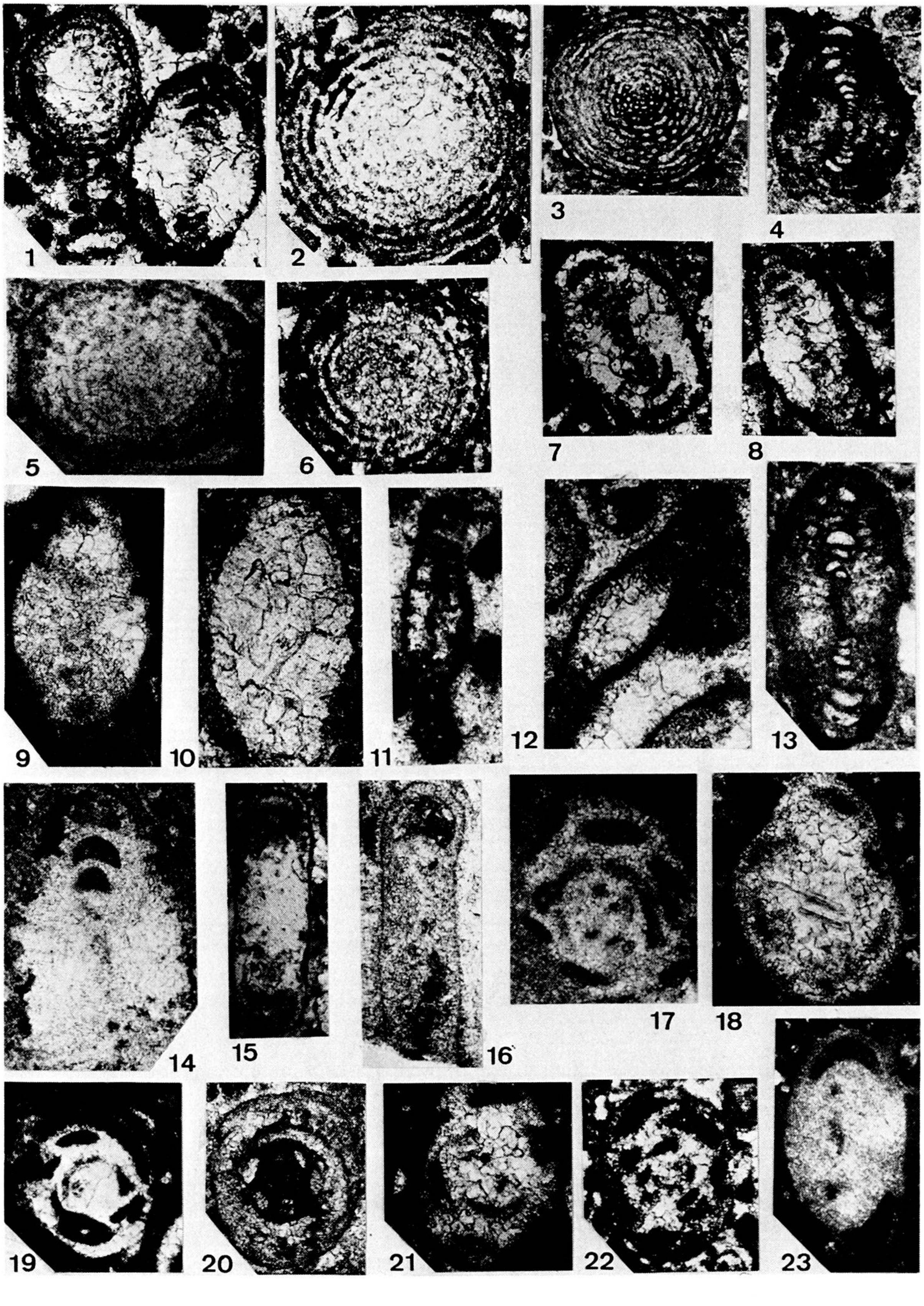
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PLATE 2

Association of porcelaneous foraminifera in the Upper Triassic of Seram:

1-4, 7, 8, 14	*Miliolipora cuvillieri* BRÖNNIMANN and ZANINETTI, 1971.
5, 6, 9, 10	*Galeanella* sp. 1 or overgrown *Galeanella panticae* ZANINETTI and BRÖNNIMANN, 1973.
11	*Galeanella* ? sp.
12, 13, 20	« *Sigmoilina* » *schaeferae* ZANINETTI, ALTINER, DAGER and DUCRET, 1982.
15-19, 21-24	*Planiinvoluta carinata* LEISCHNER, 1961.
25	*Ophthalmidium* sp.

1-4, 7, 8, 11-25, sample CC 13; 5, 6, 9, 10, sample CC 10.
1-4, 7, 8, 12-25, 80 × ; 5, 6, 9-11, 50 × .


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PLATE 3

Association of porcelaneous foraminifera in the Upper Triassic of Seram.

1, 2	*Spiriamphorella* ? sp.
3-7, 28-30	*Ophthalmidium* spp.
8, 12, 13	*Miliolipora cuvillieri* BRÖNNIMANN and ZANINETTI, 1971 ?
9, 10, 11 ?, 14, 15 ?, 16 ?	*Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN, 1964.
17-20, 21 ?	*Galeanella* ? *laticarinata*, n. sp.; holotype fig. 18.
22-24, 25 ?	*Galeanella panticae* ZANINETTI and BRÖNNIMANN, 1973.
26	« *Sigmoilina* » *schaeferae* ZANINETTI, ALTINER, DAGER and DUCRET, 1982 ?
27	*Agathammina* sp.
31	*Planiinvoluta carinata* LEISCHNER, 1961.

1, 2, 5, 8-13, 15, 17, 26, 30, 31, sample CC 13; 3, 19, sample 13-1; 4, sample CC 28; 6, sample CC 85; 7, 18, 20-25, 28, 29, sample CC 10; 14, sample CER 45; 16, sample 12-9; 27, sample 21-1. 1, 28-30, 75 × ; 2, 9, 11, 20, 80 × ; 3, 6, 120 × ; 4, 250 × ; 5, 300 × ; 7, 40 × ; 8, 17, 80 × ; 10, 14, 18, 100 × ; 12, 27, 85 × ; 13, 26, 110 × ; 15, 27, 85 × ; 16, 50 × ; 19, 105 × ; 21, 95 × ; 22, 23, 55 × ; 24, 25 × ; 25, 65 × ; 31, 70 ×.


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