Molluscan fauna of the Lower Gelingseh Beds s. str., Sangkulirang area, Kalimantan timur (East Borneo)

C. Beets

Beets, C. Molluscan fauna of the Lower Gelingseh Beds s. str., Sangkulirang area, Kalimantan timur (East Borneo). — Scripta Geol., 82: 1-82, 2 figs., pls 1-5, Leiden, January 1987.

A compilation is given of the results of an investigation of all the molluscs collected by L.M.R. Rutten some seventy years ago, at five localities in the type area of the Gelingseh Beds s. str., Late Miocene. Thirteen new species are described, viz, *Smaragdia gelingsehensis, Rissoina maduparensis, Architectonica ickeae, Strombus ickeae, Hexaplex sampajauensis, Hinia gelingsehensis, Olivancillaria altenai, Melo persolida, Gibberulina menkrawitensis, Strioterebrum gelingsehense, Ringicula seriaensis, Spondylus apiapiensis,* and *Linga antjamensis*.
For over fifty years the Gelingseh Beds have been correlated with the Upper Balikpapan Layers, Tf3 (Preangerian). According to Rutten's field work, the fossil localities occur at approximately the same level in the lower part of the Gelingseh Beds. However, now, as before (concluded by K. Martin), it seems that the fauna from the 'Source area of Sungai Gelingseh' (presently dubbed A) could be a little older than the fossil assemblage obtained at a locality known as just 'Sungai Gelingseh' (B-Bb in the present paper), and to correlate with, say, the apparent overlap in time of type Rembangian on to Preangerian. Loc. B-Bb yielded the largest fauna, which offers ample evidence of a full-blown Preangerian status, and so does fauna C (from Rutten's loc. 144). On the other hand, faunas D (loc. 149) and E (loc. 150) jointly seemingly represent a higher stratigraphic level of Tf3 – with a possibility that Odengian is approached, if not actually reached – to date however there being known no Bornean faunas of a comparable composition and age. As to the relationships with other Preangerian faunas of Borneo, Java and Sumatra, the Gelingseh faunas invariably show strong ties with the assemblage of the basal Menkrawit Beds of nearby Mangkalihat Peninsula (L. 114, Leupold) and also, and sometimes even more strongly so (faunas Bb and C), with the classical Javanese Preangerian, except however faunas A and B. Among themselves, faunas A to E show relationships varying as much in quality as their several ties with Preangerian faunas both distant and near.

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Introduction

This paper gives a compilation of the results of work on all the molluscan collections obtained by Dr L.M.R. Rutten about seventy years ago from five localities, reportedly of almost exactly the same age, in the Lower Gelingseh Beds of the Sangkulirang area (Rutten, 1913). The first list of molluscs from Sungai (= river) Gelingseh was published by K. Martin (1914) comprising a number of species from one of the five localities. He concluded that the age of the fauna could be intermediate between the Javanese Njalindung and Tjilanang faunas. Gerth (1923) confirmed Martin's conclusions. Next, the present author published a number of revisions and additions based on the collections from four of the localities discussed below but, although naming 66 species in all, it was still only a partial inventory (Beets, 1941, pp. 189, 192-197). Some further additions and revisions were also published by the author (Beets, 1942a, 1950e), but only in recent years the opportunity could be taken to assemble all the material of the Gelingseh fauna collected by Rutten, finalize its examination and rediscuss the age of the various collections separately as well as collectively.

Notes on the fossil localities

The Gelingseh Beds were correlated with the Upper Balikpapan Layers and dated as Tf3 by Leupold & van der Vlerk (1931, p. 619 and stratigraphic table; see also Marks, 1956, pp. 10, 50 and first stratigraphic table). They are considered to form a mainly marine neritic facies, overlying the littoral/continental Lower Balikpapan Layers, and eastwards occupying more and more of the total column of the Balikpapan Formation. Since no detailed sections clarifying the spatial stratigraphic relationships involved have been published, it seems expedient (1) to rely on the original field observations which place Rutten's localities in the lower part of the Gelingseh Beds s. str., as examined in their type area of Sungai Gelingseh/Sungai Sampajau; and (2) to retain the name Gelingseh Beds (forming part and parcel of these, the Mollusca could not be more intimately connected with the pioneering exploration of the type area), be it on the tacit understanding that it has since been considered obsolete and should probably indeed be replaced by Upper Balikpapan Layers.

As mentioned before (Beets, 1941, p. 196), Rutten's localities 144, 149, 150, 'Sg. Gelingseh layers 1 & 2' – and also 'Source area of Sg. Gelingseh', not included at the time – were all considered to be of approximately the same age, according to the evidence obtained by Rutten in the field. For convenient reference they are indicated in the present paper by the letters A (Source area of Sg. Gelingseh), B-Bb (Sg. Gelingseh, layers 2 (= lower) and 1 (= upper) respectively), C (loc. 144), D (loc. 149) and E (loc. 150). It should be noted that the order in which the localities are mentioned does not by itself carry any sequential stratigraphic connotation.

As may be repeated here, Martin (1914) concluded that the one collection discussed by him, from loc. B-Bb, seemed to correlate with a level intermediate between Njalindung and Tjilanang, a view supported by Gerth (1923, pp. 41, 46: Nr 35). He added that in his opinion the Foraminifera from the Source area of Sg. Gelingseh, loc. A, showed it to be older than B-Bb (Martin, 1914, p. 336).

It is most regrettable that Rutten's field notes should appear to have vanished in the post-war years, the localities A and B-Bb being the only ones indicated on a small-scale map (Martin, 1914, p. 327). As matters stand, the author can merely add a few particulars of the localities C-E from a letter received by him from Rutten as long ago as 1940. The localities may be enumerated as follows:

A — Source area of Sungai Gelingseh (actually, just south of it): calcareous clays. First mentioned by Rutten (1913, pp. 283-284, 287: 'Mergel vom Sg. Gelingseh (Sangkoelirang)') as probably being of the same age as his locality Tapian Langsat (Beets, 1981b). Next, it is mentioned by van der Vlerk (1925, table facing p. 30): Lower part of the Gelingseh Beds: 'b. A clayish marl from the source district of Sgei. Gelingseh, at the Gg. Batoe-anticline, ...'.

B-Bb — Sungai Gelingseh (actually, just north of it), layers 2 (lower) and 1 (upper): calcareous clays which Rutten likened to the deposit at loc. A, and situated about 4 km north-northeast of the latter. According to a letter from Rutten dated 6-11-1940, the locality B-Bb is about halfway between his localities 144 and 149, nearer 149 and of approximately the same age as those localities and loc. 150, these three being grouped around loc. B-Bb. It is first mentioned by Rutten, 1913, p. 283, last paragraph just after loc. A; next, by Martin (1914) and Gerth (1923, pp. 41, 46, Nr 35) who properly connected the locality with the Gunung Batu anticline, whereas van der Vlerk erroneously mentioned the Batu Hidup anticline (1925, table facing p. 30: Lower part of the Gelingseh Beds: 'c. A marl from the Sgei. Gelingseh').

C — Loc. 144: According to Rutten's letter to the writer referred to above, the locality is situated about 7 km west of the junction of Sungai Sampajau with Sungai Sangkulirang (compare Rutten, 1927, p. 509, fig. 148: reconnaissance map). It is also south-southwest from loc. B-Bb, that is, nearer Sungai Gelingseh.

D — Loc. 149: According to Rutten's letter referred to under B-Bb, the locality is about 5½ km west and 7½ km south of the junction of Sungai Sampajau with Sungai Sangkulirang.

E — Loc. 150: According to Rutten's letter (see above), the locality is about 1 km southeast of loc. 149 and stratigraphically slightly younger.

Schematically, therefore, the fossil localities are distributed about as follows: see Fig. 1. The mention of Sungai Sampajau – obviously at the time more of a reference point for Rutten than Sg. Gelingseh – in connection with the positions of localities C, D and E, is at first mystifying until one compares Gerth's inset map (1923, p. 43) with Rutten's map of the Batu Hidup anticline (Rutten, 1927, p. 509).

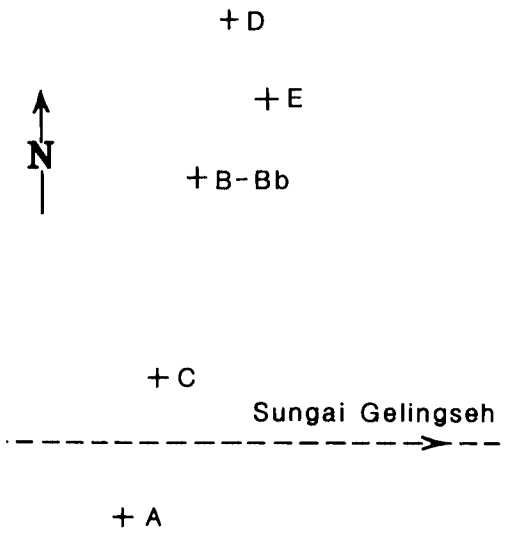


Fig. 1. Sketch to elucidate the position of the fossil localities in the Sangkulirang area. Please note that E is about 1 km SE of D, and B-Bb about 4 km NNE of A.

Description of the fauna

As is repeated here, Rutten's Gelingseh material derives from five localities which for the sake of convenience are given the letters A-E:
A – Source area of Sungai Gelingseh
B-Bb – Sungai Gelingseh, layer 2 (lower) and 1 (upper)
C – Loc. 144
D – Loc. 149
E – Loc. 150.

The specimens from the localities A and B-Bb are kept in the Rijksmuseum van Geologie en Mineralogie, their registration numbers being prefixed by the abbreviation RGM. The collections from the localities C, D and E are housed in the Instituut voor Aardwetenschappen, Utrecht.

The stratigraphic records of the species correspond with the list preceding the faunal inventory in the next chapter, to which a new symbol EM is added for application to that part of pre-Preangerian exclusive of Kama and Upper Gaj. This is done because an effort is made to consider the effect of K and UG being possibly entirely Preangerian, upon the age determination of the Gelingseh fauna.

In the descriptions the following abbreviations are used to designate institutional collections:
BMNH – British Museum (Natural History), London;
IAU – Instituut voor Aardwetenschappen, Utrecht;
RGM – Rijksmuseum van Geologie en Mineralogie, Leiden;
RNH – Rijksmuseum van Natuurlijke Historie, Leiden;
ZMA – Zoölogisch Museum, Amsterdam.

Euchelus (Euchelus) atratus (Gmelin, 1790)

Locality — B (RGM 312 001).

Range — Preangerian to Recent: NT (basal Menkrawit Beds: L.114) - N - PQ - Q - Re.

References — Altena, 1938, p. 276; Beets, 1941, pp. 11, 168, 175, 192, 196.

Comment — A juvenile specimen is available, first mentioned in 1941 with some doubt, yet so like the early part of the shell of other specimens now at the author's disposal that the identification is not doubted any more.

Gibbula (Colliculus) leupoldi Beets, 1941

Localities — B (RGM 312 002); D (IAU).

Range — Preangerian: NT (basal and Lower Menkrawit Beds: L.114, L.386; Tapian Langsat; Gunung Madupar, Rutten and Wanner).

References — Beets, 1941, pp. 12, 168, 190, 192, 196, pl. 1, figs. 11-13, 17; Beets, 1981b, pp. 15, 23, 24.

Trochus (Trochus) maculatus Linné, 1758

Localities — Bb (RGM 17 730); E (IAU).

Range — Preangerian to Recent: NT (basal Menkrawit Beds: L.114; Gunung Batuta) - UM (Antjam Beds: L.747) - P - N (Guam) - Q - Re.

References — Mawson, 1905, p. 478; Beets, 1941, pp. 16 (refs), 168, 190; Abrard, 1942, p. 50, pl. 5, fig. 29; Beets, 1950e, p. 329; Beets, 1981b, pp. 19, 23, 26.

Comments — The specimens from Rutten's localities are very much alike. It should be added that both, and the specimen from Gunung Batuta, show a partly somewhat convex base, exactly as in likewise smaller Recent shells and unlike mature ones.

Clanculus (Clanculus) gemmulifer Pilsbry, 1901

Locality — Bb (RGM 17 729).

Range — Quaternary to Recent: Q - Re (Japan).

Reference — Beets, 1941, pp. 192, 196.

Comment — The Gelingseh specimen is a fine shell which matches a smaller Recent specimen in the RNH collection very well indeed.

Smaragdia (Smaragdia) gelingsehensis sp. nov.
Pl. 1, figs. 1-7.

Holotype — RGM 312 154; Pl. 1, figs. 1-3; height 1.7 mm.
Paratypes — RGM 312 155; Pl. 1, fig 4; height 1.6 mm; loc B. RGM 312 156; fig. 5; height 1.6 mm; loc. A. RGM 312 157; fig. 6; height 1.7 mm; loc. Gunung Madupar, Rutten. RGM 312 158; fig. 7; height 1.5 mm; loc. Gunung Madupar, Rutten. RGM 312 159; loc. A.

Type-locality — Sungai Gelingseh, layer 2, Gunung Batu anticline (loc. B, this paper).

Type-horizon — Lower Gelingseh Beds s. str., exact horizon unknown.

Name — Derived from the name Sungai Gelingseh.

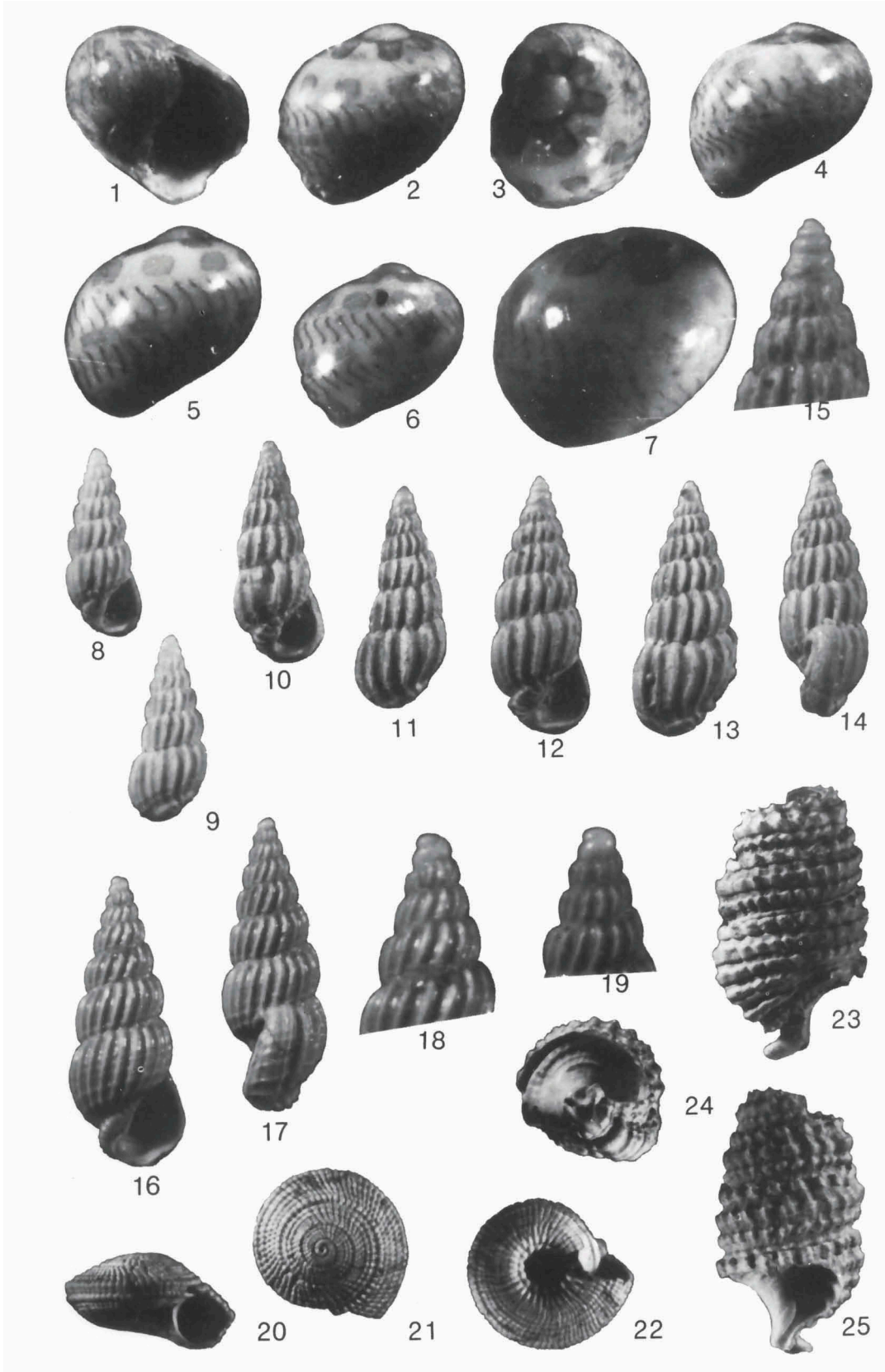
Range — Preangerian: NT (Gunung Madupar, Rutten).

Description — This is a very small species. The shell is ovoid, its protoconch button-shaped, consisting of the nucleus and nearly half a whorl, sharply delimited by an incised line. Teleoconch barely more than a single whorl, adapically flattened and with distant, near-rectangular to almost triangular brown spots which at the suture may be more or less clearly interconnected. On the abapical side first another spiral row of spots, this time squarish, and a wide zone consisting of two spiral rows of dark-brown dashes, roughly axial and showing variable shapes. Between these rows a variably expressed spiral row of short, light-brown lines (Pl. 1, fig. 4) to spirally rectangular spots (figs. 2 and 5). The base of the body whorl bears another spiral row of squarish spots.

Plate 1

Figs. 1-3. *Smaragdia gelingsehensis* sp. nov. Holotype, RGM 312 154, height 1.7 mm; loc. Sungai Gelingseh, layer 2 (= B).
Fig. 4. *Smaragdia gelingsehensis* sp. nov. Paratype, RGM 312 155, height 1.6 mm; loc. Sungai Gelingseh, layer 2 (= B).
Fig. 5. *Smaragdia gelingsehensis* sp. nov. Paratype, RGM 312 156, height 1.6 mm; loc. Source area of Sungai Gelingseh (=A).
Fig. 6. *Smaragdia gelingsehensis* sp. nov. Paratype, RGM 312 157, height 1.7? mm; loc. Gunung Madupar, Rutten.
Fig. 7. *Smaragdia gelingsehensis* sp. nov. Paratype, RGM 312 158, height 1.5 mm; loc. Gunung Madupar, Rutten.
Figs. 8-9. *Rissoina maduparensis* sp. nov. Paratype, RGM 312 162, length 2.9 mm; loc. Gunung Madupar, Rutten.
Figs. 10-11. *Rissoina maduparensis* sp. nov. Paratype, RGM 312 161, length 3.6 mm; loc. Gunung Madupar, Rutten.
Figs. 12-15. *Rissoina maduparensis* sp. nov. Holotype, RGM 312 160, length 3.9 mm; fig. 15: protoconch enlarged; loc. Gunung Madupar, Rutten.
Figs. 16-18. *Rissoina ramai* Beets, 1941. RGM 17 750, length 4.1 mm; fig. 18: protoconch enlarged; loc. Sungai Gelingseh, layer 2 (= B).
Fig. 19. *Rissoina ramai* Beets, 1941. RGM 312 164, protoconch enlarged; loc. Sungai Gelingseh, layer 2 (= B).
Figs. 20-22. *Architectonica ickeae* sp. nov. Holotype, RGM 17 760, height 5 mm, maximum diameter 13.2 mm; loc. Sungai Gelingseh, layer 2 (= B).
Figs. 23-25. *Cerithium travancorense* Dey, 1962. RGM 17 718, length 30.5+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).

Plate 1



Aperture oblique, interior of outer lip smooth, the well delimited inner labial area gently convex, its apertural edge bearing fine denticles, one or two adapical ones being a little more prominent than the others.

The author is not aware of the existence of closely related species.

Smaragdia (Smaragdia) semari Beets, 1941

Locality — A (RGM 312 004).

Range — Preangerian: NT (basal Menkrawit Beds: L.114; Gunung Madupar, Rutten and Wanner).

Reference — Beets, 1941, pp. 21, 168, pl. 1, figs. 31-33, 43 (holotype); 34-35; 36-37, 42; 38-39; 40; 41.

Comments — Eight specimens are available from loc. A and also a number from G. Madupar. Most of these do not offer any new points as to ornament, be it that the lines between the spiral rows of axial dashes are on the whole well developed: a fine dark spiral line may be present between the adapical suture and dashed zone 1, between the zones 1 and 2, 2 and 3 and between 3 and 4. One specimen (loc. A) shows, instead of zone 1, a row of almost triangular spots, each seemingly circled by a fine dark line. Other more dot-like spots may occur between the spot-like areas of dashed zones 2 and 3, while zone 4 is absent. For this reason, Ladd's *Smaragdia* sp. A (Ladd, 1966, p. 59, pl. 11, figs. 8-9), given additional material, could conceivably turn out to be synonymous with *S. semari.*

Japonia (Lagocheilus) trilirata (Pfeiffer, 1852)

Locality — E (IAU).

Range — Recent: Re (Borneo to Aru Islands).

References — Kobelt, 1902, p. 57 (refs); von Martens, 1908, p. 256.

Comments — A single fine specimen is available, bearing the same characteristic ornament as Recent Bornean shells, its height being c. 2.5 mm (the type is 3 mm high, other Recent specimens up to 6 mm). It was obtained from the filling of a marine gastropod, a *Polinices* from Rutten's loc. 150, so that there can be no doubt about the occurrence of the species in a marine deposit, as a penecontemporaneous derivative of a land fauna in the neighbourhood of its Miocene locality.

Rissoina (Schwartziella) indrai Beets, 1941

Locality — B (RGM 17 749, 312 005 (Beets, 1941, pl. 1, fig. 47), RGM 312 006 (op. cit., pl. 1, fig. 48))

Range — Preangerian: NT (basal and Lower Menkrawit Beds: L.114, L.386 & L.391; Gunung Madupar, Wanner).

Reference — Beets, 1941, pp. 23, 168, 190, 192, 196, pl. 1, figs. 44-48, 52-56.

Rissoina (Rissolina) maduparensis sp. nov.
Pl. 1, figs. 8-15.

Holotype — RGM 312 160; Pl. 1, figs. 12-15; height 3.9 mm.
Paratypes — RGM 312 161; Pl. 1, figs. 10-11; height 3.6 mm; loc. Gunung Madupar, Rutten RGM 312 162; figs. 8-9; height 2.9 m; loc. Gunung Madupar, Rutten. RGM 312 007 (one specimen): loc. A; RGM 312 163 (three specimens): loc. Gunung Madupar, Rutten, Wanner.

Type-locality — Gunung Madupar, Rutten

Type-horizon — Upper part of Upper Balikpapan Layers, precise level not known.

Name — Derived from the locality name.

Range — Preangerian: NT (Gunung Madupar, Rutten and Wanner).

Description — Shell small and slender, the protoconch consisting of three smooth whorls or a little more, terminated by an axial riblet. The whorls of the teleoconch bearing some sharp and smooth axial riblets extending from suture to suture, being almost equally narrow over most of their length but narrowing adapically and gradually more distant from one another towards the last whorl. In the middle of the whorls the riblets are variably curved, forming more or less regular axial rows. There are usually about 14 riblets per whorl, but the number may rise to 17. A few examples are: 14(last whorl)-14-14-15-14 ribs; 14-14-14-?; 15-17-14-14. Their interspaces are extremely delicately spirally striate, while in the abapical suture a stronger thread may be visible, but only on the penultimate and last whorls. The striations are sometimes almost absent. They extend into the flanks of the riblets but do not override them.

On the last whorl the weakly s-shaped riblets are continuous down to the siphonal fasciole; near it, they abruptly turn towards the axis and disappear in the groove along the fasciole. Aperture pointed adapically, outer lip bearing a strong varix, its inside smooth. Inner lip lamellate, smooth.

The species is not unlike for instance *R. ramai* (see below) but much smaller, delicately ornamented and having more apical whorls.

Rissoina (Rissolina) ramai Beets, 1941
Pl. 1, figs. 16-19.

Locality — B (RGM 17 750: Pl. 1, figs. 16-18; height 4.1 mm; RGM 312 164: Pl. 1, fig. 19; RGM 312 165: 2 specimens).

Range — Preangerian to Late Miocene: NT (basal and Lower Menkrawit Beds: L.114, L. 386; Gunung Madupar, Rutten and Wanner) - UM (Antjam Beds: L. 747).

Reference — Beets, 1941, pp. 24, 168, 190, pl. 9, figs. 341-342.

Comments — A variable species, at present also available from L.386 and G. Madupar. Protoconch variably high (Pl. 1, figs. 18-19), with 1½ smooth whorl, its nucleus small and

flattish. The post-apical whorls – one can now see slightly more than 6 of them – start with the incoming of fine axial riblets, the number of riblets per whorl remaining within the variation first observed, the greater numbers always occurring on the younger whorls. Examples: 21(last whorl) -20-17-16-14; 20-19-16-15-13; 23-20-18-16-15-15.

The spiral ornament is variable, particularly that of the flat spiral striations: these may be stronger than in the type specimens, the abapical ones invariably strongest or even the only ones developed, so that adapically to these the whorls may be smooth but for the axials (this is also shown by the holotype but only on its earlier spire whorls).

The outer lip bears a strong varix, its inside with a slight smooth callosity adapically terminated by a shallow spiral groove.

Cyclostremiscus (Ponocyclus) novemcarinatus (Melvill, 1906)

Locality — B (RGM 312 008: 2 specimens).

Range — Preangerian to Recent: NT (basal Menkrawit Beds: L.114; Tapian Langsat; Gunung Madupar, Rutten and Wanner) - M ('Early Miocene, Tf', Eniwetok) - Q - Re.

References — *Vitrinella novemcarinata*: Beets, 1941, pp. 26, 168, 175, 192, 196, pl. 1, fig. 59, pl. 9, figs. 343-345; *Cyclostremiscus novemcarinatus*: Ladd, 1966, p. 80, pl. 16, figs. 12-14; Beets, 1981b, pp. 16, 23, 24.

Comments — Two of Wanner's four specimens bear 9 spiral lirae and a secondary one on the adapical side; and another finer lira and fine striae in the umbilicus. In the other specimens the adapical secondary lira is absent. In two of Wanner's shells a couple of the most adapical primary lirae on the first 1-1½ whorl are delicately granulated due to strong development of the growth lines.

Turritella (Zaria) angulata djadjariensis Martin, 1905
Fig. 2

Locality — E (IAU).

Range — Early Miocene to Pliocene: pPr: UG (Sind; Kachh; Kathiawar: Vredenburg, 1925-1928, p. 378, in part) - Tj (loc. O, Junghuhn) - UM (Tjiodeng) - P - N - PQ.

References — *Turritella djadjariensis:* Oostingh, 1935, pp. 5 (refs), 214; Altena, 1938, p. 307, text-fig. 27; *T. angulata djadjariensis:* Beets, 1941, pp. 194, 196; *Zaria djadjariensis:* Shuto, 1974, p. 141, pl. 20, figs. 1-9.

Comments — A damaged and slightly worn specimen with four whorls preserved (height 49 mm, maximum width 23.5 mm) is available, its whorls showing almost the same profile as a shell figured by Martin as *T. duplicata* (Martin, 1879-1880, p. 69, pl. 11, fig. 13), its ornament more as in Shuto's fig. 2, with its main keel slightly more prominent, with two keels abapically to it and on th sutural ramp, three gradually weaker, fairly distant keels; adapically to these, finally three fine spiral cords closely together. The specimen was wrongly revised as *T. angulata talahabensis* Martin, 1905 (Beets, 1950e, p. 330), a form described by Martin as a variety of *T. bantamensis* Martin, 1905.

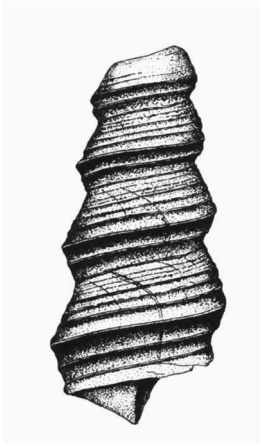


Fig. 2. *Turritella (Zaria) angulata djadjariensis* Martin, 1905, × 1 (semischematic); from loc. 150, Rutten.

Turritella (Zaria) angulata jenkinsi Cossmann & Peyrot, 1922

Locality — E (IAU).

Reference — Beets, 1941, pp. 194, 196, 197.

Comment — The characteristic subspecies *jenkinsi* (= *simplex* Jenkins, 1864) has to be struck from the faunal list of Sungai Gelingseh since the specimen once assigned to it must be presumed lost.

Turritella (Zaria) damarwulani Beets, 1941

Localities — B (RGM 312 010); Bb (RGM 17 738: holotype); C (IAU).

Range — Preangerian to Late Miocene: NT (basal Menkrawit Beds: L.114: paratypes; Lower Palembang Beds) - UM (Antjam Beds: L. 747; L. 640: paratypes, both localities).

References — Beets, 1941, pp. 27, 168, 190, 192, 194, 196, pl. 1, figs. 49, 51; Beets, 1950e, p. 330.

Comment — One specimen from the locality B is slenderer than normally is the case.

Turritella (Haustator) talarensis Eames, 1950

Localities — A (RGM 312 014: f. sedanensis); Bb (RGM 17 737: f. sedanensis); C (IAU: f. sedanensis); D (IAU: f. typica).

Range — Early Miocene to Pliocene (to Quaternary?): pPr: EM (Ba: f. typica - W: f. typica and f. sedanensis - R: f. typica and f. sedanensis, - Rr: Rm: f. sedanensis) and UG (Quilon; forma?) - NT (basal, Lower and Upper Menkrawit Beds: L.114: f. typica and f. sedanensis, L.386 & L.391: f. sedanensis, L.745: f. sedanensis; Sekurau: f. typica; Tapian Langsat: f. typica and f. sedanensis; Lower Palembang Beds: f. sedanensis) - UM (Antjam Beds: L.963: f. sedanensis; Talar Beds: f. typica) - P (Benkulen: f. sedanensis) - (?Q: presumed lapse: f. typica).

References — The species is better known as *T. subulata* Martin, 1884 and its variety sedanensis Martin, 1905: Beets, 1941, pp. 28 (refs), 168, 188, 190, 192, 194, 196, 199, 200, pl. 9, figs. 346-347; Dey, 1962, pp. 8, 13, 59; *Haustator sedanensis*: Shuto, 1974, p. 150, pl. 21, figs. 8-9; *H. subulata*: op cit., p. 151, pl. 20, figs. 29, 34, pl. 21, figs. 1-7; *Turritella talarensis*: Beets, 1981b, pp. 16, 23, 24; Beets, 1985a, pp. 5, 9, 10.

Comment — One specimen from Rutten's loc. 144 (C) is almost the forma typica while a specimen from Rutten's loc. 149 (D) is nearly the forma sedanensis.

Turritella (Haustator) trifunis Cossmann, 1910

Localities — A (RGM 312 015); B (RGM 17 740).

Range — Pliocene: P.

References — Cossmann, 1910, p. 42, pl. 2, figs. 20-21; Beets, 1950e, p. 330.

Comments — A fair number of specimens is available from loc. B, but their apical part is invariably missing. The early whorls of the teleoconch are angulate, bearing a spiral on the angulation, another at the adapical suture and soon an initially weaker third lira along the adapical suture. Later whorls flattening fairly rapidly, the adapical spiral at the same time getting stronger (as in Cossmann's fig. 21) and receding from the suture, which may then be accompanied by an additional very weak lira. Finer lirae develop between the three primary ones, usually three (the middle one stronger than the others), or two in intervals abapically to the angulation or even four adapically to it (in a specimen from loc. A). The growth lines may result in a fine reticulate ornament of the spaces between the spirals. The whorls are finally flat, but slightly concave between the ever present three primary spirals. Finally, between the secondary spirals even more delicate threads appear, one in each interval. It should be added that the adapical primary lira may be weak, or grooved and consequently double. The same applies to the middle and abapical primary lirae, but in none of the specimens more than one double spiral is present.

When more complete material is found, Ladd's *Vermicularia* sp. A (Ladd, 1972, p. 17, pl. 2, figs. 5-7) may conceivably turn out to be *T. trifunis*.

Turritella (Torcula) heberti d'Archiac & Haime, 1854
Pl. 2, figs. 1-7.

Localities — Bb (RGM 312 167: Pl. 2, fig. 1; RGM 312 168: fig. 2; RGM 312 169: fig. 3; RGM 312 170: fig. 6; RGM 312 171: fig. 7; RGM 17 739: one specimen; C.

Range — Early Miocene to Preangerian, Miocene: pPr: UG (Sind: type; Kachh, Assam) - NT (Kari Orang, Witkamp: Pl. 2, figs. 4, 5) - M ('Early Miocene, Tf', Fiji).

Reference — Beets, 1983b, pp. 25 (refs), 38, 39.

Comments — The apical part of the shells is missing but more is preserved of the earliest teleoconch whorls than in the specimens recorded so far. These early whorls reveal an unsuspected reversal of both the profile of the whorls and the role of certain spiral keels throughout growth.

The earliest whorls observed are convex, bearing a prominent spiral keel (here called no. 2) abapically to their middle, and another (no. 4) at the abapical suture. Between them, but nearer keel no. 2, a secondary spiral, no. 3 develops and, while the whorls flatten, this one becomes the 'foremost prominent spiral' of authors. Contrariwise keel no. 2 diminishes rapidly to a fine thread in the then sunken area between the newly most prominent spirals, finally disappearing altogether, while another prominent spiral, no. 1, is developing more or less along the adapical suture and receding from it. Both spirals no. 1 and no. 3 may finally be double, though not strongly so; sometimes spiral no 3 may become much weaker (this in case it had previously not been developed so prominently as in other shells).

A variable number of fine to very delicate spiral threads – which may be absent altogether – and growth striae causing granulation to varying degrees, complete the ornament. At regular intervals, more prominent growth lines with almost scale-like edges denote interrupted growth.

The species is so variable that the author does not see much point in naming varieties, as has been done by both Vredenburg and Mukerjee. There can be little doubt that Ladd's *Turritella* sp. C from Fiji (Ladd, 1972, p. 17, pl. 1, fig. 16) belongs to *T. heberti.*

Architectonica (Architectonica) karikalensis (Cossmann, 1910)

Locality — B (RGM 312 016).

Range — Early Miocene to Pliocene: pPr: UG (Quilon) - NT (basal Menkrawit Beds: L.114) - P.

References — *Philippia karikalensis*: Beets, 1941, pp. 31 (ref.), 168; Beets, 1950e, p. 330; *Architectonica karikalensis*: Dey, 1962, p. 53.

Comment — A single specimen is available, not well preserved but sufficiently so as to enable safe identification.

Architectonica (Nipteraxis) ickeae sp. nov.
Pl. 1, figs. 20-22.

Holotype — RGM 17 760: Pl. 1, figs. 20-22; height 5 mm, diameter 13.2 mm.

Type-locality — Sungai Gelingseh, layer 2; Gunung Batu anticline (loc. B, this paper).

Type-horizon — Lower Gelingseh Beds s. str., exact horizon not known.

Name — The species is named for the late Mrs H. Martin-Icke, the first palaeontologist to study Mollusca from the Gelingseh area (Martin, 1914).

Range — No previous records.

Description — Spire fairly low, protoconch sharply delimited, consisting of 1¾ smooth whorl with submerged small nucleus. There are 3½ flattened post-apical whorls, their ornament starting abruptly with fine transverse riblets and a few beaded spiral cords, two of which are more prominent: one slightly abapically to the middle, the other at the abapical suture and in between a rather deep groove. Adapically, three cords are added: a stronger one along the adapical suture, the other two weaker. All five spiral cords are beaded due to the intersection with the numerous riblets, the beads more often than not being near-rectangular. The riblets broadening abapically, prosocline but on the adapical cord suddenly radial. On the last whorl, secondary spiral lirae are added, one between the abapical couple of strong cords and another in the interval adapically to these. The most adapical cord is separated from the suture by a gradually widening and deepening flat-bottomed channel in which the riblets are weakly developed; between them occur very fine riblets or strong growth lines.

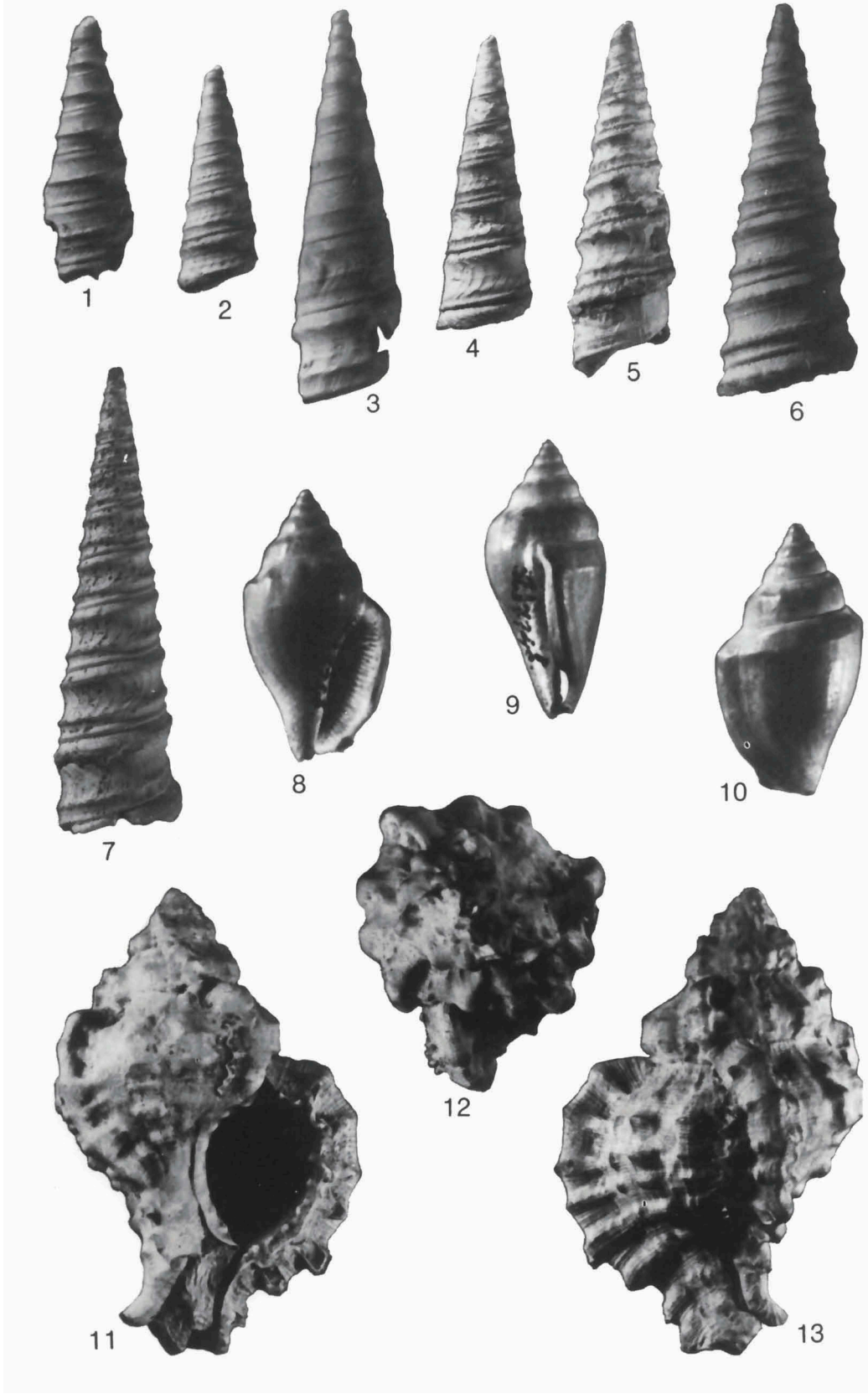
The base is convex, umbilicate, the umbilical wall with well developed growth lines and a single beaded spiral adapically to the middle. Umbilicus bordered by a strong beaded keel demarcated by a deep groove. Abapically to it occur six spiral bands and cords, the first three flat and from broad to narrower, followed by three beaded cords – the middle one more prominent – separated by gradually wider intervals, and finally, a prominent seventh cord, likewise beaded, emerging from the adapical part of the aperture. Beaded secondary spirals occur between the four beaded cords and the strong cord at the periphery, which is the most abapical cord of the dorsal surface. The numerous transverse riblets much as on the dorsal surface but less numerous at the umbilical keel, and their interspaces wedge-shaped, other riblets being inserted once or twice towards the periphery. Aperture subcircular, adapical channel rudimentary.

A. corwini Ladd (1972, p. 18, pl. 1, figs. 14-18) appears to be closely related but is more conical, has one apical whorl and four spiral cords on its dorsal surface (though in one case, five), while the base of the shell bears two instead of three flat spiral bands along the umbilical keel and again, fewer beaded cords towards the periphery. Additional material may reveal even closer relationships between the two species than presently apparent.

Plate 2

Fig. 1. *Turritella heberti* d'Archiac & Haime, 1854. RGM 312 167, length 8.5+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Fig. 2. *Turritella heberti* d'Archiac & Haime, 1854. RGM 312 168, length 15.2+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Fig. 3. *Turritella heberti* d'Archiac & Haime, 1854. RGM 312 169, length 14.2+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Fig. 4. *Turritella heberti* d'Archiac & Haime, 1854. Length 19.6+ mm; loc. Kari Orang, Witkamp.
Fig. 5. *Turritella heberti* d'Archiac & Haime, 1854. Length 23.5+ mm; loc. Kari Orang, Witkamp.
Fig. 6. *Turritella heberti* d'Archiac & Haime, 1854. RGM 312 170, length 26+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Fig. 7. *Turritella heberti* d'Archiac & Haime, 1854. RGM 312 171, length 30+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Figs. 8-10. *Strombus ickeae* sp. nov. Holotype, RGM 17 746, length 19.7 mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Figs. 11-13. *Hexaplex sampajauensis* sp. nov. Holotype, height 56.5 mm; loc. 144, Rutten (= C).

Plate 2



Vermetus (Lemintina) javanus Martin, 1879

Locality — D (a well-preserved partial shell).

Range — Early Miocene to Quaternary: pPr: EM (W - R - Rr: Rm, Rl) and K (Burma), UG (Assam, ?) - Nj - Tj - Ta - NT (basal Menkrawit Beds: L.114; Kari Orang, loc. 141, Rutten; West Borneo) - UM (Antjam Beds: L.747; Upper Dingle Formation, Panay) - M - P - N - PQ (Togopi) - Q.

Reference — Beets, 1983c, pp. 50, 59, 61.

Vermicularia (Vermicularia) lumbricalis (Linné, 1758)

Localities — A (RGM 312 011); B (RGM 312 144); C.

Range — Preangerian to Recent: NT (Mandul) - Q - Re.

Reference — Beets, 1985c, pp. 53, 70, 73.

Comment — Fragments of the *Turritella*-like spires of several specimens at hand which perhaps could not have been identified without a close comparison with the material from Mandul.

Tenagodus (Tenagodus) cf. *T. (T.) obtusiformis* Martin, 1905

Locality — C (IAU: three fragments).

Range — Early Miocene to Pliocene?: pPr: EM (R - Rr: Rl) - Ta - NT (Kari Orang, Witkamp; Lower Palembang Beds, ?) - P, ?.

Reference — Beets, 1983b, pp. 25 (refs), 38, 39.

Tympanotonos (Tateiwaia) cf. *T. (T.) merangianus* (Martin, 1922)

Locality — Bb (RGM 17 720).

Range — Preangerian to Late Miocene:: Nj - NT (Kari Orang, Witkamp) - UM (Antjam Beds: L.751).

Reference — Beets, 1983b, pp. 25, 38, 39.

Comment — A damaged specimen is at hand, 16.5+ mm long, which does not show spines on its adapical main spiral cord and on the whole, for the time being, defies certain identification although some of the Njalindung shells are quite similar.

Menkrawia callosalabiata Beets, 1941

Localities — B (RGM 312 019 (paratype: Beets, 1941, pl. 2, fig. 69); RGM 312 020 (paratype: op. cit., pl. 2, fig. 73); RGM 312 021 (paratype)); Bb (RGM 17 717 (paratype); RGM 312 017 (paratype); RGM 312 018 (paratype: op. cit., pl. 2, figs. 70, 77)).

Range — Preangerian to Late Miocene: NT (Sandakan Formation, N.E. Borneo; basal Menkrawit Beds: L.114 (holotype and paratype) - UM (Antjam Beds: L.963).

References — Beets, 1941, pp. 42, 168, 192, 196, pl. 2, figs. 69, 70-73, 77; Shuto, 1975, p. 294.

Comments — The specimen from the Antjam Beds is a fragment which compares best with shells from loc. Bb. Dickerson (1922, p. 223, pl. 2, fig. 5) figured a shell, *Cerithium* sp., which would seem to represent *M. callosalabiata*, but the figure is not wholly convincing.

Soon after the description of this species the author came to the conclusion that the relationships between *Menkrawia* and *Tympanotonos* were, after all, closer than first acknowledged (Beets, 1943, p. 92). This stand was once more taken a few years later (Beets, 1950e, p. 330). However, after careful reconsideration, taking into account also, for instance, *Diptychochilus* Cossmann, 1907, the author now reverts to his original opinion, feeling even more strongly than at first that *Menkrawia* is not just another *Tympanotonos*. This is mainly based on the peculiar, straight and *Vicarya*-like inner lip which is quite unlike any seen in *Tympanotonos*: all species belonging to this group ever seen by the author have an inner lip shaped so as to result in a well rounded peristome.

It may be added that Vredenburg (1928, p. 363, pl. 15, figs. 6, 15, 16) has figured a possibly related species from the Nari Formation, *Tympanotonos laevis* Vredenburg, 1928, whose innner lip is unfortunately not well preserved so that a close comparison with *Menkrawia* remains impossible, for the time being.

Vicarya (Vicarya) callosa Jenkins, 1864

Localities — Bb (RGM 17 734); C (IAU).

Range — Preangerian, Miocene: Nj - Tj (also loc. O & loc. P, Junghuhn) - Bo - NT (Sandakan Formation, N.E. Borneo; basal Menkrawit Beds: L.114; Gunung Batuta; Sungai Klindjau; Lower Buluan Formation, Cagayan) - M.

References — Beets, 1941, pp. 40 (refs), 168, 186, 192, 194, 196, 197, 198; *Vicarya verneuilli callosa*: Shuto, 1975, p. 294; *Vicarya callosa*: Beets, 1981b, pp. 19, 23, 26.

Comment — A fair number of beautifully preserved specimens is at hand.

Terebralia (Terebralia) kelirensis (Martin, 1916)

Localities — Bb (RGM 17 719, 17 721); C (IAU).

Range — Early Miocene to Pliocene/Quaternary: pPr: EM (W) - Nj - NT (basal, Lower and Upper Menkrawit Beds: L.114, L.386 & L.391, L.745) - UM (Antjam Beds: L.747) - PQ (Nias).

References — Beets, 1941, pp. 44 (refs), 168, 186, 190, 192, 194, 196, 197, pl. 2, figs. 80-83; Wissema, 1947, p. 49, pl. 2, figs. 35-37.

Comment — For the systematical position of this quite remarkable species compare also Shuto (1978, p. 155, pl. 18, fig. 3) and Beets (1983b, p. 26).

Colina (Ischnocerithium) menkrawitensis (Beets, 1941)

Locality — B (RGM 312 022).

Range — Preangerian: NT (basal and Lower Menkrawit Beds: L.114, L.386).

References — *Cerithium menkrawitense*: Beets, 1941, pp. 48, 168, 190, pl. 2, figs. 84-86; *Colina menkrawitensis*: Beets, 1950c, p. 330.

Comment — Three damaged specimens are available.

Rhinoclavis (Proclava) leupoldi (Beets, 1941)

Locality — B (RGM 312 023).

Range — Early Miocene to Preangerian, Neogene: pPr: EM (R - Rr: Ra) - NT (basal Menkrawit Beds: L.114; Tapian Langsat; Mentawir Beds s. str.) - N (Mandul, mixed fossils: Beets, 1950c).

References — *Cerithium leupoldi*: Beets, 1941, pp. 48, 168, pl. 2, figs. 78-79; Beets, 1950c, p. 330; *Rhinoclavis leupoldi*: Beets, 1981a, pp. 4, 5; Beets, 1981b, pp. 16, 23, 24.

Comment — Quite a few damaged specimens are at hand which are characteristic representatives of the species.

Rhinoclavis (Proclava) junghuhni (Wanner & Hahn, 1935)

Locality — A (RGM 312 025).

Range — Early Miocene to Preangerian: pPr: EM (R) - NT (Muara Kobun; Sekurau).

References — Beets, 1983a, pp. 3 (refs), 14, 16; Beets, 1985a, pp. 5, 9, 11.

Comment — A damaged but identifiable specimen is at hand.

Cerithium noetlingi Martin, 1899

Locality — B (RGM 17 715).

Range — Preangerian: NJ - NT (basal and Lower Menkrawit Beds: L.114, L.742).

Reference — Beets, 1941, pp. 54 (refs), 169, 186, 190, 192, 196, 199.

Comments — A fairly large number of specimens is available. Considering the clearly constricted siphonal canal it seems unlikely that this species could belong to *Batillaria* (cf. Shuto, 1978, p. 125, pl. 16, figs. 2a-b).

Cerithium sp. nov. aff. *C. noetlingi* Martin, 1899

Locality — B (RGM 312 142).

Range — Preangerian: NT (Kari Orang, Witkamp).

Reference — Beets, 1983b, pp. 27, 38, 39.

Comment — Several specimens at hand, much smaller than *C. noetlingi* but having a comparable ornament.

Cerithium (Ptychocerithium) travancorense Dey, 1962
Pl. 1, figs. 23-25.

Locality — Bb (RGM 17 718).

Range — Early Miocene: pPr: UG (Quilon).

Reference — Dey, 1962, p. 61, pl. 7, fig. 13.

Comment — A damaged large shell is available, its ornament so characteristic that the author can hardly doubt the identification but perhaps for the number of ribs: Dey mentions 7-9 ribs on the comparably later whorls, whereas the Gelingseh shell bears 15 or so. Nevertheless, the writer is confident that the latter belongs to *C. travancorense*, the difference being compatible with the variation in species of *Ptychocerithium*.

Cerithium (Ptychocerithium) rude Sowerby, 1840

Locality — C (IAU).

Range — Early Miocene to Preangerian: pPr: EM (R - Rr: Ra; Tsk) and UG (Sind; Kachh; Quilon) - NT (Mentawir Beds s. str.: cf.).

References — Dey, 1962, p. 61 (refs), pl. 5, figs. 11, 19; Shuto, 1978, p. 147, pl. 17, figs. 11a-b; Beets, 1981a, pp. 4, 5.

Comments — The one specimen from Rutten's loc. 144 was first recorded by the author as *C.* cf. *progoense* Martin, 1916 (Beets, 1941, pp. 194, 196). Actually, it proves to represent *C. rude*, which occurs also in collections from East Kalimantan (Pasir), as recorded before.

Cerithium (Thericium) trailli Sowerby, 1855

Locality — Bb (RGM 17 722: two specimens).

Range — Preangerian to Recent: NT (Kari Orang, loc. 141, Rutten; Gunung Batuta) - P (Sekurau, Coral Lst.) - PQ (Togopi) - Q - Re.

References — Beets, 1950a, pp. 254, 261; Beets, 1950d, pp. 307, 314, 315; *Clava trailli* var.: Nutall, 1965, pp. 161, 169; *Cerithium trailli*: Beets, 1981b, pp. 20, 23, 26; Beets, 1983c, pp. 51, 59, 61.

Clypeomorus verbeeki (Woodward, 1879)

Localities — B (RGM 312 028); Bb (RGM 17 716); C (IAU).

Range — Preangerian to Pliocene/Quaternary: Nj - Tj - UM (Tg, Eniwetok) - M - P - N - PQ (Togopi).

References — *Cerithium verbeeki*: Oostingh, 1935, pp. 48, 215; Beets, 1941, pp. 192, 194, 196; *Clypeomorus verbeeki*: Nuttall, 1965, p. 169; Ladd, 1972, p. 40; Shuto 1978, p. 147, pl. 17, figs. 10a-d.

Comment — A fairly large number of specimens is at hand, smaller than usual, presumably due to different facies conditions.

Triphora (Inella) javana berauensis Beets, 1981

Locality — B (RGM 17 728: six specimens).

Range — Early to Late Miocene: pPr: EM (Rr: Rl) - NT (Mandul; basal and Lower Menkrawit Beds: L.114, L.386; Tapian Langsat; Gunung Madupar, Rutten and Wanner) - UM (Antjam Beds: L.747).

References — Beets, 1981b, pp. 16, 23, 24; Beets, 1984c, pp. 54, 70, 73.

Triphora (Inella) maharatai Beets, 1941

Locality — E (IAU: one paratype).

Range — Preangerian to Late Miocene, Miocene: NT (basal Menkrawit Beds: L.114) - UM (Tg, Eniwetok) - M ('Early Miocene, Tf', Eniwetok).

References — Beets, 1941, pp. 62, 169, 194, 196, pl. 4, figs. 145-146; Ladd, 1972, p. 46, pl. 12, fig. 1.

Rimella (Dientomochilus) javana (Martin, 1879)

Locality — B (RGM 17 724: seven damaged specimens).

Range — Early Miocene to Quaternary?: pPr: K (Burma) - Nj - Tj (and loc. O, Junghuhn) - NT (basal and Lower Menkrawit Beds: L.114, L.386; Sekurau; West Borneo) - UM (Palabuanratu; Talar Beds: var.) - N - PQ (Togopi: var.) - Q?

Reference — Beets, 1985a, pp. 5, 9, 12.

Rimella (Dientomochilus) cancellata spinifera (Martin, 1899)

Locality — D (IAU).

Range — Pliocene to Pliocene/Quaternary: P - N - PQ (Togopi).

References — Altena, 1941, p. 42 (refs); Nuttall, 1965, p. 169.

Comment — A single quite characteristic specimen is available. It has no ornament on the exterior of the labrum; the spine at the base is broken off.

Tibia (Tibia) verbeeki(Martin, 1899)

Locality — Bb (RGM 17 723: three damaged specimens).

Range — Early to Late Miocene (to Recent?): pPr: EM (R - Rr: Rm, Rl) - Nj - Ta - Pa - Bo - NT (Mandul; Sekurau; West Borneo) - UM (Tjiodeng). If actually synonymous with *T. fusus* (Linné, 1758), which seems likely, its range would include: NT (Kari Orang, Witkamp) - UM (Upper Dingle Formation, Panay) - M - P - PQ - Q? - Re.

References — Beets, 1985a, pp. 5, 9, 12; Beets, 1985c, pp. 54, 70, 73.

Strombus (Canarium) ickeae sp. nov.
Pl. 2, figs. 8-10.

Holotype — RGM 17 746; Pl. 2, figs. 8-10; height 19.7 mm.
Paratype — RGM 312 035 (damaged specimen), loc. Bb.

Type-locality — Sungai Gelingseh, layer 1, Gunung Batu anticline (loc. Bb, this paper).

Type-horizon — Lower Gelingseh Beds s. str., exact horizon not known.

Range — No previous records.

Description — The shell is rather plump, with 7 whorls preserved which show little ornament. Protoconch damaged. Of the earlier post-apical whorls present, two are rounded, subsequent whorls bearing a rounded angulation adapically to the middle. Sutural ramp of the younger whorls slightly concave, finally largely convex instead; five whorls bearing a spiral groove near the adapical suture which disappears on the body whorl. Axial ornament consisting of weak inflations which on the last two whorls grow into ribs, best developed on the periphery. A few of the inflations which stretch from suture to suture could be varices.

Last whorl large, inflated, bearing a number of spiral striae opposite the aperture, the adapical ones weak, abapical striae better expressed. Columella adapically concave, abapically bearing a weak siphonal fasciole corresponding to the shallow siphonal notch, canal short. Inner lip well delimited, its edge adapically slightly callous and bearing a few weak granulations; also callous abapically to the middle and bearing a row of 12(?) short ridges. Outer lip thickened, its interior bearing numerous spiral ridges.

A closely related species is *S. unifasciatus* Martin, 1884 (Beets, 1941, p. 65 (refs), pl. 3, figs. 119-122) which is generally slenderer and if not, its whorls are in any case not strongly shouldered, showing many more varices which may be distributed regularly, and its ribs, when developed, being genuine ribs. Closer relationships may be shown by further material but for the time being, *S. unifasciatus* is assumed to be a separate species.

S. ickeae is one of the species originally referred to by Martin (1914, p. 330) as '*Strombus*, 2 andere Arten'.

Strombus (Strombus) preoccupatus Finlay, 1927

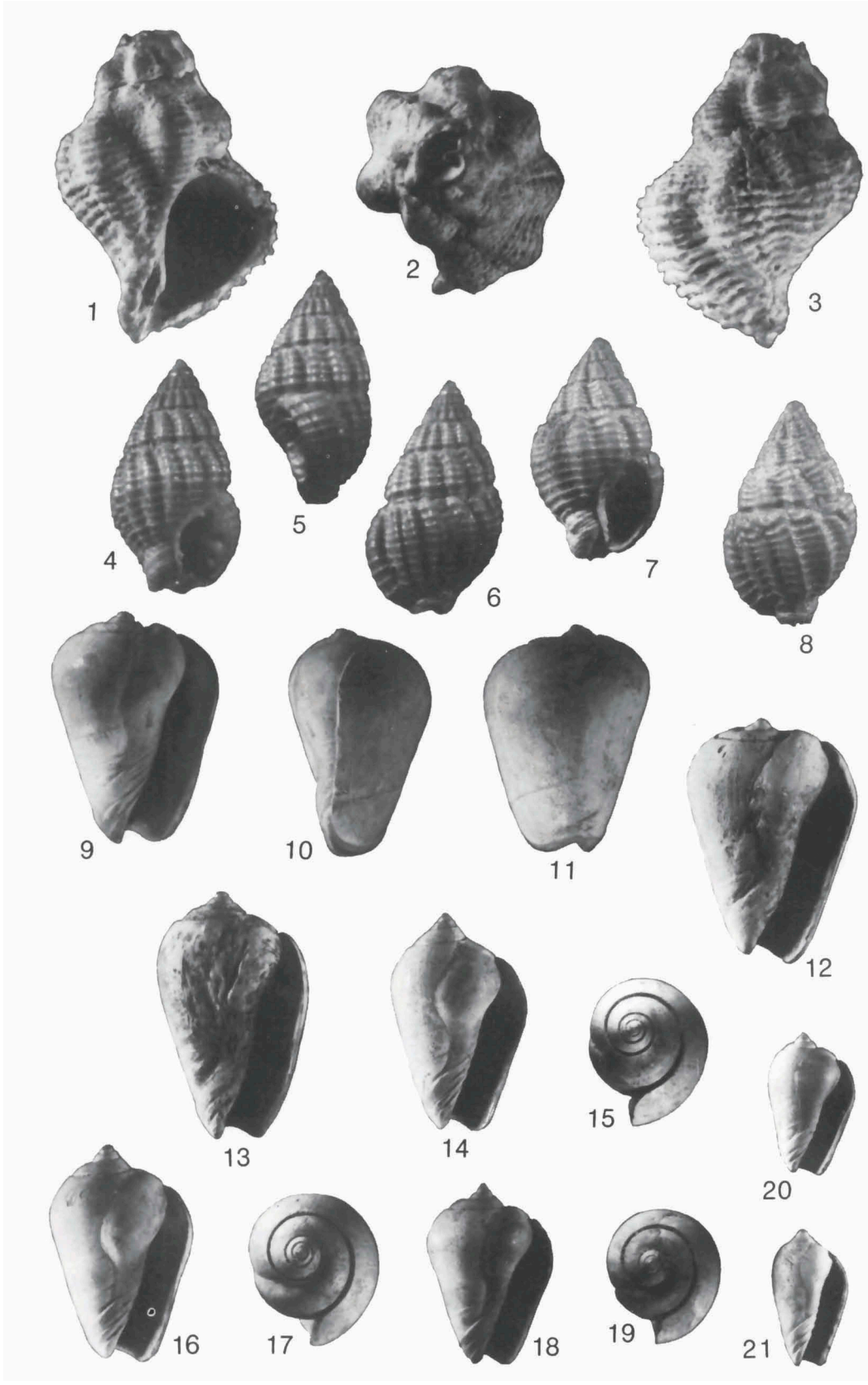
Localities — Bb (RGM 312 036); C (IAU).

Range — Early to Late Miocene: pPr: EM (W) and UG (Sri Lanka; Quillon) - Nj - Tj - NT (basal Menkrawit Beds: L.114; Purwodadi- Wirosari; Lower Palembang Beds) - UM (Tg, Guam).

Plate 3

Figs. 1-3. *Coralliophila nodosa* (Adams, 1853). RGM 17 752, height 20+ mm; loc. Sungai Gelingseh, layer 1 (= Bb).
Figs. 4-6. *Hinia gelingsehensis* sp. nov. Holotype, RGM 312 046, height 6 mm; loc. L.386, Leupold.
Figs. 7-8. *Hinia gelingsehensis* sp. nov. Paratype, RGM 17 759, height 6.4 mm; loc. Sungai Gelingseh, layer 2 (= B).
Figs. 9-11. *Olivancillaria altenai* sp. nov. Holotype, height 27.5 mm; loc. 150, Rutten (= E).
Fig. 12. *Olivancillaria altenai* sp. nov. Paratype, height 29.7 mm; loc. 150, Rutten (= E).
Fig. 13. *Olivancillaria altenai* sp. nov. Paratype, height 30 mm; loc. 150, Rutten (= E).
Figs. 14-15. *Olivancillaria altenai* sp. nov. Paratype, height 26.9 mm; loc. 150, Rutten (= E).
Figs. 16-17 *Olivancillaria altenai* sp. nov. Paratype, height 26.9 mm; loc. 150, Rutten (=E).
Figs. 18-19. *Olivancillaria altenai* sp. nov. Paratype, height 22.2 mm; loc. 150, Rutten (=E).
Fig. 20. *Olivancillaria altenai* sp. nov. Paratype, height 18 mm; loc. 150, Rutten (= E).
Fig. 21. *Olivancillaria altenai* sp. nov. Paratype, height 17.2 mm; loc. 150, Rutten (= E).

Plate 3



References — Beets, 1941, pp. 67, 169, 173, 194, 196, 199, pl. 3, figs. 123-144; *S. quilonensis*: Dey, 1962, p. 64, pl. 6, figs. 1, 5; *S.* cf. *preoccupatus*: Ladd, 1972, p. 60, pl. 18, fig. 9; pl. 19, fig. 1.

Comments — Part of the columella and an adjoining portion of the last whorl of a very large *Strombus* is available from loc. Bb, which after careful comparison is assigned to *S. preoccupatus*, together with a likewise large specimen from Rutten's loc. 144, which is easily identified. It should be noted that the specimen recorded from Gunung Batuta (Beets, 1941, p. 194) must be presumed lost.

S. quilonensis Dey, 1962 is evidently synonymous, its type being closest to specimens represented in the figs. 140 and 141 of *S. preoccupatus* given by the present author in 1941.

Strombus (Strombus) sedanensis Martin, 1899

Locality — Bb (RGM 17 745).

Range — Early Miocene: pPr: EM (R) and UG (Quilon; Sind; Kachh).

References — Vredenburg, 1925, p. 313; Haanstra & Spiker, 1932a, p. 1097; Pannekoek, 1936, p. 52; Beets, 1941, pp. 192, 196, 199; Eames, 1950, p.243.

Comments — A fine specimen and two fragments are at hand, also, a shell collected from the stream bed of Sungai Kebasian, coll. Witkamp, Instituut voor Aardwetenschappen, Utrecht.

S. daviesi Dey (1962, p. 64, pl. 6, figs. 10, 15; pl. 9, fig. 1) from Quilon is closely related but its outer lip does not reach back as wing-like as in *S. sedanensis*. Further material may clarify the relationships between these species.

Barycypraea suryai (Beets, 1942)
Pl. 5, figs. 17-19.

Locality — E (IAU: holotype, refigured).

Range — No records.

Reference — *Zoila suryai*: Beets, 1942a, p. 234, pl. 25, figs. 1-4. The original figs. 1-3 of the holotype are reproduced here.

Polinices (Polinices) callosior (Martin, 1879)

Locality — E (IAU).

Range — Preangerian to Pliocene: Tj - NT (basal Menkrawit Beds: L.114; Kari Orang, loc. 141, Rutten) - P (loc. Z, Junghuhn).

Reference — Beets, 1983c, pp. 51, 59, 61.

Polinices (Conuber?) orangensis Beets, 1983

Locality — E (IAU: holotype).

Range — Preangerian: NT (Kari Orang, loc. 141, Rutten).

Reference — Beets, 1983c, pp. 52, 59, 61, pl. 4, figs. 1-5.

Pliconacca manoharae (Beets, 1942)

Locality — A (RGM 312 039).

Range — Preangerian: NT (loc. Ko 134, Rutten: paratype, Beets, 1942a, pl. 26, fig. 42; loc. Ko 140, Rutten: holotype, Beets, 1942a, pl. 26, figs. 43-45; paratypes, Beets, 1942a, pl. 26, figs. 40- 41; Gunung Mendong).

Reference — *Natica manoharae*: Beets, 1942a, p. 251, pl. 26, figs. 40-45.

Comment — Two quite characteristic representatives of this minute species are at hand.

Natica helvacea Lamarck, 1822

Locality — E (IAU).

Range — Early Miocene to Recent: pPr: EM (Rr:Rm) and UG (Assam) - Nj - Tj - NT (Mandul; basal and Lower Menkrawit Beds: L. 114, L.386 & L.391; Sekurau; West Borneo; Tjilintung/Tjiangsana; Lower Palembang Beds) - UM (Tjiodeng; Palabuanratu; Talar Beds) - M - P - N - PQ (Togopi) - Q - Re.

Reference — Beets, 1985a, pp. 5, 9, 13; Beets, 1985c, pp. 57, 70, 73.

Natica rufa (Born, 1778)

Locality — Bb (RGM 17 733).

Range — Early Miocene to Recent: pPr: EM (R) and UG (Quilon) - Nj - Tj - Ta - Pa - NT (Mandul; West Borneo; Lower Palembang Beds) - M - P - N - PQ - (e.g., Togopi) - Q - Re.

Reference — Beets, 1985c, pp. 58, 70, 73.

Natica solida (de Blainville, 1825)

Locality — E (IAU).

Range — Pliocene? to Recent: P? - Re.

Reference — Martin, 1911-1912, p. 169.

Comment — A single specimen is at hand, agreeing very well with Recent shells from Banda and particularly, Ambon (leg. C. Jellema) in the RNH, all being slender variants in which, moreover, the umbilicus is almost closed.

Naticarius (Naticarius) marochiensis (Gmelin, 1790)

Locality — B (RGM 17 732: one juvenile shell).

Range — Early Miocene to Recent: pPr: EM (W - R - LM: Sumatrensis Lst., loc. U 24) - Nj - Ta - NT (basal Menkrawit Beds: L.114, Sekurau; Gunung Madupar, Wanner; Batu Panggal; Tjilintung/Tjiangsana) - UM (Fiji) - P - N (Tjigugur) - PQ (Togopi) - Q - Re.

Reference — Beets, 1985a, pp. 5, 9, 14.

Cymatium (Lampusia) pileare (Linné, 1767)

Localities — Bb (RGM 17 741); C (IAU: one damaged, otherwise fine specimen).

Range — Early Miocene to Recent: pPr: EM (W - R - Rr: Rm) and UG (Quilon) - Nj - Tj - Ta - Pa - NT (basal and Lower Menkrawit Beds: L.114, L.391; Tjilintung/Tjiangsana) - P - PQ - Q - Re.

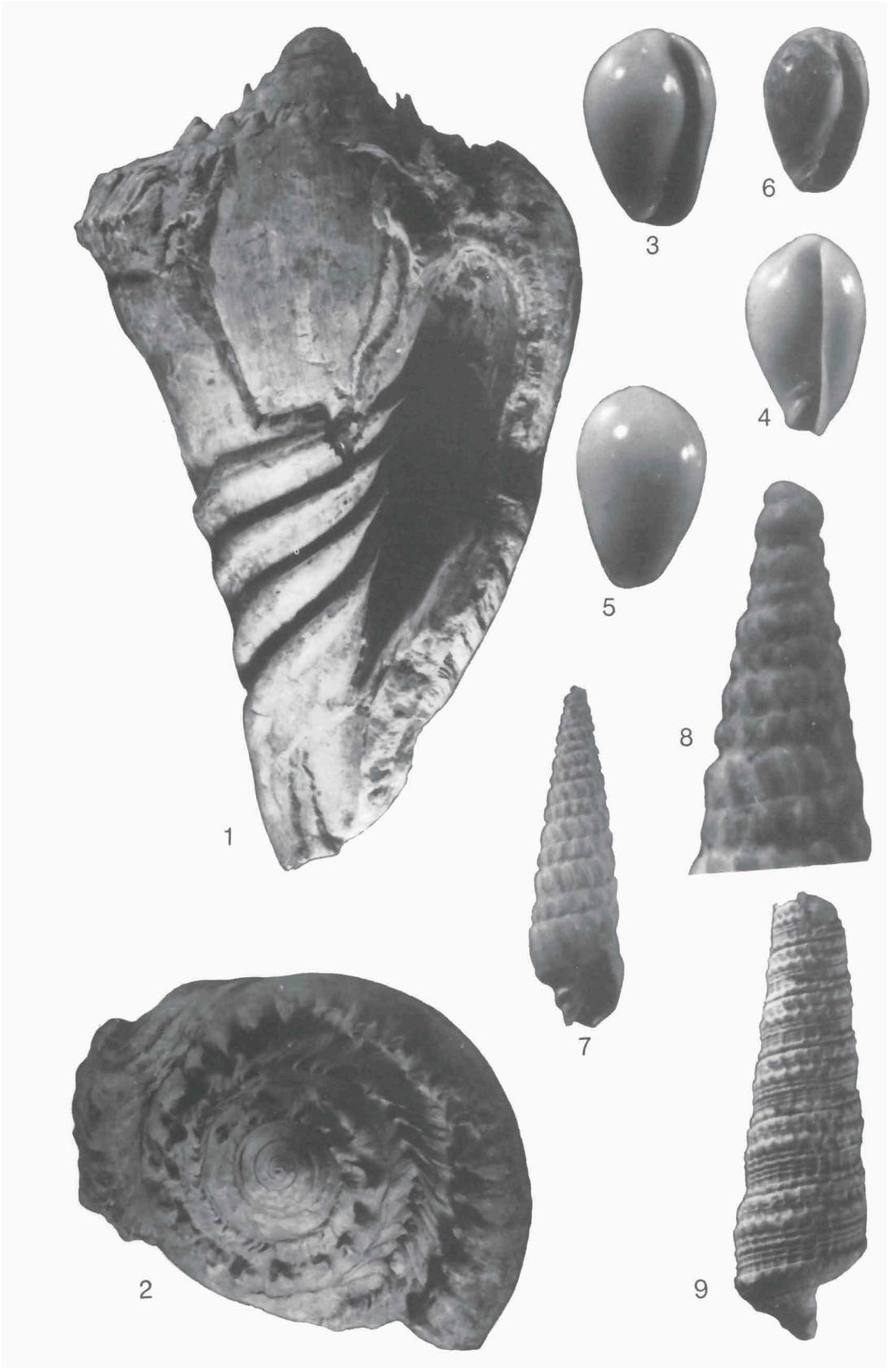
References — *Tritonium pileare*: Abrard, 1942, p. 69, pl. 7, fig. 19; *Cymatium pileare*: Beets, 1950e, p. 333 (no 46 & 47); Dey, 1962, p. 73; MacNeil, 1960, p. 59, pl. 17, fig. 10; Schmid & Walther, 1962, p. 256, pl. 27, figs. 1-2; *Lampusia pileare*: Nuttall, 1965, p. 171; *Cymatium pileare:* Kosuge, 1969, p. 784, pl. 3, fig. 50.

Comment — Two specimens are available from loc. Bb, representing the var. borneana Cox, 1948 which however seems to fall within the range of normal variability of the species.

Plate 4

Figs. 1-2. *Melo persolida* sp. nov. Holotype, height 147 mm; loc. 149, Rutten (= D).
Figs. 3-5. *Gibberulina menkrawitensis* sp. nov. Holotype, RGM 312 054, height 3 mm; loc. L. 742, Leupold.
Fig. 6. *Gibberulina menkrawitensis* sp. nov. Paratype, RGM 312 052, height 3.1 mm; loc. Sungai Gelingseh, layer 2 (= B).
Fig. 7. *Strioterebrum gelingsehense* sp. nov. Holotype, RGM 312 070, length 9.2+ mm; loc. Gunung Madupar, Rutten.
Fig. 8. *Strioterebrum gelingsehense* sp. nov. Paratype, RGM 312 071, protoconch enlarged; loc. Gunung Madupar, Rutten.
Fig. 9. *Strioterebrum* sp. a. Length 32.3+ mm; loc. 149, Rutten (= D).

Plate 4



Charonia (Sassia) fennemai (Martin, 1899)

Locality — Bb (RGM 17 742).

Range — Early to Late Miocene: pPr: EM (W - R) - Nj - Ta - Pa - NT (basal Menkrawit Beds: L.114; Kari Orang, Witkamp) - UM (Antjam Beds: L.747).

Reference — Beets, 1983b pp. 29, 38, 39.

Charonia (Sassia) menkrawitensis Beets, 1941

Locality — C (IAU: holotype and two paratypes).

Range — Preangerian: NT (basal Menkrawit Beds: L.114).

Reference — Beets, 1941, pp. 92, 169, 194, 196, pl. 5, figs. 194-198.

Colubraria tjilonganensis (Martin, 1899)

Locality — Bb (RGM 17 743).

Range — Preangerian to Pliocene: Pa - P.

References — Triton tjilonganensis: Martin, 1891-1922, p. 139, pl. 22, fig. 319; *Eutritonium tjilonganense*: Martin, 1919, pp. 87, 130; van der Vlerk, 1931, p. 239; van Es, 1931, p. 57.

Comments — A 19.5 mm long specimen is available which was considered to be a variety (Beets, 1941, pp. 192, 196: *Charonia tjilonganensis*). Compared with the type, its ribs are sometimes more curved, the interior of the labrum bears a couple of denticles less, its spire is a little plumper and its whorls a little flatter. However, these points after all would seem to fall within the variation normal for the species of this genus (Beets, 1950e, p. 333).

Hexaplex (Phyllonotus) sampajauensis sp. nov.
Pl. 2, figs. 11-13.

Holotype — Pl. 2, figs. 11-13; height 56.6 mm (IAU).
Paratype — RGM 17 735; loc. Bb.

Type-locality — Loc. 144, Rutten, about 7 km west of the junction of Sungai Sampajau with Sungai Sangkulirang (loc. C, this paper).

Type-horizon — Lower Gelingseh Beds s. str., exact horizon not known.

Name — Derived from the name Sungai Sampajau.

Range — No previous records.

Description — This is the so-called variety of *H. microphyllus* (Lamarck, 1822) recorded by Martin and the author in succession (Beets, 1941, pp. (96), 192, 194, 197), which now appears to be a separate species.

The shell is plump, its spire fairly high, the protoconch not preserved; there are five postapical whorls, with three to four varices each and usually two ribs in their intervals. The spiral ornament consists of two abapical lirae most prominent on ribs and varices; a third, adapical one is confined to the varices and their slopes. The body whorl is large, globose, with four additional broad spirals. The aperture is large, ovate, its adapical channel demarcated by pustules on either side; interior of labrum with 8 pustules diminishing in size towards the siphonal canal. The inner lip bears a row of 9 pustules. The siphonal canal is very narrow, curved, clearly notched at its recurved end; the siphonal fasciole is rather well developed.

Closely related is *Murex timorensis* (Tesch, 1915, p. 64, pl. 10, figs. 141a-b) from the Pliocene of Timor, whose inner and outer lips however seem to be devoid of pustules, while it has an open umbilicus and is densely covered with spiral ornament.

Chicoreus juttingae (Beets, 1941)

Locality — B (RGM 17 747).

Range — Preangerian: NT (basal and Lower Menkrawit Beds: L.114, L.386).

Reference — *Murex juttingae*: Beets, 1941, pp. 95, 169, pl. 5, figs. 207-211; Beets, 1950e, p. 334.

Comments — Two juvenile specimens are at hand, likening two shells from L.386. As to shape, the species is closest to *Foveomurex* Iredale, 1936, which has however a scaly ornament.

Taurasia talahabensis (Martin, 1921)

Locality — C (IAU: one specimen).

Range — Early Miocene?, Preangerian, Neogene: pPr: K? (Burma) - Nj - Tj - N (Mandul, mixed fossils).

Reference — Beets, 1985b, pp. 40, 41, 46, pl. 2, figs. 4-6.

Coralliophila (Aldrichia?) nodosa (Adams, 1853)
Pl. 3, figs. 1-3.

Locality — Bb (RGM 17 752).

Range — Recent: Re.

Reference — *Rapana nodosa*: Hedley, 1913, p. 331, pl. 19, fig. 80.

Comments — This is Martin's *Purpura* (Martin, 1914, p. 330), much like *Aldrichia*, but apparently lacking interior labral denticles.

The spire is high, its apical part missing and only 2½ spire whorls being preserved. The latter have an angulation abapically to the middle, but gradually more rounded. Axial ornament consists of rounded ribs, which are narrower and weaker adapically. A broad flat band occurs at the adapical suture, the remainder of the surface is covered with spirals, the abapical ones are strongest. The last whorl is large, markedly constricted abapically, covered with strong spirals and between them finally occur fine lirae, one in each interval. The outer lip is damaged, its interior apparently smooth. The aperture is large, with rounded angulations at the shoulder and adapical channel; siphonal canal probably narrow, barely notched but the siphonal fasciole is well developed, hence a quite open though narrow false umbilicus is present.

Except for the siphonal fasciole flaring out more in the shell figured by Hedley, and the axial ribs seemingly less well developed on the spire whorls, it bears a remarkable resemblance to the Bornean fossil.

Coralliophila sp. A from Eniwetok (Ladd, 1977, p. 42, pl. 15, fig. 3) is perhaps related, but its angulation is sharper than in *C. nodosa* and the whorls flatter on either side of it.

Buccinulum orangense Beets, 1942

Locality — E (IAU: holotype and paratype).

Range — Early Miocene: pPr: EM (R).

Reference — Beets, 1942a, p. 225, pl. 24, figs. 10-13.

Comment — At present, a specimen referred to *B. martini* (Wanner & Hahn, 1935) and figured by the author (Beets, 1942a, p. 224, pl. 24, figs. 5-6) is assigned to *B. orangense*.

Plate 5

Figs. 1-4. *Ringicula seriaensis* sp. nov. Holotype, RGM 312 074, height 2.4 mm; loc. Seria Well 15, interval 1570-1580 m.

Figs. 5-7. *Nuculana ventricosa* (Hinds, 1843). RGM 312 178, height 5.9 mm, length 8.9 mm, inflation 2.6 mm; loc. Gunung Madupar, Rutten.

Figs. 8-10. *Spondylus apiapiensis* sp. nov. Holotype, left valve, RGM 41 570, height 19 mm, width 16.8 mm, inflation 6.3 mm; loc. Api Api, Pasir.

Figs. 11-12. *Linga antjamensis* sp. nov. Paratype, left valve, RGM 312 173, length 3.2 mm; loc. L.391, Leupold.

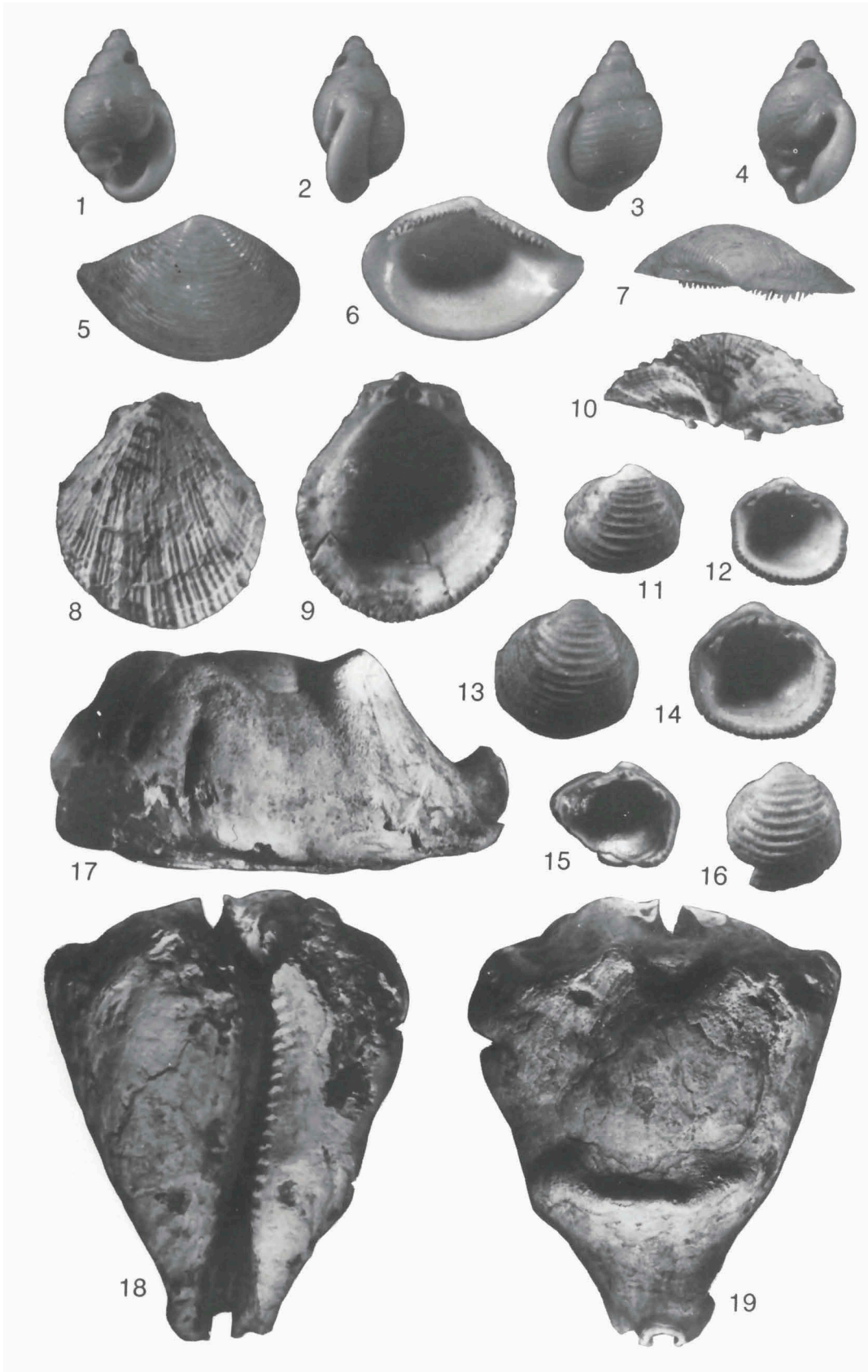
Figs. 13-14. *Linga antjamensis* sp. nov. Holotype, left valve, RGM 312 174, length 3.9 mm; loc. L.390, Leupold.

Fig. 15. *Linga antjamensis* sp. nov. Paratype 3, damaged right valve, RGM 312 175, length 3.1 mm; loc. L.747, Leupold.

Fig. 16. *Linga antjamensis* sp. nov. Paratype, damaged left valve, RGM 312 172, length 3+ mm; loc. L.386, Leupold.

Figs. 17-19. *Barycypraea suryai* (Beets, 1942). Holotype, length 107 mm, width 88 mm, inflation 53 mm (reproduction of original photographs, see Beets, 1942a, pl. 25, figs. 1-3); loc. 150, Rutten (= E).

Plate 5



Cantharus (Pollia) bucklandi (d'Archiac, 1850)

Localities — Bb (RGM 312 043); C (IAU).

Range — Early Miocene to Pliocene, Neogene (to Recent?): pPr: EM (R - Rr: Rl) and K (Burma), UG (Sind; Kachh) - Nj - Tj - Ta - Pa - NT (Mandul; Gunung Batuta) - UM (Miyazaki Group, Japan) - P - N. If actually conspecific with *C. erythrostoma* (Reeve, 1846), which seems very likely, its range would include: P - Q - Re.

References — Beets, 1950e, p. 334; Shuto, 1962, p. 51, pl. 6, fig. 13; Beets, 1981b, pp. 21, 23, 25, 26; Beets, 1985c, pp. 60, 70, 73.

Comment — The specimen from loc. Bb is juvenile. The material from Rutten's loc. 144 (C) agrees very well with Javanese specimens from Tjadasngampar (RGM 9186).

Cantharus (Pollia) fumosus (Dillwyn, 1817)

Locality — C (IAU: one specimen).

Range — Neogene to Recent: N (Saonek Besar) - Q - Re.

Reference — *Tritonidea fumosa*: van der Vlerk, 1931, p. 232.

Cantharus (Pollia) fusiformis (Martin, 1883)

Locality — Bb (RGM 17 744).

Range — Age of holotype unknown, Neogene?

References — *Tritonidea fusiformis*: van der Vlerk, 1931, p. 232; *Cantharus fusiformis*: Beets, 1941, pp. 192, 197.

Comment — A fine specimen at hand, merely 17.6 mm long but agreeing very well with the holotype and also showing the more inflated whorls characterising the species in comparison with *C. fumosus*.

Clea (Clea) nigricans Adams, 1855

Locality — Bb.

Reference — Beets, 1941, pp. 192, 197.

Comments — Unfortunately, the specimen recorded in 1941 was lost in the mails on the way to the Netherlands after having been compared with material in the BMNH by the late J.R. le B. Tomlin in 1939/'40. This species perhaps held special interest as its recent distribution in Borneo includes such localities as Sungai Guleh and S. Selankau, i.e., localities in the same general area as its Miocene habitat.

The species has to be struck from the faunal list of Sungai Gelingseh.

Volema (Volema) junghuhni (Martin, 1895)

Locality — Bb (RGM 17 731; 312 044).

Range — Early Miocene to Preangerian: pPr: EM (W) - Nj - NT (Tjilintung/Tjiangsana).

References — *Pyrula junghuhni*: Martin, 1891-1922, p. 94, pl. 20, figs. 302-304; *Melongena junghuhni*: Martin, 1911-1912, pp. 8, 10, 12, 19, 109; Martin, 1916-1917, p. 240, pl. 2, figs. 35-36; Martin, 1919, pp. 82, 126, 131; Martin, 1928, p. 122.

Comments — Martin (1914, p. 330) surprisingly left the two Bornean specimens unidentified, recording them as *Rapana*. Yet they are quite characteristic: a small, 34 mm long shell (RGM 312 044) cannot be distinguished from the Javanese specimens from Tjitalahab (RGM 9121) allthough its umbilicus is wider. The umbilicus of the larger, 50 mm long specimen is extremely wide and the suture finally more clearly channelled even than in Javanese shells from Tjibodas (RGM 9122) and Njalindung (RGM 9116). In this respect, a specimen from Tjilintung (RGM 9117) is quite alike, or almost so. Considering the variation of this and other species, for instance, *V. paradisiaca* (Roeding, 1798), there seems to be no reason for setting the Bornean specimens apart as a variety or subspecies.

As Martin remarked, *V. myristica* (Roeding, 1798) (= *Pyrula galeodes* Lamarck, 1822) is on the whole not unlike *V. junghuhni*.

Hinia (Telasco) sinusigera (Adams, 1852)

Locality — E (IAU).

Range — Pliocene to Recent: P - Q - Re.

Reference — *Nassarius sinusigerus*: Oostingh, 1938-1940, pt 12, p. 176 (refs), pl. 16, figs. 275-278.

Comment — A damaged specimen is available, with spiral ornament and riblets up to the end of the labrum. It matches Recent specimens in the RNH collection, obtained by the Siboga Expedition, beautifully.

Hinia (Uzita) gelingsehensis sp. nov.
Pl. 3, figs. 4-8.

Holotype — RGM 312 046; Pl. 3, figs. 4-6; height 6 mm.
Paratypes — RGM 17 759; Pl. 3, figs. 7-8; height 6.4 mm; loc. B. RGM 312 045 (one specimen, four) fragments); loc. B.

Type-locality — Loc. L.386, Leupold (See Beets, 1941).

Type-horizon — Lower Menkrawit Beds, exact horizon not published.

Name — Derived from the name Sungai Gelingseh.

Range — Preangerian: NT (Lower Menkrawit Beds: L.386).

Description — The shell is small, rather plump. The Protoconch has 2½ smooth whorls, including a small nucleus. The ornament of the 4¼ post-apical whorls initially consisting of fine, rapidly coarser axial riblets and, after about ¼ whorl, spiral lirae. There are from 15-16 riblets on the earlier whorls, 13 on the later ones. They extend from suture to suture, are about as wide as their intervals or a little narrower, and slightly curved to straight. There are six spirals: five adapical lirae, four of approximately equal strength, the fifth over the abapical angulation and stronger; the sixth lira is fine, near the abapical suture. Finally, a secondary lira may come in along the adapical suture. The five adapical primary lirae are slightly inflated on the ribs. Growth lines are not well developed, except for the end- varix.

Ornament of the last whorl as in *H. mangkalihatensis* (Beets, 1941, p. 101, pl. 9, figs. 357-359). The aperture is ovate, oblique, labrum with a strong varix, its interior has four abapical denticles diminishing towards the base, and two to three very weak adapical ones. The inner lip is thin, sharply delimited, bearing a strong parietal ridge demarcating the adapical channel, and about seven protruberances: 3 lirae and 3-4 granules, one of which is stronger, pustule-like.

H. mangkalihatensis is related but its protoconch is of a different shape, and consists of 2 whorls to a little over 2, while the spire whorls bear more riblets, usually 16-17.

Alectrion (Zeuxis) siquijorensis (Adams, 1852)

Locality — D (IAU: three specimens).

Range — Preangerian to Recent : NT (Lower Menkrawit Beds: L.742; Sekurau) - P - N - PQ - Q - Re.

Reference — Beets, 1985a, pp. 5, 9, 17.

Latirus (Dolicholatirus) lancea (Gmelin, 1790)

Locality — B (RGM 17 748).

Range — Miocene, Quaternary to Recent: M ('Early Miocene, Tf', Eniwetok: cf.) - Q - Re.

References — Schepman, 1907, p. 171; Beets, 1950e, p. 334; Ladd, 1982, p. 52, pl. 13, figs. 9-10.

Comments — A damaged juvenile specimen is available, 11+ mm long. It matches the early portion of a Recent specimen (leg. Hoogeveen) in the RNH splendidly. In both, the ribs are still parallel to the axis of the shell.

Peristernia (Peristernia) beberiana (Martin, 1921)

Locality — B (RGM 312 047; three specimens).

Range — Preangerian: Nj - NT (basal and Lower Menkrawit Beds: L.114, L.386).

Reference — Beets, 1941, pp. 102 (refs), 170, 190, 192, 197, 199.

Clavilithes (Clavilithes) fennemai (Martin, 1906).

Locality — C (IAU).

Range — Preangerian to Pliocene: Nj - NT (Mandul; Gunung Batuta) - P.

Reference — Beets, 1985c, pp. 69 (refs), 70, 73.

Ancilla (Sparella) cinnamomea (Lamarck, 1810)

Localities — Bb (RGM 17 726); E (IAU).

Range — Early Miocene to Recent: pPr: EM (Rr: Rm) - Nj - Tj (and loc. 0, Junghuhn) - NT (basal and Lower Menkrawit Beds: L.114, L.386; Kari Orang, loc. 141, Rutten; Sekurau; Gunung Madupar, Rutten and Wanner) - M - P - Q - Re.

Reference — Beets, 1985a, pp. 5, 9, 18.

Ancilla spec. a

Localities — A (RGM 312 049); B (RGM 312 048).

Range — Preangerian: NT (Gunung Madupar, Rutten).

Comment — At hand are three shells, a juvenile one from loc. B, a bigger one from loc. A and the biggest from Gunung Madupar, which for the time being are left undescribed.

Olivancillaria (Olivancillaria) altenai sp. nov.
Pl. 3, figs. 9-21.

Holotype — Pl. 3, figs. 9-11; height 27.5 mm; (IAU).
Paratypes — Fig. 12; height 29.7 mm; loc. E (IAU). Fig. 13; height 30 mm; loc. E. Figs. 14-15; height 26.9 mm; loc. E. Figs. 16-17; height 26.9 mm; loc. E. Figs. 18-19; height 22.2 mm; loc. E. Fig. 20; height 18 mm; loc. E. Fig. 21; height 17.2 mm; loc. E. Five specimens, loc. E.

Type-locality — Loc. 150, Rutten, about 1 km southeast of loc. 149, Rutten (loc. 150 = loc. E, this paper).

Type-horizon — Lower Gelingseh Beds s. str., exact horizon not known.

Name — The species is named for the late Dr C.O. van Regteren Altena.

Range — No previous records.

Description — The new species belongs to a group whose living representatives seem to be restricted to Brazilian waters. The protoconch is not preserved. There are about seven post-apical whorls which are separated by narrow, deeply channelled sutures, the youngest three to four whorls at any rate. The latter are slightly convex, with an upturned adapical edge along the suture; or they are more convex due to callus, particularly the youngest half of the penultimate whorl.

The spire is variably high, the last whorl more or less swollen adapically, abapically however first either slightly concave or somewhat convex. Aperture widening abapically and deeply notched, narrowing adapically, with a deep channel fusing with the sutural channel.

Columella concave adapically, with callus near the channel and abapically convex, bearing a number of columellar folds over most of its length. Abapically, there are three folds, long and curved and extending to the siphonal notch; between the two adapical of these folds there are usually two to three shorter ones whose ends may fuse. At the second short fold adapically to this set of folds occurs a sharp flexure which ends at the junction between the siphonal notch and the labrum. At the fourth short fold adapically to the first mentioned set of folds, an incised line emerges from below the inner lip: it does not correspond to a denticle on the labral edge and is crossed without change of direction by the growth lines. Inner lip well delimited, callous, particularly adapically and there extended on the parietal wall and merging with the callus of the penultimate whorl.

The author did not come across similar Indopacific species, living or extinct.

Oliva (Anazola) gibbosa jenkinsi Martin, 1879

Locality — E (IAU: a number of characteristic specimens).

Range — Preangerian to Pliocene, Neogene: Tj - NT (Tjikarang, loc. R, Junghuhn) - UM (Tjiodeng) - P - N.

Reference — Oostingh, 1935, p. 103 (refs), pl. 9, figs. 94- 96.

Oliva (Strephona) rufula djocdjocartae Martin, 1884

Locality — E (IAU).

Range — Early Miocene to Pliocene: pPr: EM (Rr: Rm) - Pa - NT (Pulu Senumpah, loc. 156, Rutten; Kari Orang, loc. 141, Rutten) - UM (Palabuanratu; Upper Dingle Formation, Panay) - M (Tjidamar, loc. K, Junghuhn; W. Sumatra) - P.

References — Beets, 1983a, pp. 11 (refs), 14, 17; Beets, 1983c, pp. 53, 59, 61.

Vexillum (Costellaria) gembacanum (Martin, 1883)

Locality — C (IAU).

Range — Early Miocene to Quaternary: pPr: EM (R - Rr: Ra - LM: Madagascar) - Nj - Tj (and loc. O, Junghuhn) - Ta - NT (Kari Orang, Witkamp; Gunung Madupar, Wanner; West Borneo; Tjilintung/Tjiangsana) - M (Tjidamar, loc. K, Junghuhn; New Guinea) - P (Sungai Guleh, Sangkulirang area; Papua New Guinea) - N - Q.

References — *Turricula gembacana*: Chapman, 1918, p. 11; *Vexillum gembacanum*: Beets, 1983b, pp. 32 (refs), 38, 39.

Vexillum (Costellaria) cf. *V. (C.) rajaense* (Martin, 1895)

Locality — C (IAU).

Range — Preangerian to Pliocene: NT (West Borneo) - P.

Reference — Oostingh, 1938, pt 3, p. 49 (ref.), pl. 12, figs. 206-213.

Comment — A small, possibly dwarfed specimen is at hand which is named with some doubt. From West Borneo more convincing material is available.

Mitra sowerbyi sedanensis Martin, 1906

Localities — Bb (RGM 17 753); C (IAU).

Range — Early Miocene to Preangerian, Miocene: pPr: EM (W - R - Rr: Ra) - Nj - NT (Mandul; basal Menkrawit Beds; L.114) - M.

References — Cernohorsky, 1976, p. 19-606 (refs), pl. 363, figs. 3-6; Beets, 1985c, pp. 61, 70, 73.

Comments — From loc. Bb, a shell of 15 mm length is available which agrees well with a few of the specimens from the Menkrawit Beds described as *M. bayeri* Beets, 1941. Another, 30+ mm long shell, its abapical end damaged, derives from loc. 144. It matches the plumper of the Javanese specimens. On the whole *M. bayeri* is smaller and slenderer than *M. sedanensis*, but a few of Martin's specimens are quite similar in this as in other respects and the author fully concurs with Cernohorsky's opinion that the two are synonymous, and also a subspecies of *M. sowerbyi* d'Orbigny, 1852.

Mitra (Tiara) tjikeusikensis Oostingh, 1939

Locality — D (IAU).

Range — Pliocene: P.

Reference — Oostingh, 1938, pt 2, p. 43 (syn.).

Comments — A slightly damaged, 29+ mm long specimen is available, agreeing well with Martin's material from Tjikeusik and Oostingh's description but for its having 4-5 spirals instead of 3-4. Bearing in mind the normal variation of the group *Tiara*, the author is confident that the Bornean shell represents Oostingh's species.

Lyria (Harpella) jugosa (J. de C. Sowerby, 1840)

Locality — B (RGM 312 051).

Range — Early Miocene to Pliocene/Quaternary: pPr: EM (W - R - Rr: Ra - LM: Madagascar) and UG (Sind; Kachh; Quilon) - Nj - NT (basal Menkrawit Beds: L.114) - PQ (Togopi: var).

References — Beets, 1941, pp. 119 (refs), 170, 186, 188, 199, 201, pl. 6, figs. 253-254; Cox, 1948, p. 51, pl. 5, figs. 3a-b; Dey, 1962, p. 84, pl. 5, fig. 6; Nuttall, 1965, p. 173.

Comment — There are some fragments, matching the shells from L.114 so well however, that the author can not in the least doubt their identity.

Cymbiola (Aulicina) tjilonganensis (Martin, 1906)

Localities — Bb (RGM 17 751); D (IAU: two juvenile shells).

Range — Preangerian to Pliocene: Ta - P.

References — *Voluta tjilonganensis*: Martin, 1891-1922, p. 302, pl. 44, figs. 718, 718a-b; Beets, 1941, pp. 192, 197.

Comments — The specimen from loc. Bb, though damaged, after a careful revision is after all unhesitatingly accepted as a true representative of *C. tjilonganensis*, and so is the specimen of *V.* aff. *tjilonganensis* recorded by Haanstra & Spiker (1932b, pp. 1313, 1319).

Melo (Melocorona) cf. *M. (M.) broderipi* (Griffith & Pidgeon, 1834)

Locality — D (IAU).

Range — Recent : Re.

Reference — Weaver & du Pont, 1970, p. 73, pl. 29C-D.

Comment — The much damaged specimen at hand shows a small part of the corona and bears four columellar plaits. It is quite similar to *M. broderipi* but as most of the spire is missing this has to be left an uncertain identification.

Melo(Melocorona) persolida sp. nov.
Pl. 4, figs. 1-2.

Holotype — Pl. 4, figs. 1-2; height 147 mm; IAU.
Paratype — A juvenile shell; loc. D (IAU).

Type-locality — Loc. 149, Rutten, about 5½ km west and 7½ km south of the junction of Sungai Sampajau with Sungai Sangkulirang (loc. D, this paper).

Type-horizon — Lower Gelingseh Beds s. str., exact horizon not known.

Name — Derived from Latin per in the sense of very, and solidus, solid, thick, strong.

Range — No previous records.

Description — The holotype is a strong, thick-walled shell, its protoconch high, apparently with five whorls, four of which are mainly smooth,; the last quarter whorl rapidly descending and bearing a few weak axials; the fifth whorl is largely hidden, its last quarter bearing numerous axials which appear to be more than just strong growth lines; it is terminated by a prosocline incised line. The latter may denote damage to the living shell but it is here that an angulation is developed, first nearer the abapical suture and subsequently nearer the adapical one. Adapically along the angulation, a rapidly more pronounced depression occurs which on the last of the two spire whorls is a deep channel. In the depression the growth lines are strongly expressed, particularly towards and at the adapical suture where a large number of opisthocline scaly edges of the notched adapical apertural channel are successively developed; these recede gradually from the suture, the latter finally being hidden by callus reaching back to the corona of the previous whorl. Abapically to the angulation of the whorls occur fine growth lines, the angulation on the last 1½ whorl bearing axially directed spines which are first closed, later open; the first half whorl bearing 7, the next 9 and the last, 16 spines.

Body whorl large and plump, outer lip missing but its basal end, judging from the growth lines, deeply notched, this siphonal notch corresponding with a weak fasciole. Inner lip callous adapically, columella bearing four strong plaits at equal intervals.

M. persolida combines the elevated protoconch and four columellar plaits of *M. broderipi* (see above), with the shoulder spines of *M. aethiopica* (Linné, 1758), likewise pointed inward towards the axis (Weaver & du Pont, 1970, p. 70, pl. 27 E-F), which species however bears three columellar plaits. Again, its protoconch is even more emergent than in *M. broderipi*, having five instead of the four apical whorls shown by both living species. Also it is considerably more thick-walled than either.

Gibberulina (Gibberulina) menkrawitensis sp. nov.
Pl. 4, figs. 3-6.

Holotype — RGM 312 054; Pl. 4, figs. 3-5; height 3 mm.
Paratypes — RGM 312 052; Pl. 4, fig. 6; height 3.1 mm; loc. B RGM 312 055, loc. L. 742, Leupold (one specimen); Gunung Madupar, Rutten (one specimen).

Type-locality — Loc. L.742, Leupold (see Beets, 1941).

Type-horizon — Lower Menkrawit Beds, exact horizon not published.

Name — Derived from the name Menkrawit Beds.

Range — Preangerian: NT (Lower Menkrawit Beds: L.742; Gunung Madupar, Rutten).

Description — The species matches the genus perfectly but for its outer lip being smooth. Shell ovate, protoconch hidden by callus expanding from the inner lip (if developed), the suture of the last whorl visible and the callus disappearing just beyond the adapical apertural channel. The inner lip is not developed in the holotype, lightly indicated in other specimens or delimited by different coloration (Pl. 4, fig. 6). Outer lip when fully developed with a weak median depression, mostly straight, adapically and abapically receding, its edge thickened and its interior smooth. Aperture long and narrow, abapically wider, without siphonal notch. Columella bearing two abapical, divergent and oblique folds (the basal one merging with the edge of the siphonal canal) and two short and weaker adapical folds (the most adapical one very weak) which are not as oblique as the two stronger folds: directly adapically of the latter, a barely visible flexure is present which extends towards the base of the labrum and merges with the fine axial line which demarcates the thickening of the lip on its exterior.

Marginella aequatorialis Thiele (1925, p. 164, pl. 22, fig. 12) seems related but is not so plump, its adapical couple of columellar folds being much stronger.

Marginella (Cryptospira) aff. *M. (C.) elegans* (Gmelin, 1788)

Localities — Bb (RGM 17 725) ; C (IAU); E (IAU).

Range — Early Miocene to Prangerian: pPr: EM (R - Rr: Rm; Rl) - Tj (and loc. 0, Junghuhn) - NT (Muara Kobun; Kari Orang, Witkamp; Sekurau; Gunung Madupar, Wanner; Lower Palembang Beds).

Reference — Beets, 1985a, pp. 5, 9, 21.

Clavus spec. d

Locality — B (RGM 312 059).

Range — Preangerian: NT (Gunung Madupar, Rutten).

Gemmula (Gemmula) granosa woodwardi (Martin, 1884)

Locality — C (IAU).

Range — Early Miocene to Pliocene, Neogene: pPr: EM (R - Rr: Ra; Rm; Rl) and K (Burma), Ug (Assam) - NT (Mandul; Muara Kobun; Pulu Senumpah, loc. 156, Rutten; Mentawir Beds s. str.; West Borneo; Tjikao; Lower Palembang Beds) - UM (Upper Dingle Formation, Panay) - P - N.

Reference — Beets, 1985c, pp. 62, 70, 73.

Gemmula (Gemmula) imitatrix (Martin, 1916)

Localities — B (RGM 17 713); C (IAU).

Range — Early Miocene to Quaternary: pPr: EM (W) - Nj - Ta - NT (basal, Lower and Upper Menkrawit Beds: L.114, L.386, L.745 & L.746; Kari Orang, Witkamp; Gunung Madupar, Rutten and Wanner; Mentawir Beds s. str.) - UM (Antjam Beds: L.751) - M - P - PQ - Q.

Reference — Beets, 1983b, pp. 35, 38, 39. It should be noted that the species does not occur at loc. Bb (cf. Beets, 1941, p. 192).

Gemmula (Gemmula) karangensis (Martin, 1895)

Locality — Bb (RGM 17 727).

Range — Preangerian to Pliocene: Nj - NT (Gunung Batuta; Gunung Madupar, Rutten and Wanner; Tjilintung/Tjiangsana) - P.

References — *Pleurotoma karangensis*: van der Vlerk, 1931, p. 218; *Gemmula karangensis*: Beets, 1981b, pp. 21, 23, 26.

Comment — Three specimens at hand. On approximately one-fifth whorl at the end of the protoconch, three to four very fine axials are developed.

Turris albinoides (Martin, 1883)

Locality — D (IAU).

Range — Preangerian: K - Nj - Tj - Ta - Pa.

References — *Pleurotoma albinoides:* Martin, 1883, p. 227, pl. 10, figs. 23, 23a; Martin, 1891-1922, p. 36; Martin, 1911-1912, pp. 10, 19; Martin, 1919, pp. 74, 126, 130; Martin 1921-1922, p. 448, pl. 1, fig. 11; Martin, 1928, p. 113.

Comments — A 25.5+ mm long specimen at hand, its main keel clearly double. It agrees well with specimens from Tjilongan and Tjadasngampar. The interior of its damaged labrum does not show spiral lirae.

Turridrupa? witkampi Beets, 1983

Locality — C (IAU: holotype).

Range — Preangerian: NT (Kari Orang, Witkamp: paratype).

Reference — Beets, 1983b, pp. 34, 38, 38, 39, pl. 3 figs. 12-17.

Conus decollatus Martin, 1884

Localities — Bb (RGM 312 064); C (IAU).

Range — Early Miocene to Preangerian: pPr: EM (R) and K (Burma), Ug (Assam) - Nj - Ta - NT (Kari Orang, loc. 141, Rutten; West Borneo).

Reference — Beets, 1983c, pp. 55 (refs), 59, 61.

Comment — A small specimen at hand from loc. Bb, and a reasonably well preserved specimen from loc. C.

Conus djarianensis Martin, 1895

Locality — D (IAU).

Range — Preangerian to Pliocene/Quaternary: Tj - NT (West Borneo) - UM (Tjiodeng; Palabuanratu) - PQ (Togopi).

References — Martin, 1891-1922, p. 20, pl. 3, figs. 45-50; Martin, 1928, p. 113; Nuttall, 1965, p. 175.

Comment — One fine specimen is available which agrees very well with the smaller of the specimens from Tjiodeng, in which the spirals on the last whorl likewise do not extend far adapically.

Conus odengensis Martin, 1895

Localities — Bb (RGM 17 711); C (IAU).

Range — Early Miocene to Pliocene: pPr: EM (R - Rr: Ra, Rm, Rl) and K (Burma, UG (Pakistan; Assam; Quilon) - Nj - Ta - Pa - NT (basal Menkrawit Beds: L.114; West Borneo; Lower Palembang Beds) - UM (Tjiodeng) - P.

References — Beets, 1941, pp. 132 (refs), 170, 173, 188, 194, 197, 201; Beets, 1950e, p. 336.

Comments — Three specimens at hand from loc. Bb, originally recorded as *C.* cf. *C. junghuhni* Martin and as a new species (Beets, 1941, p. 193). After all these appear to belong to *C. odengensis*, agreeing very well with specimens from L.114. The author no longer doubts the identity of the shells from loc. 144 (C), but a doubtfully recorded specimen from loc. 150. is actually a *C. virgo* (see below).

Conus vimineus Reeve, 1849

Locality — D (IAU).

Range — Preangerian to Recent: NT (Sekurau; West Borneo; Lower Palembang Beds) - M ('Upper Miocene', Papua) - P - N - Re.

Reference — Beets, 1985a, pp. 5, 9, 25.

Comment — One rather well preserved specimen is at hand.

Conus virgo Linné, 1758

Localities — Bb (RGM 17 712); D (IAU); E (IAU).

Range — Preangerian to Recent: Tj (and loc. O, Junghuhn) - PQ - Re.

References — Martin, 1879-1880, p. 12, pl. 14, fig. 1; Tesch, 1915, p. 21, pl. 2, fig. 23,; Martin 1928, p. 113; Beets, 1941, pp. 192, 197; Beets, 1950e, p. 336, No 82.

Comment — A fine specimen from loc. Bb and two poorer ones from loc. 149 (D) and loc. 150 (E) agree well with Recent shells from Nossi-Bé in the RNH, as well as with most of Junghuhn's material.

Conus sp. a

Locality — C (one specimen defying identification).

Range — Preangerian: NT (Kari Orang, Witkamp).

Reference — Beets, 1983b, pp. 35, 38, 39.

Strioterebrum gelingsehense sp. nov.
Pl. 4, figs. 7-8

Holotype — RGM 312 070; Pl. 4, fig. 7; height 9.2+ mm.
Paratypes — RGM 312 071; Pl. 4, fig. 8, loc. Gunung Madupar, Rutten. RGM 312 069 (one specimen), loc. B; loc. Gunung Madupar, Wanner (two specimens).

Type-locality — Loc. Gunung Madupar, Rutten.

Type-horizon — Upper Gelingseh Beds s. str., precise level not known.

Name — Derived from the name Sungai Gelingseh.

Description — The slender shell consisting of flat, gradually higher whorls, the conical protoconch of 1½ smooth whorl having a rather inflated nucleus. The post-apical whorls bearing fine axials and soon (within ¼ whorl) a persistent adapical sutural band delimited by a groove cutting the riblets. On the abapical, wider part of the whorls the riblets are oriented differently from the ones on the adapical band. Growth lines are well developed,

particularly on either side along the groove. Very fine striae for the almost absent spiral ornament.

No very closely related species seem to exist.

Strioterebrum sp. a
Pl. 4, fig. 9.

Locality — D (IAU).

Range — Pliocene: P (Tanah Belang and Sungai Guleh, coll. Schmidt, RGM).

Ringicula seriaensis sp. nov.
Pl. 5, figs. 1-4.

Holotype — RGM 312 074; Pl. 5, figs. 1-4; height 2.4 mm.
Paratype — RGM 312 073, loc. A.

Type-locality — Seria Well 15, interval 1570-1580 m (Shell Co.).

Type-horizon — Miri Formation, exact level not published.

Name — Derived from the name Seria.

Range — Preangerian: NT (West Borneo, Seria Well 15).

Description — Two minute specimens with a conical spire at hand, the protoconch missing. Post-apical whorls flattened convex, with well marked sutures, almost entirely smooth and glossy, spiral grooves appearing on the penultimate whorl and covering its whole surface, clearest on the body whorl. The latter is large and convex, entirely covered with spiral grooves. Outer lip thickly callous, smooth, its middle with a rather strong swelling, at the base and around the siphonal canal merging with the inner lip. The latter is well developed and sharply demarcated, adapically bearing a parietal ridge which expands into a triangular callus towards the edge of the lip. Columella bearing two sharp divergent folds, the adapical one short, the basal fold adapically accompanied by a short fold-like swelling ending at the edge of the columellar lip. Aperture narrow, abapically clearly notched.

R. turrita Martin, 1884 (Martin, 1883-1887, p. 45, pl. 4, fig. 45) is perhaps more closely related than any other species but its shape, particularly of the wide aperture, is different and its labrum much thinner.

Ringicula sp. a

Locality — B (RGM 312 075, a characteristic minute specimen).

Range — Early Miocene: pPr: EM (LM: Sumatrensis Limestone, Antjam, loc. L.618; see Beets, 1941, p. 189).

Cylichna triplicata (Martin, 1916)

Locality — B (RGM 312 076).

Range — Early Miocene to Late Miocene: pPr: EM (W - Rr: Ra) - NT (basal Menkrawit Beds: L.114; Gunung Madupar, Rutten and Wanner) - UM (Antjam Beds: L.747).

Reference — Beets, 1941, pp. 144 (refs), 171, 186, 190, 199, pl. 7, fig. 294.

Comment — A fragment is at hand which is probably safely identified as it agrees very well with other specimens of this most characteristic species.

Cylichna? sp. a

Locality — B (RGM 312 077).

Range — Preangerian: NT (Gunung Madupar, Rutten).

Comment — Fragmentary specimens are available which very likely represent one and the same species.

Nucula (Nucula) njalindungensis Martin, 1919

Localities — A (RGM 312 079); B (RGM 17 758).

Range — Preangerian; Nj - NT (basal Menkrawit Beds: L.114; Tapian Langsat; Gunung Madupar, Rutten and Wanner; Mentawir Beds s. str.).

References — Beets, 1981a, pp. 6, 7; Beets 1981b, pp. 17, 23, 24, 25.

Comment — The specimen from loc. A is minute, yet easily identifiable due to the very characteristic ornament.

Nuculana (Sacella) ventricosa (Hinds, 1843)
Pl. 5, figs. 5-7.

Locality — A (RGM 312 080).

Range — Preangerian to Recent: NT (Gunung Madupar, Rutten (RGM 312 178: Pl. 5, figs. 5-7; RGM 312 179) and Wanner) - Re.

Reference — Reeve, 1843-1878, vol. 18, *Laeda*, pl. 5, fig. 30.

Comments — Loc. A yielded fragments, while Ruttens's material from Gunung Madupar contains a fine valve and a few fragmentary ones, and Wanner's collection from the same locality, a damaged but otherwise well preserved specimen. The material was long ago compared with the type material in the BMNH.

Barbatia (Barbatia) fusca (Bruguière, 1789)

Localities — C (IAU); E (IAU).

Range — Preangerian to Recent: Tj - NT (Kari Orang, Witkamp; Tjilintung/Tjiangsana) - M - P - PQ (Togopi) - Q - Re.

References — Beets, 1983b, pp. 35 (references to be added: Saurin, 1936, p. 234; Hudson et al., 1957, pp. 397, 399), 38, 39.

Barbatia (Acar) plicata (Dillwyn, 1817)

Localities — Bb (RGM 17 755); C (IAU).

Range — Early Miocene to Recent: pPr: EM (R) - UM (Young Miocene, New Hebrides) - M - P - PQ - Q - Re.

References — *Arca plicata*: Prashad, 1932, p. 50 (refs); *Arca divarigata*: Ostergaard, 1935, pp. 16, 17, 49; *Barbatia plicata*: Cox, 1939, p. 32; *Arca reticulata*: Beets, 1941, pp. 5, 193; *Arca plicata*: Abrard, 1942, p. 20, pl. 2, fig. 10; Abrard, 1946, p. 30; Beets, 1950e, p. 337; *Acar plicata*: Kosuge, 1969, p. 788, pl. 7, fig. 133.

Comment — A left valve is at hand from loc. Bb and three reasonably well preserved valves from loc. C. The material from the Rembang Beds recorded by the author in 1941 is numbered RGM 5276.

Trisidos semitorta (Lamarck, 1819)

Localities — B (RGM 312 081); D (IAU).

Range — Oligocene to Recent: pPr: O (Nari, Sind), EM (Lower Telisa Beds) and UG (Sind, Pakistan, Assam) - NT (basal and Lower Menkrawit Beds: L.114, L.386; basal and Lower Palembang Beds) - UM (Antjam Beds: L.747; Upper Dingle Formation, Panay) - P - PQ (Togopi) - Q - Re.

References — *Arca semitorta*: Beets, 1941, pp. 150 (refs), 171, 173, 188, 190, 193, 197; *Trisidos semitorta*: Nuttall, 1965, p. 176; Shuto, 1971, p. 9, pl. 4, fig. 17.

Comments — There are numerous more or less fragmentary valves from loc. B and from loc. D, a right valve. The latter is somewhat flatter than usual but just like a Recent shell compared, as well as a fossil figured by Tesch (1920, pl. 21, fig. 262) and also *Arca filigrana* d'Archiac & Haime, 1853 (Beets, 1950e, p. 337: misspelt *subfiligranosa*). The species appears also to occur in the Quaternary collection from Biliton in the RGM.

Anadara (Anadara) mangkalihatensis (Beets, 1941)

Locality — B (RGM 312 082); C (IAU).

Range — Preangerian: NT (basal and Lower Menkrawit Beds: L.114, L.386, L.391).

Reference — *Arca mangkalihatensis*: Beets, 1941, pp. 154, 171, 190, 193, 194, 197, pl. 8, figs. 311-312; pl. 9, figs. 380-382.

Scapharca (Scapharca) biformis (Martin, 1885)

Locality — D (IAU).

Range — Preangerian to Pliocene, Miocene, Neogene: NT (Sebahat Formation: cf.) - M ('Upper Miocene', Papua) - P - N.

References — *Arca biformis*: Chapman, 1918, p. 12; Oostingh, 1935, pp. 136 (syn., exclusive of Haanstra & Spiker, 1932), 218; Beets, 1950e, p. 337; *Anadara* cf. *biformis*: Nuttall, 1964, pp. 165, 166.

Comment — Three left valves and a right one at hand, bearing 23?-24 ribs.

Scapharca (Scapharca) hulshofi (Martin, 1910)

Locality — A (RGM 312 083).

Range — Early Miocene: pPr: EM (R).

References — *Arca hulshofi*: Martin, 1891-1922, p. 376, pl. 53, figs. 109-112; Haanstra & Spiker, 1932a, p. 1097; Pannekoek, 1936, p. 65. (Compare also Beets, 1950e, p. 337, under *Arca biformis*).

Comment — A rather juvenile left valve at hand. It matches typical specimens from the Rembang Beds.

Arcopsis (Arcopsis) sculptilis (Reeve, 1844)

Localities — B (RGM 312 085: Beets, 1941, pl. 8, fig. 306; RGM 312 086); D (IAU).

Range — Early Miocene to Recent: pPr: UG (Quilon) - NT (Mandul; basal and Lower Menkrawit Beds: L.114, L.386; Tapian Langsat; Gunung Madupar, Wanner) - PQ (Togopi) - Q? - Re.

References — *Arca sculptilis*: Beets, 1950e, p. 337; *Fossularca sculptilis*: Dey, 1962, p. 41, pl. 2, figs. 13-15; *Arcopsis sculptilis* Beets, 1981b, pp. 18, 23, 24; Beets, 1985c, pp. 64, 70, 73.

Pecten (Flabellipecten) sedanensis Martin, 1909

Locality — A (RGM 312 087).

Range — Early Miocene: pPr: EM (LM, East Africa - R - Rr: Rm) and UG (Pakistan).

References — Cox, 1927, p. 39, pl. 5, figs. 5-6; Pannekoek, 1936, p. 63; Eames & Cox, 1956, p. 51, pl. 17, figs. 2-3.

Comment — A damaged but otherwise characteristis valve is at hand.

Chlamys (Chlamys) senatoria (Gmelin, 1791)

Locality — C (IAU: a single valve belonging to the forma typica).

Range — Oligocene? to Recent: pPr: O? (Padaung), EM (LM: Lower Telisa; Iran; Pemba Island; Kenya - W - R - Rr: RM, Rl) and UG (Sind; Sri Lanka) - Nj - Tj - NT (Sekurau; West Borneo; basal and Lower Palembang Beds) - M (Middle and Upper? Fars) - P - N (e.g., Tjigugur) - PQ (Togopi) - Q - Re.

References — Eames & Cox, 1956, pp. 14, 40; Beets, 1985a, pp. 5, 9, 30.

Spondylus (Spondylus) apiapiensis sp. nov.
Pl. 5, figs. 8-10.

Holotype — RGM 41 570, left valve; Pl. 5, figs. 8-10; height 19 mm.
Paratype — RGM 312 088, a fragment; loc. A.

Type-locality — Loc. Api Api, Pasir, East Kalimantan (Shell Co.).

Type-horizon — Presumably Early Miocene (equivalent of Rembang Beds), exact horizon not published.

Name — Derived from the locality Api Api.

Range — Early Miocene: pPr: EM (Rr: Ra).

Description — Left valve: shape slightly asymmetrical, inflation fair, shell surface densely covered with numerous riblets, eleven of which are stronger and bear variably distant nodes and spine-like pustules. In the intervals between the node-bearing ribs occur several finer riblets, one in the middle of each interval stronger than its neighbours, and bearing pustules or spines only near the ventral shell margin. Growth lines are fine, slightly wavy and densely covering the shell surface. Inner shell margin is finely dented. Ligament area long and narrow, delicately crenulated transversely at both ends. Resilium pit narrowly triangular, with adjoining sockets for larger anterior and smaller posterior hinge tooth of right valve. Cardinals upturned, the posterior one more pointed than the stronger anterior cardinal.

S. ornatissimus Böhm and *S. minor* Böhm from Neogene deposits of Madura (Böhm, 1882, pp. 369-370, pl. 3, figs. 3 and 4a-b respectively) which may well be conspecific with one another, seem closely related with *S. apiapiensis*; the latter however lacks the very fine riblets described and figured by Böhm.

Placuna (Placuna) ephippium (Philipsson, 1788)

Locality — D (IAU).

Range — Prangerian to Recent: NT (Sekurau) - UM (Tjiodeng) - P - N (Tjigugur) - PQ (Togopi) - Q - Re.

Reference — Beets, 1985a, pp. 5, 9, 31.

Comment — A pair of valves is available, showing colour remains.

Lopha (Lopha) folium (Linné, 1758)

Localities — Bb (RGM 17 754); D (IAU).

Range — Early Miocene to Recent: pPr: EM (LM: Pemba Island; Kenya) and UG (Sind) - Nj - NT (basal and Lower Menkrawit Beds: L.114, L.386; Gunung Madupar, Rutten and Wanner) - UM (Antjam Beds: L.747) - M - P - PQ - Q - Re.

References — *Ostrea folium*: Oostingh, 1935, pp. 148 (refs), pl. 14, figs. 128-129; Beets, 1941, pp. 181, 190, 193, 194, 197; Beets, 1950e, p. 338 (for p. 171 read 172).

Linga (Bellucina) antjamensis sp. nov.
Pl. 5, figs. 11-16.

Holotype — RGM 312 174: Pl. 5, figs. 13-14, left valve; length 3.9 mm.
Paratypes — RGM 312 173: Pl. 5, figs. 11-12, left valve; length 3.2 mm; loc. L.391, Leupold. RGM 312 172: fig. 16, left valve; length 3+ mm; loc. L.386, Leupold. RGM 312 175: fig. 15, right valve; length 3.1 mm; loc. L.747, Leupold. RGM 312 176: loc. L.386, Leupold (2 valves); RGM 312 177: loc. L.747, Leupold (1 valve); D (IAU: 5 valves); E (IAU: 3 valves).

Type-locality — Lower Menkrawit Beds, loc. L.390, Leupold (Beets, 1941).

Type-horizon — Exact horizon not published.

Name — Derived from the name Antjam Beds.

Range — Preangerian to Late Miocene: NT (Lower Menkrawit Beds: L.386, L.390, L.391) - UM (Antjam Beds: L.747).

Description — Shell small, tumid, height at the most 5 mm, usually less. The closest relative may be *L. javana* (Oostingh, 1935) from the Pliocene of Java (Oostingh, 1935, p. 175, text-figs. 23a-c), which is bigger, has a different shape, a very weak anterior radial depression and also a smaller number of radial riblets: 15, whereas the new species has at least 18. Its shell margin is much more coarsely crenulate, while the concentric lamellae are on the whole not so distant as in *L. antjamensis*. Finally, the lunule of the latter is fairly deeply depressed.

Another related species is *L. semperianus* (Issel, 1869), to which the Bornean material, now described as a separate species, was originally referred by the author (cf. Beets, 1950e, p. 338, no. 112).

Chama (Chama) asperella Lamarck, 1819

Localities — B (RGM 312 089); Bb (RGM 17 757); E (IAU).

Range — Early Miocene to Recent: pPr: UG (Assam) - NT (basal and Lower Menkrawit Beds: L.114, L.386, L.391) - Q - Re.

References — Cox, 1930, p. 160; Abrard, 1942, p. 29, pl. 3, fig. 11; Beets, 1950e, p. 338.

Chama (Chama) brassica Reeve, 1846

Locality — E (IAU).

Range — Quaternary to Recent: Q - Re.

References — Cox, 1931, p. 8; Abrard, 1942, p. 28, pl. 3, fig. 6; Beets, 1950e, p. 338.

Comment — Two valves are available, agreeing well with Recent specimens as well as a presumably Miocene valve from Mandul (Beets, 1950c, p. 300, no. 65: *Chama* spec.).

Chama (Chama) plinthota Cox, 1927

Localities — Bb (RGM 312 090); E (IAU).

Range — Quaternary to Recent: Q - Re.

References — Cox, 1927, p. 98; Beets, 1950a, p. 255.

Comment — A large and a small valve at hand from loc. E, and fragments from loc. Bb. The material compares well with Recent specimens in the RNH.

Glans (Centrocardita?) boettgeri (Martin, 1879)

Localities — D (IAU); E (IAU).

Range — Preangerian, Miocene: NT (Sekurau; Luzón) - M (Tjidamar, loc. K, Junghuhn).

Reference — Beets, 1985a, pp. 5, 9, 32.

Comments — There are 17 valves at hand. The species is rather variable in shape and inflation, as are many other Carditidae. The radial ribs are often clearly tripartite, as in Martin's fig. 10 (Martin, 1879-1880, pl. 17). In the type material there are 25-26 ribs, while the Gelingseh shells show a variation from 21 (3 specimens), 22 (13 specimens), 23 (9 specimens), to 24 ribs (2 specimens). Two juvenile Gelingseh valves match similarly young valves in the Semper collection from the Philippines, which had been left unidentified (Martin, 1895: Luzón, loc. No. 1, right bank of the Catalangan, Minanga).

Cardita gemmea Cox (1927, p. 51, pl. 9, figs. 1-3) seems related, but its hinge teeth are different and it has fewer ribs, viz., 18.

Crassatella radiata Sowerby, 1825

Locality — D (IAU).

Range — Early Miocene to Recent: pPr: EM (R) and K (Arakan Coast) - NT (Sekurau) - P - PQ (Togopi) - Q - Re.

References — Cox, 1931, p. 8; Beets, 1985a, pp. 5, 9, 32.

Comment — A slightly damaged right valve is available; height 12.5 mm, inflation 3.3. mm. It resembles in particular the valve figured by Oostingh (1935, p. 166) but also Martin's specimen (Martin, 1883-1887, pl. 11, fig. 228) and some Recent shells in the RNH.

Trachycardium cf. *T. denticostulatum* (Beets, 1941)

Localities — B (RGM 312 093); E (IAU).

Range — Preangerian to Pliocene/Quaternary: NT (basal Menkrawit Beds: L.114; Tapian Langsat) - PQ (Togopi).

References — *Cardium denticostulatum* Beets, 1941, pp. 163, 171, 193, 197, pl. 8, figs. 319-326; *Vasticardium denticostulatum*: Nuttall, 1965, p. 179; *Trachycardium denticostulatum*: Beets, 1981b, pp. 18, 23, 24.

Comment — The Gelingseh collection contains only fragments which, despite their being recognizable due to the very characteristic ornament, have to be recorded with some doubt.

Nemocardium (Nemocardium?) jogjacartense (Martin, 1916)

Locality — A (RGM 312 094).

Range — Early Miocene: pPr: EM (W).

Reference — *Cardium jogjacartense*: Martin, 1916-1917, p. 269, pl. 4, figs. 118-119.

Comments — Three valves are at hand, agreeing best with the smallest of the types from Gunung Spolong. In ornament the species is perhaps closest to the Late Cretaceous group of *Protocardia (Brevicardium)*.

Tridacna (Tridacna) gigas (Linné, 1758)

Locality — Bb (RGM 312 096).

Range — Preangerian to Recent: Nj - Tj - Pa - UM (New Hebrides) - P - N - PQ - Q - Re.

References — Mawson, 1905, p. 478; van der Vlerk, 1931, p. 275 (refs); van Es, 1931, pp. 82, 89; Rosewater, 1965, p. 62-045, pls 263, 267, 275-278.

Comments — A corroded and damaged as well as much sponge-bored, yet seemingly safely identifiable valve at hand, with three of its ribs very strong. It may be added that in the RGM is kept a Quaternary specimen from Pulu Miang (raised (80 m) coral reef), Sangkulirang Bay area.

Tridacna (Persikima) derasa (Roeding, 1798)

Locality — E (IAU).

Range — Preangerian to Recent: NT (Mandul) - P - Re.

Reference — Beets, 1985c, pp. 66, 70, 73.

Comments — The specimen from loc. E was recorded before under the name of its synonym, *T. serrifera* Lamarck, 1819 (Beets, 1941, pp. 195, 197). It is a typical *derasa*, with low radial ornament, six folds being better developed than the others. The specimen recorded by the author from the Pliocene of Sekurau (Beets, 1950d, p. 312) as *T. squamosa* Lamarck, 1819, must be referred to *T. derasa*, its first determination having been done with insufficient care.

Hippopus hippopus (Linné, 1758)

Localities — Bb (RGM 17 761); E (IAU).

Range — Miocene, Pliocene to Recent: M - P - N - PQ (Togopi) - Q - Re.

References — Mawson, 1905, p. 477; Abrard, 1946, p. 38, pl. 3, fig. 9; Beets, 1950d, pp. 313, 314, 315; Rosewater, 1965, p. 62-031, pls 267, 270, 271.

Comment — Some damaged valves at hand, also a couple of fragments, otherwise characteristic and likewise easily identified.

Periglypta cf. *P. granosa* (Sowerby, 1840)

Locality — A (RGM 312 097).

Range — Uncertain, Early Miocene to ?: pPr: EM (LM: Pemba Island - W) and UG (Kachh; Sri Lanka).

References — *Venus listeri*: Martin, 1916-1917, p. 272, pl. 5, figs. 130-131; *Antigona granosa*: Cox, 1927, p. 56 (refs), pl. 3, fig. 2.

Comment — Two juvenile valves at hand. Apparently, they are conspecific with Martin's material from Westprogo which Cox united with *P. granosa*.

Circe (Circe) ickeae Martin, 1922

Localities — B (RGM 312 098); C (IAU).

Range — Preangerian: Nj - Tj - NT (basal Menkrawit Beds: L.114).

Reference — *Gafrarium ickeae*: Beets, 1941, pp. 164 (refs), 171, 193, 194, 197, 199, pl. 8, figs. 329-333.

Circe (Circe) scripta (Linné, 1758)

Locality — D (IAU: a few typical valves).

Range — Preangerian to Recent: NT (Sekurau) - P - N - PQ (e.g., Togopi) - Q - Re.

Reference — Beets, 1985a, pp. 5, 9, 34 (refs).

Gafrarium tumidum Roeding, 1798

Locality — D (IAU).

Range — Early Miocene to Recent: pPr: EM (R) - P - Q - Re.

References — *Circe gibba*: Mawson, 1905, p. 477; *Cytherea gibba*: Martin, 1883-1887, pp. 213, 308; *Circe gibba*: Tesch, 1920, p. 102, pl. 21, fig. 267; Martin, 1919, pp. 64, 140, 141, 146; *Gafrarium tumidum*: Beets, 1950e, p. 338.

Comments — A beautifully preserved left valve is at hand, 31 mm long and 27 mm high. The writer follows Lynge (1909, p. 234) and Prashad (1932, p. 231) in considering *G. pectinatum* (Linné, 1758) a separate species.

Atopodonta sawitrae (Beets, 1941)

Locality — Bb (RGM 312 099).

Range — Preangerian: NT (basal Menkrawit Beds; L.114).

Reference — Beets, 1950e, p. 339.

Timoclea (Timoclea) bataviana (Martin, 1885)

Locality — E (IAU).

Range — Pliocene to Recent: P - PQ (Togopi) - Re.

Comments — One right valve is available (7.4 mm long, 5.5 mm high), matching Recent specimens from Singapore in the ZMA described as *Chione siamensis* Lynge, 1909. The writer fully agrees with Cox that the latter is synonymous with *T. bataviana* (Cox, 1948, p. 65 (refs), pl. 6, fig. 9; Nuttall, 1965, p. 180). According to Eames (1950, p. 251), the species does not occur in the Karikal Pliocene.

Timoclea (Timoclea) recognita (Smith, 1885)

Locality — E (IAU).

Range — Recent: Re.

Reference — *Chione recognita*: Lynge, 1909, p. 242.

Comments — The writer long ago recovered a small and a bigger (damaged) valve from the filling of a large gastropod from Rutten's loc. 150 and compared them with the material in the BMNH. *T. recognita* is variable; the Bornean fossils belong to the form with finer radial riblets, also on the lunule, while the distances between the concentric laminae are average, the laminae themselves being slightly finer than in most Recent valves.

Corbula scaphoides Hinds, 1843

Localities — B & Bb (RGM 17 756: two valves; it cannot be said which one derives from the one or the other layer); D (IAU).

Range — Early Miocene to Recent: pPr: UG (Quilon) - NT (Kari Orang, Witkamp) - UM (Upper Dingle Formation, Panay) - M ('Upper Miocene', W. Sumatra) - P - N - Q - Re.

Reference — Beets, 1983b, pp. 36, 38, 39.

Comment — After careful reconsideration the two valves which were long ago separated as *C. scaphoides* and *C.* cf. *C. erythrodon* Lamarck, 1818 (Beets, 1941, p. 193) are now reunited.

Corbula socialis Martin, 1879

Localities — A (RGM 312 100); D (IAU).

Range — Early Miocene to Pliocene, Neogene: pPr: EM (LM: Pemba Island; Kenya - W - R - Rr: Rm) and K (Burma), UG (Quilon; Assam) - Tj - NT (Kari Orang, loc. 141, Rutten; West Borneo; Lower Palembang Beds) - UM (Upper Dingle Formation, Panay) - M - P - N.

Reference — Beets, 1983c, pp. 58, 59, 61.

Corbula solidula Hinds, 1843

Localities — A (RGM 312 102); B (RGM 312 103).

Range — Early Miocene to Recent: pPr: EM (Rr: Rl) - NT (Mandul; basal Menkrawit Beds: L.114; Gunung Mendong; Sekurau; Tapian Langsat; Gunung Madupar, Rutten en Wanner; Mentawir Beds s. str.) - P - N - Re.

Reference — Beets, 1985c, pp. 69 (refs), 70, 73.

ADDITIONAL MATERIAL

Vermetus? sp.: B (RGM 312 113)
Cerithium? sp.: A (RGM 312 121)
Cerithium sp.: A (RGM 312 122)
Cerithium sp.: B (RGM 315 300)
Rimella sp.: Bb (RGM 312 032)
Strombus? (Doxander)? sp.: Bb (RGM 312 037)
Chicoreus sp. 1: C
Chicoreus sp. 2: E
Chicoreus sp. 3: E
Chicoreus sp. 4: Bb (RGM 17 736)
Coralliophila sp.: C
Pyrene sp.: A (RGM 312 117)
Pyrene sp.: B (RGM 312 107)
Pyrene sp.: C
Latirus spp. (two): C
Oliva sp.: A (RGM 312 118)
Vexillum (Costellaria) spp. (two): D
Mitra (Tiara) sp.: C
Cancellaria sp.: B (RGM 312 111)
Clavus sp. a: B (RGM 312 057)
Clavus sp. c: B (RGM 17 714)
Clavus sp. d: B (RGM 312 059)
Clavus sp. e: A (RGM 312 061)
Clavus sp. f: D
Clavus sp.: B (RGM 312 110)
Conus sp. (juv.): B (RGM 312 108)
Conus sp.: E
Scaphander sp.: A (RGM 312 120)
Cylichna? sp.: A (RGM 312 119)
Dentalium spp. (two): A (RGM 312 114, 312 115)
Dentalium sp.: B (RGM 312 109)
Dentalium sp.: D
Siphonodentalium sp.: A (RGM 312 116)
Arca sp.: A (RGM 312 130)
Amussium sp.: A (RGM 312 128)
Chlamys sp.: E
Anomia sp.: E
Ostrea sp.: A (RGM 312 129)
Ostrea sp.: B (RGM 312 112)
'Lucina' sp.: A (RGM 312 127)
Laevicardium spp.: A (RGM 312 131, 312 132)
Dosinia? sp.: A (RGM 312 126)
Pitar sp.: A (RGM 312 125)
Circe? spp.: A (RGM 312 123, 312 124)
Penicillus sp.: E.

Faunal lists and age determinations

The symbols and abbreviations listed and explained below conform to the stratigraphical records of the species discussed in the previous chapter. There, full use has been made of them, their number having been much restricted in the following faunal lists. The

arrangement of the symbols is largely the same as in the writer's other recent papers, but for the new symbol EM, which puts a strict limitation on the use of Early Miocene, applying to pre-Preangerian exclusive of Kama and Upper Gaj, both of which may turn out to be Preangerian equivalents.

Re — Recent
Q — Quaternary
PQ — Pliocene/Quarternary (e.g., Togopi Formation, N.E. Borneo).
N — Neogene, unclassified (e.g., Tji Gugur, Java)
P — Pliocene (Th approximately), including, e.g., Karikal (S. India) and 'Coral Limestone, Hill near Sekurau'
M — Miocene, unclassified (e.g. 'Early Miocene, Tf', Eniwetok and Junghuhn's loc. K, Tijdamar, Java)
UM — Late Miocene, in part (largely Tg, Odengian), including Tjidjarian near Tjiodeng, Java; Palabuanratu, Java; Antjam Beds, E. Borneo (L. 963, L 640, Leupold); Upper Dingle Formation, Panay, Philippines; Tg, Palau; Talar Beds, Pakistan (possibly starting in Tf3)

Preangerian:

Pr — Preangerian s. str. (Tf3), Java:
Nj — Njalindung
Tj — Tjilanang (loc. O of Junghuhn separately indicated)
Ta — Tjadasngampar
Pa — Parungponteng (= Selatjau)
NT — Preangerian equivalents, including:
Java:
Bo — Bodjongmanik Beds s. str.
Tjikao
Tjikarang, Loc. R, Junghuhn
Tjilintung/Tjiangsana
Purwodadi/Wirosari
Preangerian part of Bodas Formation
West Borneo: SHELL collections, unpublished
East Borneo:
Sandakan Formation, N.E. Borneo (Shuto, c.s.)
Sebahat Formation, N.E. Borneo (Wong)
Mandul (van Holst Pellekaan), unpublished
Menkrawit Beds (basal: L.114, Lower: L.742, L.386, L.390, L.391; Upper: L.745, L.746) (Leupold)
Muara Kobun (Schmidt)
Pulu Senumpah, loc. 156 (Rutten)
Gelingseh Beds (Source area of Sg. Gelingseh; Sg. Gelingseh, 'layers 1 & 2'; loc. 144, loc. 149, loc. 150) (Rutten), partly published
Kari Orang (Witkamp)
Kari Orang, loc. 141 (Rutten)
Gunung Mendong (Schmidt), unpublished
Sekurau (this paper)
Tapian Langsat (Rutten)
Gunung Batuta (Rutten)
Gunung Madupar (Rutten, Wanner), partly published
Batu Panggal (Schmidt)
Mentawir Beds s. str. (Rutten)
Sg. Klindjau (Witkamp)
Sumatra Lower Palembang Beds
Philippines:
Lower Pitogo Formation, Luzón
Lower Buluan Formation, Cagayan
Burma: Obogan Formation

pre-Preangerian:

pPr — pre-Preangerian s.l. (Tf1-2):

UG — Upper Gaj and equivalents, apparently Rembangian going upward into Preangerian (in part), including localities in:
Sri Lanka (Ceylon)
India: Garo Hills, Assam
Quilon, S. India
Pakistan: Sind, Katch
K — Kama, Burma, perhaps correlating with UG (including localities along Arakan Coast)
EM — Early Miocene: pre-Preangerian exclusive of Kama and Upper Gaj
R — Rembang Beds, apparently extending upward into Preangerian (in part), Java
Rr — Rembangian equivalents:
Ra - Api Api, Pasir, E. Borneo (Goldschmid), unpublished
Tsk - Tandjung Sepada Ketjil, Pasir, E. Borneo (Goldschmid), unpublished
Rm - Madura (Gsell), unpublished
Rl - Langkang (van Holst Pellekaan), unpublished
W — Westprogo Beds, Java
Ba — Badui Beds (= W + R), Java
LM — Lower Miocene:
East Borneo: Sumatrensis Limestone, loc. U.24
Sumatra: Lower Telisa Beds, approximately equivalent to Westprogo, perhaps going upward into Rembangian
Burma: Pyabwe and Kyaukkok
Iran: Lower Fars
Madagascar: described by Lemoine (1906)
East-Africa: Pemba Island, Kenya, Mozambique, described by Cox
O — Older than Westprogo, reportedly Oligocene but probably going up into Miocene: Padaung, Burma

A: SOURCE AREA OF SUNGAI GELINGSEH

The number of species from this locality is only 19, merely 3 or 15.8 % of which are still living (disregarding *Periglypta granosa*), a remarkably low figure considering that almost half of all species are, bivalves, generally longer lived than gastropods. The percentage of living forms in itself would of course suggest a Rembangian age and one gets a sneaking suspicion that K. Martin was perhaps right after all in considering loc. A to be a little older than loc. B-Bb and Tapian Langsat. However, Martin's opinion was not based on mollusks and the presently obtained percentage figure can hardly be taken seriously when taking into account the restricted number of species.

The stratigraphic records of the species, while disregarding the other Gelingseh faunas, seem to favour a Preangerian age (see Table 1). If next the more logical picture is considered, that of the combined inferred stratigraphic ranges of the species, we obtain much the same result (see Table 2). The distribution in both tables gives – contrary to the percentage of living forms – a fairly solid underpinning to the conclusion that this fauna is of Preangerian status, as no less than 13 (15?) out of 19 species have been recorded from Tf3, 7 species even exclusively so. However, of the latter only *Nucula njalindungensis* may be regarded as something approaching the idea of an index fossil (although the writer prefers leaving this point open), while the others have been but rarely recorded.

Nevertheless, this little fauna poses somewhat of an enigma, considering on the other hand the surprising presence of 5 exclusively pre-Preangarian species (or 3, if K-UG = Preangerian). However, similar features are shown by the fauna of the basal Menkrawit Beds (L.114: see Beets, 1941) and the puzzling mixture of 'Early Miocene' and 'Late Miocene' species perhaps merely signifies that at this stage still far too little is known about the ranges of Indonesian Neogene species. It may be stressed that the best

Table 1. Known ranges of the 19 species from loc. A. Source area of Sungai Gelingseh.

	EM	K	UG	Pr	NT	UM	P	PQ	Q	Re
Smaragdia gelingsehensis	—	—	—	—	NT	—	—	—	—	—
Smaragdia semari	—	—	—	—	NT	—	—	—	—	—
Rissoina maduparensis	—	—	—	—	NT	—	—	—	—	—
Turritella talarensis	EM	—	UG	—	NT	UM	P	—	—	—
Turritella trifunis	—	—	—	—	—	—	P	—	—	—
Vermicularia lumbricalis	—	—	—	—	NT	—	—	—	Q	Re
Rhinoclavis junghuhni	EM	—	—	—	NT	—	—	—	—	—
Pliconacca manoharae	—	—	—	—	NT	—	—	—	—	—
Ancilla sp. a	—	—	—	—	NT	—	—	—	—	—
Ringicula seriaensis	—	—	—	—	NT	—	—	—	—	—
Nucula njalindungensis	—	—	—	Pr	NT	—	—	—	—	—
Nuculana ventricosa	—	—	—	—	NT	—	—	—	—	Re
Scapharca hulshofi	EM	—	—	—	—	—	—	—	—	—
Pecten sedanensis	EM	—	UG	—	—	—	—	—	—	—
Spondylus apiapiensis	EM	—	—	—	—	—	—	—	—	—
Nemocardium jogjacartense	EM	—	—	—	—	—	—	—	—	—
Periglypta cf. *P. granosa*	EM	—	UG	—	—	—	—	—	—	—
Corbula socialis	EM	K	UG	Pr	NT	UM	P	—	—	—
Corbula solidula	EM	—	—	—	NT	—	P	—	—	Re
Total species for each age:	9	4		13		2	4	—	1	3
			15		(if UG = Pr)					

relationships with Early Miocene faunas are those with Rembang (7 species). In Java too, similar relationships exist between Preangerian and Rembangian.

The relations with other Preangerian faunas are shown in Table 17. It appears that the strongest ties exist with Gunung Madupar (l: 7 species) a locality in the Upper Gelingseh Beds and as a poor second, the basal Menkrawit fauna (b: 4 species), other faunas lagging more behind. The relationships with the other Bornean faunas are on the whole no better than with the classical Preangerian (pr: 2 species) or the Lower Palembang Beds (lop: 2 species).

With the largest fauna of the Gelingseh Beds, B-Bb, merely 5 species are in common with B and a meagre 1 species with Bb (see Table 14).

Table 2. Inferred ranges of the species from loc. A.

EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
EM	———	———	———	———	———	———	Re	: 1
EM	———	———	———	P				: 2
EM	———	NT						: 1
EM	—K-UG							: 2
EM								: 3
		Pr-NT						: 7
		Pr-NT	———	———	———	———	Re	: 2
				P				: 1
9	6	13	5	6	3	3	3	(19 species)
	———	15 ——	(if UG = Pr)					

Table 3. Known ranges of the 78 species from loc. Bb: Sungai Gelingseh, layer 1 (upper layer); loc. B: Sungai Gelingseh, layer 2 (lower layer).

	B	Bb	EM	K	UG	Pr	NT	UM	P	PQ	Q	Re
Euchelus atratus	B	—	—	—	—	—	NT	—	—	PQ	Q	Re
Gibbula leupoldi	B	—	—	—	—	—	NT	—	—	—	—	—
Trochus maculatus	—	Bb	—	—	—	—	NT	UM	P	—	Q	Re
Clanculus gemmulifer	—	Bb	—	—	—	—	—	—	—	—	Q	Re
Smaragdia gelingsehensis	B	—	—	—	—	—	NT	—	—	—	—	—
Rissoina indrai	B	—	—	—	—	—	NT	—	—	—	—	—
Rissoina ramai	B	—	—	—	—	—	NT	UM	—	—	—	—
Cyclostremiscus novemcarinatus	B	—	—	—	—	—	NT	—	—	—	Q	Re
Turritella damarwulani	B	Bb	—	—	—	—	NT	UM	—	—	—	—
Turritella talarensis	—	Bb	EM	—	UG	—	NT	UM	P	—	—	—
Turritella trifunis	B	—	—	—	—	—	—	—	P	—	—	—
Turritella heberti	—	Bb	—	—	UG	—	NT	—	—	—	—	—
Architectonica karikalensis	B	—	—	—	UG	—	NT	—	P	—	—	—
Architectonica ickeae	B	—	—	—	—	—	—	—	—	—	—	—
Vermicularia lumbricalis	B	—	—	—	—	—	NT	—	—	—	Q	Re
Tympanotonos cf. *T. merangianus*	—	Bb	—	—	—	Pr	NT	UM	—	—	—	—
Menkrawia callosalabiata	B	Bb	—	—	—	—	NT	UM	—	—	—	—
Vicarya callosa	—	Bb	—	—	—	Pr	NT	—	—	—	—	—
Terebralia kelirensis	—	Bb	EM	—	—	Pr	NT	UM	—	PQ	—	—
Colina menkrawitensis	B	—	—	—	—	—	NT	—	—	—	—	—
Rhinoclavis leupoldi	B	—	EM	—	—	—	NT	—	—	—	—	—
Cerithium noetlingi	B	—	—	—	—	Pr	NT	—	—	—	—	—
Certithium aff. *C. noetlingi*	B	—	—	—	—	—	NT	—	—	—	—	—
Cerithium travancorense	—	Bb	—	—	UG	—	—	—	—	—	—	—
Certihium trailli	—	Bb	—	—	—	—	NT	—	P	PQ	Q	Re
Clypeomorus verbeeki	B	Bb	—	—	—	Pr	—	UM	P	PQ	—	—
Triphora javana berauensis	B	—	EM	—	—	—	NT	UM	—	—	—	—
Rimella javana	B	—	—	K	—	Pr	NT	UM	—	PQ	Q?	—
Tibia verbeeki	—	Bb	EM	—	—	Pr	NT	UM	—	—	—	—
(*T. fusus*	—	—	—	—	—	—	NT	UM	P	PQ	Q?	Re)
Strombus ickeae	—	Bb	—	—	—	—	—	—	—	—	—	—
Strombus preoccupatus	—	Bb	EM	—	UG	Pr	NT	UM	—	—	—	—
Strombus sedanensis	—	Bb	EM	—	UG	—	—	—	—	—	—	—
Natica rufa	—	Bb	EM	—	UG	Pr	NT	—	P	PQ	Q	Re
Naticarius marochiensis	B	—	EM	—	—	Pr	NT	UM	P	PQ	Q	Re
Cymatium pileare	—	Bb	EM	—	UG	Pr	NT	—	P	PQ	Q	Re
Charonia fennemai	—	Bb	EM	—	—	Pr	NT	UM	—	—	—	—
Colubraria tjilonganensis	—	Bb	—	—	—	Pr	—	—	P	—	—	—
Hexaplex sampajauensis	—	Bb	—	—	—	—	—	—	—	—	—	—
Chicoreus juttingae	B	—	—	—	—	—	NT	—	—	—	—	—
Coralliophila nodosa	—	Bb	—	—	—	—	—	—	—	—	—	Re
Cantharus bucklandi	—	Bb	EM	K	UG	Pr	NT	UM	P	—	—	—
(*C. erythrostoma*	—	—	—	—	—	—	—	—	P	—	Q	Re)
Cantharus fusiformis	—	Bb	—	—	—	—	—	—	—	—	—	—
Volema junghuhni	—	Bb	EM	—	—	Pr	NT	—	—	—	—	—
Hinia gelingsehensis	B	—	—	—	—	—	NT	—	—	—	—	—
Latirus lancea	B	—	—	—	—	—	—	—	—	—	Q	Re
Peristernia beberiana	B	—	—	—	—	Pr	NT	—	—	—	—	—
Ancilla cinnamomea	—	Bb	EM	—	—	Pr	NT	—	P	—	Q	Re
Ancilla sp. a	B	—	—	—	—	—	NT	—	—	—	—	—
Mitra sowerbyi sedanensis	—	Bb	EM	—	—	Pr	NT	—	—	—	—	—
Lyria jugosa	B	—	EM	—	UG	Pr	NT	—	—	PQ	—	—
Cymbiola tjilonganensis	—	Bb	—	—	—	Pr	—	—	P	—	—	—
Gibberulina menkrawitensis	B	—	—	—	—	—	NT	—	—	—	—	—
Marginella aff. *M. elegans*	—	Bb	EM	—	—	Pr	NT	—	—	—	—	—

	B	Bb	EM	K	UG	Pr	NT	UM	P	PQ	Q	Re
Clavus sp. d	B	—	—	—	—	—	NT	—	—	—	—	—
Gemmula imitatrix	B	—	EM	—	—	Pr	NT	UM	P	PQ	Q	—
Gemmula karangensis	—	Bb	—	—	—	Pr	NT	—	P	—	—	—
Conus decollatus	—	Bb	EM	K	UG	Pr	NT	—	—	—	—	—
Conus odengensis	—	Bb	EM	K	UG	Pr	NT	UM	P	—	—	—
Conus virgo	—	Bb	—	—	—	Pr	—	—	—	PQ	—	Re
Strioterebrum gelingsehense	B	—	—	—	—	—	NT	—	—	—	—	—
Ringicula sp. a	B	—	EM	—	—	—	—	—	—	—	—	—
Cylichna triplicata	B	—	EM	—	—	—	NT	UM	—	—	—	—
Cylichna? sp. a	B	—	—	—	—	—	NT	—	—	—	—	—
Nucula njalindungensis	B	—	—	—	—	Pr	NT	—	—	—	—	—
Barbatia plicata	—	Bb	EM	—	—	—	—	UM	P	PQ	Q	Re
Trisidos semitorta	B	—	EM	—	UG	—	NT	UM	P	PQ	Q	Re
Andara mangkalihantensis	B	—	—	—	—	—	NT	—	—	—	—	—
Arcopsis sculptilis	B	—	—	—	UG	—	NT	—	—	PQ	Q?	Re
Lopha folium	—	Bb	EM	—	UG	Pr	NT	UM	P	PQ	Q	Re
Chama asperella	B	Bb	—	—	UG	—	NT	—	—	—	Q	Re
Chama plinthota	—	Bb	—	—	—	—	—	—	—	—	Q	Re
Trachycardium cf. *T. denticostulatum*	B	—	—	—	—	—	NT	—	—	PQ	—	—
Tridacna gigas	—	Bb	—	—	—	Pr	—	UM	P	PQ	Q	Re
Hippopus hippopus	—	Bb	—	—	—	—	—	—	P	PQ	Q	Re
Circe ickeae	B	—	—	—	—	Pr	NT	—	—	—	—	—
Atopodonta sawitrae	—	Bb	—	—	—	—	NT	—	—	—	—	—
Corbula scaphoides	B	Bb	—	—	UG	—	NT	UM	P	—	Q	Re
Corbula solidula	B	—	EM	—	—	—	NT	—	P	—	—	Re
Total species for each age:												
Loc. Bb, (upper) layer 1 (41 species):			17		13		31	16	17	10	13	15
									18?	11?	15?	17?
					32			(if UG = PR)				
(loc. B, (lower) layer 2 (42 species):			9		7		38	11	8	9	10	10
											12?	
					38			(if UG = PR)				
Loc. B+Bb (78 species):			26		18		64	23	23	18	20	23
									24?	19?	24?	25?
					65			(if UG = Pr)				

B-Bb: SUNGAI GELINGSEH, LAYERS 2 AND 1 RESPECTIVELY

This is the fauna on which a preliminary report was given by K. Martin (1914). It may be emphasized that the two layers sampled yielded different assemblages, be it that the differences are in part artificial. Thus, the (upper) layer 1, apart from its molluscan content, proved to be rich in beautifully preserved corals, which were subsequently described by Gerth (1923), while the (lower) layer 2 contains coral debris and numerous small gastropods. However, the true composition of the fauna of layer 1 is not known as these fossils were hand-picked and consequently, small species, if present, were missed out anyway whereas the sediment of layer 2 was passed through a sieve. Therefore, when lumping together the two assemblages (see Table 3), one probably obtains a truer picture of the total fauna present at the locality than by keeping them apart, as has been done for a preliminary analysis of their value for age determination.

B: layer 2 or lower layer: this assemblage contains 42 species, 10 or 23.8 % of which are still living. This would place it, for whatever such figures are worth, on a par with Njalindung. The stratigraphic records of the species (Table 3), again disregarding the

Table 4. Inferred ranges of the species from loc. B = (lower) layer 2.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM ———	———	———	———	———	———	———	Re	: 3
	EM ———	———	———	———	———	———	Q		: 1
	EM ———	———	———	———	———	PQ			: 1
	EM ———	———	———	UM					: 2
	EM ———	———	Pr-NT						: 1
	EM								: 1
		K-UG ———	———	———	———	———	———	Re	: 3
		K-UG ———	———	———	———	PQ —	?		: 1
		K-UG ———	———	———	P				: 1
			Pr-NT						: 17
			Pr-NT	UM					: 3
			Pr-NT ———	———	———	PQ			: 2
			Pr-NT ———	———	———	———	———	Re	: 3
					P				: 1
							Q ———	Re	: 1
(a)	9	13	38	20	16	14	11	10	(41 species)
		—38 —— (if UG = Pr)					12?		
(b)	6	10	35	17	13	11	8	7	(38 species)
		—35 —— (if UG = Pr)					9?		

(a) Number of species for each zone.
(b) Ditto, disregarding the three longest lived species.

other Gelingseh faunas, overwhelmingly support a Preangerian age, as 38 of the 42 species involved occur in that age; the combined inferred ranges are shown in Table 4.

As to the relationships with other Preangerian faunas (see Table 17), it appears that strong ties exist with the basal Menkrawit fauna (b: 27 species), followed by the Upper Menkrawit Beds (c: 16 species) and Gunung Madupar in the Upper Gelingseh Beds (l: 17 species), while the classical Preangerian faunas (pr: 9 species) fare a little better than in the case of fauna A. No strong ties exist with any of the other faunas of the Gelingseh Beds, A, C, D, and E (see Table 14).

Bb: layer 1 or upper layer: the assemblage comprises 41 species, 15 (17?) or 36.6 (41.5?) % are still living, this percentage agreeing with Tjilanang. The stratigraphic records (Table 3; eliminating the other Gelingseh faunas) again support a Preangerian age, though not as convincingly as the records of the assemblage of layer 2, considering the stronger showing of UM and P. The inferred ranges (Table 5) lead to the same conclusion. The composition of this fauna, unlike that of B, provides for strongest ties with the classical Preangerian (pr: 21 species), while those with the basal Menkrawit Beds (b: 15 species) are weaker, and the ones with Gunung Madupar, Upper Gelingseh Beds (l: 4 species) even more so (see Table 17).

Comparing the other Gelingseh assemblages, this time rather strong relationships are shown with fauna C (loc. 144: 15 species): see Table 14.

B + Bb: the total fauna (Table 3), holding 78 species, contains 23 (25?) species which are still living, or 29.5 (32?) %, a percentage in itself pointing at typical Preangerian again. The stratigraphic records strongly support this conclusion, with 64 out of 78 species occurring in Preangerian, and so do the inferred ranges: Table 6. The difference in composition of the two faunas is illustrated by the fact that no more than five species

Table 5. Inferred ranges of the species from loc. Bb = (upper) layer 1.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM	—	—	—	—	—	—	— Re	: 5
	EM	—	—	—	P —	? —	? —	?	: 1
	EM	—	—	— UM —	? —	? —	? —	?	: 1
	EM	—	—	—	— PQ				: 1
	EM	—	—	—	P				: 2
	EM	—	— UM						: 2
	EM	— Pr-NT							: 4
	EM — K-UG								: 1
	K-UG								: 1
	K-UG	Pr-NT							: 1
	K-UG	—	—	—	—	—	—	— Re	: 2
		PR-NT							: 2
		Pr-NT-UM							: 3
		Pr-NT —	— P						: 3
		Pr-NT —	—	—	— PQ				: 1
		Pr-NT —	—	—	—	—	—	— Re	: 4
			P —	—	—	—	—	— Re	: 1
							Q —	— Re	: 2
								Re	: 1
(a)	17	21	32	25	20	14	14	15	(37 species)
					21?	16?	16?	17?	
		—34 — (if UG = Pr)							
(b)	12	16	27	20	15	9	9	10	(32 species)
					16?	10?	10?	12?	
		—28 — (if UG = Pr)							

(a) Number of species for each zone.
(b) Ditto, disregarding the three longest lived species.

are common to both: *Turritella damarwulani, Menkrawia callosalabiata, Clypeomorus verbeeki, Chama asperella,* and *Corbula scaphoides*. Had these been small species, it could have been held that the difference in collecting method mentioned above might be falsifying the record, but they are all of the easily discernable kind.

Differences are also demonstrated by the many (17) species of fauna B, which are so far known exclusively from Preangerian, as opposed to but 2 of fauna Bb. This does incidentally not imply a belief in their value as potential index fossils as most of them have not been often and widely observed, with the exception of *Vicarya callosa*. As usual, a few species have so far been recorded exclusively from other than Preangerian deposits, viz. *Turritella trifunis* (fauna B) in Pliocene, and in pre-Preangerian: *Ringicula* sp. a (fauna B) and *Strombus sedanensis* (fauna Bb).

The Preangerian records, considered a little more closely (see Table 17), show overall strongest ties with the basal Menkrawit Beds (b: 39 species), followed by classical Preangerian (pr: 29 species), while the relationships with the Upper Menkrawit Beds (c: 21 species) and Gunung Madupar, Upper Gelingseh Beds (l: 21 species) are satisfactory.

Because the composite fauna B+Bb occupies a dominant position among the assemblages of the Gelingseh Beds s. str., for the time being at any rate, it seems appropriate to evaluate the overall stratigraphic record once again, now with the exclusion of all Bornean occurrences on which the age determination rests so heavily, implying the danger of arguing in a circle, as happens so frequently and not wholly unavoidably in palaeontology. In other words, how would one interpret the age of the

Table 6. Inferred ranges of the species from loc. B + Bb.

EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
EM	———	———	———	———	———	———	Re	: 8
EM	———	———	———	P	?	?	?	: 1
EM	———	———	UM	?	?	?	?	: 1
EM	———	———	———	———	———	Q		: 1
EM	———	———	———	———	PQ			: 2
EM	———	———	———	P				: 2
EM	———	———	UM					: 4
EM	———	Pr-NT						: 5
EM	K-UG							: 1
EM								: 1
	K-UG							: 1
	K-UG	Pr-NT						: 1
	K-UG	———	———	P				: 1
	K-UG	———	———	———	PQ	?		: 1
	K-UG	———	———	———	———	———	Re	: 3
		Pr-NT						: 19
		Pr-NT	UM					: 4
		Pr-NT	———	P				: 3
		Pr-NT	———	———	PQ			: 2
		Pr-NT	———	———	———	———	Re	: 7
				P				: 1
				P	———	———	Re	: 1
						Q	Re	: 3
							Re	: 1

(a)	26	32	65	40	33	25	23	23	(73 species)
					34?	27?	26?	25?	
		— 67 —— (if UG = Pr)							
(b)	18	24	57	32	25	17	15	15	(65 species)
					26?	19?	18?	17?	
		— 59 —— (if UG = Pr)							

(a) Number of species for each zone.
(b) Ditto, disregarding the eight longest lived species.

fauna if it were the first fairly sizable assemblage investigated – as did Martin in 1914 in precisely the same case – in an otherwise unknown territory outside the classical Javanese Neogene realm. Table 7 gives the result of this approach, considering 55 out of 78 species, 23 having 'no previous records'. The distribution obtained, as compared with Table 6, is quite compatible again with a Preangerian age, perhaps somewhat surprisingly so but nevertheless sufficiently convincingly of a 'first reconnaissance survey' in a new area.

C. LOC. 144, RUTTEN

This assemblage contains 32 species, 6 (7?) or 18.8 (21.9?) % of which are still living, a percentage figure which in itself might fit 'lowermost' Preangerian, were it not that only a few of the longer lived bivalves are present and that the figure is unreliable anyway because of the rather small number of species. The combined stratigraphic records of the species, as usual excluding the other Gelingseh localities, offer a much more telling

Table 7. Inferred ranges of the species from loc. B + Bb, excluding all Bornean records.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM	—	—	—	—	—	—	Re	: 8
	EM	—	—	—	—	—	Q		: 1
	EM	—	—	—	—	PQ			: 1
	EM	—	—	—	P	— ? —	? —	?	: 1
	EM	—	—	—	P				: 2
	EM	—	—	UM	— ? —	? —	? —	?	: 1
	EM	—	—	UM					: 1
	EM	—	Pr-NT						: 5
	EM	— K-UG							: 1
	EM								: 3
		K-UG							: 2
		K-UG	—	UM	— ? —	? —	?		: 1
		K-UG	—	—	P				: 1
		K-UG	—	—	—	—	—	Re	: 3
			Pr-NT						: 7
			Pr-NT	—	P				: 4
			Pr-NT	—	—	—	—	Re	: 2
				UM	—	—	—	Re	: 1
					P				: 1
					P	—	—	Re	: 1
						PQ	—	Re	: 1
							Q —	Re	: 6
								Re	: 1
(a)	24	28	38	27	26	18	23	23	(55 species)
					28?	21?	26?	25?	
		— 41 —		(if UG = Pr)					

(a) Number of species for each zone.

picture (Table 8). Considering the overwhelming majority of species occurring in Preangerian faunas, a Tf3 age is strongly suggested, as in the case of fauna B. The more realistic picture of the combined ranges of the species is shown by Table 9.

The relationships to other Preangerian faunas are illustrated by Table 17. This time by far the strongest ties appear to exist with the distant Javanese Preangerian (pr: 18 species), even Sumatra (lop: 8 species) not doing badly in comparison with the basal Menkrawit fauna (b: 11 species), while Kari Orang (g: 8 species) is doing better than the Upper Menkrawit Beds (c: 5 species), not to mention the weak ties with other assemblages. It may be added that unlike fauna A, no less than 14 species are in common with fauna Bb, and only 6 with fauna B.

D. LOC. 149, RUTTEN

This collection contains 26 species, with 12, or 46.1 %, still living, a percentage figure which by itself would suggest uppermost Miocene or even Lower Pliocene, but this may well be caused by a comparatively large percentage of bivalves. The combined stratigraphic records of the species (Table 10), ignoring the other Gelingseh faunas, would seem to favour a Preangerian age, but the high figure for Pliocene is certainly in keeping with the high percentage of living species and difficult to ignore, despite the ranges of *Gibbula leupoldi* and *Glans boettgeri,* being seemingly confined to Tf3. Their potential stratigraphic

Table 8. Known ranges of the species from loc. C (= loc. 144, Rutten). About 7 km west of junction of Sg. Sampajau with Sg. Sangkulirang.

	O	EM	K	UG	Pr	NT	UM	P	PQ	Q	Re
Turritella damarwulani	—	—	—	—	—	NT	UM	—	—	—	—
Turritella talarensis	—	EM	—	UG	—	NT	UM	P	—	—	—
Turritella heberti	—	—	—	UG	—	NT	—	—	—	—	—
Vermicularia lumbricalis	—	—	—	—	—	NT	—	—	—	Q	Re
Tenagodus cf. *T. obtusiformis*	—	EM	—	—	Pr	NT	—	P?	—	—	—
Vicarya callosa	—	—	—	—	Pr	NT	—	—	—	—	—
Terebralia kelirensis	—	EM	—	—	Pr	NT	UM	—	PQ	—	—
Cerithium rude	—	EM	—	UG	—	NT	—	—	—	—	—
Clypeomorus verbeeki	—	—	—	—	Pr	—	UM	P	PQ	—	—
Strombus preoccupatus	—	EM	—	UG	Pr	NT	UM	—	—	—	—
Cymatium pileare	—	EM	—	UG	Pr	NT	—	P	PQ	Q	Re
Charonia menkrawitensis	—	—	—	—	—	NT	—	—	—	—	–
Hexaplex sampajauensis	—	—	—	—	—	—	—	—	—	—	—
Taurasia talahabensis	—	—	K?	—	Pr	—	—	—	—	—	—
Cantharus bucklandi	—	EM	K	UG	Pr	NT	UM	P	—	—	—
(*C. erythrostoma*	—	—	—	—	—	—	—	P	—	Q	Re)
Cantharus fumosus	—	—	—	—	—	—	—	—	—	Q	Re
Clavilithes fennemai	—	—	—	—	Pr	NT	—	P	—	—	—
Vexillum gembacanum	—	EM	—	—	Pr	NT	—	P	—	Q	—
Vexillum cf. *V. rajaense*	—	—	—	—	—	NT	—	P	—	—	—
Mitra sowerbyi sedanensis	—	EM	—	—	Pr	NT	—	—	—	—	—
Marginella aff. *M. elegans*	—	EM	—	—	Pr	NT	—	—	—	—	—
Gemmula granosa woodwardi	—	EM	K	UG	—	NT	UM	P	—	—	—
Gemmula imitatrix	—	EM	—	—	Pr	NT	UM	P	PQ	Q	—
Turridrupa? witkampi	—	—	—	—	—	NT	—	—	—	—	—
Conus decollatus	—	EM	K	UG	Pr	NT	—	—	—	—	—
Conus odengensis	—	EM	K	UG	Pr	NT	UM	P	—	—	—
Conus sp. a	—	—	—	—	—	NT	—	—	—	—	—
Barbatia fusca	—	—	—	—	Pr	NT	—	P	PQ	Q	Re
Barbatia plicata	—	EM	—	—	—	—	UM	P	PQ	Q	Re
Anadara mangkalihatensis	—	—	—	—	—	NT	—	—	—	—	—
Chlamys senatoria	O	EM	—	UG	Pr	NT	—	P	PQ	Q	Re
Circe ickeae	—	—	—	—	Pr	NT	—	—	—	—	—
Total species for each age:	1	16	11		29	10	13	7	8	6	
			12?				14?		9?	7?	
			——	29	——	(if UG = Pr)					

value is not necessarily impaired by the fact that, so far, two species (*Mitra tjikeusikensis* and *Strioterebrum* sp. a) are known from Pliocene only, or *Melo broderipi,* exclusively from the living fauna. The most logical evidence is again presented by the combined inferred ranges of the species (Table 11). Considering that distribution picture, Odengian (UM) is a possibility that has to be kept in mind. However, the high percentage of longer lived bivalves may well obscure the true age of the fauna, Tf3 (by inference), as postulated by Rutten.

As usual, the Preangerian connections are considered more closely: Table 17. It appears that equally strong ties exist with the Upper Menkrawit Beds (c: 7 species), Sekurau (i: 7 species), basal Menkrawit Beds (b: 6 species), and the distant Javanese Preangerian (pr: 7 species). With faunas B and Bb finally, 4 and 5 species are in common respectively (see Table 14).

Table 9. Inferred ranges of the species from loc. C.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM ———	———	———	———	———	———	———	Re	: 3
	EM ———	———	———	———	———	———	Q		: 2
	EM ———	———	———	———	P ———	? ———	? ———	?	: 1
	EM ———	———	———	———	———	PQ			: 1
	EM ———	———	———	———	P				: 3
	EM ———	———	———	UM					: 1
	EM ———	———	Pr-NT-? ———		?				: 1
	EM ———	———	Pr-NT						: 4
		K-UG-Pr-NT							: 1
		? ———	Pr-NT						: 1
			PR-NT						: 6
			Pr-NT-UM						: 1
			Pr-NT ———		P				: 2
			Pr-NT ———		———	PQ			: 1
			Pr-NT ———		———	———	———	Re	: 2
							Q ———	Re	: 1
(a)	16	17	30	17	15	9	8	6	(31 species)
		18?		18?	16?	10?	9?	7?	
		−30	(31?) − (if UG = Pr)						
(b)	13	14	27	14	12	6	5	3	(28 species)
		15?		15?	13?	7?	6?	4?	
		−27	(28?) − (if UG = Pr)						

(a) Number of species for each zone.
(b) Ditto, eliminating the three longest lived species.

E. LOC. 150, RUTTEN

This fauna is of approximately the same size as the previous one, containing 28 species: 15 of these, or 53.5 %, are still living and this would indicate Pliocene, the bivalves however perhaps being responsible for the high percentage figure. If, on the other hand, the stratigraphic records of the species are considered (see Table 12, again eliminating other Gelingseh faunas), a distribution of the various age figures is obtained not unlike the one shown by fauna D. Again, the inferred ranges (Table 13) remind very much of the picture produced by fauna D. It may therefore be concluded, tentatively at any rate, that both may be of a comparable age and probably younger than faunas B-Bb and C, in keeping with Rutten's field observations (concerning, at any rate, loc. E). In both cases, more material and additional detailed field work is needed to decide whether faunas D and E still belong to Tf3, or to Odengian. On the other hand, it is certainly noteworthy that both faunas do not show stronger ties with other assemblages in the higher brackets of Tf3 – such as Gunung Madupar and Muara Kobun (Beets, 1983a) – than with faunas from lower levels such as the basal Menkrawit Beds and classical Preangerian (see Table 17). Vagaries in distribution and errors of random sampling may well obscure the true picture and the writer is in favour of accepting the correctness of Rutten's field observations postulating near-equivalence of the localities A to E, until new evidence to the contrary becomes available. Nevertheless, for future reference each of the faunas has of course been treated as a separate entity. As to the ties with other Gelingseh faunas, 7 species from loc. 150 are in common with Bb, 3 with D, 2 with both B and C, and none with E (see Table 14).

Table 10. Known ranges of the 26 species from loc. D (= loc. 149, Rutten). About 5½ km west and 7½ km south of the junction of Sg. Sampajau with Sg. Sangkulirang.

	O	EM	K	UG	Pr	NT	UM	P	PQ	Q	Re
Gibbula leupoldi	—	—	—	—	—	NT	—	—	—	—	—
Turritella talarensis	—	EM	—	UG	—	NT	UM	P	—	—	—
Vermetus javanus	—	EM	K	UG	Pr	NT	UM	P	PQ	Q	—
Rimella cancellata spinifera	—	—	—	—	—	—	—	P	PQ	—	—
Alectrion siquijorensis	—	—	—	—	—	NT	—	P	PQ	Q	Re
Mitra tjikeusikensis	—	—	—	—	—	—	—	P	—	—	—
Cymbiola tjilonganensis	—	—	—	—	Pr	—	—	P	—	—	—
Melo cf. *M. broderipi*	—	—	—	—	—	—	—	—	—	—	Re
Melo persolida	—	—	—	—	—	—	—	—	—	—	—
Turris albinoides	—	—	K	—	Pr	—	—	—	—	—	—
Conus djarianensis	—	—	—	—	Pr	NT	UM	—	PQ	—	—
Conus vimineus	—	—	—	—	—	NT	—	P	—	—	Re
Conus virgo	—	—	—	—	Pr	—	—	—	PQ	—	Re
Strioterebrum sp. a	—	—	—	—	—	—	—	P	—	—	—
Trisidos semitorta	O	EM	—	UG	—	NT	UM	P	PQ	Q	Re
Scapharca biformis	—	—	—	—	—	NT	—	P	—	—	—
Arcopsis sculptilis	—	—	—	UG	—	NT	—	—	PQ	Q?	Re
Placuna ephippium	—	—	—	—	—	NT	UM	P	PQ	Q	Re
Lopha folium	—	EM	—	UG	Pr	NT	UM	P	PQ	Q	Re
Linga antjamensis	—	—	—	—	—	NT	UM	—	—	—	—
Glans boettgeri	—	—	—	—	—	NT	—	—	—	—	—
Crassatella radiata	—	EM	K	—	—	NT	—	P	PQ	Q	Re
Circe scripta	—	—	—	—	—	NT	—	P	PQ	Q	Re
Gafrarium tumidum	—	EM	—	—	—	—	—	P	—	Q	Re
Corbula scaphoides	—	—	—	UG	—	NT	UM	P	—	Q	Re
Corbula socialis	—	EM	K	UG	Pr	NT	UM	P	—	—	—
Total species for each age:	1	7	9		20	9	17	11	9 10?	12	
				——20——		(if UG = Pr)					

Table 11. Inferred ranges of the species from loc. D.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM	——	——	——	——	——	——	Re	: 4
	EM	——	——	——	——	——	Q		: 1
	EM	——	——	——	P				: 2
		K-UG	——	——	——	——	——	Re	: 2
		K-UG	Pr-NT						: 1
			Pr-NT						: 2
			Pr-NT-	UM					: 1
			Pr-NT	——	P				: 2
			Pr-NT	——	——	PQ			: 1
			Pr-NT	——	——	——	——	Re	: 5
					P				: 2
					P	PQ			: 1
								Re	: 1
(a)	7	10	21	18	20	14	12	12	(25 species)
		—21——		(if UG = Pr)					
(b)	3	6	17	14	16	10	8	8	(21 species)
		—17——		(if UG = Pr)					

(a) Number of species for each zone.
(b) Ditto, eliminating the four longest lived species.

Table 12. Known ranges of the 28 species from loc. E (= loc. 150, Rutten).

	EM	K	UG	Pr	NT	UM	P	PQ	Q	Re
Trochus maculatus	—	—	—	—	NT	UM	P	—	Q	Re
Japonia trilirata	—	—	—	—	—	—	—	—	—	Re
Turritella angulata djadjariensis	—	—	UG	Pr	—	UM	P	PQ	—	—
Triphora maharatai	—	—	—	—	NT	UM	—	—	—	—
Barycypraea suryai	—	—	—	—	—	—	—	—	—	—
Polinices callosior	—	—	—	Pr	NT	—	P	—	—	—
Polinices orangensis	—	—	—	—	NT	—	—	—	—	—
Natica helvacea	EM	—	UG	Pr	NT	UM	P	PQ	Q	Re
Natica solida	—	—	—	—	—	—	P?	—	—	Re
Buccinulum orangense	EM	—	—	—	—	—	—	—	—	—
Hinia sinusigera	—	—	—	—	—	—	P	—	Q	Re
Ancilla cinnamomea	EM	—	—	Pr	NT	—	P	—	Q	Re
Olivancillaria altenai	—	—	—	—	—	—	—	—	—	
Oliva gibbosa jenkinsi	—	—	Pr	NT	UM	P	—	—	—	—
Oliva rufula djocdjocartae	EM	—	—	Pr	NT	UM	P	—	—	—
Marginella aff. *M. elegans*	EM	—	—	Pr	NT	—	—	—	—	—
Conus virgo	—	—	—	Pr	—	—	—	PQ	—	Re
Barbatia fusca	—	—	—	Pr	NT	—	P	PQ	Q	Re
Linga antjamensis	—	—	—	—	NT	UM	—	—	—	—
Chama asperella	—	—	UG	—	NT	—	—	—	Q	Re
Chama brassica	—	—	—	—	—	—	—	—	Q	Re
Chama plinthota	—	—	—	—	—	—	—	—	Q	Re
Glans boettgeri	—	—	—	—	NT	—	—	—	—	—
Trachycardium cf. *T. denticostulatum*	—	—	—	—	NT	—	—	PQ	—	—
Tridacna derasa	—	—	—	—	NT	—	P	—	—	Re
Hippopus hippopus	—	—	—	—	—	—	P	PQ	Q	Re
Timoclea bataviana	—	—	—	—	—	—	P	PQ	—	Re
Timoclea recognita	—	—	—	—	—	—	—	—	—	Re
Total species for each age:	5	3		17		7	12 13?	7	9	15
		—— 17 ——					(if UG = Pr)			

TOTAL FAUNA A TO E, INCLUSIVE

Table 14 lists all the species from Rutten's localities in the Gelingseh Beds s. str., with more detailing attention to the classical Javanese Preangerian localities than shown by the faunal lists in the preceding pages. The overall fauna, if indeed deriving from one and the same stratigraphical unit, contains 138 species, including 42 (44?) or 30.4 (31.9?) % known to occur in the living fauna. The considerable number of 102 species, or 73.8 %, are known from Preangerian faunas, with Odengian (UM) and Pliocene lagging far behind.

The inferred ranges as shown in Table 15 again favour Preangerian in no uncertain way, more so than when eliminating all Bornean records (Table 16): compare B-Bb above, with broadly similar results. The Preangerian records (Table 17) reveal equally strong ties with the basal Menkrawit fauna (b: 45 species) and the classical Preangerian (pr), while next best are the relationships with higher stratigrapic levels: Upper Menkrawit Beds (c: 24 species) and Gunung Madupar (l: 25 species).

Table 13. Inferred ranges of the species from loc. E.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM	——	——	——	——	——	——	Re	: 2
	EM	——	——	——	P				: 1
	EM	——	Pr-NT						: 1
	EM								: 1
		K-UG	——	——	——	PQ			: 1
		K-UG	——	——	——	——	——	Re	: 1
			Pr-NT						: 2
			Pr-NT	-UM					: 2
			Pr-NT	——	P				: 2
			Pr-NT	——	——	PQ			: 1
			Pr-NT	——	——	——	——	Re	: 4
					P	——	——	Re	: 3
					?	—— ? ——	? ——	Re	: 1
							Q ——	Re	: 2
								Re	: 2
(a)	5	6	17	14	15	12	12	15	(26 species)
					16?	13?	13?		
		— 17 —— (if UG = Pr)							
(b)	3	4	15	12	13	10	10	13	(24 species)
					14?	11?	11?		
		— 15 —— (if UG = Pr)							

(a) Number of species for each zone.
(b) Ditto, disregarding the two longest lived species.

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Table 14. Fauna of the Gelingseh Beds s. str.: known ranges of the 138 molluscan species.

Rutten's localities	A	B	Bb	C	D	E	O	EM	K	UG	Nj	Tj	Ta	Pa	Bo	NT	UM	M	P	N	PQ	Q	RE
Euchelus atratus	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	N	PQ	Q	Re
Gibula leupoldi	—	B	—	—	D	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Trochus maculatus	—	—	Bb	—	—	E	—	—	—	—	—	—	—	—	—	NT	UM	—	P	N	—	Q	Re
Clanculus gemmulifer	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Q	Re
Smaragdia gelingsehensis	A	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Smaragdia semari	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Japonia trilirata	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Re
Rissoina indrai	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Rissoina maduparensis	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Rissoina ramai	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	UM	—	—	—	—	—	—
Cyclostremiscus novemcarinatus	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	M	—	—	—	Q	Re
Turritella angulata djadjariensis	—	—	—	—	—	E	—	—	—	UG	—	Tj	—	—	—	—	UM	—	P	N	PQ	—	—
Turritella damarwulani	—	B	Bb	C	—	—	—	—	—	—	—	—	—	—	—	NT	UM	—	—	—	—	—	—
Turritella talarensis	A	—	Bb	C	D	—	—	EM	—	UG	—	—	—	—	—	NT	UM	—	P	—	—	—	—
Turritella trifunis	A	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	P	—	—	—	—
Turritella heberti	—	—	Bb	C	—	—	—	—	—	UG	—	—	—	—	—	NT	—	M	—	—	—	—	—
Architectonica karikalensis	—	B	—	—	—	—	—	—	—	UG	—	—	—	—	—	NT	—	—	P	—	—	—	—
Architeconica ickeae	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vermetus javanus	—	—	—	—	D	—	—	EM	K	UG	Nj	Tj	Ta	—	—	NT	UM	M	P	N	PQ	Q	—
Vermicularia lumbricalis	A	B	—	C	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	Q	Re
Tenagodus cf. *T. obtusiformis*	—	—	—	C	—	—	—	EM	—	—	—	—	Ta	—	—	NT	—	—	P?	—	—	—	—
Tympanotonos cf. *T. merangianus*	—	—	Bb	—	—	—	—	—	—	—	Nj	—	—	—	—	NT	UM	—	—	—	—	—	—
Menkrawia callosalabiata	—	B	Bb	—	—	—	—	—	—	—	—	—	—	—	—	NT	UM	—	—	—	—	—	—
Vicarya callosa	—	—	Bb	C	—	—	—	—	—	—	Nj	Tj	—	—	Bo	NT	—	M	—	—	—	—	—
Terebralia kelirensis	—	—	Bb	C	—	—	—	EM	—	—	Nj	—	—	—	—	NT	UM	—	—	—	PQ	—	—
Colina menkrawitensis	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Rhinoclavis leupoldi	—	B	—	—	—	—	—	EM	—	—	—	—	—	—	—	NT	—	—	—	N	—	—	—
Rhinoclavis junghuhni	A	—	—	—	—	—	—	EM	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Cerithium noetlingi	—	B	—	—	—	—	—	—	—	—	Nj	—	—	—	—	NT	—	—	—	—	—	—	—
Cerithium aff. *C. noetlingi*	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Certihium travancorense	—	—	Bb	—	—	—	—	—	—	UG	—	—	—	—	—	—	—	—	—	—	—	—	—
Cerithium rude	—	—	—	C	—	—	—	EM	—	UG	—	—	—	—	—	NT	—	—	—	—	—	—	—
Certihium trailli	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	P	—	PQ	Q	Re

Clypeomorus verbeeki	—	B	Bb	C	—	—	—	—	—	—	Nj	Tj	—	—	—	—	UM	M	P	N	PQ	—	—
Triphora javana berauensis	—	B	—	—	—	—	—	EM	—	—	—	—	—	—	—	NT	UM	—	—	—	—	—	—
Triphora maharatai	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	NT	UM	M	—	—	—	—	—
Rimella javana	—	B	—	—	—	—	—	—	K	—	Nj	Tj	—	—	—	NT	UM	—	—	N	PQ	Q?	—
Rimella cancellata spinifera	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	P	N	PQ	—	—
Tibia verbeeki	—	—	Bb	—	—	—	—	EM	—	—	Nj	—	Ta	Pa	Bo	NT	UM	—	—	—	—	—	—
(*T. fusus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	UM	M	P	—	PQ	Q?	Re)
Strombus ickeae	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Strombus preoccupatus	—	—	Bb	C	—	—	—	EM	—	UG	Nj	Tj	—	—	—	NT	UM	—	—	—	—	—	—
Strombus sedanensis	—	—	Bb	—	—	—	—	EM	—	UG	—	—	—	—	—	—	—	—	—	—	—	—	—
Barycypraea suryai	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Polinices callosior	—	—	—	—	—	E	—	—	—	—	—	Tj	—	—	—	NT	—	—	P	—	—	—	—
Polinices orangensis	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Pliconacca manoharae	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Natica helvacea	—	—	—	—	—	E	—	EM	—	UG	Nj	Tj	—	—	—	NT	UM	M	P	N	PQ	Q	Re
Natica rufa	—	—	Bb	—	—	—	—	EM	—	UG	Nj	Tj	Ta	Pa	—	NT	—	M	P	N	PQ	Q	Re
Natica solida	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	P?	—	—	—	Re
Naticarius marochiensis	—	B	—	—	—	—	—	EM	—	—	Nj	Tj	Ta	—	—	NT	UM	—	P	N	PQ	Q	Re
Cymatium pileare	—	—	Bb	C	—	—	—	EM	—	UG	Nj	Tj	Ta	Pa	—	NT	—	—	P	—	PQ	Q	Re
Charonia fennemai	—	—	Bb	—	—	—	—	EM	—	—	Nj	—	Ta	Pa	—	NT	UM	—	—	—	—	—	—
Charonia menkrawitensis	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Colubraria tjilonganensis	—	—	Bb	—	—	—	—	—	—	—	—	—	—	Pa	—	—	—	—	P	—	—	—	—
Hexaplex sampajauensis	—	—	Bb	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chicoreus juttingae	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Taurasia talahabensis	—	—	—	C	—	—	—	—	K?	—	Nj	Tj	—	—	—	—	—	—	—	N	—	—	—
Coralliophila nodosa	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Re
Buccinulum orangense	—	—	—	—	—	E	—	EM	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chantharus bucklandi	—	—	Bb	C	—	—	—	EM	K	UG	Nj	Tj	Ta	Pa	—	NT	UM	—	P	N	—	—	—
(*C. erythrostoma*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	P	—	—	Q	Re)
Cantharus fumosus	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	—	Q	Re
Cantharus fusiformis	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	—	—	—
Volema juhnghuhni	—	—	Bb	—	—	—	—	EM	—	—	Nj	—	—	—	—	NT	—	—	—	—	—	—	—
Hinia sinusigera	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	P	—	—	Q	Re
Hinia gelingsehensis	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Alectrion siquijorensis	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	NT	—	—	P	N	PQ	Q	Re
Latirus lancea	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	M	—	—	—	Q	Re
Peristernia beberiana	—	B	—	—	—	—	—	—	—	—	Nj	—	—	—	—	NT	—	—	—	—	—	—	—
Clavilithes fennemai	—	—	—	C	—	—	—	—	—	—	Nj	—	—	—	—	NT	—	—	P	—	—	—	—

Rutten's localities	A	B	Bb	C	D	E	O	EM	K	UG	Nj	Tj	Ta	Pa	Bo	NT	UM	M	P	N	PQ	Q	RE
Ancilla cinnamomea	—	—	Bb	—	—	E	—	EM	—	—	Nj	Tj	—	—	—	NT	—	M	P	—	—	Q	Re
Ancilla sp. a	A	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Olivancillaria altenai	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oliva gibbosa jenkinsi	—	—	—	—	—	E	—	—	—	—	—	Tj	—	—	—	NT	UM	—	P	N	—	—	—
Oliva rufula djocdjocartae	—	—	—	—	—	E	—	EM	—	—	—	—	—	Pa	—	NT	UM	M	P	—	—	—	—
Vexillum gembacanum	—	—	—	C	—	—	—	EM	—	—	Nj	Tj	Ta	—	—	NT	—	M	P	N	—	Q	—
Vexillum cf. *V. rajaense*	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	P	—	—	—	—
Mitra sowerbyi sedanensis	—	—	Bb	C	—	—	—	EM	—	—	NJ	—	—	—	—	NT	—	M	—	—	—	—	—
Mitra tjikeusikensis	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	P	—	—	—	—
Lyria jugosa	—	B	—	—	—	—	—	EM	—	UG	Nj	—	—	—	—	NT	—	—	—	—	PQ	—	—
Cymbiola tjilonganensis	—	—	Bb	—	D	—	—	—	—	—	—	—	Ta	—	—	—	—	—	P	—	—	—	—
Melo cf. *M. broderipi*	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Re
Melo persolida	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Gibberulina menkrawitensis	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Marginella aff. *M. elegans*	—	—	Bb	C	—	E	—	EM	—	—	—	Tj	—	—	—	NT	—	—	—	—	—	—	—
Clavus sp. d	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Gemmula granosa woodwardi	—	—	—	C	—	—	—	EM	K	UG	—	—	—	—	—	NT	UM	—	P	N	—	—	—
Gemmula imitatrix	—	B	—	C	—	—	—	EM	—	—	Nj	—	Ta	—	—	NT	UM	M	P	—	PQ	Q	—
Gemmula karangensis	—	—	Bb	—	—	—	—	—	—	—	Nj	—	—	—	—	NT	—	—	P	—	—	—	—
Turris albinoides	—	—	—	—	D	—	—	—	K	—	Nj	Tj	Ta	Pa	—	—	—	—	—	—	—	—	—
Turridrupa? witkampi	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Conus decollatus	—	—	Bb	C	—	—	—	EM	K	UG	Nj	—	TA	—	—	NT	—	—	—	—	—	—	—
Conus djarianensis	—	—	—	—	D	—	—	—	—	—	—	Tj	—	—	—	NT	UM	—	—	—	PQ	—	—
Conus odengensis	—	—	Bb	C	—	—	—	EM	K	UG	Nj	—	Ta	Pa	—	NT	UM	—	P	—	—	—	—
Conus vimineus	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	NT	—	M	P	N	—	—	Re
Conus virgo	—	—	Bb	—	D	E	—	—	—	—	—	Tj	—	—	—	—	—	—	—	—	PQ	—	Re
Conus sp. a	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Strioterebrum gelingsehense	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Strioterebrum sp. a	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	P	—	—	—	—
Ringicula seriaensis	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Ringicula sp. a	—	B	—	—	—	—	—	EM	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cylichna triplicata	—	B	—	—	—	—	—	EM	—	—	—	—	—	—	—	NT	UM	—	—	—	—	—	—
Cylichna? sp. a	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	—
Nucula njalindungensis	A	B	—	—	—	—	—	—	—	—	Nj	—	—	—	—	NT	—	—	—	—	—	—	—
Nuculana ventricosa	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NT	—	—	—	—	—	—	Re
Barbatia fusca	—	—	—	C	—	E	—	—	—	—	—	Tj	—	—	—	NT	—	M	P	—	PQ	Q	Re

Barbatia plicata	—	—	Bb	C	—	—		—	EM	—	—		—	—	—	—	—	—		UM	M		P	—	PQ	Q		Re
Trisidos semitorta	—	B	—		—	D	—	O	EM	—	UG		—	—	—	—	—	NT		UM	—		P	—	PQ	Q		Re
Anadara mangkalihatensis	—	B	—	C	—	—		—	—	—	—		—	—	—	—	—	NT		—	—		—	—	—	—		—
Scapharca biformis	—	—	—		—	D	—	—	—	—	—		—	—	—	—	—	NT		—	M		P	N	—	—		—
Scapharca hulshofi	A	—	—		—	—	—	—	EM	—	—		—	—	—	—	—	—		—	—		—	—	—	—		—
Arcopsis sculptilis	—	B	—		—	D	—	—	—	—	UG		—	—	—	—	—	NT		—	—		—	—	PQ	Q?		Re
Pecten sedanensis	A	—	—		—	—	—	—	EM	—	UG		—	—	—	—	—	—		—	—		—	—	—	—		—
Chlamys senatoria	—	—	—	C	—	—		O	EM	—	UG	Nj	Tj	—	—	—	NT			—	M		P	N	PQ	Q		Re
Spondylus apiapiensis	A	—	—		—	—	—	—	EM	—	—		—	—	—	—	—	—		—	—		—	—	—	—		—
Placuna ephippium	—	—	—		—	D	—	—	—	—	—		—	—	—	—	—	NT		UM	—		P	N	PQ	Q		Re
Lopha folium	—	—	Bb		—	D	—	—	EM	—	UG	Nj	—	—	—	—	NT			UM	M		P	—	PQ	Q		Re
Linga antjamensis	—	—	—		—	D	E	—	—	—	—		—	—	—	—	—	NT		UM	—		—	—	—	—		—
Chama asperella	—	B	Bb		—	—	E	—	—	—	UG		—	—	—	—	—	NT		—	—		—	—	—	Q		Re
Chama brassica	—	—	—		—	—	E	—	—	—	—		—	—	—	—	—	—		—	—		—	—	—	Q		Re
Chama plinthota	—	—	Bb		—	—	E	—	—	—	—		—	—	—	—	—	—		—	—		—	—	—	Q		Re
Glans boettgeri	—	—	—		—	D	E	—	—	—	—		—	—	—	—	—	NT		—	M		—	—	—	—		—
Crassatella radiata	—	—	—		—	D	—	—	EM	K	—		—	—	—	—	—	NT		—	—		P	—	PQ	Q		Re
Trachycardium cf. *T. denticostulatum*	—	B	—		—	—	E	—	—	—	—		—	—	—	—	—	NT		—	—		—	—	PQ	—		—
Nemocardium jogjacartense	A	—	—		—	—	—	—	EM	—	—		—	—	—	—	—	—		—	—		—	—	—	—		—
Tridacna gigas	—	—	Bb		—	—	—	—	—	—	—	Nj	Tj	—	Pa	—	—			UM	—		P	N	PQ	Q		Re
Tridacna derasa	—	—	—		—	—	E	—	—	—	—		—	—	—	—	—	NT		—	—		P	—	—	—		Re
Hippopus hippopus	—	—	Bb		—	—	E	—	—	—	—		—	—	—	—	—	—		—	M		P	N	PQ	Q		Re
Periglypta cf. *P. granosa*	A	—	—		—	—	—	—	EM	—	UG		range uncertain																		
Circe ickeae	—	B	—	C	—	—		—	—	—	—	Nj	Tj	—	—	—	NT			—	—		—	—	—	—		—
Circe scripta	—	—	—		—	D	—	—	—	—	—		—	—	—	—	—	NT		—	—		P	N	PQ	Q		Re
Gafrarium tumidum	—	—	—		—	D	—	—	EM	—	—		—	—	—	—	—	—		—	—		P	—	—	Q		Re
Atopodonta sawitrae	—	—	Bb		—	—	—	—	—	—	—		—	—	—	—	—	NT		—	—		—	—	—	—		—
Timoclea bataviana	—	—	—		—	—	E	—	—	—	—		—	—	—	—	—	—		—	—		P	—	PQ	—		Re
Timoclea recognita	—	—	—		—	—	E	—	—	—	—		—	—	—	—	—	—		—	—		—	—	—	—		Re
Corbula scaphoides	—	B	Bb		—	D	—	—	—	—	UG		—	—	—	—	—	NT		UM	M		P	N	—	Q		Re
Corbula socialis	A	—	—		—	D	—	—	EM	K	UG	—	Tj	—	—	—	NT			UM	M		P	N	—	—		—
Corbula solidula	A	B	—		—	—	—	—	EM	—	—		—	—	—	—	—	NT		—	—		P	N	—	—		Re
Total species for each locality and age:	19	42	41		32	26	28	2	44		9	26	33	25	14	10	2	94		34			50		30	34		42
		–78–									10?		———			102	———			(Pr- NT)			53?		31	37?		44?
											———				106		———			(if UG = PR)								

Table 15. Inferred ranges of the species of the Gelingseh fauna.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM	———	———	———	———	———	———	Re	: 12
	EM	———	———	———	———	———	Q		: 3
	EM	———	———	———	———	PQ			: 2
	EM	———	———	———	P	?	?	?	: 1
	EM	———	———	———	P				: 5
	EM	———	———	UM	?	?	?	?	: 1
	EM	———	———	UM					: 4
	EM	———	Pr-NT	?	?				: 1
	EM	———	Pr-NT						: 7
	EM	K-UG							: 3
	EM								: 5
		K-UG							: 1
		K-UG	Pr-NT						: 1
		?	Pr-NT						: 1
		K-UG	———	———	P				: 1
		K-UG	———	———	———	PQ			: 1
		K-UG	———	———	———	PQ	?		: 1
		K-UG	———	———	———	———	———	Re	: 3
			Pr-NT						: 29
			Pr-NT	UM					: 6
			Pr-NT	———	P				: 8
			Pr-NT	———	———	PQ			: 3
			Pr-NT	———	———	———	———	Re	: 14
					P				: 3
					P	———	PQ		: 1
					P	———	———	Re	: 3
(a)	44	47	104	65	61	43	40	42	(129 species)
		48?		66?	64?	46?	44?	44?	
		—108	———	(if UG = Pr)					
(b)	32	35	92	53	48	31	28	30	(117 species)
		36?		54?	52?	34?	32?	32?	
		—96	———	(if UG = Pr)					

(a) Number of species for each zone.
(b) Ditto, desregarding the twelve longest lived species.

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Table 16. Inferred ranges of the species of the Gelingseh fauna, Including all Bornean records.

	EM	K-UG	Pr-NT	UM	P	PQ	Q	Re	
	EM	—	—	—	—	—	—	Re	: 12
	EM	—	—	—	—	—	Q		: 3
	EM	—	—	—	—	PQ			: 1
	EM	—	—	—	P	?	?	?	: 1
	EM	—	—	—	P				: 5
	EM	—	—	UM	?	?	?	?	: 1
	EM	—	—	UM					: 1
	EM	—	Pr-NT	?	?				: 1
	EM	—	Pr-NT						: 6
	EM	K-UG							: 4
	EM								: 7
		K-UG							: 2
		?	Pr-NT						: 1
		K-UG	—	UM	?	?	?		: 1
		K-UG	—	—	P				: 2
		K-UG	—	—	—	—	—	Re	: 3
			Pr-NT						: 9
			Pr-NT	UM	?	?	?		: 1
			Pr-NT	—	P				: 7
			Pr-NT	—	—	—	—	Re	: 4
				UM					: 1
				UM	—	—	—	Re	: 2
					P				: 5
					P	—	—	Re	: 1
						?	?	Re	: 1
							Q	Re	: 8
								Re	: 5
(a)	42	43 44?	59	45 46?	50 54?	31 36?	38 42?	41 43?	(100 species)

(a)Number of species for each zone.

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Table 17. Preangerian records of the Gelingseh fauna.

	Rutten's localities																											
	A	B	Bb	C	D	E	as	aa	a	b	c	d	e	f	g	gr	gm	i	j	k	l	m	n	o	p	pr	prx	lop
Euchelus atratus	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Gibbula leupoldi	—	B	—	—	D	—	—	—	—	b	c	—	—	—	—	—	—	—	j	—	l	—	—	—	—	—	—	—
Trochus maculatus	—	—	Bb	—	—	E	—	—	—	b	—	—	—	—	—	—	—	—	—	k	—	—	—	—	—	—	—	—
Smaragdia gelingsehensis	A	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Smaragdia semari	A	—	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Rissoina indrai	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Rissoina maduparensis	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Rissoina ramai	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Cyclostremiscus novemcarinatus	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	j	—	l	—	—	—	—	—	—	—
Turritella angulata djadjariensis	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Turritella damarwulani	—	B	Bb	C	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	lop
Turritella talarensis	A	—	Bb	C	D	—	—	—	—	b	c	d	—	—	—	—	—	i	j	—	—	—	—	—	—	—	—	lop
Turritella heberti	—	—	Bb	C	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectonica karikalensis	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vermetus javanus	—	—	—	—	D	—	—	—	—	b	—	—	—	—	—	gr	—	—	—	—	—	—	—	—	p	pr	—	—
Vermicularia lumbricalis	A	B	—	C	—	—	—	—	a	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Tenagodus cf. *T. obtusiformis*	—	—	—	C	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	pr	—	lop
Tympanotonos cf. *T. merangianus*	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	pr	—	—
Menkrawia callosalabiata	—	B	Bb	—	—	—	as	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vicarya callosa	—	—	Bb	C	—	—	as	—	—	b	—	—	—	—	—	—	—	—	—	k	—	—	—	o	—	pr	prx	—
Terebralia kelirensis	—	—	Bb	C	—	—	—	—	—	b	c	d	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Colina menkrawitensis	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhinoclavis leupoldi	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	j	—	—	—	n	—	—	—	—	—
Rhinoclavis junghuhni	A	—	—	—	—	—	—	—	—	—	—	—	e	—	—	—	—	i	—	—	—	—	—	—	—	—	—	—
Cerithium noetlingi	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Cerithium aff. *C. noetlingi*	—	B	—	—	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	—	—	—
Cerithium rude	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	n	—	—	—	—	—
Cerithium trailli	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	gr	—	—	—	k	—	—	—	—	—	—	—	—
Clypeomorus verbeeki	—	B	Bb	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Triphora javana berauensis	—	B	—	—	—	—	—	—	a	b	c	—	—	—	—	—	—	—	j	—	l	—	—	—	—	—	—	—
Triphora maharatai	—	—	—	—	—	E	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rimella javana	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	i	—	—	—	—	—	—	p	pr	—	—

Tibia verbeeki	—	—	Bb	—	—	—	—	—	a	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	p	pr	prx	—
(*Tibia fusus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	—	—	—)
Strombus preoccupatus	—	—	Bb	C	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	prx	lop
Polinices callosior	—	—	—	—	—	E	—	—	—	b	—	—	—	—	—	gr	—	—	—	—	—	—	—	—	—	pr	—	—
Polinices orangensis	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	gr	—	—	—	—	—	—	—	—	—	—	—	—
Pliconacca manoharae	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	gm	—	—	—	—	—	—	—	—	—	—	—
Natica helvacea	—	—	—	—	—	E	—	—	a	b	c	—	—	—	—	—	—	i	—	—	—	—	—	—	p	pr	prx	lop
Natica rufa	—	—	Bb	—	—	—	—	—	a	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	p	pr	—	lop
Naticarius marochiensis	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	i	—	—	l	m	—	—	—	pr	prx	—
Cymatium pileare	—	—	Bb	C	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	prx	—
Charonia fennemai	—	—	Bb	—	—	—	—	—	—	b	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	pr	—	—
Charonia menkrawitensis	—	—	—	C	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Colubraria tjilonganensis	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Chicoreus juttingae	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Taurasia talahabensis	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Cantharus bucklandi	—	—	Bb	C	—	—	—	—	a	—	—	—	—	—	—	—	—	—	k	—	—	—	—	—	—	pr	—	—
Volema junghuhni	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	prx	—
Hinia gelingsehensis	—	B	—	—	—	—	—	—	—	—	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Alectrion siquijorensis	—	—	—	—	D	—	—	—	—	—	c	—	—	—	—	—	—	i	—	—	—	—	—	—	—	—	—	—
Peristernia beberiana	—	B	—	—	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Clavilithes fennemai	—	—	—	C	—	—	—	—	a	—	—	—	—	—	—	—	—	—	k	—	—	—	—	—	—	pr	—	—
Ancilla cinnamomea	—	—	Bb	—	—	E	—	—	—	b	c	—	—	—	—	gr	—	i	—	—	l	—	—	—	—	pr	—	—
Ancilla sp. a	A	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Oliva gibbosa jenkinsi	—	—	—	—	—	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	prx	—
Oliva rufula djocdjocartae	—	—	—	—	—	E	—	—	—	—	—	—	—	f	—	gr	—	—	—	—	—	—	—	—	—	pr	—	—
Vexillum gembacanum	—	—	—	C	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	l	—	—	—	p	pr	prx	—
Vexillum cf. *V. rajaense*	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	p	—	—	—
Mitra sowerbyi sedanensis	—	—	Bb	C	—	—	—	—	a	b	—	—	—	—	—	—	—	—	—	—	—	-	—	—	—	pr	—	—
Lyria jugosa	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Cymbiola tjilonganensis	—	—	Bb	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Gibberulina menkrawitensis	—	B	—	—	—	—	—	—	—	—	c	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Marginella aff. *M. elegans*	—	—	Bb	C	—	E	—	—	—	—	—	—	e	—	g	—	—	i	—	—	l	—	—	—	—	pr	—	lop
Clavus sp. d	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Gemmula granosa woodwardi	—	—	—	C	—	—	—	—	a	—	—	—	e	f	—	—	—	—	—	—	—	—	n	—	p	—	prx	lop
Gemmula imitatrix	—	B	—	C	—	—	—	—	—	b	c	d	—	—	g	—	—	—	—	—	l	—	n	—	—	pr	—	—
Gemmula karangensis	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	k	l	—	—	—	—	—	pr	prx	—
Turris albinoides	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Turridrupa? witkampi	—	—	—	C	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	—	—	—
Conus decollatus	—	—	Bb	C	—	—	—	—	—	—	—	—	—	—	—	gr	—	—	—	—	—	—	—	—	p	pr	—	—

	Rutten's localities																											
	A	B	Bb	C	D	E	as	aa	a	b	c	d	e	f	g	gr	gm	i	j	k	l	m	n	o	p	pr	prx	lop
Conus djarianensis	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	p	pr	—	—
Conus odengensis	—	—	Bb	C	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	p	pr	—	lop
Conus vimineus	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	p	—	—	lop
Conus virgo	—	—	Bb	—	D	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Conus sp. a	—	—	—	C	—	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	—	—	—
Strioterebrum gelingsehense	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—
Ringicula seriaensis	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	p	—	—	—
Cylichna triplicata	—	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—
Cylichna? sp. a	—	B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—
Nucula njalidungensis	A	B	—	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	j	—	l	—	n	—	—	pr	—	—
Nuculana ventricosa	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	l	—	—	—	—	—	—	—
Barbatia fusca	—	—	—	C	—	E	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	pr	prx	—
Trisidos semitorta	—	B	—	—	D	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	lop
Anadara mangkalihatensis	—	B	—	C	—	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Scapharca biformis	—	—	—	—	D	—	—	aa	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arcopsis sculptilis	—	B	—	—	D	—	—	—	a	b	c	—	—	—	—	—	—	—	j	—	l	—	—	—	—	—	—	—
Chlamys senatoria	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	p	pr	—	lop
Placuna ephippium	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	—	—	—	—
Lopha folium	—	—	Bb	—	D	—	—	—	—	b	c	—	—	—	—	—	—	—	—	—	l	—	—	—	—	pr	—	—
Linga antjamensis	—	—	—	—	D	E	—	—	—	—	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chama asperella	—	B	Bb	—	—	E	—	—	—	b	c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Glans boettgeri	—	—	—	—	D	E	—	—	—	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	—	—	—	—
Crassatella radiata	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	—	—	—	—
Trachycardium cf. *T. denticostulatum*	—	B	—	—	—	E	—	—	—	b	—	—	—	—	—	—	—	—	j	—	—	—	—	—	—	—	—	—
Tridacna gigas	—	—	Bb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Tridacna derasa	—	—	—	—	—	E	—	—	a	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Circe ickeae	—	B	—	C	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	pr	—	—
Circe scripta	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	i	—	—	—	—	—	—	—	—	—	—
Atopodonta sawitrae	—	—	Bb	—	—	—	—	—	—	b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Corbula scaphoides	—	B	Bb	—	D	—	—	—	—	—	—	—	—	—	g	—	—	—	—	—	—	—	—	—	—	—	—	—
Corbula socialis	A	—	—	—	D	—	—	—	—	—	—	—	—	—	—	gr	—	—	—	—	—	—	—	—	p	pr	—	lop
Corbula solidula	A	B	—	—	—	—	—	—	a	b	—	—	—	—	—	—	gm	i	j	—	l	—	n	—	—	—	—	—

Loc.	Total species	Pr-NT	as	aa	a	b	c	d	e	f	g	gr	gm	i	j	k	l	m	n	o	p	pr	prx	lop
A	19	13	—	—	2	4	1	1	1	—	—	1	2	3	3	—	7	—	2	—	2	2	—	2
		68.4%	0	0	15.4	30.8	7.7	7.7	7.7	0	0	7.7	15.4	23.1	23.1	0	53.8	0	15.4	0	15.4	15.4	0	15.4
B	42	38	1	—	4	27	16	1	—	—	3	—	1	3	8	—	17	1	4	—	1	9	1	2
		90.5%	2.6	0	10.5	71.1	42.1	2.6	0	0	7.9	0	2.6	7.9	21.1	0	44.7	2.6	10.5	0	2.6	23.7	2.6	5.3
Bb	41	32	2	—	4	15	6	2	1	—	4	3	—	4	1	5	4	—	—	1	4	21	6	6
		78%	6.3	0	12.5	46.9	18.8	6.3	3.1	0	12.5	9.4	0	12.5	3.1	15.6	12.5	0	0	3.1	12.5	65.6	18.8	18.8
B + Bb	78	64	2	—	8	39	21	3	1	—	7	3	1	6	9	5	21	1	4	1	5	29	7	7
		82.1%	3.1	0	12.5	60.9	32.8	4.7	1.6	0	10.9	4.7	1.6	9.4	14.1	7.8	32.8	1.6	6.3	1.6	7.8	45.3	10.9	10.9
C	32	29	1	—	4	11	5	3	2	1	8	1	—	3	1	3	3	—	3	1	6	18	6	8
		90.6%	3.4	0	13.8	37.9	17.2	10.3	6.9	3.4	27.6	3.4	0	10.3	3.4	10.3	10.3	0	10.3	3.4	20.7	62.1	20.7	27.6
D	26	20	—	1	1	6	7	1	—	—	1	2	—	7	3	—	3	—	—	—	4	7	—	4
		76.9%	0	5	5	30	35	5	0	0	5	10	0	35	15	0	15	0	0	0	20	35	0	20
E	28	17	—	—	2	7	4	—	1	1	2	4	—	4	1	1	1	—	—	—	1	8	3	2
		60.7%	0	0	11.8	41.2	23.5	0	5.9	5.9	11.8	23.5	0	23.5	5.9	5.9	5.9	0	0	0	5.9	47.1	17.6	11.8
total	138	102	2	1	12	45	24	3	3	2	13	8	2	16	9	6	25	1	6	1	15	45	12	13
A-E		73.8%	1.9	1	11.7	43.7	23.3	2.9	2.9	1.9	12.6	7.8	1.9	15.5	8.7	5.8	24.3	1	5.8	1	14.6	43.7	11.7	12.6

Symbols (as in other papers by the writer) in the above distribution table:

as – Sandakan Formation, N.E. Borneo
aa – Sebahat Formation, N.E. Borneo
a – Mandul Island, Miocene
b – Basal Menkrawit Beds, L.114
c – Lower Menkrawit Beds
d – Upper Menkrawit Beds
e – Muara Kobun
f – Pulu Senumpah
g – Kari Orang, Witkamp
gr – Loc. 141, Rutten, Kari Orang
gm – Gunung Mendong
i – Sekurau, Miocene
j – Tapian Langsat
k – Gunung Batuta
l – Gunung Madupar
m – Batu Panggal
n – Mentawir Beds s. str.
o – Sungai Klindjau
p – West Borneo
pr – Classical Preangerian, Java (Nj, Tj, Ta, Pa)
prx – Other Preangerian deposits, Java (Bo, also Tjikao; loc. R, Junghuhn; Tjilintung/Tjiangsana; Purwodadi/Wirosari)
lo? – Lower Palembang Beds, Sumatra

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Manuscript received 20 February 1984.