

Miocene (Preangerian) molluscs from Kari Orang, northern Kutai, East Borneo

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In 1908 H. Witkamp, then with the Royal Dutch Petroleum Company, collected a number of molluscan fossils at a locality near Sungai Kari Orang, on the north flank of the Kari Orang anticline, the locality subsequently being known simply as Kari Orang. It yielded also a few corals which were described by J. Felix and H. Gerth and dated as just Miocene.

In the present paper 27 molluscan species, containing few bivalves are described from Kari Orang, including 5 new ones: *Terebralia? orangensis*, *Erosaria (Erosaria) kutaiana*, *Hinia (Uzita) kalimantanensis*, *Mitra (Mitra) ickeae*, and *Turridrupa? witkampi*. No less than 17 out of 21 species used for age determination occur in Preangerian assemblages, equally close relationships existing with the classical Preangerian of Java and the Lower Gelingseh fauna of East Borneo, while the ties with other Bornean molluscan assemblages are weak to non-existent. It is concluded that the age of the Kari Orang fauna is Preangerian, Tf3.

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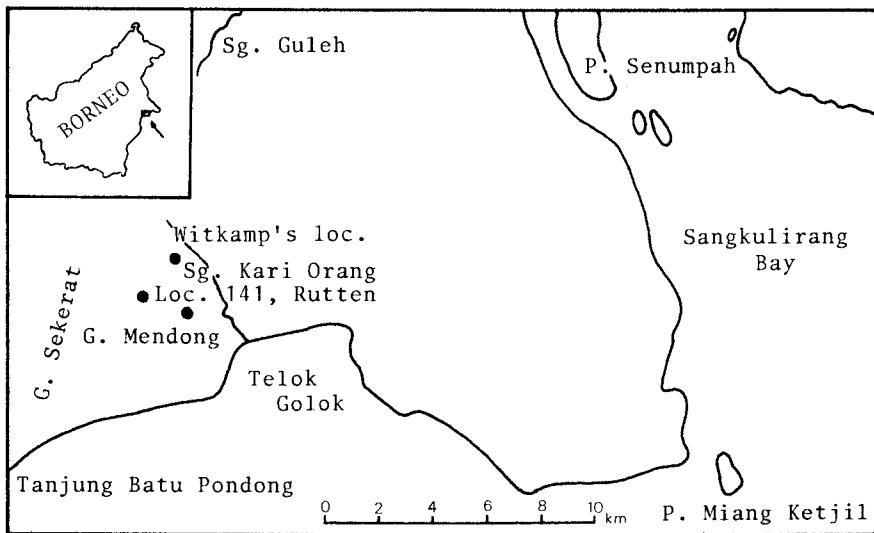


Fig. 1. Sketch map of Kari Orang area between Gunung Sekerat and Sangkulirang Bay.
Sg. = Sungai (river), G. = Gunung (hill, mountain), P. = Pulu (island).

Introduction

A fossiliferous outcrop not far from the Sungai Kari Orang and roughly 4 km from the mouth of that river (see Fig. 1), was visited by H. Witkamp as far back as 1908, in the course of geological investigations carried out on behalf of the Royal Dutch Petroleum Company, at present Shell Internationale Petroleum Maatschappij (S.I.P.M.), Witkamp at that time acting as assistant to J. Wanner.

The locality, afterwards known simply as Kari Orang, was first mentioned in the literature by Wanner (in Felix, 1921, pp. 3 (sketch map), 13) who stated that its position was to the west of Sungai Kari Orang, on the north flank of the so-called Kari Orang anticline. Detailed geological maps of the Kari Orang area produced at the time of Wanner's and Witkamp's investigations, which were kindly made available to the writer by S.I.P.M., unfortunately failed to divulge the exact locality of the fossiliferous outcrop that yielded the corals and molluscs collected by Witkamp, yet a few outcrops were recognized as possibly to agree with the location suggested by Wanner's sketch map. Wanner reported that there, corals were collected — the collector's name, H. instead of J. Witkamp not being mentioned in this context — from deposits which supposedly correlated with L.M.R. Rutten's 'Miopliocene'. Wanner (in Felix, 1921, p. 1) also stated that at all the localities yielding corals, there were accompanying molluscs and Foraminifera. Felix (1921, p. 16) described a single coral, which was subsequently mentioned again by Gerth (1923, pp. 41, 45, loc. 27), together with a few more, and dated as Miocene. The writer is not aware of any subsequent reference to the locality.

Discussion of the Mollusca

The material is kept in the Instituut voor Aardwetenschappen, Utrecht. Fossils kept in the Rijksmuseum van Geologie en Mineraologie are referred to by means of their registration numbers preceded by: RGM.

For stratigraphical data compare faunal list.

Turritella (Torcula) heberti d'Archiac & Haime, 1854

Material – Two specimens.

Range – Pre-Preangerian to Preangerian, Miocene: UG (Sind, Katch, Assam) – NT (Gelingseh Beds: Sg. Gelingseh, 'layer 1'; loc. 144, Rutten) – M ('Early Miocene?', Tf, Fiji).

Comment – An interesting find. The material will be discussed in a forthcoming paper on the fauna of the Lower Gelingseh Beds.

References – d'Archiac & Haime, 1853-1854, p. 296, pl. 27, figs. 21, 21a; Vredenburg, 1925-1928, p. 381; Mukerjee, 1939, p. 46, pl. 3, fig. 3; Ladd, 1972, p. 17, pl. 1, fig. 16: *Turritella (Torcula?)* sp. C.

Tenagodus (Tenagodus) obtusiformis Martin, 1905

Material – A fragment which is however so like other representatives that it is recorded here unhesitatingly.

Range – Pre-Preangerian to Pliocene?: R - Rr (R1) - Ta - NT (Gelingseh Beds: loc. 144, Rutten; Lower Palembang Beds(?)) - P (?).

References – Martin, 1919, pp. 95, 130, 140; van der Vlerk, 1931, p. 252; Haanstra & Spiker, 1932a, p. 1096; 1932b, p. 1314; Wanner & Hahn, 1935, pp. 235, 260; Pannekoek, 1936, pp. 7, 54.

Tymanotonos (Tateiwaia) merangianus (Martin, 1922)

Material – Three small specimens.

Range – Preangerian to Odengian: Nj - NT (Gelingseh Beds: Sg. Gelingseh, 'layer 1' (cf.)) - UM (Antjam Beds: L.751).

Comment – Although very small, the specimens from Leupold's locality L.751 are typical, some, however, quite like the Gelingseh shell and Kari Orang specimens which do not bear spines.

References — Martin, 1921-1922, pp. 472, 493, pl. 3, figs. 72-74 (*Potamides (Tympanotonos) merangianus* sp. nov.); Beets, 1941, pp. 191 (pars: loc. L.751 (exclusively)), 192, 194, 196, 199 (exclusive of records Su and M) (*Tympanotonos merangianus* (Mart.), compare Beets, 1950c, p. 330, nrs. 14, 18); Shuto, 1978, p. 127, pl. 18, figs. 11a-b: *Tateiwaia merangianus* (Martin).

Terebralia? orangensis spec. nov.

Pl. 2, figs. 1-4.

Holotype — Pl. 2, figs. 1-2. Length 10 mm.

Paratype 1 — Pl. 2, figs. 3-4. Length 9+ mm.

Type-locality — Locality Kari Orang, H. Witkamp, Sungai Kari Orang area, N. Kutai, E. Borneo.

Type-horizon — Not ascertained, presumed equivalent of the Gelingseh Beds.

Name — Derived from the type-locality.

Material — Six specimens are available, up to about 10 mm long.

Range — No previous records.

Description — This somewhat odd looking small species is hard to place but since it resembles *Terebralia kelirensis* (Martin, 1916), it is likewise, with reservations, classified as a *Terebralia*.

Shell small, slender to fairly stout, strikingly flat sided with sharply impressed sutures. Protoconch apparently consisting of a single smooth convex whorl, followed by about nine whorls that make up the teleoconch. The first three spire whorls decreasingly convex, with three spiral lirae, the adapical one less prominent than the other two, all three forming beads on the close-set axial riblets which are mostly straight. The beads usually disappear on the flat whorls but may sometimes still be indicated. The most abapical spiral, a little away from the suture, is the strongest one and remains so throughout the spire, marking the abapical edge of the sutural channel, while along the suture a finer spiral lira becomes visible. The number of lirae grows rapidly, all becoming flatter and broader, and mostly also of approximately equal strength.

On the body whorl the ribs do not extend over the base, which bears a prominent spiral ornamentation. Aperture rather narrowly ovate, siphonal canal short, posterior canal well delimited by a ridge on the parietal lip. Inner lip well defined but thin. Outer lip invariably damaged, with a strong varix quite distant from the edge of the lip, the inside of the varix bearing a node- to ridge-like callosity, as in *T. kelirensis*.

T. kelirensis (Martin) (Beets, 1941, p. 44, pl. 2, figs. 80-83; Wissema, 1947, p. 49, pl. 2, figs. 35-37) is generally similar, but *T. orangensis* is appreciably smaller and also slenderer, with much flatter whorls and more numerous and ridge-like ribs instead of convex ones.

Shuto (1978, p. 155, pl. 18, fig. 3) classified *T. kelirensis* as *Clypeomorus? kelirensis*, but although the present writer has long had misgivings about the systematical position of this species, he still believes that both it, and the new one described above, belong to the Potamididae rather than the Cerithiidae.

Rhinoclavis (Proclava) karangensis (Martin, 1899)

Material — A single specimen is available.

Range — Preangerian to Quaternary: Ta - NT (Mentawir Beds s.str.; Tjilintung/Tjiangsana) - P - N - Q.

Comment — The Kari Orang specimen was recorded in 1941 (Beets, 1941, p. 195). There is also an undescribed specimen of uncertain age available from Java (Batavia, RGM 10 450).

References — Altena, 1941, p. 18 (syn.) (*Cerithium karangense* K. Martin); Wissema, 1947, p. 51, pl. 2, fig. 38 (*Clava (Proclava) karangensis* (Martin)); Beets, 1981a, pp. 4, 5.

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

Material — A single specimen.

Range — Preangerian: NT (Gelingseh Beds: Sg. Gelingseh, 'layer 2').

Comment — This is a very small species. Several specimens occur in the collection from the Gelingseh Beds. For *C. noetlingi* see Beets, 1941, p. 54 (syn.).

Cerithium spec. indet.

Material — A single small specimen is available.

Range — No previous records.

Rimella spec. indet.

Material — A single shell is available.

Range — No previous records.

*Tibia (Tibia) cf. *T. fusus** (Linné, 1758)

Material — A fragmentary spire.

Range — Odengian to Recent: UM (Dingle Formation) - M - P - PQ (Togopi Formation) - Q? - Re.

Comments — The fragment compares so nicely with recent specimens with comparatively flat whorls, that the writer can hardly doubt its identity. However, as

there is only a fragment the identification remains uncertain. Shuto quite rightly suspects *T. verbeekii* (Martin, 1899) of being a synonym.

References – Altena, 1941, p. 44 (syn.); Shuto, 1969, p. 71, pl. 3, figs. 14, 15, 18, 19, text fig. 20.

Barycypraea orangensis Beets, 1942

Holotype – Beets, 1942, p. 233, pl. 25, figs. 11-13 (*Zoila (Barycypraea) caputviperae* (Martin) var. *orangensis* v.n.).

Type-locality – Locality Kari Orang, H. Witkamp, Sungai Kari Orang area, N. Kutai, E. Borneo.

Type-horizon – Not ascertained, presumed equivalent of the Gelingseh Beds.

Name – Derived from the locality.

Material – The holotype is the only specimen available.

Range – No other records.

Comments – The writer has come to consider the 'variety' as a separate species altogether. The main distinguishing features having all been described in 1942, it remains to be stated that the holotype of the 'variety' reappears as the holotype of the new species.

Erosaria (Erosaria) kutaiana spec. nov.

Pl. 2, figs. 5-9.

Holotype – Pl. 2, figs. 5-9. Height 26.4 mm, width 15.3 mm, dorso-ventral diameter 12.5 mm.

Type-locality – Locality Kari Orang, H. Witkamp, Sungai Kari Orang area, N. Kutai, E. Borneo.

Type-horizon – Not ascertained, presumed equivalent of the Gelingseh Beds.

Name – Derived from the Province of Kutai, East Kalimantan (E. Borneo).

Material – The holotype is the only specimen available.

Range – No previous records.

Description – Shell of rather small size, not very convex dorsally, slightly convex ventrally, protracted anteriorly, with a slightly indented spire and node-like callosity. Right side sharply marginate and pitted; so are the anterior and posterior portions of the left side. Aperture narrower than in *E. sabahensis* Cox, 1948. Outer lip almost straight, flattened, declivitous near its anterior end, strongly curved to the left posteriorly, bearing 16 prominent teeth. Posterior half of inner lip convex, extending into a narrow ridge along the deeply cut posterior outlet; the anterior part of the lip terminating into an even stronger, well separated, long ridge. Fossula all but absent, defined by a couple of short inner teeth not close to the terminal ridge. Inner lip bearing 16 teeth and a secondary one between each pair of the three foremost teeth, the posterior of the secondary teeth

only semi-detached. The hindmost tooth close to the terminal ridge, the six teeth in front of it extending quite far on to the ventral surface of the shell. All teeth not reaching very far into the aperture.

The species is perhaps closest to *E. sabahensis* Cox (1948, p. 32, pl. 3, figs. 7a-b) which is, however, much bigger and has 24 outer lip teeth, while those of the inner lip do not reach so far on to the ventral surface.

Natica vitellus (Linné, 1758)

Material – There are six specimens.

Range – Pre-Preangerian to Recent: R - Rr (Rl) - UG (Assam?) - Nj - NT (loc. 141, Rutten, Kari Orang; Lower Palembang Beds) - UM (Tjirodeng; Tjitarum) - M - P - N - PQ - Q - Re.

References – Altena, 1941, p. 69 (syn.); Beets, 1941, p. 195; Wissema, 1947, p. 132.

Apollon (Apollon) gyrinus (Linné, 1758)

Material – One shell is available.

Range – Odengian to Recent: UM - M - P - N - PQ - Q - Re.

Comments – The specimen is well preserved. It matches Recent specimens from Timor (coll. Wienecke) in the Rijksmuseum van Natuurlijke Historie, Leiden, beautifully.

References – Beets, 1941, p. 195: *Argobuccinum (Gyrineum) gyrinus* (Linn.); Altena, 1942, p. 98 (syn.): *Gyrineum (Gyrineum) gyrinus* (Linné); Wissema, 1947, p. 144.

Charonia (Sassia) fennemai (Martin, 1899)

Material – Two specimens are available.

Range – Pre-Preangerian to Late Miocene: W - R - Nj - Ta - Pa - NT (basal Menkrawit Beds: L.114; Gelingseh Beds: Sg. Gelingseh, 'layer 1') - UM (Antjam Beds: L. 747).

Reference – Beets, 1941, pp. 91 (syn.), 169, 190, 192, 194, 196, 199.

Chicoreus (Chicoreus) microphyllus (Lamarck, 1822)

Material – A single specimen is available.

Range – Preangerian to Recent: Ta - Pa - NT (basal Menkrawit Beds: L.114) P N - PQ - Q(?) - Re.

Comment – The specimen is juvenile but agrees very well with the material from L.114 and Recent shells.

Reference – Beets, 1941, pp. 96 (syn.), 169, 188: *Murex (Chicoreus) microphyllos* Lam.; non: pp. 192, 194, 197: a 'variety' which will be described as a new species in a forthcoming paper on the fauna of the Gelingseh Beds; Schmid & Walther, 1962, p. 259, pl. 26, figs. 11-12.

Drupa (Morula) concatenata (Lamarck, 1822)

Material – A single small specimen is available.

Range – Pliocene to Recent: P - N - PQ - Q - Re.

Comments – The shell is only 11.4 mm long. The denticles on the columellar lip near the canal and the ones on the inside of the outer lip are well developed. The specimen, despite its small size, is not immature, and so similar to the specimen from the Pliocene of Sekurau (Beets, 1950b), which is likewise one of the slenderer representatives of the species, that one cannot but suspect stunted growth due to facies conditions which so often seem to cause dwarfism of species in fossil faunas from east Borneo.

References – Abrard, 1946, p. 70, pl. 4, fig. 43: *Ricinula (Sistrum) concatenata* Lamarck; *Drupa (Morula) concatenata* (Lamarck): Wissema, 1947, p. 180; Altena, 1950, p. 211; Beets, 1950b, pp. 309, 314.

Thais (Cymia) costata (de Blainville, 1832)

Material – A single specimen is present.

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

Comment – The specimen is very characteristic and matches recent specimens in the Rijksmuseum van Natuurlijke Historie, Leiden, beautifully.

References – Oostingh, 1935, pp. 66 (syn.), 211, 216, pl. 5, figs. 59-61; Altena, 1950, p. 213: *Cymia costata* (Blainville, 1832).

Engina? spec. indet.

Material – A single, small and well preserved specimen which it is not easy to classify as it shows affinities to *Engina*, *Drupa* and *Peristernia* alike.

Range — No previous records.

Hinia (Uzita) kalimantanensis spec. nov.
Pl. 2, figs. 10-16.

Holotype — Pl. 2, figs. 13-16. Length 6.4 mm.

Paratype — Pl. 2, figs. 10-12. Length 7.4 mm.

Type-locality — Locality Kari Orang, H. Witkamp, Sungai Kari Orang area, N. Kutai, E. Borneo.

Type-horizon — Not ascertained, presumed equivalent of Gelingseh Beds.

Name — Derived from Kalimantan, the name of the Indonesian part of Borneo.

Material — Three specimens are available.

Range — No previous records.

Description — Shell small, protoconch pointed, consisting of three smooth convex whorls, the youngest fifth part of the last apical whorl with fine, close-set smooth riblets which are arched backward, and very faint spiral striations merging in the lirae on the spire whorls. The ornamentation of the post-apical whorls begins abruptly with fairly strong rounded ribs and three spiral threads, the adapical one moving away from the suture where a fourth lira is developed which, too, moves away from the suture. Lirae beaded on the ribs, beads spirally elongate. The whorls are convex, inturned towards the abapical suture from which a secondary lira emerges, and another one just before the body whorl begins. The foremost of the four primary spirals delimits the abapical concavity which owes its existence merely to the delicacy of the secondary lirae. Ribs expanding in abapical direction, only faintly developed in the concavity. Growth lines delicate, no secondary lirae are developed between the primary ones.

Base of the last whorl convex, with additional spiral lirae varying in number and setting, constricted at its extremity, a deep sulcus accenting the siphonal fasciole which bears a pronounced adapical ridge and is spirally corded. Aperture ovate, siphonal canal short and narrow, not deeply notched; its posterior canal well delimited. Outer lip varicose, its inside bearing a strong tooth quite far from the posterior canal, with three fine lirae in the intervening space. Between the strong tooth and another, less conspicuous one at the entrance to the siphonal canal, two more spiral lirae, or two secondary lirae in addition. Inner lip well defined, not expanded on to the base, with a prominent parietal ridge delimiting the posterior canal, and up to four faint nodes on the columellar lip, with two prominent oblique teeth on the part over the siphonal fasciole, the abapical one of these abutting against a spiral ridge accompanying the siphonal canal.

H. mangkalihatensis (Beets) (Beets, 1941, p. 101, pl. 9, figs. 357-359) seems to be related, more closely so than *H. varicosecostata* (Fischer) (Fischer, 1927, p. 77, pl. 2, fig. 49), but the former has a blunt apex with only two whorls and a large nucleus, is smaller and plumper and has flatter whorls bearing more numerous riblets, its inner lip being less prominently ornamented.

Hinia (Uzita) aff. H. (U.) agapeta (Watson, 1882)

Material – A single specimen.

Range – No previous records.

Comment – The Kari Orang shell seems remarkably close to a Recent specimen from the Siboga Expedition in the Rijksmuseum van Natuurlijke Historie, Leiden, which has, however, a more contracted aperture and denticles on its parietal lip (see Schepman, 1908-1913, p. 327).

Latirus subcostatus (Woodward, 1879)

Material – A single shell is available.

Range – Miocene: M.

Comment – The specimen resembles Woodward's figure very well. Its apical part is missing.

References – Woodward, 1880, p. 238, pl. 5, figs. 5a-b: *Turbinella subcostata*, H. Woodw.; van der Vlerk, 1931, p. 230.

Vexillum (Costellaria) gembacanum (Martin, 1883)

Material – A single specimen is available.

Range – Pre-Preangerian to Quaternary: R - Rr (Ra) - Nj - Tj - Ta - NT (Geling-seh Beds: loc. 144, Rutten; Gunung Madupar, Wanner; West Borneo; Tjilintung/Tjiangsana) - M (Tjidamar; New Guinea) - P (Sungai Guleh, Borneo; Papua, New Guinea; Pliocene of Ceram and Timor excluded) - N - Q.

References – *Turridula gembacana* Martin: Schepman, 1907, p. 169; Martin, 1928b, pp. 113, 121; Haanstra & Spiker, 1932a, p. 1096; Haanstra & Spiker, 1932b, p. 1313; *Vexillum (Vexillum) gembacanum* Mart.: Pannekoek, 1936, pp. 6, 38 (syn.).

Mitra (Mitra) ickeae spec. nov.
Pl. 3, figs. 1-11.

Holotype – Pl. 3, figs. 3-4. Length 10.6 mm.

Paratype 1 – Pl. 3, figs. 5-7. Length 7.7 mm.

Paratype 2 – Pl. 3, figs. 1-2. Length 10.7 mm.

Paratype 3 – Pl. 3, figs. 8-9. Length 9.8 mm.

Paratype 4 – Pl. 3, figs. 10-11. Length 9.0 mm.

Type-locality – Locality Kari Orang, H. Witkamp, Sungai Kari Orang area, N. Kutai, E. Borneo.

Type-horizon – Not ascertained, presumed equivalent of Gelingseh Beds.

Name – This species is named for the late Mrs H. Martin-Icke who was the first palaeontologist to study Gelingseh molluscs (Martin, 1914).

Material – Five specimens are available.

Range – No previous records.

Description – A small species, in the same group as *M. arntzenii* Martin, 1916. Protoconch (paratype 1) consisting of 1½ smooth convex whorl – with a rather bulbous nucleus – its end marked by a varicose axial riblet. Post-embryonic whorls with distinct sutures, not markedly convex, each one abutting against the preceding whorl. Ornamentation initially consisting of fine narrow axial riblets and three delicate, rapidly stronger spiral threads which are predominant after about ¼ whorl: riblets there-after more closely set and causing punctate appearance of the spiral grooves of diminishing width, the three spiral lirae simultaneously developing into slightly rounded, fairly broad bands. Penultimate whorl with a third spiral groove near the apical suture, a small part of a fourth spiral band becoming visible too. The groove between the two apical bands remains wider and deeper and more clearly punctate than the other grooves, while all three bands become more or less conspicuously bisected by a secondary groove. On the body whorl bands and grooves may become obsolete, the resulting variable ornamentation being shown by the series of figures given.

Base with additional bands and cords. Aperture long and rather narrow, smooth within, outer lip regularly convex, moderately thickened, simple. Inner lip usually well developed and thickened, sharply marginate. Columella bearing 4 sharp folds decreasing in size anteriorly, the fourth sometimes very weak. Siphonal fasciole hardly developed, siphonal notch shallow.

M. arntzenii (Martin, 1916-1917, p. 236, pl. 1, figs. 28-28a) is rather closely related, but slenderer, has slightly more flattened whorls and five spiral bands.

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

Material – Two shells are available.

Range – Pre-Preangerian to Preangerian: R - Rr (Rm; R1) - Tj - NT (Muara Koubun; Gelingseh Beds: Sungai Gelingseh, 'layer 1'; loc. 144, Rutten; loc. 150, Rutten; Sekurau; Gunung Madupar, Wanner; Lower Palembang Beds).

References – Oostingh, 1938-1940, prt 5, p. 125 (syn.), pl. 8, figs. 157a-b; Beets, 1950c, p. 335; Beets, 1983, pp. 6.

Clavus spp. 1, 2, 3

Material – One specimen each.

Range – No previous records.

Turridrupa? witkampi spec. nov.

Pl. 3, figs. 12-17.

Holotype — Loc. 144, Rutten: Pl. 3, figs. 16-17. Length 26 mm.*Paratype* — Pl. 3, figs. 12-15. Length 13 mm.*Type-locality* — Loc. 144, L.M.R. Rutten.*Type-horizon* — Gelingseh Beds, reportedly Lower Gelingseh Beds, level approximately the same as that of Sg. Gelingseh, 'layer 1 & layer 2', Rutten (Martin, 1914).*Name* — This species is named for H. Witkamp, collector of the Kari Orang fauna.*Material* — One small specimen from Kari Orang (Paratype).*Range* — Preangerian: NT (Gelingseh Beds: loc. 144, Rutten).

Description — Shell slender, its protoconch short, rather bulbous, blunt, with large nucleus: well over one smooth and convex whorl, followed by $\frac{1}{2}$ whorl with intermediate sculpture consisting of smooth axial riblets, curved backward and extending from suture to suture, the last few riblets more v-shaped. The beginning of the post-embryonic whorls not very abrupt, yet clearly indicated by the appearance of a smooth spiral cord at the abapical suture, with another, stronger one adapically fairly close to it, the first and subsequent riblets abutting against this cord and suddenly being more strongly curved to even more v-shaped, than the last apical ones, the v-shape indicating the development of the anal notch. Riblets soon shorter, comma-shaped and swollen in the middle, while another spiral cord appears along the adapical suture. The riblets gradually shorten, becoming bead-like and joined by a gradually developing low sinus cord - just off the apex of the sinus - in the middle of the concavity, which corresponds with the fairly broad, u-shaped sinus of the outer lip. The two cords delimiting the sinus gradually developing into sharply raised carinae, the abapical one becoming the main carina and the adapical one moving away from the suture. Growth lines well developed, the sinus edges often standing out scale-like above the surface of the concavity. Likewise, the gradually developing secondary spiral threads (except the ones between the two anterior carinae) are more or less scale-like on account of the growth lines.

Last whorl on its base and neck with several more, often scaly spiral cords, the first two in front of the suture closely together and rather strong, those in the middle with wider intervals and the ones near the anterior extremity closest. Secondary spiral threads in most of the intervals between the primary spirals.

Inner lip thin, well delimited; outer lip on its inside with five smooth and thin spiral lirae (paratype), or six lirae, two of which appear to be secondary ones developed between primary lirae (holotype).

The siphonal canal is long and unnotched, even longer than in *T. prestoni* Powell, 1967, but not as in *Heteroturris* which has, moreover, a smooth spiral thread instead of a gemmate sinus rib. Perhaps a new genus is required for *T.? witkampi*, possibly including species like *Pleurotoma albinoidea* Martin, 1883 and *P. ickei* Martin, 1906.

T.? ickei (Martin, 1906) (Martin, 1891-1922, p. 293, pl. 43, figs. 703, 703a-b; Vredenburg, 1925-1928, p. 40) seems distantly related, but its protoconch, as described by Vredenburg, is quite different: with a minute nucleus and

four additional apical whorls (Martin presupposed the presence of three whorls), the last two of these axially costate; its sinus rib is much stronger than in *T? witkampi* and double, while its nodes are much more clearly spirally elongate.

Gemmula (Gemmula) imitatrix (Martin, 1916)

Material – Three specimens are available.

Range – Pre-Preangerian to Quaternary: W - Nj - Ta - NT (basal Menkrawit Beds: L.114; Lower Menkrawit Beds: L.386; Upper Menkrawit Beds: L.745, L.746; Gelingseh Beds: Sg. Gelingseh, 'layer 2'; loc. 144, Rutten; Gunung Madupar, Rutten, Wanner; Mentawir Beds s. str.) - UM (Antjam Beds: L.751) - M - P - PQ - Q.

References – Beets, 1941, pp. 129 (syn.), 170, 190, 192, 194, 197 (*Turris (Gemmula) imitatrix* (Mart.)); Beets, 1981a, p. 6.

Conus hardi Martin, 1879

Material – A single fine shell.

Range – Pre-Preangerian to Preangerian: W - Tj - Ta - Pa - NT (Sebahat Formation, N.E. Borneo; Tjilintung/Tjiangsana; Preangerian part of Bodas Formation).

References – Martin, 1879-1880, p. 12, pl. 14, fig. 2; Martin, 1883, p. 224; Martin, 1883-1887, p. 52; Martin, 1891-1922, p. 18, pl. 2, fig. 35, pl. 3, figs. 36-38a; Martin, 1916-1917, pp. 226, 278; Martin, 1919, pp. 72, 129, 130, 131; Martin, 1928, pp. 113, 119; van der Vlerk, 1931, p. 213; Beets, 1941, pp. 195, 199, 201; Beets, 1950c, p. 336, nrs. 79-80; Nuttall, 1964, pp. 165, 166.

Conus spec. indet.

Material – A juvenile specimen.

Range – Preangerian: NT (Gelingseh Beds: loc. 144, Rutten).

Barbatia (Barbatia) fusca (Bruguière, 1789)

Material – A left valve is available.

Range – Preangerian to Recent: Tj - NT (Gelingseh Beds: loc. 144, Rutten; Loc. 150, Rutten; Tjilintung/Tjiangsana) - M - P - PQ (Togopi Formation) - Q - Re.

Comments – The synonymy was given by the writer in 1941, but the material from Leupolds's localities L.114 and L.391, after a careful re-examination prov-

ed to belong to a different species more akin to *B. wenki* Cox, 1948. The writer's other identifications made in the past are upheld and comprise: one left valve from Kari Orang; two left valves and a fragmentary right one from Rutten's loc. 144; finally, one right valve from Rutten's loc. 150; all agree well with a large suite of the smaller amongst the Recent specimens in the Rijksmuseum van Natuurlijke Historie, Leiden.

References — Beets, 1941, pp. 5, 181, 188, 194, 197 (non: pp. 148, 171, 190); *Arca (Barbatia) fusca* Brug. (pars); Abrard, 1942, p. 19, pl. 2, fig. 6; Beets, 1950a, pp. 254, 258, 260; Nuttall, 1965, p. 176: *Barbatia fusca* (Bruguière).

Corbula scaphoides Hinds, 1843

Material — Two valves present.

Range — Pre-Preangerian to Recent: UG (Quilon) - NT (Gelingseh Beds: Sg. Gelingseh, 'layer 1', 'layer 2'; loc. 149, Rutten) - UM (Dingle Formation, Panay) - M - P - N - Q - Re.

References — Beets, 1941, pp. 193, 194, 197: *Aloidis scaphotides* (Hinds); Shuto, 1971, p. 66 (syn.), pl. 10, figs. 1, 3-6, 10, 17, textfigs. 1-4: *Corbula (Corbula) scaphoides* Hinds.

Corbula taitensis acuticosta Martin, 1885

Material — A single right valve is available.

Range — Preangerian to Pliocene, Neogene: Nj - Tj - NT (Sekurau) - M (Tjidamar) - P - N.

Comment — This subspecies will be discussed in a forthcoming paper on Neogene molluscs from the Vogelkop (Bird's Head), New Guinea.

References — *Corbula acuticosta* Martin: Martin, 1883-1887, p. 197, pl. 10, fig. 200; Martin, 1919, pp. 66, 128; Martin, 1928b, pp. 111, 117; Vredenburg, 1925-1928, prt 2, p. 461; *Aloidis taitensis acuticosta* (Martin): Beets, 1947, p. 203.

Faunal list

The abbreviations and symbols listed below stand for the stratigraphical records of the species from Kari Orang discussed in the previous chapter.

It should be noted that the present writer adheres to Martin's usage of a twofold subdivision of the Miocene, be it that the Njalindung Beds are no longer accepted as the top part of 'Lower Miocene', or the Tjilanang Beds as the lower

part of 'Upper Miocene': together, they form Oostingh's Preangerian. Early Miocene as used by the writer ranges upward to the interval between the Rembang Beds (corresponding to the top part of Lower Miocene of some authors, or the lower part of Middle Miocene according to others) and Preangerian = Late Miocene, in part (or Middle Miocene according to some modern authors), the top part of Late Miocene being occupied by Odengian (Upper Miocene of authors). For age determinations, the writer gives preference to the terminology pre-Preangerian (instead of Early Miocene), Preangerian and Odengian.

- Re — Recent
- Q — Quaternary
- PQ — Pliocene/Quaternary (e.g., Togopi Formation, N.E. Borneo)
- N — Neogene, unclassified (e.g., Tji Gugur, Java)
- P — Pliocene (Th approximately)
- M — Miocene, not classified (e.g., 'Early Miocene? Tf^p, Fiji Is.)
- UM — Late Miocene, in part (largely Tg, Odengian, including Antjam Beds, E. Borneo; Upper Dingle Formation, Panay, Philippine Is.)

- Pr — Preangerian (Tf3):
- Bo — Bodjonganmanik Beds s. str., Java
- Nj — Njalindung Beds, Java
- Tj — Tjilanang Beds, Java
- Ta — Tjadasngampar, Java
- Pa — Parungponteng (= Selatjau), Java
- NT — Preangerian, unspecified, including:
 - East Borneo:
 - Menkrawit Beds, coll. W. Leupold, L.114 a.o. (Beets, 1941)
 - Muara Kobun, coll. M. Schmidt (Shell) (Beets, 1983)
 - Gelingseh Beds, partly published (Martin, 1914; Beets, 1941), including: Sg. Geling-seh, 'layers 1 & 2', coll. L.M.R. Rutten; loc. 144, Rutten; loc. 149, Rutten; loc. 150, Rutten;
 - loc. 141, Rutten, Kari Orang, partly published (Beets, 1941)
 - Sekurau, coll. M. Schmidt (Shell), unpublished
 - Gunung Madupar, coll. L.M.R. Rutten and J. Wanner, unpublished Mentawir Beds s. str., coll. L.M.R. Rutten (Beets, 1981a).
 - N.E. Borneo:
 - Sebahat Formation, Dent Peninsula (Nuttall, 1964)
 - West Borneo: coll. Shell, unpublished
 - Java:
 - Tjilintung/Tjiangsana
 - Preangerian part of Bodas Formation
- pPr — pre Preangerian (tfl-2)
- UG — Upper Gaj & equivalents (seemingly Rembang going upward into Preangerian (in part))
- Rr — Rembang equivalents:
 - Ra — Api Api, Pasir, E. Borneo, coll. K. Goldschmid (Shell), unpublished
 - Rm — Madura, coll. R. Gsell (Shell), unpublished
 - R1 — Langkang, Sumatra, coll. W. van Holst Pellekaan (Shell), not published
 - R — Rembang Beds (apparently extending upward into Preangerian), Java
- W — Westprogo Beds, Java

Table 1. Known ranges of the molluscs from Kari Orang.

	pPr				Pr				NT	UM	M	P	N	PQ	Q	Re		
	W	R	Rr	UG	Nj	Tj	Ta	Pa										
<i>Turritella heberti</i>	--	--	--	UG	--	--	--	--	NT	---	M	--	--	--	--	--	--	
<i>Tenagodus obtusiformis</i>	--	R	Rr	---	---	Ta	--	--	NT	---	---	P?	--	--	--	--	--	
<i>Tymanonotonus merangianus</i>	--	--	--	---	Nj	---	---	---	NT	UM	--	--	--	--	--	--	--	
<i>Terebralia? orangensis</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Rhinoclavis karangensis</i>	--	--	--	---	---	Ta	--	--	NT	---	---	P	N	--	Q	--	--	
<i>Cerithium aff. C. noetlingi</i>	--	--	--	---	---	---	---	---	NT	---	---	---	---	---	---	---	---	
<i>Tibia cf. T. fusus</i>	--	--	--	---	---	---	---	---	--	UM	--	P	--	PQ	Q?Re	--	--	
<i>Barycypraea orangensis</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Erosaria kutaiana</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Natica vitellus</i>	--	R	Rr	UG	Nj	--	--	--	NT	UM	M	P	N	PQ	Q	Re	--	
<i>Apollon gyrinus</i>	--	--	--	---	---	---	---	---	--	UM	M	P	N	PQ	Q	Re	--	
<i>Charonia fennemai</i>	W	R	--	---	Nj	--	Ta	Pa	NT	UM	--	--	--	---	---	---	---	
<i>Chicoreus microphyllus</i>	--	--	--	---	---	Ta	Pa	--	NT	---	---	P	N	PQ	Q?Re	--		
<i>Drupa concatenata</i>	--	--	--	---	---	---	---	---	--	---	---	P	N	PQ	Q	Re	--	
<i>Thais costata</i>	--	--	--	---	---	---	---	---	--	---	---	P	--	---	Q	Re	--	
<i>Hinia kalimantanensis</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Latirus subcostatus</i>	--	--	--	---	---	---	---	---	--	---	M	--	--	---	---	---	---	
<i>Vexillum gembacanum</i>	--	R	Rr	---	Nj	Tj	Ta	--	NT	---	M	P	N	--	Q	--	--	
<i>Mitra ickeae</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Marginella aff. M. elegans</i>	--	R	Rr	---	---	Tj	--	--	NT	---	---	---	---	---	---	---	---	
<i>Turridrupa? witkampi</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Gemmula imitatrix</i>	W	--	--	---	Nj	--	Ta	--	NT	UM	M	P	--	PQ	Q	--	--	
<i>Conus hardi</i>	W	--	--	---	---	Tj	Ta	Pa	NT	---	---	---	---	---	---	---	---	
<i>Conus spec. indet.</i>	--	--	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	
<i>Barbatia fusca</i>	--	--	--	---	---	Tj	--	--	NT	---	M	P	--	PQ	Q	Re	--	
<i>Corbula scaphoides</i>	--	--	--	UG	---	---	---	---	NT	UM	M	P	N	--	Q	Re	--	
<i>Corbula taitensis acuticosta</i>	--	--	--	---	Nj	Tj	--	--	NT	---	M	P	N	--	--	--	--	
Number of species recorded in each zone:	pPr				Pr				UM				P				Q Re	
	9				17				7				12				9	
													(13?)				(11?) 8	

Age determination

Of 27 species considered, 8 or 30% are still living, a percentage that would indicate a Preangerian age approximately, were it not that such a determination is unreliable considering the rather small number of species involved. The actual records of the species as shown by the faunal list above (Table 1) may however be taken as a much more convincing argument in favour of a Preangerian age of the assemblage. The composite actual ranges of the species present the following picture (Table 2).

Table 2. Inferred time ranges of the molluscs from Kari Orang.

pPr	Pr	UM	P	PQ	Q	Re	
pPr						Re: 2	
pPr					Q	: 2	
pPr	— Pr	— ? —	— P			: 1	
pPr		— UM				: 1	
pPr	— Pr					: 3	
Pr						: 3	
Pr	— UM					: 1	
Pr		— P				: 1	
Pr			— Q			: 1	
Pr					Re: 2		
		— UM			Re: 2		
			— P		Re: 2		
<hr/>							
(a) pPr	9	Pr	UM	P	PQ	Q	Re
(a)	9	17	12 (13?)	12 (13?)	11	11	8 (21 species)
(b)	7	15	10 (11?)	10 (11?)	9	9	6 (19 species)

Note - (a) Number of species recorded in each zone, 5 new species and *Latirus subcostatus* excluded

(b) Ditto, when disregarding the two longest lived species

Table 3. Preangerian records of the species from Kari Orang.

	aa	b	c	d	e	gb	gr	i	l	n	p	pr	prx	lop
<i>Turritella heberti</i>	--	--	--	--	--	gb	--	--	--	--	--	--	--	--
<i>Tenagodus obtusiformis</i>	--	--	--	--	--	gb	--	--	--	pr	--	pr	--	lop?
<i>Tympanotonos merangianus</i>	--	--	--	--	--	gb?	--	--	--	pr	--	pr	--	--
<i>Rhinoclavis karangensis</i>	--	--	--	--	--	--	--	--	n	--	pr	prx	--	--
<i>Cerithium aff. C. noetlingi</i>	--	--	--	--	--	gb	--	--	--	--	--	--	--	--
<i>Natica vitellus</i>	--	--	--	--	--	gr	--	--	--	pr	--	pr	--	lop
<i>Charonia fennemai</i>	--	b	--	--	--	gb	--	--	--	pr	--	pr	--	--
<i>Chicoreus microphyllus</i>	--	b	--	--	--	--	--	--	--	pr	--	pr	--	--
<i>Vexillum gembacanum</i>	--	--	--	--	--	gb	--	1	--	p	pr	prx	--	--
<i>Marginella aff. M. elegans</i>	--	--	--	e	gb	--	i	1	--	pr	--	pr	--	lop
<i>Turridrupa? witkampi</i>	--	--	--	--	--	gb	--	--	--	--	--	--	--	--
<i>Gemmula imitatrix</i>	--	b	c	d	--	gb	--	1	n	--	pr	--	--	--
<i>Conus hardi</i>	aa	--	--	--	--	--	--	--	--	pr	pr	prx	--	--
<i>Conus spec. indet.</i>	--	--	--	--	--	gb	--	--	--	--	--	--	--	--
<i>Barbatia fusca</i>	--	--	--	--	--	gb	--	--	--	pr	pr	prx	--	--
<i>Corbula scaphoides</i>	--	--	--	--	--	gb	--	--	--	--	--	--	--	--
<i>Corbula taitensis acuticosta</i>	--	--	--	--	--	--	i	--	--	pr	--	--	--	--

The number of species in common with: aa: 1 (5.9%); b: 3 (17.6%); c: 1 (5.9%); d: 1 (5.9%); e: 1 (5.9%); gb: 12 (70.6%) gr: 1 (5.9%); l: 2 (11.8%); i: 3 (17.6%); n: 2 (11.8%); p: 1 (5.9%); pr: 12 (70.6%); prx: 4 (23.5%); lop: 3 (17.6%).

Symbols in the above distribution table:

aa - Sebahat Formation, N.E. Borneo	i - Sekurau
b - basal Menkrawit Beds, L.114	l - Gunung Madupar
c - Lower Menkrawit Beds	n - Mentawir Beds s. str.
d - Upper Menkrawit Beds	p - West Borneo
e - Muara Kobun	pr - classical Preangerian, Java (Nj, Tj, Ta, Pa)
gb - Gelingseh Beds	prx - other Preangerian deposits, Java
gr - loc.141, Rutten, Kari Orang	lop - Lower Palembang Beds, Sumatra

From the above distribution, not less than from the one presented by the faunal list, it can be seen that a Preangerian (Tf3) age of the fauna appears most likely, despite the fact that, so far, two species had not been recorded from deposits older than Pliocene, and two other species not prior to Odengian. Three species so far 'confined' to Preangerian carry very little counterweight in this respect, having been but rarely observed.

Finally, the relationships between the Kari Orang fauna and other Preangerian faunas may be considered, as illustrated by Table 3.

The distribution shown above demonstrates that very close relationships exist with both the Gelingseh fauna of the same area in Kutai and the distant classical Preangerian faunas of Java. On the other hand, the ties with other Bornean faunas are weak, while none would appear to exist with Mandul, Tapian Langsat, Gunung Batuta and Batu Panggal at all.

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Plate 2

- Figs. 1- 2. *Terebralia? orangensis* sp. n. Holotype; length 10 mm, loc. Kari Orang (H. Witkamp).
- Figs. 3- 4. *Terebralia? orangensis* sp. n. Paratype 1; length 9+ mm; loc. Kari Orang (H. Witkamp).
- Figs. 5- 9. *Erosaria (Erosaria) kutaiana* sp. n. Holotype; height 26.4 mm, width 15.3 mm, dorso-ventral diameter 12.5 mm; loc. Kari Orang (H. Witkamp).
- Figs. 10-12. *Hinia (Uzita) kalimantanensis* sp. n. Paratype; length 7.4 mm; loc. Kari Orang (H. Witkamp).
- Figs. 13-16. *Hinia (Uzita) kalimantanensis* sp. n. Holotype; length 6.4 mm; loc. Kari Orang (H. Witkamp).
- Fig. 16: protoconch and part of teleoconch extra enlarged.

Plate 2

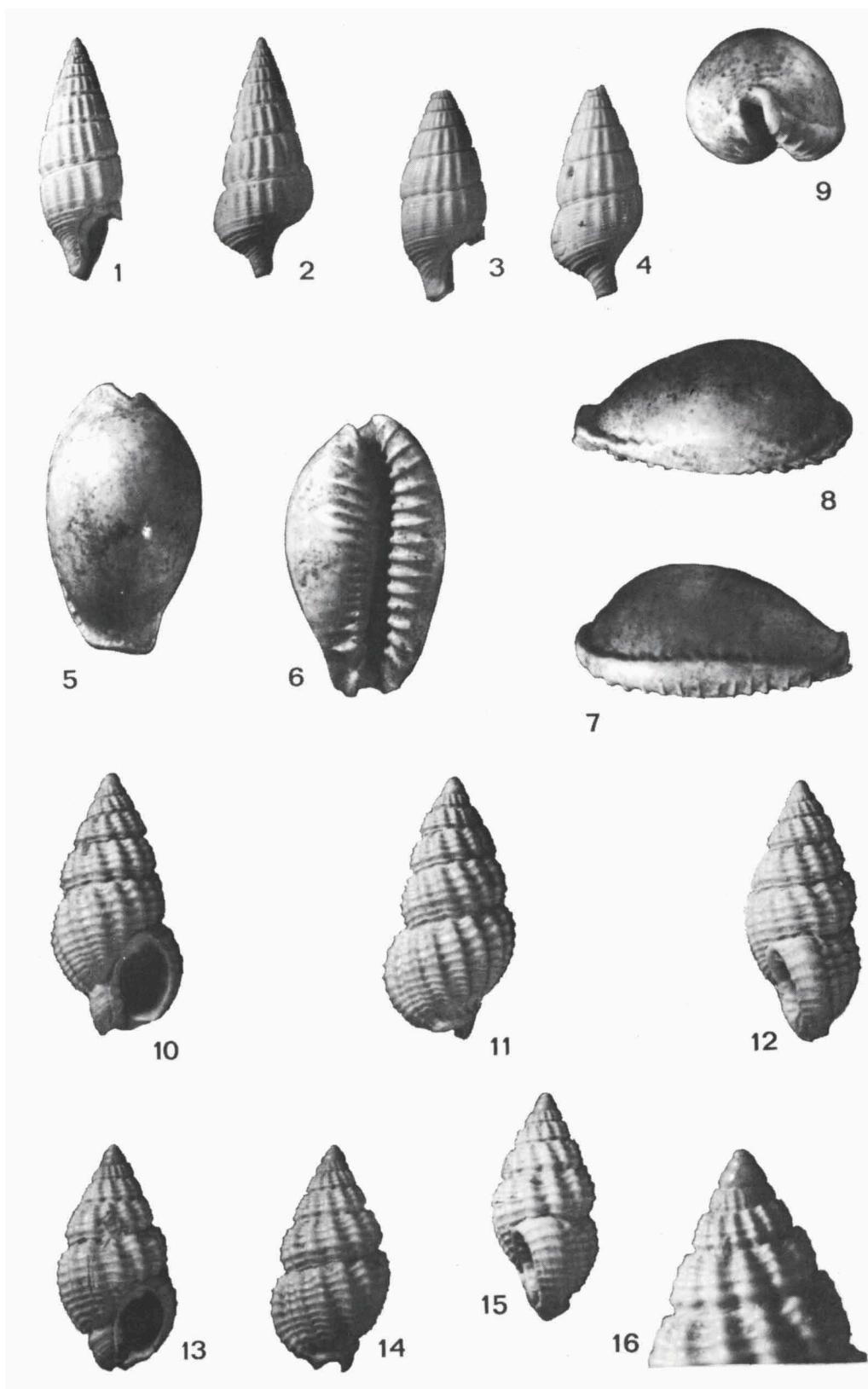


Plate 3

- Figs. 1- 2. *Mitra (Mitra) ickeae* sp. n. Paratype 2, length 10.7 mm; loc. Kari Orang (H. Witkamp).
- Figs. 3- 4. *Mitra (Mitra) ickeae* sp. n. Holotype, length 10.6 mm; loc. Kari Orang (H. Witkamp).
- Figs. 5- 7. *Mitra (Mitra) ickeae* sp. n. Paratype 1, length 7.7 mm; fig. 7: protoconch extra enlarged; loc. Kari Orang (H. Witkamp).
- Figs. 8- 9. *Mitra (Mitra) ickeae* sp. n. Paratype 3, length 9.8+ mm; loc. Kari Orang (H. Witkamp).
- Figs. 10-11. *Mitra (Mitra) ickeae* sp. n. Paratype 4, length 9 mm; loc. Kari Orang (H. Witkamp).
- Figs. 12-15. *Turridrupa? witkampi* sp. n. Paratype, length 13 mm; figs. 13-15: successive stages of growth from protoconch to teleoconch, extra enlarged; loc. Kari Orang (H. Witkamp).
- Figs. 16-17. *Turridrupa? witkampi* sp. n. Holotype; fig. 17: ornament extra enlarged; loc. 144 (L.M.R. Rutten), Kari Orang.

Plate 3

