Miocene molluscs from Muara Kobun and Pulu Senumpah, Sangkulirang Bay, northern Kutai (East Borneo)

C. Beets

Beets, C. Miocene molluscs from Muara Kobun and Pulu Senumpah, Sangkulirang Bay, northern Kutai (East Borneo). – Scripta Geol., 67: 1 - 21, 1 fig., pl. 1, Leiden, October 1983.

The fossils from Muara Kobun were collected by M. Schmidt (Royal Dutch Petroleum Company) as far back as 1902. Eighteen species, including two new ones (*Cerithium (Gourmya) kobunense* and *Carditella witkampi*) have been examined, the majority being gastropods whose combined stratigraphical ranges suggest a Preangerian age, with, however, the additional stipulation that perhaps some level high up in Tertiary f3 is involved rather than an age comparable to that of the Gelingseh faunas first partly described by K. Martin and the present writer.

The molluscs from Pulu Senumpah were collected by L.M.R. Rutten in the period 1911-1913. There are no more than seven species, all gastropods, over half of which indicate best relationships with the Muara Kobun fauna, hence their being tentatively assigned the same age.

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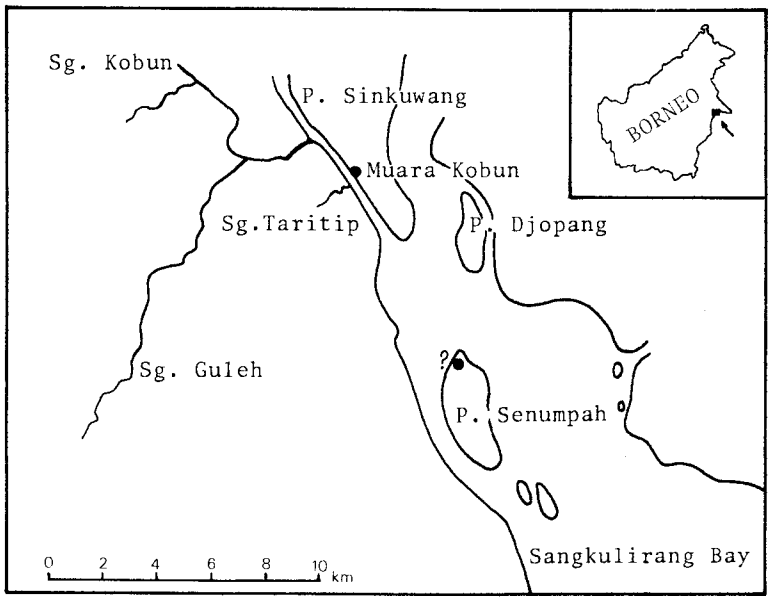

Fig. 1. Sketch map of Sangkulirang Bay area.
Sg. = Sungai (river), P. = Pulu (island).

Introduction

The present paper deals in the first place with a rather small, yet interesting fauna of Neogene Mollusca from Muara Kobun in the Sangkulirang Bay. The material was labelled: 'Muara Kobun, Sangkulirang, Kutai - Ufer am Tongkang M. Schmidt leg., 29-6-1902'. Dr Schmidt collected the fossils while carrying out geological explorations on behalf of the Royal Dutch Petroleum Company, later Bataafsche Petroleum Maatschappij and now, Shell Internationale Petroleum Maatschappij (S.I.P.M.). He mentioned the locality in a company report dated 30-7-1902 which S.I.P.M. kindly made available to the writer in recent months. The locality is situated on the west bank of Pulu Sinku(w)ang (Fig. 1), apparently at the time close to a barge (tongkang, for transshipment of loads to and from ships and land), which presumably by being anchored or made fast by hawsers acted as a jetty and thus, in those early exploration days, could serve as a welcome landmark where there were few others present. The locality is also obliquely across the Muara (roadstead) Kobun, from the mouth of Sungai Taritip, or Teritip, on the nearby mainland.

Apart from molluscs, the locality (see: Gerth, 1923, pp. 41, 46: loc. 39; compare p. 47, loc. 40) yielded but a single coral, a solitary one of deeper water habitat, which was described as *Acanthocyathus malayicus* Gerth, 1923 (l.c., p. 57, pl. 1, figs. 20-21), subsequently also recorded from Pliocene/Pleistocene deposits of Ceram (see: Gerth, 1925, p. 53). Gerth somewhat casually concluded that its age could be Late Miocene but in 1925 he referred it to Miocene, unspe-

cified. The last reference to the locality was made by Krijnen (1931, p. 532, Nr 176), who classified it, together with a number of other localities, as 'Young Miocene, Gelingseh beds, Tertiary f' (i.e., Tf3).

In addition to the coral described by Gerth, and the molluscs discussed below, the following fossils from Muara Kobun appeared to be present in the collections of the Rijksmuseum van Geologie en Mineralogie: *Flabellum* spp. (two), *Heterocyathus* spp. (two), one of which is *H. parasiticus* Semper, 1872, and other corals; finally, a few echinoid spines (*Cidaris?* sp.).

In the second place, a few molluscs are described from L.M.R. Rutten's loc. 156, Pulu Senumpah, likewise in the Sangkulirang Bay (Fig. 1). Most of the species have been mentioned before (Beets, 1941, pp. 194-196). According to Rutten the stratigraphic level of this small assemblage could be somewhat higher than that of the fauna of the Gelingseh Beds first discussed by Martin (1914) and the present writer (1941).

Description of the molluscan species

MUARA KOBUN

The material is kept in the Rijksmuseum van Geologie en Mineralogie, the registration numbers being preceded by the abbreviation RGM. For stratigraphical data see the next chapter.

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

Material – RGM 312 026.

Range – Pre-Preangerian to Preangerian: R - NT (Gelingseh Beds: source area of Sungai Gelingseh; Sekurau).

Comment – This species is represented by two specimens which agree very well with material from both the Miocene of Sekurau and Sungai Gelingseh.

References – Wanner & Hahn, 1935, pp. 238, 259, pl. 19, fig. 26 (*Potamides (Terebralia) Junghuhni* Wanner & Hahn); Pannekoek, 1936, p. 7.

Cerithium (Gourmya) kobunense spec. nov.
Pl. 1, figs. 1-6

Holotype – RGM 312 151; Pl. 1, figs. 1-3. Length: 21 mm.
Paratypes – RGM 312 152; Pl. 1, figs. 4-6. Length 25.6 mm RGM 312 153 (2 specimens).
Type-locality – Muara Kobun, Pulu Sinkuang, Sangkulirang Bay, E. Borneo.
Type-horizon – Not specified, presumably some level high up in the Gelingseh Beds.
Name – Derived from the type-locality.

Range – No previous records.

Description – The rare subgenus *Gourmya* Bayle (in Fischer), 1884, is here represented by a characteristic species. Four specimens are available, two of which are rather poorly preserved. The figured paratype, the largest specimen on hand, is comparatively plump, while the holotype is slenderer. The protoconch is not preserved. The spire whorls are flat, but clearly defined, although the sutures are not very distinct.

The sculpture is quite simple: as in certain other species of *Gourmya*, it consists of a number of primary and secondary spiral lirae, one secondary spiral between each couple of primary ones. On the youngest whorls, a more prominent spiral may be visible in the abapical suture.

The last whorl is large and entirely covered with spirals of two sizes. On this, and preceding whorls, the growth lines are rather inconspicuous, slightly arched forward at the adapical suture, slightly arched backward over the greatest part of the whorls and somewhat forward again over the base of the shell, while finally they turn towards the columella in a short curve.

The outer lip is provided with a rather strong varix but its edge is thin and sharp. No other varices are developed. The inside of the outer lip is smooth, and so is the columellar lip, while the parietal lip bears a conspicuous parietal ridge. The columellar lip is thin, except anteriorly where it detaches itself a little from the base.

No closely related species are known to the writer, except perhaps the living *C. gourmyi* Crosse, 1861, from New Caledonia which however is more than double the size of the new species and gross of appearance.

Niso (Niso) spec. indet.

Material – RGM 312 030. Length 7+ mm.

Range – No previous records.

Comment – The specimen's apical portion is damaged.

The worls of the teleoconch are slightly convex, low and separated by rather conspicuous sutures. They are glossy in appearance and bear some exceedingly fine growth lines, a few of which may be more conspicuous.

The last whorl is rather high, with a conspicuously rounded periphery and a convex base. The umbilicus is fairly narrow, smooth and encircled by a rounded, rather narrow convexity. The outer lip almost orthocline, sometimes, as indicated by growth lines, arching slightly forward at the adapical suture and also on the base next to the periphery, arching slightly backward on the rest of the base. The inner lip thin, its abapical portion slightly thicker and somewhat expanded over the umbilicus.

The specimen is reminiscent of *N. brunnea* (Sowerby, 1834) (Nomura, 1935, p. 221, pl. 10, fig. 28), which has, however, an angular periphery. *N. niasensis* Wissema, 1947 (Wissema, 1947, p. 78, pl. 3, figs. 92-93) is bigger and has flat whorls, its umbilicus being encircled by a sharp keel and the umbilical wall bearing a crenulated keel.

Capulus spec. indet.

Material – RGM 312 041.

Range – No previous records.

Comment – A single specimen is available which is reminiscent of *C. javanus* Wanner & Hahn, 1935 (Wanner & Hahn, 1935, p. 263, pl. 20, figs. 5-7, pl. 21, fig. 1) from the Rembang Beds, but it is too much damaged to be described.

Tibia (Sulcogladius) powisii (Petit, 1840)

Material – RGM 312 033.

Range – Preangerian to Recent: NT (loc. 156, Pulu Senumpah, Rutten) - M ('upper Miocene': Timor; New Guinea) - P - Re.

Comments – The body whorl of a single damaged specimen is available. It belongs to the var. modesta (Martin, 1899) and agrees particularly well with specimens from the Kendeng Beds identified by van Regteren Altena (Altena, 1941, p. 45, with syn.). The spiral depression of the abapical side of the shoulder is somewhat less concave than in the Sondé shells.

Tibia (Rostellariella) butaciana (Martin, 1899)

Material – RGM 312 034.

Range – Pre-Preangerian: R - Rr (Rm).

Comments – This characteristic species is represented by five specimens; four spires and an almost fullgrown shell. The material agrees very well with the Javanese type specimens and with undescribed material from the Rembang Beds of Madura which is now under examination.

References – Martin, 1891-1922, p. 190, pl. 30, figs. 441-442 (*Rostellaria* (s. str.) *butaciana* Martin); van der Vlerk, 1931, p. 246; Wanner & Hahn, 1935, pp. 235, 236, 258.

Polinices (Polinices) cumingianus (Récluz, 1844)

Material – RGM 312 038.

Range – Pre-Preangerian to Recent: R - Rr (Ra, Rl) - UG (Pakistan) - Nj - Tj (loc. O, Junghuhn) - Ta - Pa - NT (Loc. R, Tjikarang, Junghuhn; West Borneo) - M - P - N (e.g., Tji Gugur) - PQ - Q - RE.

Comments – This characteristic species is represented by four specimens, two being immature. The largest specimen agrees particularly well with van Regteren Altena's fig. 16.

References – Altena, 1941, p. 58, with syn.; Altena & Beets, 1945, pp. 38, 60; Wissema, 1947, p. 126.

Naticarius (Naticarius) lineatus (Roeding, 1798)

Material – RGM 312 040.

Range – Pre-Preangerian to Recent: R - Rr (Rm, Rl) - NT (Lower Palembang Beds) - P - PQ - Q - Re.

Comment – A single immature specimen is available which matches other Recent and fossil shells of the same size.

References – Altena, 1941, p. 79, with syn.; Wissema, 1947, p. 135; Beets, 1950c, p. 331.

Ficus (Ficus) spec. nov.

Material – RGM 312 042.

Range – Pre-Preangerian to Preangerian: Rr (Ra?, Rm?, Rl (Holotype)) -NT (Lower Palembang Beds?).

Comment – Three damaged specimens are available, which agree so well with the type material of an as yet undescribed species from Rembang deposits of Sumatra that their identity with the latter can hardly be doubted.

Oliva spec. indet.

Material – RGM 312 050.

Range – No previous records.

Comment – Three damaged specimens are available which could not be identified.

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

Material – RGM 312 056.

Range – Pre-Preangerian to Preangerian: R - Rr (Rm, Rl) - Tj (incl. loc. O, Junghuhn) - NT (Gelingseh Beds: Sg. Gelingseh, 'layer 1', loc. 144, Rutten,

loc. 150, Rutten; Kari Orang; Sekurau; Gunung Madupar, Wanner; Lower Palembang Beds).

Comments – Two well preserved specimens are available.

Reference – Beets, 1950c, p. 335.

Clavus spec. indet. b

Material – RGM 312 058.

Range – No previous records.

Comment – A single badly damaged specimen available.

Gemmula (Gemmula) granosa woodwardi (Martin, 1884)

Material – RGM 312 063.

Range – Pre-Preangerian to Pliocene, Neogene: R - Rr (Ra; Rm; Rl) - K -UG (Assam) - NT (Mandul; loc. 156, Pulu Senumpah, Rutten; Gelingseh Beds: loc. 144, Rutten; Mentawir Beds s. str.; West Borneo; Tjikao; Lower Palembang Beds) - UM (Dingle Formation, Panay) - P - N.

Comment – Five specimens are available.

References – Oostingh, 1935, pp. 110 (*Turris carinata woodwardi* (Martin), with syn.), 210, 217, 226; Oostingh, 1938, p. 27; Beets, 1950c, p. 335; Beets, 1981a, pp. 4, 6.

Lophiotoma indica (Roeding, 1798)

Material – RGM 312 062.

Range – Preangerian to Recent: Tj - NT (Mandul; loc. 141, Kari Orang, Rutten) - UM (Tjiodeng) - P - N - PQ (Togopi) - Q - Re.

Comments – Two damaged specimens available. The species will be discused in a paper on molluscs from Mandul.

Conus fennemai Schepman, 1907

Material – RGM 312 065.

Range – Quaternary exclusively: Q.

Comments – The species was described from Kaju Ragi, N. Celebes. It is represented in the Muara Kobun collection by two specimens, 14.3 and 15 mm long respectively, smaller therefore than the type which is 25 mm long, but perfectly similar in other respects. The protoconch is partly preserved in one case, showing at least three smooth apical whorls.

C. niasensis Woodward, 1879, the type of which is 15 mm long, is closely related (Woodward, 1879, p. 226, pl. 4, fig. 1), although its sculpture and shape seem to differ. Future finds may clarify the relationships between these species.

Conus ornatissimus Martin, 1883

Material – RGM 312 068.

Range – Preangerian to Pliocene/Quaternary: Ta - Pa - NT (Loc. 156, Pulu Senumpah, Rutten) - UM (Dingle Formation, Panay) - M (New Guinea) - P - PQ (Togopi?; Ceram).

Comments – A fragmentary specimen is available. It is so characteristic that the identification is considered safe. Cox (1948, p. 59, pl. 6, figs. 3a-d) described a new species, *C. vlerki*, which may not be *C. ornatissimus* as concluded by Shuto.

Reference – Shuto, 1969, p. 221, with syn. (*Asprella ornatissima* (Martin)), pl. 22, figs. 1, 2, 4, 11-14; text-figs. 40-41.

Conus cf. *C. sinensis* Sowerby, 1833

Material – RGM 312 066.

Range – Not fully ascertained, generally Preangerian to Recent: NT (loc. 141, Kari Orang, Rutten) - Re.

Comments – There are two specimens available, one damaged at its anterior end, the other merely a spire. The shoulder-angle of the older whorls is not tubercled, but apart from that the material agrees well with specimens from Rutten's loc. 141. *C. sinensis* not being clearly defined and its relationships to other species requiring revision, the writer uses it in a restricted fashion for age identification.

Conus socialis Martin, 1895

Material – RGM 312 067.

Comments – A fine specimen and two spire fragments available. The material is particularly similar to Tesch's figs. 16a-b, quoted by Oostingh.

Range – Preangerian to Pliocene, Neogene: Ta - NT (Lower Palembang Beds?; West Borneo) - P - N (e.g., Tji Gugur).

References – Martin, 1928, pp. 13, 26; Haanstra & Spiker, 1932b, p. 1313; Oostingh, 1938, p. 20; Altena & Beets, 1945, pp. 47, 60, pl., fig. 1 (var.); Beets, 1950c, p. 336.

Terebra (Myurella) cf. *T. (M.) torquata pliocenica* Koperberg, 1931

Material – RGM 312 072.

Range – Pliocene, Neogene: P - N.

Comment – A small specimen which could not be identified more securely.

References – Koperberg, 1931, p. 38; de Bruijne, 1941, p. 27.

Dentalium (Fissidentalium) magnificum junghuhni Martin, 1879

Material – RGM 312 143.

Range – Preangerian to Pliocene, Neogene: NT (loc. R, Tjikarang, Junghuhn) - P - N.

Comments – A single specimen is present. It agrees with numerous specimens in unpublished Pliocene collections from East Borneo. Tesch and Koperberg rightly drew attention to the close relationships between *D. junghuhni* and the living *D. magnificum* Smith, 1896, the writer being firmly convinced now that the former is but an ancestral form of the latter. The material recorded as *D. junghuhni* from Singu and Kama deposits in Burma by Noetling, Pascoe and Cotter, and from Gaj equivalents of Assam by Mukerjee, may actually be a different species altogether.

References – Martin, 1879-1880, p. 87, pl. 12, fig. 11; Martin, 1883-1887, pp. 185, 325, 330, pl. 10, figs. 182-183; Martin, 1919, pp. 68, 135, 154; Tesch, 1920, p. 81, pl. 16, figs. 226-227; Siemon, 1929, pp. 317, 322, 325, 343, 360; van Es, 1931, p. 58; Koperberg, 1931, p. 27; de Bruijne, 1941, p. 32.

Carditella witkampi spec. nov.
Pl. 1, figs. 7-9

Holotype – RGM 312 091; Pl. 1, figs. 7-9.
Type-locality – Muara Kobun, Pulu Sinkuang, Sangkulirang Bay, E. Borneo.
Type-horizon – Not specified, presumably some level high up in the Gelingseh Beds.
Name – The species is named for H. Witkamp, one of the petroleum geologists who pioneered for Shell in Kutai in the early years of this century.

Range – No previous records.

Description – This species is represented by a single left valve. Its dimensions are: length 4 mm, height 4 mm, diameter 1.5 mm. The strongly curved anterior, ventral and posterior margins merge gradually into one another, the first also into the dorsal margins, whereas the latter and the posterior margin meet at a distinct angle. Posteriorly, the valve is flattened (not depressed).

The entire surface of the shell is covered with 21 tubercled costae. The tubercles are stretched, parallelling the growth lines but never forming scales. The umbo is covered with concentrical wrinkles, but this sculpture changes ventrally quite rapidly into the sculpture just described. The wrinkles on the anterior and posterior portions of the valve remain visible longer than on the central portion, even if only over a short distance. The interspaces of the costae bear inconspicuous growth lines. On the posterior half of the valve the costae are comparatively narrow and less prominently tubercled than the anterior costae. The lunule is small, smooth and shallow. Posterior area narrow and smooth; it is defined by a rounded and smooth, inconspicuous riblet.

The inner margin of the shell is crenulated; corresponding, very shallow grooves continue over the inner surface. The posterior muscle scar is small, the anterior one bigger but less clearly defined. Hinge with two cardinals separated by a deep pit, the anterior tooth small and curved inward, the posterior one long and curved outward, parallel to the posterior dorsal margin. On its outside, a narrow and shallow ligament groove. The anterior lateral is well developed though far from prominent. An oblong pit is present which corresponds with the posterior lateral of the right valve.

C. torresi Smith, 1885, which the writer knows from Neogene deposits in the Vogelkop region, New Guinea, is related (see Smith, 1885, p. 217, pl. 15, figs. 8, 8a). However, it has fewer (14-17) costae which are differently ornamented and a wrinkled hinge margin between cardinals and laterals.

Laevicardium (Fulvia?) njalindungense (Martin, 1922)

Material – RGM 312 095.

Range – Preangerian: Nj - NT (Mandul; basal Menkrawit Beds: L.114; Sekurau; Batu Panggal; West Borneo; Lower Palembang Beds; Pitogo Formation, Philippines).

Comment – A juvenile, fragile valve is present, agreeing very well with material from Sekurau.

References – Beets, 1941, pp. 162 (syn.), 171, 186, 200, pl. 8, fig. 313; Beets, 1950a, pp. 272, 277, 279; Beets, 1950c, p. 338.

PULU SENUMPAH

This material is kept in the Instituut voor Aardwetenschappen, Utrecht.

Tibia (Tibia) powisii (Petit, 1840)

Material – A specimen belonging to the var. modesta (Martin, 1899).

Range – Preangerian to Recent: NT (Muara Kobun) - M ('Upper Miocene': Timor; New Guinea) - P - Re.

Reference – Altena, 1941, p. 45 (with. syn.).

Distorsio (Distorsio) reticulatus (Roeding, 1798)

Comment – The specimen recorded by the writer (Beets, 1941, p. 394: *Distortrix cancellina* (de Roissy)) is presumed lost.

Oliva (Strephona) rufula djocdjocartae Martin, 1884

Material – One rather small specimen.

Range – Pre-Preangerian to Pliocene: Rr (Rm) - Pa - NT (Gelingseh Beds: loc. 150, Rutten; loc. 141, Kari Orang, Rutten) - UM (Palabuanratu; Dingle Formation, Panay) - M (Tjidamar; W. Sumatra) - P.

References – Van der Vlerk, 1931, p. 223; Haanstra & Spiker, 1932b, p. 1313; Shuto, 1969, p. 155, pl. 15, figs. 1-6, 9, 10 (*Oliva (Anazola) djocdjocartae* Martin).

Oliva (Galeola) menkrawitensis Beets, 1941

Material – The holotype of the species (Beets, 1941, figs. 221-224), a figured paratype (op. cit., fig. 226) and a third specimen.

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

Reference – Beets, 1941, pp. 107, 194, pl. 6, figs. 221-226.

Gemmula (Gemmula) granosa woodwardi (Martin, 1884)

Material – One specimen.

Range – Pre-Preangerian to Pliocene, Neogene: R - Rr (Rm, Rl) - K - UG (Assam) - NT (Mandul; Muara Kobun; Gelingseh Beds: loc. 144, Rutten; Mentawir Beds s. str.; West Borneo; Tjikao; Lower Palembang Beds) - UM (Dingle Formation, Panay) - P - N.

References – see under Muara Kobun above.

Unedogemmula sp.

Material – One specimen is available.

Range – Pliocene: P.

Comment – The species will be discussed in another paper.

Conus ornatissimus Martin, 1883

Material – A single damaged but characteristic specimen is present.

Range – Preangerian to Pliocene/Quaternary: Ta - Pa - NT (Muara Kobun) - UM (Dingle Formation, Panay) - M - P - PQ (Togopi?; Ceram).

Comments – The specimen has a comparatively strongly wavy shoulder angle and broad spirals on the adapical half of the last whorl. It resembles particularly a shell from Ceram (det. Fischer) in the RGM collection.

Faunal Lists

The abbrevations and symbols listed below correspond with the stratigraphical records of the species described in the preceding chapter, their number being restricted in the faunal lists to save space.

In order to avoid misunderstandings it should be noted that the present writer, as in his previous papers, 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 in the present writer's papers extends 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 many a modern author), 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
N – Neogene, not classified
P – Pliocene (approximately Th)
M – Miocene, unclassified
UM – Late Miocene, pro parte (largely Tg, Odengian; including Palabuanratu, Java; Dingle Formation, Philippines)

Pr – Preangerian (Tf3):
Nj – Njalindung Beds, Java
Tj – Tjilanang Beds, Java
Ta – Tjadasngampar, Java
Pa – Parungponteng (= Selatjau), Java
NT – Preangerian, unspecified, including:
East Borneo:
Mandul Island, coll. W. van Holst Pellekaan (Shell), unpublished
Menkrawit Beds, coll. W. Leupold (Beets, 1941)
Muara Kobun, coll. M. Schmidt (Shell)
Pulu Senumpah, Loc. 156, L.M.R. Rutten
Gelingseh Beds, partly published (Martin, 1914; Beets, 1941), including: Source area Sg. Gelingseh; Sg Gelingseh, 'layers 1 & 2'; Loc. 144 and Loc. 150, all collected by L.M.R. Rutten
Kari Orang, coll. H. Witkamp (Shell), partly published (Beets, 1941)
Loc. 141, Kari Orang, L.M.R. Rutten, partly published (Beets, 1941)
Sekurau, coll. M. Schmidt (Shell), unpublished
Gunung Madupar, coll. L.M.R. Rutten and J. Wanner, unpublished
Batu Panggal, coll. M. Schmidt (Shell) (Beets, 1950a)
Mentawir Beds s. str., coll. L.M.R. Rutten (Beets, 1981a)
West Borneo: coll. Shell, unpublished
Java:
Loc. R, Tjikarang, F. Junghuhn
Tjikao, loc. C.H. Oostingh
Sumatra:
Lower Palembang Beds
Philippines:
Pitogo Formation

pPr – pre-Preangerian (Tfl-2):
UG – Upper Gaj and equivalents (apparently Rembang going upward into Preangerian (in part), including:
India:
Assam (Garo Hills)
Quilon
Pakistan:
Sind
K – Kama, Burma, perhaps correlating with UG
Rr – Rembang equivalents:
Ra - Api Api, Pasir, E. Borneo, coll. K. Goldschmid (Shell), not published
Rm - Madura, coll. R. Gsell (Shell), unpublished
Rl - Langkang, Sumatra, coll. W. van Holst Pellekaan (Shell), not published
R – Rembang Beds (apparently extending upward into Lower Preangerian), Java

Age determinations

MUARA KOBUN

The percentage of living forms, 27.7% (5 out of 18 species considered), falling within the variation of Preangerian, can hardly be trusted as an aid in age deter-

Table 1. Stratigraphical records of the Mollusca from Muara Kobun.

	pPr				Pr											
	R	Rr	K	UG	Nj	Tj	Ta	Pa	NT	UM	M	P	N	PQ	Q	Re
Rhinoclavis junghuhni	R	---	--	-----	---	---	---	---	NT	-----	---	--	---	-----	---	----
Cerithium kobunense	--	---	--	-----	---	---	---	---	-----	-----	---	--	---	-----	---	----
Tibia powisii	--	---	--	-----	---	---	---	---	NT	-----	M	P	---	-----	---	Re
Tibia butaciana	R	Rr	--	-----	---	---	---	---	-----	-----	---	--	---	-----	---	----
Polinices cumingianus	R	Rr	--	UG	Nj	Tj	Ta	Pa	NT	-----	M	P	N	PQ	Q	Re
Naticarius lineatus	R	Rr	--	-----	---	---	---	---	NT	-----	---	P	---	PQ	Q	Re
Ficus spec. nov.	--	Rr	--	-----	---	---	---	---	NT	-----	---	--	---	-----	---	----
Marginella aff. *M. elegans*	R	Rr	--	-----	---	Tj	---	---	NT	-----	---	--	---	-----	---	----
Gemmula granosa woodwardi	R	Rr	K	UG	---	---	---	---	NT	UM	---	P	N	-----	---	----
Lophiotoma indica	--	---	--	-----	---	Tj	---	---	NT	UM	---	P	N	PQ	Q	Re
Conus fennemai	--	---	--	-----	---	---	---	---	-----	-----	---	--	---	-----	Q	----
Conus ornatissimus	--	---	--	-----	---	---	Ta	Pa	NT	UM	M	P	---	PQ	---	----
Conus cf. *C. sinensis*		(not-ascertained)							NT	-----	---	--	---	-----	---	Re
Conus socialis	--	---	--	-----	---	---	Ta	---	NT	-----	---	P	N	-----	---	----
Terebra cf. *T. torquata pliocenica*	--	---	--	-----	---	---	---	---	-----	-----	---	P	N	-----	---	----
Dentalium magnificum junghuhni	--	---	--	-----	---	---	---	---	NT	-----	---	P	N	-----	---	----
Carditella witkampi	--	---	--	-----	---	---	---	---	-----	-----	---	--	---	-----	---	----
Laevicardium njalindungense	--	---	--	-----	Nj	---	---	---	NT	-----	---	--	---	-----	---	----

Number of species recorded in each zone:	pPr	Pr	UM	P	Q	Re
	7	13	3	9	4	5

Table 2. Stratigraphical records of the species from Pulu Senumpah.

	pPr				Pr									
	R	Rr	K	UG	Ta	Pa	NT	UM	M	P	N	PQ	Q	Re
Tibia powisii (*Distorsio reticulatus* omitted)	--	---	--	-----	---	---	NT	-----	M	P	--	----	---	Re
Oliva rufula djocdjocartae	--	Rr	--	-----	---	Pa	NT	UM	M	P	--	----	---	----
Oliva menkrawitensis	--	---	--	-----	---	---	NT	-----	---	--	--	----	---	----
Gemmula granosa woodwardi	R	Rr	K	UG	---	---	NT	UM	---	P	N	----	---	----
Unedogemmula sp.	--	---	--	-----	---	---	-----	-----	---	P	--	----	---	----
Conus ornatissimus	--	---	--	-----	Ta	Pa	NT	UM	M	P	--	PQ	---	----

Number of species recorded in each zone:	pPr	Pr	UM	P	Q	Re
	2	5	3	5	0	2

mination of such small faunas as the one from Muara Kobun. The actual records of the species (see Table 1) seem to argue a little more convincingly in favour of a Preangerian age, with, however, both Early Miocene and Pliocene being runners-up. The combined actual time ranges of the species are given in Table 3. The above distribution still suggests a Preangerian age with, however, again a Pliocene hue. Consequently, it may be asked whether perhaps Odengian (Tg) should be considered the correct age of the fauna.

Table 3. Time range of the Mollusca from Muara Kobun.

	pPr	Pr	UM	P	PQ	Q	Re	
	pPr	—	—	—	—	—	Re	: 2
	pPr	—	—	P				: 1
	pPr	—	Pr					: 3
	pPr							: 1
		Pr						: 1
		Pr	—	P				: 3
		Pr	—	—	PQ			: 1
		Pr	—	—	—	—	Re	: 2
				P				: 1
				P	—	—	Re	: 1
						Q		: 1
(a)	7	13	9	11	6	6	5	(16 species)
(b)	5	11	7	9	4	4	3	(14 species)

Note - (a) Number of species recorded in each zone (2 new species omitted).
(b) Ditto, when disregarding the two longest ranging species.

Unfortunately, little is known about Odengian deposits of Borneo, so it seems that we have to consider the ranges of certain selected species more closely. We see then that *Tibia butaciana* seemingly introduces a pre-Preangerian element. However, it has been rarely recorded and this first impression is counterbalanced also by the presence of *Terebra torquata pliocenica*, a rare Pliocene element, and *Conus fennemai*, a Quaternary one. If we finally disregard the occurrence of three species in the Pulu Senumpah fauna, the above distribution picture would hardly change.

It simply has to be admitted that we know much too little about the ranges of the Indonesian Neogene molluscs to justify relying on the ranges of individual species instead of using their combined overall distribution. It may be recalled also that the writer, when describing the first sizable Neogene fauna from Borneo (Beets, 1941), noted the peculiarity, or perhaps only seeming aberration, that decidedly Early Miocene Javanese species appeared to mingle quite naturally with younger Neogene elements in one and the same Preangerian assemblage, a fact that may well render the age determination of small faunas from Borneo more hazardous even than usually is the case. While, therefore, looking askance at the range of *Tibia butaciana*, we may perhaps take the presence of *Laevicardium njalindungense* in the assemblage of Muara Kobun more seriously, this species so far apparently being confined to the Preangerian. On the other hand, giving heed to the strong showing of Pliocene illustrated above, it seems quite possible that the Muara Kobun fauna should be relegated to the uppermost portion of the Preangerian time span, rather than a level equal to that of the Gelingseh fauna from Sg. Gelingseh.

If, finally, the relationships with other Preangerian faunas are considered, the various records show the following distribution, for 12 of the 19 species taken into account (Table 4).

Table 4. Preangerian records of the Mollusca from Muara Kobun.

	a	b	f	gb	g	gr	i	l	m	n	p	pr	prx	lop
Rhinoclavis junghuhni	--	--	--	gb	--	--	i	--	---	--	--	---	----	---
Tibia powisii	--	--	f	---	--	--	--	--	---	--	--	---	----	---
Polinices cumingianus	--	--	--	---	--	--	--	--	---	--	p	pr	prx	---
Naticarius lineatus	--	--	--	---	--	--	--	--	---	--	--	---	----	lop
Ficus spec. nov.	--	--	--	---	--	--	--	--	---	--	--	---	----	lop
Marginella aff. *M. elegans*	--	--	--	gb	g	--	i	l	---	--	--	pr	----	lop
Gemmula granosa woodwardi	a	--	f	gb	--	--	--	--	---	n	p	---	prx	lop
Lophiotoma indica	a	--	--	---	--	gr	--	--	---	--	--	pr	----	---
Conus ornatissimus	--	--	f	---	--	--	--	--	---	--	--	pr	----	---
Conus socialis	--	--	--	---	--	--	--	--	---	--	p	pr	----	lop
Dentalium magnificum junghuhni	--	--	--	---	--	--	--	--	---	--	--	---	prx	---
Laevicardium njalindungense	a	b	--	---	--	--	i	--	m	--	p	pr	----	lop

The number of species in common with: a: 3 (25%); b: 1 (8.3%); f: 3 (25%); gb: 3 (25%); g: 1 (8.3%); gr: 1 (8.3%); i: 3 (25%); l: 1 (8.3%); m: 1 (8.3%); n: 1 (8.3%); p: 4 (33.3%); pr: 6 (50%); prx: 3 (25%); lop: 6 (50%).

Symbols applying to the above distribution table:

a - Mandul
b - basal Menkrawit Beds, L. 114
f - Pulu Senumpah, Loc. 156
gb - Gelingseh Beds
g - Kari Orang, Witkamp
gr - Loc. 141, Rutten, Kari Orang
i - Sekurau
l - Gunung Madupar
m - Batu Panggal
n - Mentawir Beds s. str.
p - West Borneo
pr - classical Preangerian, Java (Nj, Tj, Ta, Pa)
prx - other Preangerian deposits, Java
lop - Lower Palembang Beds, Sumatra

It is worth noting that the relationships with other faunas of Borneo, even near ones like the Gelingseh fauna and the one from the basal Menkrawit Beds, on the whole are weaker than one might expect, the strongest links existing with the much more distant Javanese faunas and even Sumatra. There appear to be no connexions with Tapian Langsat and Gunung Batuta, nor with the Lower and Upper Menkrawit faunas.

PULU SENUMPAH

The fauna is patently much too small for a precise age determination, the percentage of living species, 16.6% (1 out of 6) being almost meaningless. The actual records (see Table 2) of the species as shown by the faunal list, however, seem to indicate an age which is comparable to that of Muara Kobun, the overall distribution showing strong similarity with the composite ranges of the species from that assemblage.

The combined time ranges are given in Table 5.

Considered in this way, and as far as appearances go in the case of so small an assemblage, the age of Loc. 156 could be either Preangerian, Odengian, or even Pliocene. On the other hand, five out of six species considered occur in Preangerian deposits (one exclusively so, but it has rarely been recorded), a third

of these in classical Preangerian and half in the Muara Kobun fauna (see Table 6). Taking all in all, it would seem that we are dealing with a fauna that is of about the same age as Muara Kobun. The relationships with other Preangerian faunas are shown in Table 6.

Table 5. Time range of the species from Pulu Senumpah

pPr	Pr	UM	P	PQ	Q	Re	
pPr ———			P			:	2
	Pr					:	1
	Pr ———			PQ		:	1
	Pr ———					Re:	1
			P			:	1

pPr	Pr	Um	P	PQ	Q	Re
2	5	4	5	2	1	1(16 species)

Table 6. Preangerian records of the species from Pulu Senumpah

	a	b	e	gb	gr	n	p	pr	prx	lop
Tibia powisii	-	-	e	---	---	--	--	---	-----	-----
Oliva rufula djocdjocartae	-	-	-	gb	gr	--	--	pr	-----	-----
Oliva menkrawitensis	-	b	-	---	---	--	--	---	-----	-----
Gemmula granosa woodwardi	a	-	e	gb	---	n	p	---	prx	lop
Conus ornatissimus	-	-	e	---	---	--	--	pr	-----	-----

The number of species in common with: a: 1 (16.6%); b: 1 (16.6%); e: 3 (50%); gb: 2 (33.3%); gr: 1 (16.6%); n: 1 (16.6%); p: 1 (16.6%); pr: 2 (33.3%); prx: 1 (16.6%); lop: 1 (16.6%).

The symbols used are the same as applied in the distribution table for Muara Kobun, with the addition of: e – Muara Kobun.

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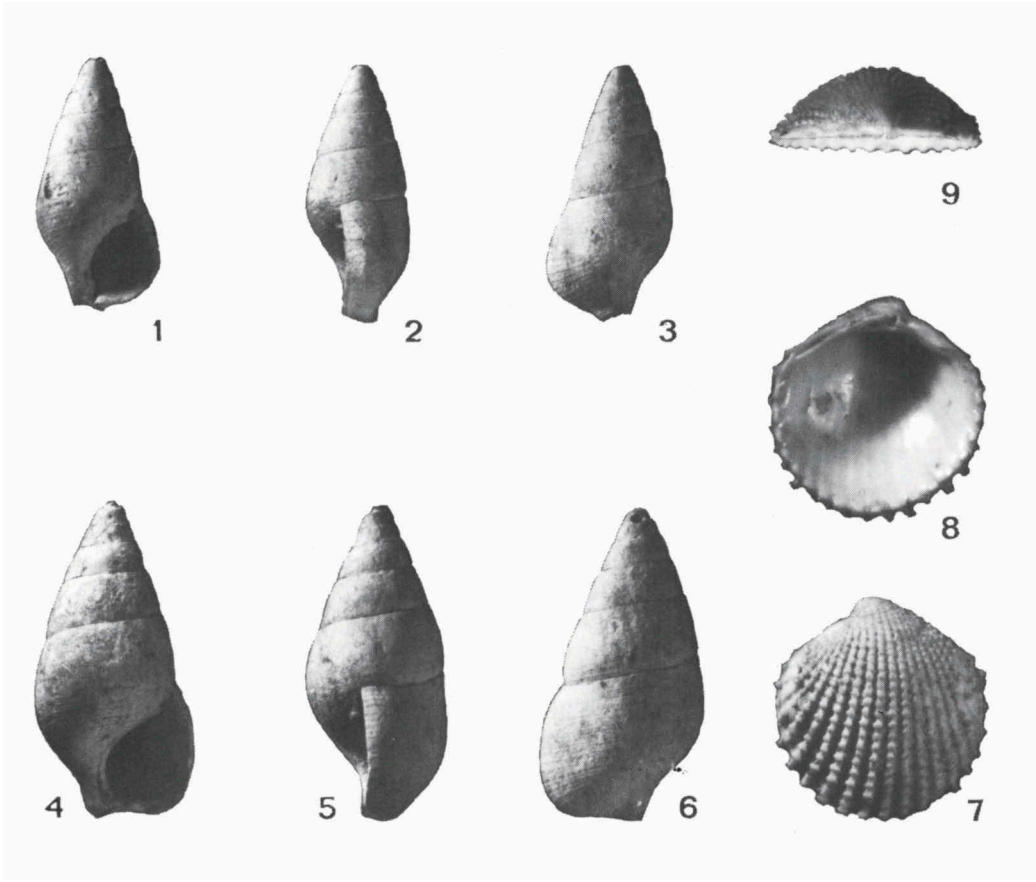
Manuscript received 15 May 1982, revised manuscript 14 March 1983.

Plate 1



Figs. 1- 3. *Cerithium (Gourmya) kobunense* sp. n. Holotype, RGM 312 151, length 21 mm; loc. Muara Kobun.

Figs. 4- 6. *Cerithium (Gourmya) kobunense* sp. n. Paratype, RGM 312 152, length 25.6 mm; loc. Muara Kobun.

Figs. 7- 9. *Carditella witkampi* sp. n. Holotype, left valve, RGM 312 091, length 4 mm, height 4 mm, diameter 1.5 mm; loc. Muara Kobun.