

ON FOSSIL MOLLUSCA FROM THE ISLAND OF MANDUL, EAST-BORNEO

BY

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INTRODUCTION.

This paper presents the results of the examination of a fairly big collection of mollusca from the island of Mandul, north of Tarakan, East-Borneo. The material was collected by Dr. VAN HOLST PELLEKAAN while investigating the geology of Mandul in the service of the "Bataafsche Petroleum Maatschappij" (Royal Dutch/Shell). It was sent to Prof. K. MARTIN of Leyden for closer examination, and afterwards was embodied into the collections of the Leyden Geological Museum.

Prof. MARTIN recorded the results of his preliminary examination, which excluded the bivalves, in a report to the "Bataafsche", dated 12th January 1917. He came to the conclusion that the fossils were of a Pliocene age.

The writer is much indebted to the Directorate of the "Bataafsche Petroleum Maatschappij", The Hague, and the "Rijksmuseum voor Geologie en Mineralogie", Leyden, for permission to study the material and to publish the new results. Many thanks are due to the "Zoölogisch Insulinde-Fonds" for financial support in this and other studies carried out during the last war.

The collection has, for the time being, merely systematical value, because accurate indications of localities are not available, and the state of preservation of the mollusca indicated quite soon that most probably three collections of different ages had been mixed and despatched as one. This view was supported by information kindly supplied by Ir. A. J. MULDER ("Bataafsche") in 1941. Some of the fossils were collected from cores of a well, Toengkoe Dasin No. 10, in the middle of the northern part of Mandul. Here, a series of deposits is met with, which for the greater part belongs to the Miocene. According to Ir. MULDER, it would be possible to consider a restricted part of the marl and limestone series of Toengkoe Dasin as Pliocene, but merely on the negative evidence of the lack of typically Miocene fossils (oral information). Ir. MULDER also pointed out that another part of Dr. VAN HOLST's fossils could very well have been taken from sandy Quaternary deposits.

While making a preliminary examination of the fossils, the author was struck by the fact that no less than three different kinds of preservation are present. The majority of the shells must have been derived from sandy deposits and are very fresh in appearance, still bearing their original colouring and as a whole being strikingly similar to Quaternary fossils of neighbouring areas. Others must have been embedded in grey, fossiliferous, sandy/marly sediments and evidently are of a Pliocene age. The well Toengkoe Dasin seems to be their most probable source. Finally, there are

some yellow/brown shells which had been embedded in brown marly deposits and limestones, and cannot be distinguished from material of definite Miocene age, which was collected by Dr. VAN HOLST at approximately the same time as the other fossils, in the south-western part of the island. It appears that the yellow/brown fossils actually belong to the latter collection and somehow, got mixed up with Quaternary and Pliocene material.

Unfortunately, it did not prove possible to split the material up with certainty according to the kind of preservation, but even if this would have been successful, the material could not be relied upon from a stratigraphical point of view. Palaeontologically speaking, it is worth description on account of its beautiful preservation and the zoological value.

The material should be regarded, therefore, as being derived from different beds, without it being possible to state with certainty from which bed any particular fossil was derived.

In the systematical part below, four abbreviations occur repeatedly, viz.,

NHL: "Rijksmuseum voor Natuurlijke Historie", Leyden.

LGM: "Rijksmuseum voor Geologie en Mineralogie", Leyden.

ZMA: "Zoologisch Museum", Amsterdam.

BML: British Museum (Natural History), London.

SYSTEMATICAL PART.

The following species were distinguished.

1. *Euchelus* (*Euchelus*) *atratus* (Gmelin). Three Quaternary? shells. The spirals on the inside of the right lip are very short and the anterior columellar tooth obsolete. Ref.: BEETS, 1941, pp. 11, 168, 175, 192, 196.

2. *Solariella* (*Solariella*) spec. A single shell which will be described separately.

3. *Isanda* (*Minolia*) spec. Two fine shells which will be described in another paper.

4. *Nerita* (*Theliostyla*) *chameleon* Linné. A single Quaternary? shell, belonging to the forma *squammulata* Le Guillou. Ref.: VAN REGTEREN ALTENEA, 1938—1942, 1 (1938), p. 295.

5. *Turritella* spec. A good number of Quaternary? shells which had been labelled *T. fascialis* Menke and *Turritella* spec. They will be described separately.

6. *Cerithidea* spec. Eight fine shells, which will be described in another paper.

7. *Cerithidea* spec. 1. A single unidentifiable shell.

8. *Cerithidea* spec. 2. An unidentifiable specimen.

9. *Cerithium karangense* Martin. Three Miocene? specimens belonging to the slender form. Ref.: VAN DER VLIERK, 1931, p. 249.

10. *Cerithium leupoldi* Beets. Represented by a fine Miocene? specimen, 20.7 mm long, with somewhat more rounded earlier whorls than the type which was mistaken for a *Proclava* (BEETS, 1941, p. 48, pl. 2, figs. 78—79). The riblets seem to be slightly coarser than in the type. The posterior sutural spiral splits off a very narrow posterior part and both of the anterior primary spirals, as well as the secondary ones, are wider than in the type. Secondary riblets are scarcer and restricted to the body-whorl. Additional material from other localities in Borneo, and especially the numerous specimens from Rembang which have been identified by Miss PANNEKOEK (1936, pp. 7, 52) as *C. erectum* Martin, but actually belong

to *C. leupoldi*, reveal that the latter is a variable species. One extreme is represented by the type and other Bornese specimens, and the other by the Mandul material and some of the Rembang shells with the sculpture described above. The extremes are connected by all possible intermediary stages.

11. *Rimella* spec. A single damaged specimen.
12. *Strombus* (*Labiostrombus*) *canarium* Linné. Only a single damaged Quaternary? specimen is present, similar to recent shells from Madagascar (Nosy Bé) in the NHL. Refs.: VAN REGTEREN ALTENA, 1938—1942, 2 (1941), p. 47; ETHERIDGE, 1889, p. 174; JACK & ETHERIDGE, 1892, p. 695; DE BRUIJNE, 1941, p. 30.
13. *Strombus* spec. Two unidentifiable fragments.
14. *Calpurnus* (*Procalpurnus*) *lacteus* (Lamarck). One Quaternary? specimen, 9 mm long, which belongs to the variety *semistriata* (Pease) and is similar to shells in the LGM from the Quaternary of Kaju Ragi, N. Celebes (SHEPMAN, 1907, p. 183), especially to a specimen in which the spirals on the middle portion of the shell are also very obsolete and the remainder have a fine development. The average size of this form is 11—12 mm, according to SCHILDER. Refs.: SCHILDER, 1932, a, p. 231, cf. 1932, b, pp. 53, 60.
15. *Natica lineata* (Roeding). Three fine Quaternary? specimens, one of which shows the original colouring. Refs.: OOSTINGH, 1935, p. 46; VAN REGTEREN ALTENA, 1938—1942, 2 (1941), p. 79.
16. *Natica rufa* (Born). A Miocene? specimen and an operculum are present. Ref.: VAN REGTEREN ALTENA, 1938—1942, 2 (1941), p. 73.
17. *Natica vitellus* (Linné). Three specimens. Refs.: OOSTINGH, 1935, p. 45; VAN REGTEREN ALTENA, 1938—1942, 2 (1941), p. 69; BEETS, 1941, p. 195.
18. *Apollon* (*Apollon*) *natator* (Roeding). Synonymous with "*Argobuccinum*" *tuberculatum* (Broderip). It is represented by numerous Quaternary? specimens showing the original colouring. Refs.: VAN REGTEREN ALTENA, 1938—1942, 4 (1942), p. 99 ("*Gyrineum*"); BARRON & HUME, 1902, pp. 143, 144 ("*tuberculatum*").
19. *Murex* (*Hexaplex*) *cichoreus* Gmelin. Synonymous with *M. endivia* Linné. Represented by a fine Quaternary? shell, 33.5 mm high, with obsolete ribs between the varices and belonging to the less spined forms. It is similar to a recent specimen in the NHL (coll. HOEDT, Nr. 73e). MARTIN identified the present specimen preliminarily with *M. junghuhni*, but that species seems vastly different. Refs.: ADAM & LÉLOUP, 1938, p. 154; SHEPMAN, 1907, p. 179; DICKERSON, 1921, pp. 5, 6, 10, 11; DICKERSON, 1922, pp. 202, 224, pl. 3, fig. 8.
20. *Murex* (*Tubicauda*) spec. Two Quaternary? fragments which which might belong to either *M. unidentatus* Sowerby (= *martinianus* Reeve), or *M. ternispina* Lamarck.
21. *Muricopsis* spec. A few representatives of a very characteristic species which may be new to science though it is most probably still living as the shells have an extremely fresh appearance.
22. *Thais* (*Cymia*) *carinifera* (Lamarck). Four Quaternary? specimens and two fragments of juvenile forms, in which the keel behind the main keel has not yet developed. They were compared with similar recent material (cf. also OOSTINGH, 1935, p. 65, pl. 5, figs. 57—58) and the similar Javanese fossil from Banjar Anjar in the LGM. All these specimens differ from the Javanese fossils in the LGM and from those figured by OOSTINGH, in bearing finer spines on their main spiral keel. One specimen (covered

by Bryozoa) from Mandul cannot be distinguished from the type material of "*Purpura*" *dijki* Martin (1883—1887, p. 112, pl. 6, fig. 112) which the writer considers synonymous with *T. carinifera*. The Mandul material was previously identified with the very different *T. thiarrella* (Lamarck). It may be recalled that "*Purpura*" *undataeformis* Martin, another synonym of *T. carinifera*, was considered a synonym of *Cymia sacellum* (Reeve): VREDENBURG, 1925, p. 228; MARTIN, 1931, p. 2. The writer had no opportunity to investigate this matter. Refs. concerning *T. carinifera*: OOSTINGH, 1935, p. 65; BLANFORD, 1862, p. 193; NEWTON, 1905, p. 510; SCHÜRMAN, 1931, pp. 915, 921; SAURIN, 1936, p. 235.

23. *Ocinebrina serotina* (Adams). This rare recent species has never been recorded as a fossil. It is represented by three Quaternary? specimens, previously identified as "*Latirus* spec. 2", which agree very well with the type material in the BML and also with similar shells in the ZMA and NHL, from the Siboga-expedition. Recordings from present day waters are: Persia, Neth. E. Indies, and "Loc. unknown". Refs.: ADAMS, 1851, *b*, p. 268 (*Murex*); MELVILL & STANDEN, 1901, p. 398 (*Murex*); SCHEPMAN, 1908—1913, *d* (1911), p. 350.

24. *Bursa* spec. A fragment of the spire of a shell which had been identified previously as "*Ranella*" *rana* Linné, but could belong to another species as well.

25. *Pyrene* cf. *essingtonensis* (Reeve). This species has not been recorded in a fossil state up to now. It is represented by a single Quaternary? specimen, being partly damaged. Length 6 + ? mm. The shell is very similar to the recent Northern Australian species "*Columbella*" *essingtonensis* (REEVE, 1843—1878, vol. 11, Monogr. *Columbella*, pl. 27, spec. 174), especially to REEVE's figure 174b showing the same spiral colouring. The type could not be compared.

26. *Pyrene flavidaeformis* (Martin). This rarely recorded species is represented by a fine Pliocene? specimen, being 13 mm long and very similar to the type in the LGM, the only other representative collected up to now. Ref.: MARTIN, 1883—1887, p. 115, pl. 6, fig. 116.

27. *Nassa* (*Preangeria*) *talahabensis* (Martin). Described from the Javanese Njalindung series and represented in the Mandul collection by a single Miocene? specimen previously left unidentified. It will be discussed in a separate paper. Ref.: VAN DER VLERK, 1931, p. 237.

28. *Nassarius* (*Plicarcularia*) *thersites* (Bruguère). A single typical specimen, about 16 mm long. Refs.: VAN DER VLERK, 1931, p. 234; VAN ES, 1931, p. 115.

29. *Nassarius* (*Hima*) *ovoideus* (Schepman). This species had not been previously recorded as a fossil. Two Quaternary? specimens present, similar in every detail to the type in the ZMA. Ref.: SCHEPMAN, 1908—1913, *d* (1911), p. 316, pl. 20, fig. 1.

30. *Nassarius* (*Tritonella*) *microstoma* (Pease). Never reported before as a fossil. A single Quaternary? specimen present, 12 mm long and agreeing very well with a recent shell from Tahiti in the NHL, both specimens showing the finest spiral sculpture. Refs.: PEASE, 1860, p. 145; TRYON, 1879—1897, vol. 4 (1882), p. 47, pl. 15, fig. 247. The species is homonymous with *N. microstoma* Wood, 1879, an extinct species from N.W. Europe, for which the writer recently proposed *N. boytonensis* as a nomen novum¹⁾.

¹⁾ C. BEETS (1946) — The Pliocene and Lower Pleistocene gastropods of the Netherlands; Mededeeel. v. d. Geologische Stichting, Ser. C—IV—1—No. 6 (VAN AELST, Maastricht; Ref.: p. 20.

31. *Nassarius (Telasco) pictus* (Dunker). Three Quaternary? shells and two fragments present, being very close to the Javanese Quaternary material recorded by MARTIN: 1891—1922, p. 112, pl. 18, figs. 258, 258a—b; MARTIN, 1895, p. 34. As in the Javanese material, both spiral ornamentation and riblets persist longer than one generally observes in recent material. The ribs, however, are similar to those in some recent shells. *N. luridus* (Gould), which according to TRYON (1879—1897, vol. 4 (1882), pp. 35—36) is synonymous with *N. pictus*, seems to be a separate, though related form.

32. *Nassarius (Zeuxis) scalaris* (Adams). Four fine Quaternary? specimens, being exactly similar to recent shells in the NHL. They had been identified as *N. concinnus* (Powis) and are indeed synonymous with Quaternary Javanese specimens recorded by MARTIN as *N. concinnus* (1891—1922, p. 114, pl. 18, figs. 260, 260a—b; MARTIN, 1883—1887, p. 121, pl. 6, fig. 125). All the shells mentioned above are, however, very different from the true *N. concinnus* (also known as a fossil: cf. NOMURA & ZINBÔ, 1936, p. 256). The latter species has a more ovoid, less slender shape, more obsoletely separated whorls, a finer posterior spiral, no expanded inner lip, and more and finer ribs. The Mandul material agrees well with material recorded from the Kendeng Beds by VAN RIEGTEREN ALTENA (*in lit.*) and are very similar to a recent shell from Ambon (coll. HOEDT) in the NHL, with a slender spiral. One specimen has colouring similar to recent shells from Priok, Java (coll. BUTTENDIJK, NHL). The Javanese fossil from Bunder recorded by MARTIN, closely resembles the specimen from Mandul which bears a bore-hole in its inner lip; Both specimens had not yet developed an expanded inner lip. Refs.: ADAMS, 1851, *a*, p. 108; TRYON, 1879—1897, vol. 4 (1882), p. 29, pl. 9, figs. 69—70.

33. *Oliva (Strophona) australis* Duclou var. Martin Ms. Nine hitherto unidentified Miocene? specimens present. The transition between the apex and the postembryonic whorls is only at times visible. The apex may have less than three whorls, and the boundary between it and the postembryonic whorls may be clearly expressed, but also indirectly, by a rapid descending of the youngest part of the apex. Ref.: BEETS, 1941, pp. 106, 170. A misprint in the list of localities in this paper was omitted: It should read: "Pliocän: Java; (?) S.W. Neuginee".

34. *Oliva (Anazola)* spec. A Miocene? species also represented in the Miocene of the southwestern part of the island. It will be described separately.

35. *Olivella (Lamprodoma)* spec. A species which will be described separately.

36. *Vexillum (Costellaria) amanda* (Reeve). SCHEPMAN (1907, p. 170) recorded this recent species for the first time as a fossil from the Quaternary of Kaju Ragi, N. Celebes. A single Quaternary? specimen is present in the Mandul collection, being exactly similar to the big and plump recent and fossil shells with which comparison was made. It shows the characteristic development of the inner side of the right lip as described by SCHEPMAN, i. e., fine, quite well developed granules, which are rather unequally distributed.

37. *Vexillum (Costellaria) ickei* (Martin). Three Miocene? specimens, being slightly more slender than the type material from the Njalindung beds: MARTIN, 1891—1922, p. 305, pl. 44, figs. 724, 724a—b (1906); MARTIN, 1911—1912, 1 (1911), pp. 8, 19; MARTIN, 1921—1922, p. 492 (1922). MARTIN later united this species with his *V. gembacanum* (cf. MARTIN,

1928, p. 122) but here the writer cannot follow MARTIN until more convincing material is available.

38. *Mitra* (*Tiara*) *interlirata interlirata* (Reeve). Two Quaternary? shells, previously identified as "*M. flammea* Quoy". OOSTINGH has revised this and related species: 1938—1939, 6, 1939, p. 10, pl. 10, figs. 179—182. The Mandul shells, up to 14 mm long, are particularly similar to OOSTINGH's fig. 180. The columella bears 6 plaits and the secondary sculpture is partially well developed.

39. *Trigonostoma* (*Scalptia*) *costiferum* (Sowerby). A fine specimen, previously identified as "*Cancellaria crispata* Sowerby". *T. costiferum* is now recorded for the first time as a fossil. It is represented by a single Quaternary? shell, 14.6 mm long, agreeing particularly well with SOWERBY's fig. 71 (SOWERBY, 1842—1887, vol. 2, p. 456, pl. 95, figs. 65, 66, 71) and being very similar to recent material in the NHL and ZMA. The recent material in the NHL (Nr. 32-f, Madura) was identified as "*Cancellaria*" *scalarina* Lamarck. The fossil bears on, and behind, the body-whorl: 11, 12, 13 and 12 ribs per whorl respectively, which is more than in the related species *T. thomasianum* (Crosse) (cf. OOSTINGH, 1938—1939, 4, 1938, p. 109, pl. 6, figs. 121a—b). The apex consists of 2½ smooth and rounded whorls being separated from the postembryonic whorls by an oblique riblet. The latter whorls bear obsolete spiral sculpture. *T. tegalense* Oostingh (l.c., p. 108, pl. 6, figs. 116a—c) is related. OOSTINGH has clearly defined the differences that exist between these species. *T. crispatum* (Sowerby) (SOWERBY, l.c., p. 452, pl. 96, fig. 89) is more closely related to *T. creniferum* (Sowerby) (cf. OOSTINGH, l.c., p. 107, pl. 6, figs. 111—115) and bears little resemblance to *T. costiferum*. OOSTINGH has revised some of the fossil specimens recorded as *T. crispatum*. To his observations we may add now, that the material mentioned by SCHEPMAN (1907, p. 164) and HAANSTRA & SPIKER (1932, b, pp. 1313, 1319) certainly belongs to *T. creniferum*, as could be settled by a comparison in the LGM and the Geol. Inst. Utrecht. The Javanese material from Tjikeusik mentioned by MARTIN is very different indeed, as has been mentioned by OOSTINGH. The specimens recorded by VAN DER VLIERK (1932, p. 111) and VAN ES (1931, pp. 51, 94, 115) were not accessible to the writer. *T. scalarinum* (Lamarck) seems to be closely related to *T. costiferum* as regards its shape, but its spiral sculpture is very different (cf. OOSTINGH, l.c.).

40. *Marginella* (*Eratoidea*) *alchymista* Melvill et Standen. Represented by a Quaternary? specimen, 5.3 mm long and very similar to a recent co-type from the Gulf of Oman, in the NHL, and to the types in the BML. It belongs to the uncoloured variety *b*. Refs.: MELVILL & STANDEN, 1903, p. 309, pl. 22, fig. 13; MELVILL, 1917, p. 249. The species has never been recorded as a fossil, neither has it been previously recorded from the East Indian fauna.

41. *Turricula* (*Turricula*) spec. Two juvenile specimens, agreeing very well with the apical portion of an as yet undescribed species represented by four shells in the Java-collection in the LGM: Locality G. Gombel. Ref.: MARTIN, 1911—1912, 2 (1912), p. 163: "*Pleurotoma* (*Surcula*) spec. nov."

42. *Clavus* spec. An as yet undescribed species which will be discussed separately. It had been identified as "*Drillia*" *picta* Reeve.

43. *Raphitoma rufozonata* (Angas). This species has never been recorded before as a fossil. It was described from Port Jackson, near Sydney. A fine specimen, 6.8 mm long, is present in the Mandul collection.

It agrees perfectly with a recent shell in the NHL, shows the posterior brown spiral band very well and may be of Quaternary age. Both specimens, however, are more slender than ANGAS' figure: 1877, p. 38, pl. 5, fig. 13; TRYON, 1879—1897, vol. 6 (1884), p. 285, pl. 17, fig. 100. *R. punicea* Hedley (OOSTINGH, 1938—1939, 2 (1938), p. 45, pl. 4, figs. 66, 67a—b), is a related form, but is easily distinguished from *R. rufozonata* by its different apex and less elongated shape. Another species showing resemblance to *R. rufozonata* is "*Clathurella*" *opsimathes* Melvill et Standen (1903, p. 314, pl. 22, fig. 19), but this form has a different right lip and columella, and shows minor differences in shape and sculpture. *R. modesta* (Angas) (ANGAS, l. c., p. 38, pl. 5, fig. 15) bears no granules on its columella, and its riblets are closer together than in *R. rufozonata*.

44. *Conus odengensis* Martin. One juvenile specimen, which was compared with some other Bornese fossils. It is not possible to indicate its probable age. Ref.: BEETS, 1941, pp. 132, 170, 194, 197, 201.

45. *Terebra* (*Strioterebrum*) *indraii* Beets. One Miocene? shell represents this species, which was recently described: BEETS, 1941, p. 141, pl. 7, figs. 286, 289. The length of the specimen is 7.2 (+ ?) mm. It is not as well preserved as the type material.

46. *Terebra* (*Noditerebra*) spec. A single Miocene? specimen which had been previously identified as *T. bisulcata* ? Martin, but will be described separately as a new form which is also represented in the Miocene of Western Borneo.

47. *Ringicula glabra* Martin. This rare species is represented by two shells of possibly Pliocene age which agree very well with the Javanese type. Ref.: MARTIN, 1883—1887, p. 44, pl. 4, fig. 44.

48. *Dentalium michelottii* Hoernes. This species is synonymous with *D. jonkeri* Martin, as a recent comparison in the ZMA with the Siboga-material revealed. The latter material was identified by Miss BOISSEVAIN. The Mandul shells may be of a Pliocene age.

49. *Yoldia subquadrata* (Martin). Represented by a fine Pliocene? valve, being 8.4 mm long, 4.5 mm high and 1.7 mm thick. The anterior area is less defined than in the type (MARTIN, 1883—1887, p. 234 (*Leda*), pl. 12, fig. 238), but this is a normal variation in *Yoldia*, as a comparison with related species revealed. The hinge bears about 18 anterior teeth and 15 posterior ones. The type, a smaller valve being 8 mm long, 4 mm high and 1.5 mm thick, has 16 anterior teeth and 14 posterior. A closely related form is *Y. serotina* (Hinds). Some fine shells of this recent species were compared in the ZMA, NHL and BML collections, and a Pliocene shell from the Mahakkam delta, Borneo (BEETS, 1947, p. 201). *Y. serotina* is certainly a variable species, but it always has a much more pointed rostrum than *Y. subquadrata*, and its concentric laminae, which are obsolete on the middle portion of the shell, normally form scale-like protrusions along the rostral ridge. Further, the valve bears a wide, weakly developed radial depression corresponding to the anterior margin, whereas in *Y. subquadrata* the valve is radially merely slightly flattened. "*Nuculana*" *belcheri* (Hinds), i. e., the juvenile form as figured by LYNGBE (1909, p. 104 (8), pl. 1, figs. 18—19; cf. REEVE, 1843—1878, vol. 18, Monogr. *Leda*, spec. 23), while it seems to represent a separate species, is also related to *Y. subquadrata*. It lacks, however, the quite pronounced sharp bend in the concentric laminae, which is typical for the latter species. Also, its shape is different from that of *Y. subquadrata*.

50. *Arca* (*Barbatia*) *bistrigata* Dunker. Some Quaternary?

valves are present, most of them being exactly similar to the fossil and recent material with which a comparison was made. Refs.: cf. VAN ES, 1931, pp. 45, 58, 95, 111; OOSTINGH, 1935, p. 125. A few valves, however, are different, showing a winged instead of a rounded transition between posterior and dorsal margin. Similar shells are, indeed, present in fossil collections from Java (Tjepoe; Kendeng area; Dessah Garoeng). The species has recently been dealt with at some length: BEETS, 1947, p. 202. To the observations mentioned there, we may add, that NOETLING's *Arca nannodes* (NOETLING, 1901, pl. 7, figs. 4, 4a—d) appears similar, as does the typical *A. nannodes* Martin, to the winged form of *A. bistrigata*, but differences in sculpture evidently deny synonymy.

51. *Arca* (*Barbatia*) *gibba* Martin. Two right valves of Quaternary? age, showing secondary sculpture between all primary ribs (cf. OOSTINGH, 1923, pp. 108—109). This sculpture was not mentioned by MARTIN (1879—1880, p. 114, pl. 18, figs. 7, 7a; 1891—1922, p. 363 (1910), pl. 51, figs. 80, 80a). The bigger of the Mandul valves is 33.5 mm long, its thickness 8 mm. The smaller valve is 10 mm long, its thickness 3 mm. BOETTGER has figured material identified as *A. gibba* which certainly belongs to another species (BOETTGER, 1883, p. 134, pl. 5, fig. 5). His *Arca* spec., however (l. c., p. 136 (*pars*), pl. 5, only fig. 7) may be the true *A. gibba*. The question is, whether *A. gibba* Krauss, 1848, is a varietal form of *A. lactea* Linné or a genuine species, in the latter case MARTIN's species should be renamed. While comparing the BML collections, the writer noticed a very similar, if not identical, shell amongst recent material from Siam which was labelled as *A. venusta*, and others from Dar-es-Salaam labelled *A. lateralis*. Similarity is also shown by NARDINI's *A. lacerata* Linné from the Quaternary of Somaliland; NARDINI, 1933, p. 188, pl. 24 (19), fig. 5.

52. *Arca* (*Barbatia*) *paulucciana* (Tapparone-Canefri). Some well-preserved, evidently Quaternary, valves are present. Ref.: PRASHAD, 1932, p. 45, pl. 1, figs. 58—59. This species has not been previously found in a fossil state. The writer had the opportunity of comparing some other fossil shells in the Geol. Inst. Amsterdam, from the mud-"volcanoe" Kalang Anjar, near Surabaya, Java. Other fossil specimens will be described from New Guinea.

53. *Arca* (*Arcopsis*) *sculptilis* Reeve. This species is synonymous with *A. menkrawitensis* Beets (1941, p. 151), as was shown by a thorough comparison of a series of fossils from various localities in Eastern Borneo, with abundant material in the BML collection. The matter will be discussed separately. The Mandul collection contains a single Quaternary? small valve, which very closely resembles the fossil represented in writers' figure 304 (l. c., pl. 8) and recent material in the BML identified with the form called *A. zebuënsis* Reeve (cf. PRASHAD, 1932, p. 53). The outermost part of the inner margin bears quite obsolete wrinkles representing the end of the radial riblets. Comparison with the other material showed, that this feature occurs in both small (though evidently fullgrown shells) and normally sized specimens, in which the ventral, posterior and anterior margins are thickened by supplementary deposition of shell material.

54. *Arca* (*Arcopsis*) *symmetrica* Reeve. Five Quaternary? valves present, agreeing very well with recent material in the NHL and ZMA. Ref.: LAMY, 1907, p. 103; PRASHAD, 1932, p. 57. The material shows the following dimensions:

Length	Height	Thickness
10.9	7.4	3.3 mm.
9.8	7	3.5 mm.
8.3	6	3.1 mm.
8.2	5.1	2.4 mm.
8	5.4	2.6 mm.

This species has not previously been recorded from East Indian sediments. Refs.: NOMURA, 1932, p. 69; OTUKA, 1935, p. 883.

55. *Arca (Arcopsis) tenebrica* Reeve. A single Quaternary? valve was found, which was compared with recent material in the BML. The species proves to be variable. The Mandul specimen bears a rather coarse radial sculpture, similar to that of a recent shell from China (Shantung), its shape, however, being similar to other specimens in the BML. This species has rarely been seen in sediments: DICKERSON, 1922, pp. 203, 226, 229, pl. 6, fig. 4, pl. 15, fig. 14; YOKOYAMA, 1924, p. 60, pl. 5, fig. 7.

56. *Arca (Arcopsis) spec.* A very characteristic species which is most probably still living. It has not yet been described. This will be done separately.

57. *Arca (Arca) hulshofi* Martin. One right valve, 43 mm long, and a fragment of a smaller left valve are present. The material must have been derived from Miocene deposits. Refs.: VAN DER VLERK, 1931, p. 271; PANNEKOEK, 1936, p. 65; HAANSTRA & SPIKER, 1932, a, p. 1097.

58. *Arca (Arca) granosa* Linné. This wide-spread recent and fossil species, which according to LAMY is synonymous with *A. oblonga* Philippi (cf. OOSTINGH, 1935, pp. 133, 211, 218), is represented by a juvenile valve and a fragmentary specimen, both bearing 22 ribs. The material agrees with the rather flat, more juvenile specimens in the LGM, especially with one, figured by MARTIN in the past, from JUNGHUHN's loc. O, which had been identified as *A. oblonga* (St. Nr. 4738 in the LGM).

59. *Arca* aff. *luzonica* Reeve. A fragmentary small valve was found, which shows finer radial sculpture than either of the related species *A. luzonica* and *A. rustica* Martin.

60. *Volsella* spec. Two Quaternary? fragments representing the beak region of an unidentifiable species.

61. *Pinna* cf. *vexillum* Born. A fragmentary specimen. Refs.: VAN ES, 1931, pp. 96, 116; VAN DER VLERK, 1931, p. 269; HAANSTRA & SPIKER, 1932, b, p. 1314; PRASHAD, 1932, p. 135.

62. *Plicatula plicata* (Linné). This species was erected in 1767 and according to LAMY (1939, p. 8) includes among other forms, *P. imbricata* Menke, 1843 (nec Koch et Dunker, 1837). FINLAY has renamed *P. imbricata* as *P. menkeana* (FINLAY, 1927, p. 527; COX, 1931, pp. 6, 8). Two fine specimens and a single valve are present, and are evidently Quaternary in age. Refs.: JOUSSEAUME, 1888, p. 223; MARTIN, 1891—1922, p. 345 (1909), pl. 49, fig. 40; W. D. SMITH, 1910, p. 329; W. D. SMITH, 1913, p. 276, pl. 10, fig. 6; DICKERSON, 1922, p. 208; COX, 1930, p. 153; VAN ES, 1931, pp. 95, 116; PANNEKOEK, 1936, pp. 8, 62; WEIR, 1938, pp. 66, 67; cf. also ADAM & LELOUP, 1939, p. 55.

63. *Pecten (Pecten) javanus* Martin. A fine shell is present. It may have been derived from Pliocene deposits (Toengkoe Dasin well-core). Refs.: VAN DER VLERK, 1931, p. 269 ("Vola"); HAANSTRA & SPIKER, 1932, b, p. 1314; NOMURA, 1933, pp. 4, 57; WESTERVELD, 1941, p. 1138; VAN REGTEREN ALTENA & BEETS, 1945, pp. 54, 61.

64. *Pecten* spec. A damaged valve was found which resembles *P. singaporena* Sowerby.

65. *Chama* spec. A single Miocene? valve which could not be identified.

66. *Taras* spec. Two Quaternary valves which will be discussed separately.

67. *Venus* (*Ventricola*) *sumatrana* Martin. A complete shell is present, much better preserved than the type in the LGM (MARTIN, 1881, p. 88). Related species are *V. semberanensis* Wanner et Hahn (1935, pp. 234, 270; PANNEKOEK, 1936, pp. 9, 75), and especially *V. mindoroensis* Smith (1916, p. 17, pl. 1, figs. 1—3). The latter, however, has a finer secondary concentric sculpture than *V. sumatrana*. It seems worth while making a closer comparison between these species.

68. *Venus* (*Timoclea*) *scabra* Hanley. A fine right valve present, which seems to be of Quaternary age and agrees in every detail with recent material in the ZMA which was compared with the BML types (PRASHAD, 1932, p. 257). It is also similar to the fossils in the LGM: MARTIN, 1883—1887, pp. 208, 313, 336, 337, pl. 11, fig. 208.

69. *Clementia* (*Clementia*) *papyracea* (Gray). One deformed specimen is present, being of either Miocene? or Pliocene age. Ref. OOSTINGH, 1935, pp. 193—195.

70. *Standella* (*Standella*) *pellucida* (Gmelin). This quite variable species had not been previously recorded as a fossil. A fine left valve of Quaternary age is present, which is 46 mm long, and 31 mm high, and agrees very well with recent material in the ZMA. Refs.: REEVE, 1843—1878, vol. 8, Monogr. *Mactra*, pl. 20, spec. 118 (a more elongated form); WEINKAUF, in MARTINI & CHEMNITZ, Syst. Conch. Cab., vol. XI, 2, 1884, p. 17, pl. 5, fig. 1; LAMY, 1917—1918, p. 383, pl. 7, fig. 7. A more elongated valve is present in the Geol. Inst. Amsterdam, being collected from the mud-"volcanoe" Kalang Anjar, near Surabaja, Java. It is very similar to LAMY's figures.

71. *Macoma* (*Macalia*) *bruguieri* (Hanley). Represented by two fragmentary valves, most probably of Quaternary age. This Philippine species was recorded from the Quaternary of N. Celebes by SCHEPMAN (1907, p. 195). The writer will describe it separately from Young Quaternary deposits in E. Borneo.

72. *Arcopagia* *languida* (Smith). A very well preserved Quaternary right valve, it is 7 mm high, 8.4 mm long and 2.2 mm thick. This species has not been previously recorded as a fossil. However, more fossil material is present in the Geol. Inst. Utrecht (Neogene = Pliocene? of New Guinea: Nr. 486, 1932). Recent specimens are recorded from Siam, the Torres Straits, and Flinders Passage. The fossil was compared with recent specimens from the Bay of Batavia in the ZMA. Ref.: SMITH, 1885, p. 110, pl. 4, figs. 8, 8a—b. The rostrum of this species is variously well defined, as SMITH's figures show and as is also shown by the recent material compared. SMITH mentioned a height of 7 mm, a length of 9 mm, and a thickness of 2¼ mm.

73. *Aloidis* *cuneata* (Hinds). Some ten well-preserved Quaternary? specimens are present. The species is also represented in a collection from the mud-"volcanoe" Kalang Anjar near Surabaja, Java, kept in the Geol. Inst. Amsterdam (Nr. O. 7126). Refs.: HINDS, 1843, p. 55; MARTIN, 1881, p. 86, pl. 4, fig. 5; MARTIN, 1883—1887, p. 199; BARRON & HUME, 1902, p. 142; TESCH, 1913, p. 159 (material kept in the "Geologische Stichting", Haarlem).

74. *Aloidis socialis* (Martin). Three complete Miocene? or Pliocene? specimens. Ref.: OOSTINGH, 1935, p. 202.

75. *Aloidis tjiguhanensis* (Martin). A valve 9.4 mm long is present which agrees well with shells provided with wide interspaces of the concentric ribs from the Njalindung beds (MARTIN, 1921—1922, fig. 114). Two other smaller valves belong to the finer sculptured form, agreeing well with other Njalindung specimens. Refs.: OOSTINGH, 1935, pp. 205, 211, 219; Jaarb. Mijnw. Ned. Indië, Jaarg. 60 (1931), Alg. Ged., pp. 178, 179.

Finally, there are some remains of gastropods and bivalves whose discussion is being left for the time being.

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