Notes on *Buccinulum* (Gastropoda, Buccinidae), a reappraisal

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Beets, C. Notes on *Buccinulum* (Gastropoda, Buccinidae), a reappraisal. — Scripta Geol., 82: 83-100, pls 6-7, Leiden, January 1987

An attempt was made to assemble what is known at present of *Buccinulum* in the Indo-Western Pacific Region, fossil and Recent, more scope being offered by the discovery of new Miocene fossils from Java and Sumatra, and the recognition of further fossil species from India and Burma. This induced comparisons with, and revisions of some of the fossil and living species occurring in adjacent zoogeographical provinces. The Recent distribution of the subgenus *Euthria* appears to be much more extensive than when recorded by Wenz (1938-1944), the minimum enlargement encompassing an area stretching from the eastern Indian Ocean to Japan, via the Philippines and Ryukyu Islands. The knowledge of its fossil distribution, in the Indopacific Region long confined to Javanese Eocene, has likewise greatly expanded by discoveries made in Neogene to Quaternary of India, Burma, Indonesia (Sumatra, Java, Madura, and Borneo), the Philippines, New Hebrides, Fiji?, Ryukyu Islands, and Japan. The relevant data were tabulated. New taxa described are: *Buccinulum pendopoense* and *B. sumatrense*, both from presumed Preangerian of Sumatra, and *B. walleri sedanense* from the Rembangian of Java.
It is proposed to include *Ornopsis*, which was described from the Upper Cretaceous of North America, as a subgenus of *Buccinulum*. It may well be ancestral to *Euthria*, considering its similarity to certain of the latter's fossil and living species.
Also, a new subgenus, *Samudra*, with the type species *B. djocdjocartae* (Martin, 1884) is proposed, for species bearing a very characteristic and pronounced labral sinus. So far this species group seems confined to Indonesian Eocene to Late Miocene, but it may include a Lower Oligocene species described from Germany as well.

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Introduction

In the Indo-Western Pacific Region, the investigation of the species group *Buccinulum* Deshayes, 1830 has long had a somewhat chequered career. Probably the first species ascribed to it from that region, or rather, to its subgenus *Euthria* Gray, 1850, namely *E. aracanensis* Angas, 1873 from the Bay of Bengal was by and large overlooked and the species group reported as non-existent in Indopacific waters. Consequently, fossil species assigned to it in the region, were looked upon more or less as oddities, at least as elements foreign to their province.

The first Indonesian representative, a fossil from the Javanese Eocene, was originally named *Pusio djocdjocartae* Martin, 1884, to be relegated to *Euthria* thirty years later. Around that time too, Martin in an unpublished report (dated 1916) on Rembangian? fossils from Sumatra, correctly recorded a *Euthria* sp. (subsequently named *Buccinulum overmanae* Beets, 1942). Next came a Javanese Rembangian species named *Siphonalia martini* Wanner & Hahn, 1935, which was soon after followed by *Euthria bantamensis* Oostingh, 1939 from the Pliocene of Java. The Rembangian material was revised, reassigned to *Buccinulum* and a few new species described, including one from Preangerian deposits of East Borneo: Beets, 1942. Also included were comparisons with a number of species known from outside the Indopacific Region, classification then, as now, being hampered by a somewhat bewildering variety of shape, axial and spiral ornament, and the features of columella, labrum and siphonal canal, which has demonstrably baffled many an experienced malacologist. A second paper added descriptions of two Rembangian species from Madura, which incidentally had been recorded as *Fusus* sp. by Martin, in an unpublished report dated 1932 (Beets, 1944). Subsequently, Altena (1950) described *Buccinulum oostinghi* from the Early Pleistocene of Java. Recently, the earlier identification of an Indonesian fossil was revised (Beets, 1987).

Thus, by fits and starts the distribution record of *Buccinulum* had been expanded; and more was to come, the latest addition to its Recent occurences being a species first described as *Fasciolaria walleri* Ladd, 1976 from the Pleistocene of the New Hebrides: it was subsequently found living off Mactan Island, the Philippines, and reassigned (Ladd, 1982) to *Siphonofusus*, a genus correctly considered synonymous with *Euthria* by Shuto (1969). Below, a new subspecies is described from the Rembangian of Java, *B. walleri sedanense*. A generally similar Recent species is *B. queketti* (Smith, 1901) from off the coast of Natal, South Africa. Ladd also described two species from Pliocene deposits of Fiji which he assigned to *Euthria* (Ladd, 1977, 1982). These however would appear to be doubtful representatives of the group.

Nearer to Indonesia, the new *Buccinulum dinglense* had meanwhile been described by Shuto (1969), from Odengian deposits of the Philippines. He concluded that *Siphonofusus* Kuroda & Habe, 1952 and *Euthria* must be united, as indeed seems inescapable. Shuto also refuted, as does the writer, MacNeil's (1960) opinion that the Indonesian fossils ascribed to *Buccinulum*, should be referred to *Afer* Conrad, 1858 instead. Also included by MacNeil were two new fossil species from Okinawa and again, *Siphonalia longicanalis* Nomura & Zinb2, 1934 (suspected of being a *Buccinulum* by the writer: Beets, 1942, p. 219) from the same island chain, their composite range being from Miocene to Pleistocene. A doubtful representative of one species, *Afer chinensis* MacNeil, 1960 – recorded below as *Buccinulum* aff. *B. chinense* – was found living in Japanese waters. So is *Siphonalia longicanalis*, because of its alleged synonymy with *S. lubrica* Dall, 1918 (according to Makiyama, 1941, p. 91). The latter is the type species of

Siphonofusus. MacNeil (l.c.) doubted their being conspecific and referred both to *Afer*, thereby of course relegating *Siphonofusus* to the synonymy of *Afer*. All these species are treated in the present paper as representatives of *Buccinulum*. Also, it is now believed that a Miocene/Pliocene fossil from Japan, figured as *Siphonalia spadicea fuscolineata* (Pease, 1860) by Shuto (1962), actually is a quite characteristic *Buccinulum*.

Furthermore, two species described from Burma and India as Siphonalias, appear to belong to *Buccinulum* too. These are: *Siphonalia kelletiiformis* Vredenburg, 1923 – first suspected to be a *Buccinulum* by Altena (1950) – deriving from the Kama Miocene of Burma; and *S. indica* Dey, 1962, possibly comprising two species, from the Upper Gaj of India.

Annotated list mainly of Indopacific and related species ascribed to *Buccinulum*

Since his first paper on *Buccinulum*, the writer's attention kept returning intermittently to this puzzling and at times elusive species group and the results of continual revisions were finally assembled: the following list mentions the species considered in particular, with brief annotations, their ranges being shown in the concluding Table 1.

Buccinulum (Euthria) aracanense (Angas, 1873) — Recent, Bay of Bengal, Aracan, Burma; Pl. 6, figs. 7-8. Despite its lacking a well developed columellar fold, this would seem to be a genuine *Buccinulum* (see: Descriptions).

Buccinulum (Euthria) bantamense (Oostingh, 1939) — Pliocene, Java. Originally named *Euthria bantamensis*: Oostingh, 1939, p. 116, pl. 14, figs. 242a-b. Parietal ridge absent, columellar fold weak. Generally resembling *B. corneum* rather closely.

Buccinulum (Euthria) chinense (MacNeil, 1960) — Miocene or Pliocene, Okinawa, Ryukyu Islands. Originally described as *Afer chinensis*: MacNeil, 1960, p. 76, pl. 8, fig. 19 (apparently not: pl. 15, figs. 23-24: see *B.* aff. *B. chinense*. Parietal nodule and an elongate columellar tubercle present.

Buccinulum (Euthria) aff. *B. (E.) chinense* (MacNeil, 1960) — Recent, Korea Strait, Japan. Figured as *Afer chinensis?*: MacNeil, 1960, p. 76, pl. 15, figs. 23-24. Columellar features as in *B. chinense* but its whorls are more conspicuously ribbed; siphonal canal strongly recurving. The specimen seems to lean over to *B. indicum*.

Buccinulum (Euthria) corneum (Linné, 1758) — Neogene to Recent, Southern Europe/ Mediterranean. Type species of *Euthria* Gray, 1850. This widespread species is extremely variable, as was lavishly illustrated by Settepassi (1971, section on *Buccinulum*). Parietal ridge at most a weak pustule-like swelling. Columellar fold varying in strength, usually weak, never plait-like.

Buccinulum (Euthria) dinglense Shuto, 1969 — Upper Dingle Formation (Odengian), Panay, Philippines: Shuto, 1969, p. 122, pl. 9, figs. 19, 22-24. Parietal ridge and columellar nodule/tooth present.

Table 1. Indopacific to Japan: range and distribution of the *Buccinulum* species discussed above.

Recent:	
B. aracanense	Burma (Bay of Bengal)
B. aff. *B. chinense*	Japan (Korea Strait)
B. lubricum	Japan
B. walleri	Philippines (Bohol Strait)
Quaternary:	
B. oostinghi	Java
Pliocene/Quaternary:	
B. lubricum (= *longicanalis*)	Ryukyu Islands
Pliocene:	
B. bantamense	Java
B.? hoffmeisteri	Fiji
B.? rewaense	Fiji
B. walleri	New Hebrides
Miocene/Pliocene:	
B. chinense	Ryukyu Islands
B. sp. nov.	Japan
'Miocene':	
B. aff. *B. oostinghi*	Ryukyu Islands
B. aff. *B. pendopoense*	Ryukyu Islands
Miocene:	
Odengian:	
B. dinglense	Philippines (Panay)
Preangerian:	
B. orangense	Borneo (East Kalimantan)
B. pendopoense	Sumatra (Palembang)
B. sumatrense	Sumatra (Palembang)
B. teschi	Sumatra (Palembang)
Upper Gaj, Kama:	
B. indicum	India (Quilon)
B. kelletiiformis	Burma
B. cf. *B. sumatrense*	India (Quilon)
Rembangian:	
B. madurense	Madura
B. martini	Sumatra (Palembang), Java
B. orangense	Java
B. overmanae	Sumatra (Palembang)
B. teschi	Madura
B. walleri sedanense	Java
B. wanneri	Java
Oligocene: none	
Eocene: Middle Eocene:	
B. djocdjocartae	Java

Buccinulum (Samudra) djodjocartae (Martin, 1884) — Middle Eocene part of Nanggulan Formation, Java. Described as *Pusio djocdjocartae* (Martin, 1883-1887, p. 104, pl. 6, fig. 105), reclassified as *Euthria jogjacartensis* (Martin, 1914-1915, p. 142, pl. 3, figs. 85a-b) and so referred to by Oppenoorth & Gerth (1929, pp. 14, 16) and van der Vlerk (1931, p. 230); recently mentioned by Miss Zacchello (1984, pp. 380, 381) as *Buccinulum (Euthria) jogjacartense*. Parietal ridge with pustule present and so is a well developed columellar fold: if by no means strong near its end, it is conspicuously high, sharp and plait-like inside the aperture. Type species of *Samudra* subgen. nov., bearing a pronounced labral sinus, as do a few Rembangian/Preangerian species included in the subgenus: see next chapter.

Buccinulum (Ornopsis) elevatum (Wade, 1916) — Upper Cretaceous (Senonian), Tennessee, U.S.A.; Pl. 6, figs. 2-3. Originally described as *Ornopsis elevata*: Wade, 1916, p. 464, pl. 24, figs. 2-3 (see next chapter).

Buccinulum (Ornopsis) glenni (Wade, 1916) — Upper Cretaceous (Senonian), Tennessee, U.S.A.; Pl. 6, fig. 1. Originally described as *Ornopsis glenni*: Wade, 1916, p. 463, pl. 24, fig. 1. Type species of *Ornopsis* Wade, 1916 (see next chapter).

Buccinulum? hoffmeisteri (Ladd, 1977) — Pliocene, Fiji. Described as a somewhat doubtful *Euthria* (Ladd, 1977, p. 50, pl. 17, fig. 3), it is an odd looking species, whose aperture is not constricted abapically, yet it is generally coming fairly close to a Recent Atlantic Ocean species (particularly its paratype) which was described as *Euthria boavistensis* (von Cosel, 1981, p. 158, pl. 5, figs. 4-5), and also to certain European Neogene species, such as *Buccinulum obesum* (Michelotti, 1839) (Bellardi, 1872, p. 194, pi. 13, figs. 13-14; Peyrot, 1928, p. 11, pl. 5, figs. 3-4) and *B. costatum* (Bellardi, 1872)(Bellardi, l.c., p. 197, pl. 13, fig. 19). Yet it is perhaps more likely a *Nassa*.

Buccinulum (Euthria) indicum (Dey, 1962) — Upper Gaj, Quilon, South India. Described as *Siphonalia (Kelletia) indica* (Dey, 1962, p. 76 (pars?), pl. 4, figs. 7-8 exclusively?), it is a typical *Buccinulum* akin to the Recent *B.* aff. *B. chinense*. Parietal ridge and rather strong columellar fold present. The species approaches the group of *B. queketti* and *Ornopsis*, by having a longer siphonal canal than several other species. Dey's paratype (l.c., pl. 4, fig. 6) perhaps is *B. sumatrense*.

Buccinulum (Euthria) kelletiiforme (Vredenburg, 1923) — Kama (Rembangian to Preangerian?), Burma. Described as *Siphonalia (Kelletia) kelletiiformis*: Vredenburg, 1923, p. 66, pl. 2, figs. 11a-b. Parietal ridge apparently present. Were it not for Vredenburg's mention of a columellar fold, not visible in his fig. 11a (this may have mislead Dey: 1962, p. 77), the species might indeed be judged to be a *Siphonalia*. It comes close to *B. pendopoense*.

Buccinulum (Euthria) longicanale (Nomura & Zinbô, 1934) — Pliocene/Pleistocene, Ryukyu Island: Nomura & Zinbô, 1934, p. 159, pl. 5, fig. 26; see *B. lubricum*.

Buccinulum (Euthria) lubricum (Dall, 1918) — Recent, Japan; Pl. 6, figs. 11-12. Described as *Siphonalia lubrica*; see Descriptions. With tooth-like parietal ridge and columellar tooth on callosity along the siphonal canal. *B. longicanale* would appear to be conspecific.

Buccinulum (Samudra) madurense Beets, 1944 — Rembangian, Madura: Beets, 1944, p. 16, pl., figs. 7-8. Parietal ridge and columellar fold absent, possibly due to corrosion of the shell. Deep labral sinus as considered typical for *Samudra* present: see next chapter.

Buccinulum (Euthria) martini (Wanner & Hahn, 1935) — Rembangian, Java, and presumed Rembangian, Sumatra. First described as *Siphonalia martini*: Wanner & Hahn, 1935, p. 250 (pars), pl. 18, figs. 16-17, and 20 exclusively (see also *B. orangense* and *B. wanneri*): Beets, 1942, p. 222 (pars), pl. 24, figs. 1-3 exclusively: fig. 1 is refigured in the present paper (Pl. 6, fig. 4), and so is fig. 2 (now Pl. 6, fig. 5). Siphonal canal oblique, recurved, low parietal ridge and long tooth-like columellar fold present. This peculiar species comes in shape close to *Ornopsis glenni*.

Buccinulum (Euthria) oostinghi Altena, 1950 — Lower Pleistocene, Java: Altena, 1950, p. 230, text-fig. 19. Parietal ridge and columellar tooth present. Altena compared the species with *B. kelletiiforme*, which is however much more reminiscent of *B. pendopoense, B. oostinghi* coming closer to the group of *B. orangense.*

Buccinulum (Euthria) aff. *B. (E.) oostinghi* Altena, 1950 (pars) — Miocene (Yonabaru), Okinawa, Ryukyu Islands: MacNeil, 1960, p. 76 (pars), pl. 3, figs. 27-28 exclusively for his figs. 24-25 and 33: see *B. pendopoense*. This is the only specimen with a comparatively slender spire which is reminiscent of the real *oostingi,* but it also likens *B. sumatrense.*

Buccinulum (Euthria) orangense Beets, 1942 — Gelingseh Beds (Preangerian), East Borneo (Beets, 1942, p. 225, pl. 24, figs. 10-13: fig. 12 refigured in the present paper: Pl. 10, fig. 6). Recently considered to include a paratype of *Siphonalia martini* Wanner & Hahn (1935, pl. 18, figs. 18-19), which was previously (Beets, 1942, p. 224, pl. 24, figs. 5-6) considered a somewhat doubtful *B. martini*: Beets, 1987, p. 30. Parietal ridge and columellar fold present. The species comes closest to *B. wanneri.*

Buccinulum (Samudra) overmanae Beets, 1942 — Presumed Rembangian, Sumatra (Beets, 1942, p. 226, pl. 24, figs. 7-9: fig. 8 refigured in the present paper: Pl. 6, fig. 13). Parietal ridge not developed and columellar fold extremely weak, if not absent. The labral sinus, considered typical for *Samudra*, is beautifully developed: see next chapter.

Buccinulum (Euthria) pendopoense sp. nov. — Presumed Lower Palembang Beds (Preangerian), Sumatra; Pl. 7, figs. 1-5. Parietal ridge with nodule and columellar fold with pustule present. Specimens figured by MacNeil as *Afer* aff. *A. oostinghi* (Altena, 1950) from the Miocene of Okinawa (MacNeil, 1960, p. 76 (pars), pl. 3, figs. 24-25, 33) could conceivably be a suspecies of *pendopoense,* with stronger spiral ornament; see Descriptions.

Buccinulum (Euthria) aff. *B. (E.) pendopoense* sp. nov. — Miocene (Yoanabaru), Okinawa, Ryukyu Islands: described as *Afer* aff. *A. oostinghi* (Altena, 1950) by MacNeil: 1960, p. 76 (pars), pl. 3, figs. 24-25, 33 exclusively. See *B. pendopoense.*

Plate 6

Fig. 1. *Buccinulum (Ornopsis) glenni* (Wade, 1916) Holotype, height 48 mm; Senonian, Tennessee, U.S.A. (from Wade, 1916, pl. 24, fig. 1).

Figs. 2-3. *Buccinulum (Ornopsis) elevatum* (Wade, 1916) Holotype, height 34.5 mm; Senonian, Tennessee, U.S.A. (from Wade, 1916, pl. 24, figs. 2-3).

Fig. 4. *Buccinulum (Euthria) martini* (Wanner & Hahn, 1935) Height 25 mm; Rembangian? of Langkang, Sumatra (from Beets, 1942, pl. 24, fig. 1).

Fig. 5. *Buccinulum (Euthria) martini* (Wanner & Hahn, 1935) Paratype, height 19 mm; Rembangian, Java (from Beets, 1942, pl. 24, fig. 2).

Fig. 6. *Buccinulum (Euthria) orangense* Beets, 1942 Holotype, height 25.8 mm; Gelingseh Beds, East Borneo (from Beets, 1942, pl. 24, fig. 12).

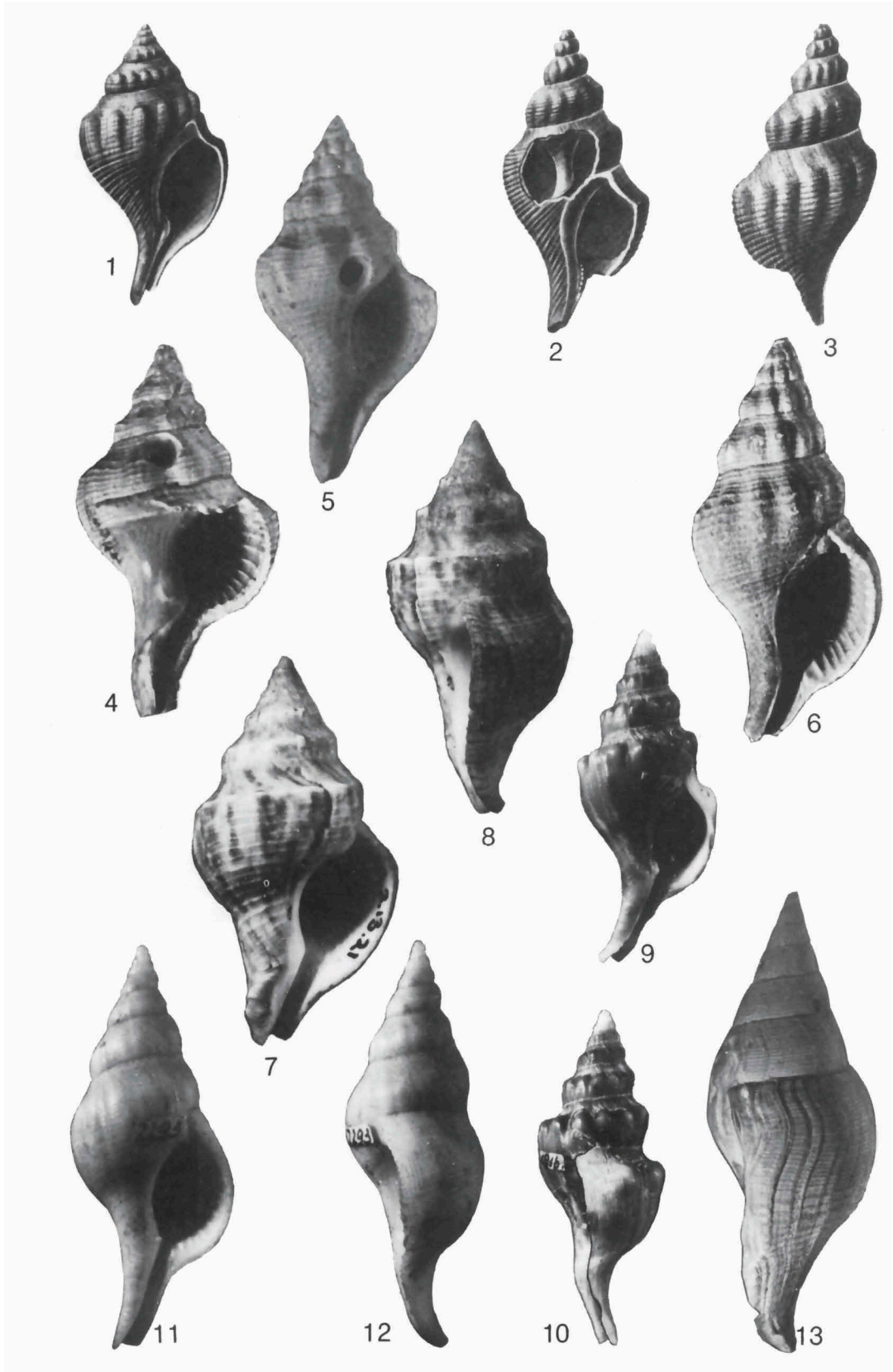
Figs. 7-8. *Buccinulum (Euthria) aracanense* (Angas, 1873) Holotype, BMNH 1900.2.13.21; height 49 mm; Recent, Bay of Bengal, Aracan, Burma.

Figs. 9-10. *Buccinulum (Euthria) queketti* (Smith, 1901) Height 42.7 mm; Recent, off Natal Coast, South Africa.

Figs. 11-12. *Buccinulum (Euthria) lubricum* (Dall, 1918) Height 51.3 mm; Recent, Japan.

Fig. 13. *Buccinulum (Samudra) overmanae* Beets, 1972 Holotype, height 34.5 mm; Rembangian? of Langkang, Sumatra (from Beets, 1942, pl. 24, fig. 8).

Plate 6



Buccinulum (Euthria) queketti (Smith, 1901) — Recent, off Natal Coast, South Africa; Pl. 6, figs. 9-10. Described as *Euthria queketti*: Smith, 1901, p. 110, pl. 1, fig. 1. Parietal ridge with nodule and well developed columellar fold with tooth-like end present; see Descriptions.

Buccinulum? rewaense (Ladd, 1982) — Pliocene, Fiji. Described as a *Euthria* (Ladd, 1982, p. 48, pl. 11, fig. 14), though not, as asserted by Ladd, belonging to the group of *B. djocdjocartae*, but rather seeming akin to *Euthria ferrae* (Reeve, 1847), originally classified as a *Buccinum*: Smith, 1879, p. 206, pl. 20, figs. 39, 39a.

Buccinulum (Euthria) sumatrense sp. nov. — Presumed Lower Palembang Beds (Preangerian), Sumatra; Pl. 7, figs. 6-13. Parietal ridge may be absent, columellar fold present. Dey's paratype of *Siphonalia indica* (Dey, 1962, pl. 4, fig. 6) may be conspecific; see Descriptions.

Buccinulum (Samudra) teschi Beets, 1944 — Rembangian, Madura: Beets, 1944, p. 14, pl., figs. 1-6. Also occurring in presumed Lower Palembang Beds (Preangerian), Sumatra. Parietal ridge and columellar fold not developed and columella straighter than usual, but labral sinus, considered characteristic for *Samudra*, well developed; see Descriptions.

Buccinulum (Euthria) walleri (Ladd, 1976) — Pliocene, Santo, New Hebrides; and Recent, Mactan Island (Cebu/Bohol Strait), Philippines. First described as a *Fasciolaria* (Ladd, 1976, pp. 132-133, figs. 16-20), subsequently reclassified as *Siphonofusus walleri* (Ladd, 1982, p. 47, pl. 16, figs. 12-14). Parietal callus and a low though rather well developed columellar fold present.

Buccinulum (Euthria) walleri sedanense subsp. nov. — Rembangian, Java; Pl. 11, figs. 14-17. A well developed columellar fold is present and a tooth-like parietal ridge (which may be absent).

Buccinulum (Euthria) wanneri Beets, 1942 — Rembangian, Java. Originally included in *Siphonalia martini* (Wanner & Hahn, 1935, p. 250 (pars), pl. 18, figs. 14-15 exclusively; Beets, 1942, p. 228, pl. 24, fig. 4). Parietal ridge and well developed columellar fold with tooth-like projection on straight columella present. Close to *B. orangense*.

Plate 7

Figs. 1-5. *Buccinulum (Euthria) pendopoense* sp. nov. Holotype, RGM 315 342; height 47.2 mm (figs. 17-18: successive transitional stages from protoconch to spire, enlarged); presumed Lower Palembang Beds, Pendopo, Sumatra.

Figs. 6-10. *Buccinulum (Euthria) sumatrense* sp. nov. Holotype, RGM 315 345; height 35 mm (figs. 9-10: successive transitional stages from protoconch to spire, enlarged); presumed Lower Palembang Beds, Pendopo, Sumatra.

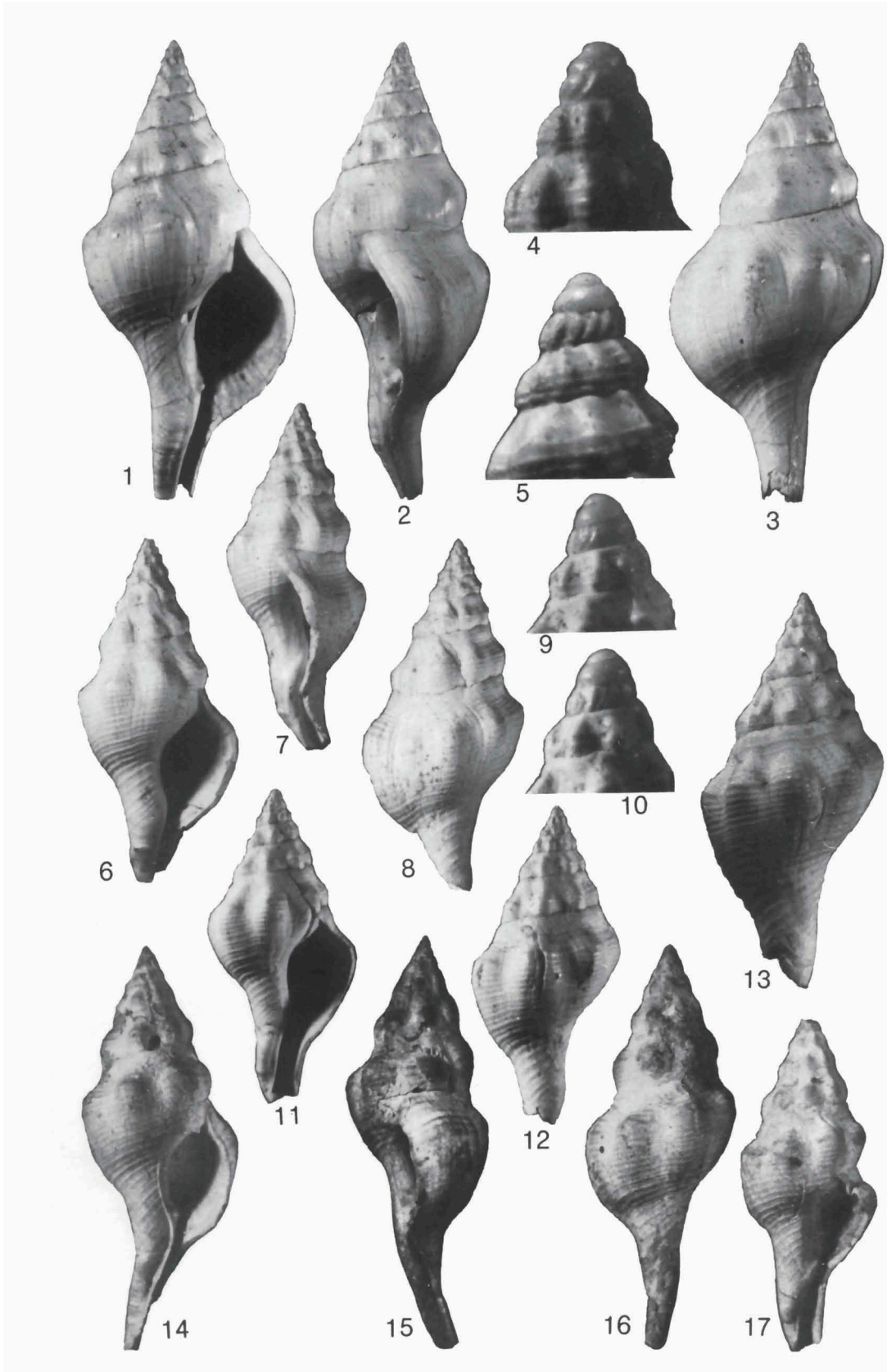
Figs. 11-12. *Buccinulum (Euthria) sumatrense* sp. nov. Paratype, RGM 315 346; height 21 mm; presumed Lower Palembang Beds, Pendopo, Sumatra.

Fig. 13. *Buccinulum (Euthria) sumatrense* sp. nov. Paratype, RGM 315 347; height 27.5 mm; presumed Palembang Beds, Pendopo, Sumatra.

Figs. 14-16. *Buccinulum (Euthria) walleri sedanense* subsp. nov. Holotype, height 33 mm; Rembangian, Java.

Fig. 17. *Buccinulum (Euthria) walleri sedanense* subsp. nov. Paratype, height 27.5 mm; Rembangian, Java.

Plate 7



Buccinulum (Euthria) sp. nov. — Miocene-Pliocene, Miyazaki Group, Japan. Determined as *Siphonalia spadicea fuscolineata* (Pease, 1860) by Shuto (1962, p. 36, pl. 7, figs. 5, 9). The apparent strong columellar fold and parietal node of Shuto's specimen are a far cry, the writer believes, from *S. fuscolineata* which at most seems to have a very gentle columellar swelling near the siphonal canal. The Miyazaki shell appears to be a typical *Buccinulum* of the group of *B. orangense*.

Finally, it may be added here that part of the material referred to a European fossil, *Euthriofusus virgineus* (Grateloup, 1833), seems to be a genuine *Buccinulum*, at least the specimen figured by Peyrot (1928, p. 61, pl. 8, figs. 7-8) which bears a conspicuous columellar fold. A careful revision of this and other European species described by Bellardi, Sacco, Hoernes, Hoernes & Auinger, and Friedberg (compare also Mortara et al., 1982) seems wanted; for instance in the case of *Fusus (Euthria) pretenuis* von Koenen (1889, p. 218, pl. 17, fig. 3), *F. (E.) subterebralis* von Koenen (l.c., p. 220, pl. 17, fig. 4) and perhaps *F. multipunctatus* von Koenen (l.c., p. 235, pl. 17, fig. 8), all three from Lower Oligocene.

Discussion of *Euthria, Ornopsis* and *Samudra*

While preparing notes on the species enumerated above as well as others, no attempt was made to revise *Buccinulum* in all its ramifications, the genus, if correctly interpreted, running rather to extremes (compare Wenz, 1938-1944). Its elucidation, if at all feasible, would go far beyond the scope of the present paper; which was, simply, once more to assemble data on Indopacific and the more closely related species first and foremost.

While much remains to be desired – partly due to imperfect knowledge of faunas fossil and Recent – at least an overall picture emerged which enlarges and deepens the zoogeographic distribution implied by Wenz's system. As before, two main groups of species may be distinguished:
(1)A large group of species from Tertiary to Recent of an extensive area, reaching from Western and Central Europe via the Mediterranean and eastern to southern Atlantic, around southern Africa and thence from the Indo-Western Pacific Region to Japan.
(2)Another group, ranging through the same time span but occurring in the Australo-Tasmanian/Neo Zelandic realm, if not beyond, and perhaps being of a different ancestry.

To the first group belongs the wide and far ranging subgenus *Euthria*. As here understood, it is known from the Early Tertiary to Quaternary of Europe, and the Miocene to Quaternary of Southern Asia, Western Pacific, Ryukyu Islands, and Japan. Its Recent distribution reaches from the Mediterranean, via the eastern and southern Atlantic to southern Africa and to the Indopacific – with large gaps which one day no doubt will be filled in – that is, from the Bay of Bengal to the Philippines, and finally, Japan. *Euthria* may conceivably have evolved from Upper Cretaceous *Ornopsis* (North America) which can generally hardly be distinguished from certain species groups within *Euthria*. A separate strain appears to be embodied by *Samudra* subgen. nov., characterised by a pronounced labral sinus and so far seemingly confined to the Indonesian Middle Eocene to Late Miocene. Interestingly enough, it may also occur in the Lower Oligocene of Europe (Germany).

The second group is that of *Buccinulum* Deshayes, 1830 s.str. and other subgenera. Its relationships with *Euthria* are nebulous: such ties as seem to exist are apparently

entirely confined to the general resemblance between *Buccinulum* s. str., *Nodopelagia* Hedley, 1915 and perhaps even *Dennantia* Tate, 1888, on the one hand, and the smoother and some of the ribbed species of *Euthria*, on the other. Saying that one suspects that such similarities may be due to paralellism may offer a way out in such cases, but an uncomfortable one which merely enters another debatable province.

Euthria Gray, 1850

If properly understood, *Euthria* comprises a highly variable group of species, its extremes, however, being interconnected by what seems to be a quite natural chain of intermediate forms. This impression may be given an underpinning by the surprising variability of its type species, *Buccinulum corneum*. Anyway, anyone dissatisfied with the view that the group should be considered a unit, and endeavouring to split it up, would most certainly be hard put to it.

The shape of Euthrias varies considerably from species to species; the spire for instance, from acuminate to low (as in *Ornopsis glenni*), the whorls bearing a more or less conspicuous adapical spiral depression to sutural ramp and being flat, or more convex and carinate. They may be devoid of axial ribs, or almost so (just like the protoconch), or a few or all may be conspicuously ribbed. Spiral ornament is usually not strong. The columella may be curved or straighter, and the same may hold true for specimens of one and the same species. The siphonal canal varies quite considerably in length and curvature and while a parietal ridge or weaker callosity is often present, it may also be absent, both features varying within one and the same species too. The same applies to the abapical labral node opposite the columellar fold. Also, the group, as do sometimes specimens of one and the same species, shows considerable variation in the development of a columellar swelling, fold, or more rarely, a true plait at the beginning of, or more alongside the siphonal canal, or absence altogether of a columellar callosity. In some species such a callosity or fold, may bear a transverse tooth-like projection or pustule and in one Recent specimen of *B. lubricum*, a couple of small additional pustules appeared to be present, adapically to the fold but close to it. This departure from the normal seemingly denotes some as yet nebulous relationship with certain other Buccinidae.

It is to be noted that of all species of *Buccinulum* considered here – not only those grouped under *Euthria*, but also *Samudra* and *Ornopsis* – no more than three have a truly pronounced columellar plait: *Ornopsis glenni, O. elevata* and *Samudra djocdjocartae*. Considering that they derive from Senonian to Middle Eocene, this may be an ancient feature within *Buccinulum*. On the other hand, a columellar fold almost as continuous along the siphonal canal as in *Ornopsis*, is shown by both the new Miocene species *B. pendopoense* and *B. sumatrense*.

If one considers such features as general shape of shell and whorls, axial ornament and length and curvature of the siphonal canal, now, as before, some vaguely definable morphological sub-groups seem to emerge from the overall picture of variation. These are tentatively set out below (Table 2) but is should be emphasized that the 'development' shown is not to be understood to represent any lineages whatsoever.

Ornopsis Wade, 1916

The likeness between this interesting species group from the North American Senonian, and *Siphonalia* has been commented upon by Cossmann (1925, pt 13, p. 251, pl. 10, fig.

Table 2. Morphlogical subgroups of *Buccinulum (Euthria)*.

Group of *B. corneum* (type species) and *B. bantamense*.

Group of *B. lubricum*
B. chinense,
B. kelletiiformis,
B. pendopoense, and
B. aff. *B. pendopoense.*

Group of *B. indicum,*
B. aff. *B. oostinghi* and
B. sumatrense.

Group of *B. queketti,*
B. walleri and
B. walleri sedanense.

Group of *B. martini* and
(*Ornopsis glenni*).

'Group' of *B. aracanense.*

Group of *B. orangense* (with conspicuously ribbed and inflated whorls),
B. dinglense,
B. oostinghi,
B. wanneri,
B. spec. nov., and
(*Ornopsis elevata*).

33: *O. glenni* Wade), who even more stressed the resemblance between *Ornopsis* and *Euthria* (l.c., p. 253). In this context *O. elevata* was meant in particular. Wenz (1938-1944, p. 1190, fig. 3385) placed *Ornopsis* next to *Buccinulum.*

The type species of *Ornopsis, O. glenni* Wade is refigured here: Pl. 10, fig. 1. It is comparatively plump and therefore comes rather close in shape to *Buccinulum martini* or even *B. aracanense*, but could also be called a 'lower-spired and plump *B. queketti*'. *O. elevata*, refigured here (Pl. 10, figs. 2-3), has a more acuminate spire and would morphologically form a link with the group of *Buccinulum orangense.*

The outer lip of *Ornopsis* is only marginally crenate within. The parietal callus is thickest next to the adapical channel but not strongly developed. The columellar plait is conspicuous, unusually strong in comparison with most Buccinulums although equal to that of *B. djocdjocartae*, and it curves along the siphonal canal, even more so than in *B. pendopoense* and *B. sumatrense*. The siphonal canal of *Ornopsis* is more or less recurved, a variable feature in *Buccinulum* too.

Taking all in all, there appear to be no valid reasons for keeping *Ornopsis* and *Buccinulum* apart except on a subgeneric level, on the meagre seeming basis of the difference between the insides of the labrum.

So far then *Ornopsis* apparently did not range into Cenozoic times while up to now most of the Buccinidae (Upper Cretaceous-Recent) appear to have started in some part of the Cenozoic, with many extending into the present, and while rarely observed in Upper Cretaceous to Eocene. The range of *Kelletia (Penion)* however is from Upper Cretaceous to Recent, *Cantharus, Metula* and *Siphonalia* starting more doubtfully in Upper Cretaceous. Consequently, there seems to be no valid reason for excluding the possiblity that there may be a genetic link between Senonian *Ornopsis* and Cenozoic to Recent *Euthria* and that one day *Ornopsis* may be found above the Upper Cretaceous.

Samudra subgen. nov.

The type species is: *Buccinulum djocdjocartae* (Martin, 1884). *Samudra* is the Malayan name of Sumatra.

Generally showing the characteristics of *Euthria*, more especially those of the latter's type species, *B. corneum*. The type species of *Samudra* as well as its other representatives, however, all possess a peculiar, pronounced and nicely shaped labral sinus (Pl. 10, fig. 13) which seems to denote a separate strain within *Buccinulum*, encompassing a species group apparently indigenous to the Indonesian region, and there ranging from Middle Eocene to Preangerian Late Miocene. It may in addition occur in the Lower Oligocene of Europe (Germany). The columella of *Samudra* varies from a weak swelling to a strong plait, as in *Ornopsis*. Its whorls are flat to slightly convex and they are spirally striate though sometimes weakly so, the base bearing a more conspicuous spiral ornament.

Apart from the type species, its members are: *B. madurense, B. overmanae* and *B. teschi*. Judging from its labral sinus, the European Lower Oligocene *Fusus edwardsi* von Koenen (1889, p. 196, pl. 16, figs. 3-4) could well belong to *Samudra* too, but, never having seen any material of this species, the writer hesitates to include it without restrictions.

In the past, other European species like *B. pretenue* (von Koenen) and *B. subterebrale* (von Koenen) were included in the group of *B. djocdjocartae* and *B. overmanae* (Beets, 1942, p. 221), but presently, they are excluded from it and referred to *Euthria* (see previous chapter).

Descriptions

In the descriptions institutional collections are designated as follows:
BMNH – British Museum (Natural History), London.
GIA – Geologisch Instituut, University of Amsterdam.
RGM – Rijksmuseum van Geologie en Mineralogie, Leiden.
RNH – Rijksmuseum van Natuurlijke Historie, Leiden.

Buccinulum (Euthria) aracanense (Angas, 1873)
Pl. 6, figs. 7-8.

Holotype — BMNH 1900.2.13.21; height 49 mm, width 25.8 mm.

Type-locality — Recent, Bay of Bengal, Arakan, Burma.

Reference — *Euthria aracanensis*: Angas, 1873, p. 182, pl. 20, fig. 1.

Comments — The writer is indebted to Dr J.D. Taylor, Dept. Zoology, British Museum (Natural History) for the loan of the type of this solid species. It is obscurely but unmistakably ribbed. The outer lip bears a very shallow sinus and, as is normal in *Euthria*, is recurrent adapically, its interior being weakly lirate. Parietal callus present,

columella inconspicuously callous at the beginning of the siphonal canal but inside the aperture more fold-like due to a accompanying shallow concavity adapically to it. Siphonal canal recurved, its end not notched but a fasciole is present. The shape of this curious species approaches that of *B. martini*. On the whole it seems to be a genuine *Buccinulum*, although additional material would be welcome to fully ascertain its systematical position.

Buccinulum (Euthria) lubricum (Dall, 1918)
Pl. 6, figs. 11-12.

Material — The figured specimen is from Abeno, Japan; in the RNH (don. C.A. van der Peijl); height 51.3 mm.

References — *Siphonalia lubrica*: Dall, 1918, p. 230; Makiyama, 1941, pp. 77, 91; *S. longicanalis:* Nomura & Zinbô 1934, p. 159, pl. 5, fig. 16.

Comments — *Siphonalia longicanalis*, suspected to be a *Buccinulum* by the writer (Beets, 1942, p. 219), was considered synonymous with *S. lubrica* by Makiyama who did not believe them to be Siphonalias but refrained from reclassifying them. The two indeed seem to be conspecific although the figure of *longicanalis* does not show parietal and columellar callosities clearly. MacNeil (1960, p. 76) doubted synonymy, mentioning eight to nine axial nodes on the whorls of *lubrica*, whereas *longicanalis* was supposed to have no more than five: in fact, Nomura and Zinb2 recorded nine to ten plicae. The Leiden specimen bears several weak ribs whose number cannot be ascertained properly, even in strike light. It should be noted that the columella of the Leiden specimen bears two small nodes adapically to the columellar fold and quite close to it. For the alleged systematic position of *B. lubricum* within *Afer* see the Introduction above.

Buccinulum (Euthria) pendopoense sp. nov.
Pl. 7, figs. 1-5.

Holotype — RGM 315 342; Pl. 7, figs. 14-18, height 47.2 mm (fig. 17: showing obligique axials of the end of the protoconch, enlarged; fig. 18, the first post-apical axials).
Paratypes — RGM 315 343-315 344 (29 specimens).

Type-locality — Pendopo, Palembang, South Sumatra, don. W.R. Huysse.

Type-horizon — Not specified, presumably Lower Palembang Beds (Preangerian).

Name — Derived from the locality.

Description — Shell medium slender, whorls gently angulate nearer abapical suture. Protoconch consisting of 2¼ - 2½ whorls, sometimes slightly angular near the abapical suture, the last half whorl (approximately) with slanting and curved riblets, at first weak, finally quite strong. The last three riblets or so may be connected by insignificant spiral striae. The post-apical whorls first evenly rounded, bearing axial riblets extending from suture to suture and being overrun by spiral lirae. In the course of some 2½ whorls the ornament weakens adapically sooner than abapically, the spirals all changing into very fine, densely packed threads, except for a few marking an abapical rounded angulation.

Whorls more and more concave adapically, the gradually disappearing from this part but remaining rather well developed in and near the angulation. Dense fine growth lines complete the ornament. On younger whorls the ribs become node-like or they may disappear altogether. Base of body whorl with rather distant, stronger spiral lirae, often alternating with finer ones. Aperture subovate, adapical channel more or less accentuated by a parietal ridge coinciding with an underlying lira, its end being more or less node-like. Outer lip thickened varix-like but its edge sharp, its sinus wide and moderately deep, its interior lirate. Columella concave, bearing a fairly conspicuous fold along much of the siphonal canal, sometimes also bearing a long node on the fold, opposite a basal labral callosity. Siphonal canal narrow, moderately recurved, its end narrowly and weakly notched, a siphonal fasciole present but not conspicuous.

B. chinense and *B.* aff. *B. chinense* (see Annotated list) are certainly related but have more angular whorls, the angulation moreover being situated clearly more abapically. MacNeil has described specimens from Okinawa as *Afer* aff. *A. oostinghi* (Altena, 1950) which actually may be either conspecific with *pendopoense*, or, as seems more likely, a subspecies with stronger spiral ornament and sometimes stronger ribbing: see *B.* aff. *B. pendopoense* in the Annotated list above. A juvenile specimen (MacNeil's figs. 24-25) cannot be separated from *pendopoense* with proper justification, but the larger shell has a spiral ornament stronger by far than any available specimen of *pendopoense*, which is a constantly 'smooth' species.

Buccinulum (Euthria) queketti (Smith, 1901)
Pl. 6, figs. 9-10.

Material — The figured specimen is one of three Recent specimens from off the Natal coast, South Africa, in the RNH.

References — *Euthria queketti*: Smith, 1901, p. 110, pl. 1, fig. 1; Kensley, 1973, p. 154, fig. 563.

Comments — The Leiden specimens are fine shells, a 42.7 mm long one being figured here. Parietal callous ridge present, best developed in the smallest specimen (height 41.5 mm). The species generally resembles *Ornopsis*, but seems closer to *B. indicum* and *B. walleri*, its siphonal canal likewise being rather strongly recurved.

Buccinulum (Euthria) sumatrense sp. nov.
Pl. 7, figs. 6-13.

Holotype — RGM 315 345; Pl. 7, figs. 6-10; height 35 mm, width 15,8 mm (figs. 9-10 showing successive transitional stages from protoconch to spire, enlarged).
Paratype — RGM 315 346, Pl. 7, figs. 11-12; height 21 mm; RGM 315 347, Pl. 7, fig. 13; height 27.5 mm; RGM 315 348 (five specimens).

Type-locality — Pendopo, Palembang, South Sumatra, don. W.R. Huysse.

Type-horizon — Not specified, presumably Lower Palembang Beds (Preangerian).

Name — Derived from the island of Sumatra.

Description — Shell fairly small, slender, whorls angulate abapically to the middle. Protoconch consisting of 2¼ whorl, smooth but for the last quarter whorl which bears curved and slanted riblets, its end marked by an axial rib showing the spiral ornament of the postapical whorls. Spiral ornament may be faintly developed on the youngest part of the protoconch, thus to a certain extent obscuring the demarcation between it and the spire. Spire whorls soon showing a median angulation which gradually shifts to a more abapical position. They are conspicuously ribbed and bear fairly coarse spiral lirae, one of which is stronger and marks the whorl angulation. An adapical sutural band is comparatively smooth and slightly raised. Abapically to it, the whorls are depressed (the ribs first gradually weaker), but convex abapically to the angulation. Spiral ornament on the base of the body whorl conspicuous, spirals more distant on the neck. Secondary spirals irregularly distributed. Growth lines rather conspicuous, dense, marking a shallow sinus of the labrum. The latter is thickened but its edge sharp, its inside lirate, sometimes bearing a callosity opposite the parietal node. Columella concave, bearing a long abapical fold along the siphonal canal. The fold may be provided with a small transverse node, opposite a basal callosity inside the outer lip. Siphonal canal not strongly recurved, narrow, its end weakly and narrowly notched corresponding with an inconspicuous siphonal fasciole.

Perhaps Dey's paratype of *Siphonalia indica* (Dey, 1962, pl. 4, fig. 6) comes closest and may be a *B. sumatrense*; his holotype (l.c., figs. 7-8) has three smooth apical whorls, its ornament may be less strongly lirate, its penultimate whorl bearing seven ribs, the corresponding whorl in *B. sumatrense* eight to nine. Nevertheless, further material may reveal closer ties between the two species.

Buccinulum (Euthria) walleri sedanense subsp. nov.
Pl. 7, figs. 14-17.

Holotype — Figs. 14-16; height 33 mm, width 12.5 mm.
Paratype — Fig. 17; height 27.5 mm.

Type-locality – Sedan, Java, GIA, don. Hulshoff.

Type-horizon — Not ascertained in detail, Rembangian.

Name — Named after the type-locality.

Description — The Rembangian fossils resemble Ladd's *B. walleri* (see Annotated list above) closely, although they are smaller. In the holotype of *sedanense* part of the protoconch and first spire whorl are corroded so as to defy accurate description. Perhaps 6 post-apical whorls are present, angulate, conspicuously ribbed, the ribs at first extending from suture to suture but on later whorls being weak in the gradually more pronounced adapical spiral concavity, while remaining strong at the angulation and abapically to it. The angulation is accented by a strong spiral which forms long node-like swellings on the ribs. There is a raised band along the adapical suture. The number of ribs per whorl is: 6 (body whorl)(the first rib is actually double) - 7 - 7 - 7 - 7 - 8? (holotype); 8 - 8 - 8 - 8 - 7 - ? (paratype). Spiral ornament gradually more conspicuous, strongest on the body whorl, here numbering 21-24 lirae abapically to the shoulder. Growth lines fine, recurrent adapically, forming a shallow sinus in the depression and over part of the angulation. Outer lip bearing a strong varix, its interior with about 13 spiral lirae, the first and the last of the row stronger and thus offsetting the adapical channel and siphonal

canal. The latter is long and recurved. Inner lip well delimited and so is a parietal ridge. Columella bearing a rather conspicuous fold.

The typical *walleri* has a slenderer spire and weaker spiral ornament and more angular whorls, at least its paratype, and apparently also more ribs (8-10 on the penultimate whorl) which are not so swollen as in *sedanense*. Adapically, its whorls are not so conspicuously concave as in the Rembangian shells. The differences are small, yet the two forms do not seem to be synonymous.

Buccinulum (Samudra) teschi Beets, 1944

Material — RGM 315 349.

Locality — Pendopo, Palembang, South Sumatra, don. W.R. Huysse.

Range — Rembangian (Madura) to presumed Lower Palembang Beds (Preangerian)(Pendopo, Sumatra).

Comments — The specimen from Pendopo is juvenile, about 18 mm long. It compares well with one of the paratypes (Beets, 1944, figs. 5-6). At present it is believed that *B. teschi* may turn out to be no more than a variety of *B. overmanae* (see Annotated list above) or even to be conspecific.

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Manuscript received 18 June 1985.