Palaeontographica, Abt. A: Palaeozoology – Stratigraphy
Vol. 313, Issues 1–3: 1–79
Stuttgart, December 2018

Article

Late Miocene gastropods from northern Borneo (Brunei Darussalam, Seria Formation)

by

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with 11 plates, 3 text-figures and 1 table

Zusammenfassung

Wir präsentieren die erste systematische Darstellung einer Gastropoden-Vergesellschaftung aus dem Tortonium (spätes Miozän) aus dem Aufschluss „Ambug Hill" im Tutong Bezirk von Brunei Darussalam. Die gering diverse Fauna umfasst 62 Arten von denen 37 bisher noch nicht aus anderen neogenen Faunen der Indo-West Pazifischen Region (IWP) bekannt sind, 23 dieser Arten werden formal als neue Arten beschrieben. Karnivore, aasfressende und detritusfressende Arten dominieren das Spektrum. Die ökologischen Ansprüche verwandter rezenter Arten deuten auf Schlammboden im innern Schelf in einigen Zehnermetern Wassertiefe mit wenig Vegetation als Ablagerungsraum hin. Die geringe Größe der meisten Individuen, das häufige Auftreten von subadulten Schalen, und die geringe Größe einiger Arten im Vergleich zu congenerischen Arten dürften auf suboptimale Umweltbedingungen zur Zeit der Ablagerung dieses Teils der Seria Formation hinweisen. Die geringen Beziehungen zu Neogenen Faunen Indonesiens auf Artniveau könnten eine biogeographische Separierung der Faunen der Javasee und Celebessee von jener des Südchinesischen Meeres anzeigen. Eine noch völlig unzureichende Besammlung und relativ punktuelle taxonomische Beschreibungen der neogenen IWP-Faunen sowie ein Fehlen von Vergesellschaftungen aus ökologisch identen Ablagerungsräumen Indonesiens könnten aber ebenso den scheinbar endemischen Charakter der Ambug-Hill-Fauna erklären.
Rhinoclavis pulcherrima n. sp., *Rissoina tutongensis* n. sp., *Ficus parvissima* n. sp., *Dolomena bruneiensis* n. sp., *Scalptia verheckeni* n. sp., *Phos bruneiensis* n. sp., *Nassarius pseudoovum* n. sp., *Indomitrella acuticonica* n. sp., *Hemifusus charlieleei* n. sp., *Prunum seriaense* n. sp., *Cymbiola ambugensis* n. sp., *Ziba waltercernohorskyi* n. sp., *Amalda bruneiana* n. sp., *Tomopleura furcata* n. sp., *Unedogemmula nuttalli* n. sp., *Gemmula sculpturata* n. sp., *Crassispira strangulata* n. sp., *Paradrillia pachyspira* n. sp., *Conasprella paupera* n. sp., *Conasprella trianginodus* n. sp., *Triplostephanus wilfordi* n. sp., *Duplicaria aequalis* n. sp. und *Architectonica beetsi* n. sp. werden als neue Arten beschrieben.

Schlüsselwörter: Gastropoda, Miozän, Tortonium, Brunei Darussalam, Südchinesisches Meer

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www.schweizerbart.de
DOI: 10.1127/pala/2018/0077
0375-0442/2018/0077 $ 35.55

Abstract

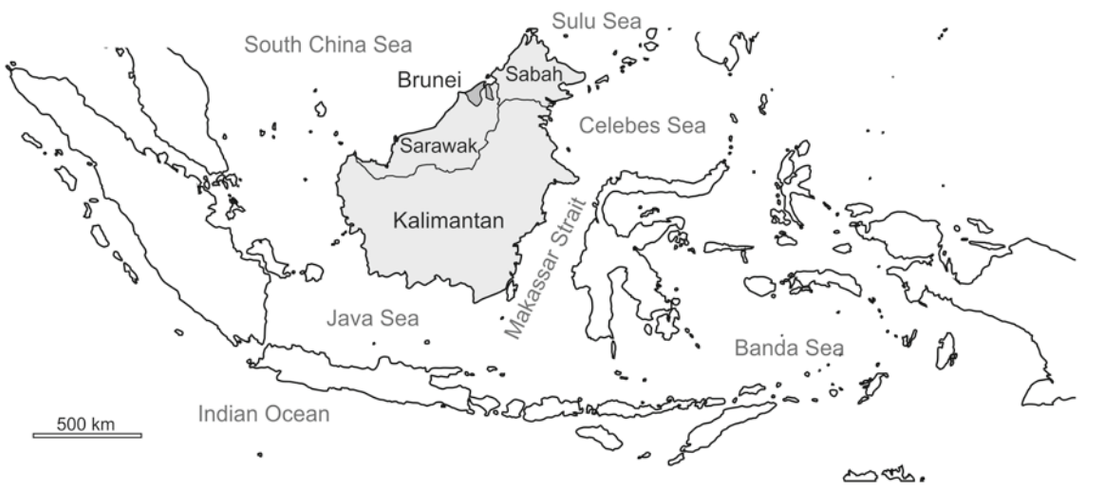
We present the first systematic description of a Tortonian (late Miocene) gastropod assemblage from the Ambug Hill section in the Tutong District in Brunei Darussalam. The low-diversity assemblage comprises 62 species of which 37 are unknown from other Neogene faunas of the Indo-West Pacific Region (IWP), 23 species are formally described as new. Carnivorous, scavenging and detritus feeding species predominate and the ecological requirements of extant relatives suggest a mud-bottom environment of the inner shelf in several tens of meters water depth with reduced vegetation. The small size of most specimens, the frequent occurrence of subadult shells and small size of several species relative to congeneric species might point to suboptimal environmental conditions during the deposition of this part of the Seria Formation. The very low relations with Neogene gastropod faunas from Indonesia at species level might be explained by the biogeographic isolation between the faunas of the Java and Celebes seas and that from the South China Sea. A severe undersampling and rather spotty taxonomic descriptions of Neogene IWP-faunas and a lack of assemblages from identical depositional environments from Indonesia may also contribute to the seemingly endemic character of the Ambug Hill fauna.
Rhinoclavis pulcherrima n. sp., *Rissoina tutongensis* n. sp., *Ficus parvissima* n. sp., *Dolomena bruneiensis* n. sp., *Scalptia verheckeni* n. sp., *Phos bruneiensis* n. sp., *Nassarius pseudoovum* n. sp., *Indomitrella acuticonica* n. sp., *Hemifusus charlieleei* n. sp., *Prunum seriaense* n. sp., *Cymbiola ambugensis* n. sp., *Ziba waltercernohorskyi* n. sp., *Amalda bruneiana* n. sp., *Tomopleura furcata* n. sp., *Unedogemmula nuttalli* n. sp., *Gemmula sculpturata* n. sp., *Crassispira strangulata* n. sp., *Paradrillia pachyspira* n. sp., *Conasprella paupera* n. sp., *Conasprella trianginodus* n. sp., *Triplostephanus wilfordi* n. sp., *Duplicaria aequalis* n. sp. and *Architectonica beetsi* n. sp. are established as new species.

Keywords: Gastropoda, Miocene, Tortonian, Brunei Darussalam, South China Sea.

1. Introduction

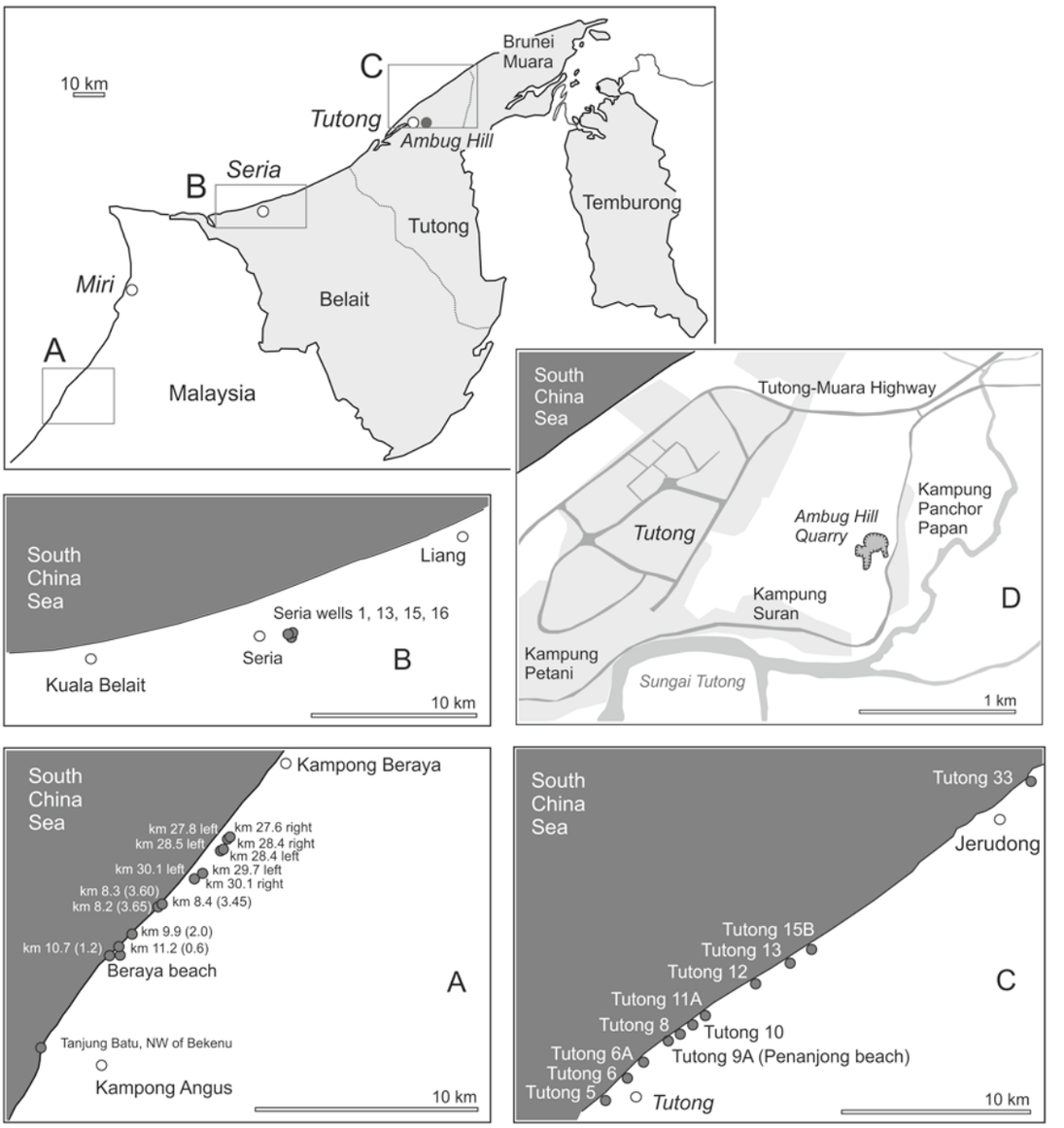
Within the modern Indo-West Pacific region (IWP), the triangle formed by Indonesia, Malaysia and the Philippines harbours an outstanding biodiversity (Hoeksema 2007). Especially its extraordinarily rich mollusc fauna has attracted scientists since the early pioneer phase of conchology and is still the focus of numerous malacological papers and monographs (e.g. Poppe 2008a, 2008b, 2010, 2011). Based on fossil evidence, this biodiversity hotspot might have evolved during the early Miocene (Harzhauser et al. 2007, Renema et al. 2008). This hypothesis is supported by molecular data suggesting an increased rate of diversification during that time in several IWP mollusc clades (Williams & Duda 2008). Despite this, the fossil record of the region is too poorly studied and known to allow a serious estimate of past biodiversity and to reconstruct evolutionary lineages of certain clades.

For several gastropod families, the fossil record of the IWP was revised and integrated into taxonomic evaluations of extant taxa, e.g. Abbott (1960) for Strombidae, Powell (1964) for Turridae, Cernohorsky (1976, 1991) for Mitridae, Houbrick (1978, 1992) for Cerithiidae and more recently Beu (2005) for Tonnoidea and Merle et al. (2011) for Muricidae.



Text-fig. 1. Overview of Borneo and Indonesia showing the position of Brunei Darussalam at the coast of the South China Sea.

These efforts were based mainly on the faunas from the Neogene of Indonesia (Text-fig. 1), from where the most comprehensive data on Neogene Indo-West Pacific molluscs are available. The fossils were collected especially in Java and Sumatra during the Dutch occupation of Indonesia in the 19th and early 20th centuries. The largest part of the shells was described by the outstanding German Geologist and Palaeontologist Johann Karl Ludwig Martin (1851–1942) and formed the basis for the famous Martin collection stored at the Naturalis Biodiversity Center, Leiden (The Netherlands). Later, Van der Vlerk (1931, 1932), Oostingh (1935, 1938, 1939, 1940, 1941) and Van Regteren Altena (1938, 1941, 1942, 1950) described additional assemblages and taxa and partly revised Martin's taxa (see Leloux & Wesselingh 2009 and Gorsel 2016 for a list of publications). Paleontological research on molluscs in Borneo started slightly later, with the papers by Beets (1941, 1947, 1950a, 1950b, 1981a, 1981b, 1983a, 1983b, 1983c,



Text-fig. 2. Position of active and historical outcrops mentioned in the text (inserts A, B and C), insert D shows the Ambug Hill (Bukit Ambug) quarry exposed east of Tutong in the Tutong District (= red dot in overview map), quarry outline based on Google Earth 2016. See Wannier et al. (2011) for additional information.

1985a, 1985b, 1986a), Cox (1948) and Nuttall (1963, 1965). More recently, Kusworo et al. (2015) studied a late Miocene coral-associated mollusc fauna from east Borneo. All these papers focused on East Kalimantan and north-eastern Borneo, whereas the Neogene mollusc fauna from the northern coast of Borneo received little attention.

During their search for oil in Brunei and Sarawak, in the 1920's and 1930's, geologists from the Bataafsche Petroleum Maatschappij (BPM, a subsidiary of Royal Dutch Shell, now represented in Brunei by Brunei Shell Petroleum – BSP) collected fossil shells from outcrops and a few oil wells (Seria field, Miri field) in Brunei and northern Sarawak and sent these to Martin for identification as a basis for determining the age of the rocks. Martin (1931, 1932) identified the shells in unpublished reports (cited by Vermeij & Raven 2009 and Wannier et al. 2011) and the same samples were studied by Beets and Nuttall. Beets identified numerous new species in this material but most were never published. Sieverts (1934) used the BPM material to describe the remarkable bivalve *Brechites pulchrum fossile* Sieverts, 1934 as a new subspecies from the Seria Formation in Brunei Darussalam (the holotype is from an outcrop named Tutong 8, see Text-fig. 2), the first new taxon described from this area.

The first publication on fossil molluscs from Sarawak came from Beets (1942b), who described *Brechites venustulus* Beets, 1942 from Sarawak and compared it with the *Brechites* from Brunei. In papers on other faunas he described a few more species based on this material (*Acila bruneiana* Beets, 1942, *Cardilia bruneiana* Beets, 1944, *Dentalium javanum tutongense* Beets, 1985 and *Ringicula seriaensis* Beets, 1986). In addition, one of the paratypes of *Babylonia luzonensis* Van Regteren Altena & Gittenberger, 1981 is from the Seria Fm. in Brunei. Nuttall (1961a) provided short lists of Miocene gastropods from the Miri and Seria formations (without figures or descriptions). He also provided a small selection of photographs of molluscs from a now disappeared outcrop at Penanjong beach in a book on the geology of Brunei (first edition James 1984, second edition Sandal 1996, figures 4.5 & 4.6 – herein references are made to the much expanded and better accessible second edition). According to Sandal (1996), the Penanjong outcrop is part of the Liang Fm., however, based on the results obtained in the present study, it is considered as part of the Seria Fm.

A small number of fossils, including molluscs, was collected on Bakam beach in Sarawak, originating from an outcrop below the low tide mark – interpreted to be part of the Liang Fm. (Raven in Wannier et al. 2011, plate 4.4.4b). This mollusc fauna is very different from the fauna found in the Seria Fm. (own data H.R.).

Nuttall also reviewed some of the samples studied by Martin and Beets and wrote his identifications on separate labels.

More recently, Raven (2008) illustrated some fossil molluscs from the Seria Fm. in a guidebook on the recent mollusc fauna of Brunei Darussalam. Typical fossils from the Sibuti, Miri and Liang formations and from the Holocene were illustrated by Raven in Wannier et al. (2011) in a geological field guide for north Sarawak and Brunei. Vermeij & Raven (2009, 2011) described Neogene Melongenidae, including various new species, and Raven (2002, 2016) described Neogene Stromboidea, Muricidae and Buccinidae from NW Borneo, including material from the Seria Fm.

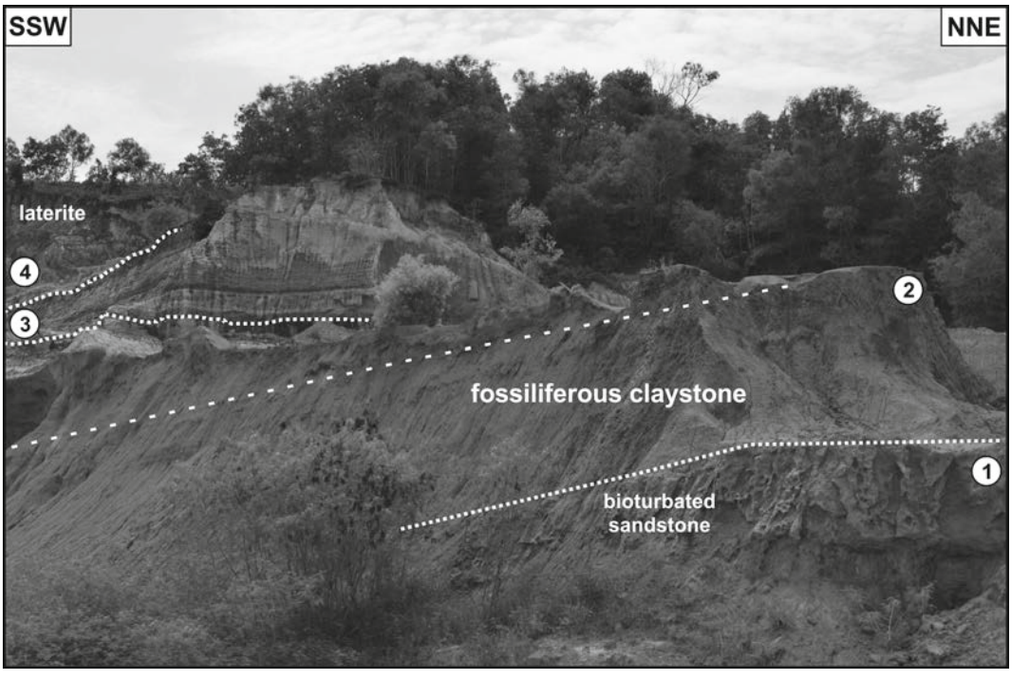
Paleontological data from adjacent IWP-regions, such as the Philippines (Dickerson 1921, 1922, Shuto 1969), Timor (Tesch 1915, 1920), Seram and Obi (Fischer 1927) and New Guinea (Siemon 1929, Beets 1986b) are even spottier. Therefore, new data on Neogene mollusc faunas from the IWP-Region will increase our knowledge on the history of this biodiversity hotspot and may provide anchors for molecular clock analyses.

Here we present the taxonomic description of 63 gastropod taxa collected from one site in the Tutong district in Brunei Darussalam, which is characterized by an extraordinary abundance of shells, and therefore can provide exceptional information on the onset of biodiversity in the region.

Although the diversity of the assemblage herein described is rather low (based on a few samples from a single outcrop), it is the first comprehensive documentation of a late Miocene gastropod fauna from the northern coast of Borneo and the South China Sea, respectively.

2. Geological Setting & Material

The investigated material was collected mainly at Ambug Hill ("Bukit Ambug" or sometimes spelled as "Bukit Ambok") in the Tutong District in Brunei Darussalam (N 4° 48′ 30.2″, E 114° 40′ 16.3″) (Text-figs 1 and 2). There, a large artificial outcrop, that from time to time is still actively excavated, exposes 72.5 me-



Text-fig. 3. The quarry at Ambug Hill (Bukit Ambug) in November 2016. – The numbers referring to the recognized four sedimentary units with the dotted lines marking the boundaries. The fossils were collected from the first 9.5 meters of the grey clay at the base of unit 2. Above the dashed line the claystone becomes barren of fossil shells.

ters of dominantly bioturbated sandstone layers. Four major sedimentary units have been distinguished that are separated by sequence boundaries. The second sequence starts with a 9.5 m-thick claystone overlying the massive, bioturbated sandstone of the previous unit. This claystone is extremely rich in marine fossils (Roslim et al. 2016 & Kocsis et al. 2018) and the molluscs were all collected from this level (Text-fig. 3). The claystone forms the base of a coarsening and shallowing upward sequence, the upper part of which consists of a massive sandstone, becoming red on top. The following unit-3 starts with more tide dominated bioturbated sandstone and without major claystone occurrence. The first two sedimentary sequences (units 1–2) are part of the Seria Fm., which covers coastal areas in the Belait and Tutong regions. For hydrocarbon exploration, the Seria Fm. was penetrated by numerous exploration wells revealing a total thickness of nearly 2000 m (Wilford 1961, Sandal 1996). A late Miocene age was proposed for the Seria Fm. by Sandal (1996, fig. 4.10) and Hutchison (2005). At Ambug Hill, the age of the Seria Fm. was confirmed recently by Roslim et al. (2016) based on micropaleontological investigations: according to the coccolithophorids the deposits are correlated with the nannoplankton biozone NN11a based on the presence of *Discoaster berggrenii* and *D. quinqueramus*. The absence of *Amaurolithus primus* reduces the stratigraphic range to the latest Tortonian (Roslim et al. 2016 & Kocsis et al. 2018). The samples from Ambug Hill are thus far the only material from onshore deposits of the Seria Fm. for which there is a proper stratigraphic context.

The shells collected from the site were either picked directly from the surface or extracted by washing and sieving of bulk samples. The described fauna represents therefore a mixture from different layers in the claystone interval and a certain amount of sampling bias cannot be excluded. Due to the mesh-size, shells < 1 mm are not recorded. The shells are fragile but well preserved. In some layers, aragonite is largely leached and gastropods occur as internal casts.

Well-preserved fossils may still show some of their original colour pattern which can be enhanced under UV light, which is increasingly used in paleontological studies (e.g. Caze et al. 2011, Landau et al. 2013). Most gastropods from Ambug Hill, however, do not show colour patterns under UV light.

For this reason, some additional materials were made available for the present study. Additional shells

have been included here whenever the same taxon collected from Ambug Hill with poor preservation is available from other local coeval assemblages with better preservation and/or with colour patterns visible. This additional material comprises shells collected during the 1920's and 1930's by BPM geologists from locations labelled as Tutong 5, 6A, 8, 9A (outcrops 8 and 9A were located along Penanjong beach), 10, 11A, 12, 13 and 15B. These locations were all situated along the coast of the Tutong district and just few kilometres west and north to north-east of Ambug Hill (Textfig. 2). Due to the building of coastal defences by the local authorities, none of these outcrops are now exposed. Brunei 01 (sample 75) and Brunei 04 (sample 80) were taken further NE along the coast, closer to Jerudong. Samples were also taken from the first wells in the Seria oil field. All this material was donated to NBC and is still available there for future reference. More material originates from several outcrops of Miri and Sibuti formations in Sarawak, Malaysia (i.e., Beraya-Bekenu road, the Beraya-Tusan seacliffs and Tanjung Batu, NW of Bekenu and has been collected by H.R. Additional information on this material has been already reported in Raven in Wannier et al. (2011).

The described material is stored in the collection of the Faculty of Science, Geology program of the Universiti Brunei Darussalam (GUBD), in the Geological-Paleontological Department of the Natural History Museum Vienna (NHMW), in Naturalis Biodiversity Center (NBC, Leiden, The Netherlands using collection numbers preceded by RGM).

3. Systematic Palaeontology

(M.H., H.R. & B.L.)

The systematic arrangement of higher taxa largely follows the proposals of Bouchet & Rocroi (2005).

Abbreviations

w = width, h = height, NHMW = Natural History Museum Wien, GUBD = Faculty of Science, Geology program, Universiti Brunei Darussalam, RGM = Naturalis Biodiversity Center, Leiden. R = J.G.M. Raven, The Hague, Lee = Charlie Lee, Kuala Lumpur, IWP = Indo-West Pacific.

Class Gastropoda Cuvier, 1795

Order Sorbeoconcha Ponder & Lindberg, 1997

Superfamily Cerithioidea Fleming, 1822

Family Cerithiinae Fleming, 1822

Genus *Rhinoclavis* Swainson, 1840

Type species: *Murex vertagus* Linnaeus, 1758, subsequent designation by Herrmannsen (1848). Recent, Indo-West Pacific.

Rhinoclavis pulcherrima n. sp.

(Plate 1, Figs 1–6)

Material: 82 specimens.
Holotype: height: 17.5 mm, diameter: 6.3 mm, NHMW 2016/0281/0001 (Plate 1, Figs 1–2).
Paratype: height: 17.1 mm, diameter: 4.9 mm, NHMW 2016/0281/0002 (Plate 1, Figs 3–4).
Paratype: height: 17.0 mm, diameter: 5.3 mm, NHMW 2016/0281/0003 (Plate 1, Figs 5–6).
Additional paratypes: 35 specimens (NHMW 2016/0281/0004), 19 specimens (GUBD), 7 specimens (RGM.1309465).
Further material: 18 specimens (R F5251).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Superlative of the Latin *pulcher* (= beautiful).

Diagnosis: Small *Rhinoclavis* species with almost straight-sided whorls, weak suture, sculpture formed by wide-spaced, orthocline to weakly prosocline axial ribs forming small beads at intersections with primary spiral cords, overrun by three beaded primary spiral cords intercalated by much weaker secondary and tertiary cords.

Description: Shell small, slender, consisting of about 13 teleoconch whorls, spire angle 20–24°. Protoconch and early teleoconch missing or abraded in all specimens. Spire whorls almost straight-sided, with shallow, slightly undulating suture, weak varices may occur on all teleoconch whorls. Sculpture regular, consisting of three primary spiral cords on early spire whorls, with single secondary spiral cord intercalated between primaries and between primaries and suture, tertiary spiral cords intercalated on last three whorls, strengthening abapically. Wide-spaced, orthocline to weakly prosocline axial ribs form small beads at intersections with primary spiral cords. Growth lines may form delicate cancellate pattern in interspaces between secondary spiral cords. Varix on last whorl coinciding with four distinct internal lirae. Base rapidly constricted. Aperture incomplete in all specimens, columellar broadly excavated in mid-portion, twisted abapically. Columellar and parietal callus forming narrow, sharply delimited callus rim, siphonal canal short, slightly reflected, anal canal narrow, moderately deep.

Remarks: *Rhinoclavis bonneti* Cossmann, 1910, from the Miocene and Pliocene of India, and *R. leupoldi* (Beets, 1941), from the middle Miocene of Borneo, differ in the presence of a single secondary spiral cord intercalated between the primary cords, lacking tertiary spiral sculpture (see Houbrick 1978 and Harzhauser 2014). *Rhinoclavis erecta* (Martin, 1884), from the late Miocene of Indonesia, is much larger, more slender, develops a shorter last whorl and lacks the crowded secondary and tertiary spiral cords. *Rhinoclavis gendinganensis* (Martin, 1906) from the Pliocene of Java has comparable sculpture on the last whorl (see Shuto 1978) but is readily distinguished by its convex spire whorls. *Rhinoclavis djunggranganensis* (Martin, 1916) from the early Miocene of Java lacks tertiary sculpture and axial ribs. *Rhinoclavis reinhardi* (Cox, 1948), from the late Miocene or Pliocene of Borneo, is comparable in size but differs in its greater number of spiral cords and more slender outline. *Cerithium dolfusi* Martin, 1916, from the early Miocene of Indonesia, is broader and lacks the regular intercalation of secondary and tertiary cords (see Leloux & Wesselingh 2009). The extant IWP-species *Cerithium coralium* Kiener, 1841 is superficially similar concerning the secondary spiral cords between the beaded primary spirals, but is much larger, broader, with deeper sutures (see Houbrick 1992).

Distribution: Only known from the Tortonian of Brunei Darussalam.

Order Littorinimorpha Golikov & Starobogatov, 1975

Superfamily Naticoidea Guilding, 1834
Family Naticidae Guilding, 1834

Genus *Natica* Scopoli, 1777

Type species: *Nerita vitellus* Linnaeus, 1758, subsequent designation by Anton (1839). Recent, Indo-West Pacific.

Natica vitellus (Linnaeus, 1758)

(Plate 1, Figs 7–15)

1758 *Nerita vitellus* Linnaeus, p. 776.
1905 *Natica rufa* Born – Martin, p. 260, pl. 39, figs 621–622a.
1905 *Natica* (*Natica*) *vitellus* (Linnaeus) – Martin, p. 261 (pars), pl. 39, figs 624–624a.
1961a *Natica rufa* Born – Nuttall, p. 73.
1969 *Natica* (*Natica*) *rufa* (Born) – Shuto, p. 79, pl. 5, figs. 13, 15–18, pl. 6, figs 5, 14.
1989 *Natica vitellus* (Linnaeus 1758) – Majima, p. 74, pl. 10, figs 1–12, text-figs 4.1, 15.38 (cum syn.).
2005 *Natica vitellus* (Linnaeus) – Dharma, p. 342, pl. 136, fig. 5a.
2005 *Natica vitellus* var. *rufa* Born – Dharma, p. 342, pl. 136, fig. 5b.
2008 *Natica vitellus* (Linnaeus 1758) – Hollmann, p. 492, pl. 191, fig. 7.
2014 *Natica vitellus* (Linnaeus 1758) – Harzhauser, p. 96, pl. 5, figs 1–3.

Material: 27 specimens plus 5 opercula from Ambug Hill: 9 specimens (NHMW 2016/0282/0003), 12 specimens (GUBD), 6 specimens (R F5236), 1 operculum (NHMW 2016/0282/0002, Plate 1, Figs 14–15), 4 opercula (GUBD), height: 13.5 mm, diameter: 13.6 mm (NHMW 2016/0282/0001, Plate 1, Figs 7–10), height: 12.7 mm, diameter: 13.2 mm (NHMW 2016/0282/0003, Plate 1, Figs 11–13).

Description: Depressed spherical shell of four teleoconch whorls and low naticoid spire, protoconch eroded in all specimens. Spire whorls weakly convex, moderately expanding. Suture deeply incised. Last whorl with strongly convex periphery, maximum diameter successively shifting from mid-whorl to slightly below. Aperture semicircular, outer lip thin, moderately flared abapically. Columella slightly thickened, parietal callus subtriangular with distinct anterior lobe passing into broad umbilical callus, funicle weak and low. Abapical sulcus broad and deep, basal fasciole convex, accentuated by few weak growth lines. Shell surface smooth, except for strongly prosocline growth lines on adapical half of whorls. Operculum moderately thick, central callus short, not exceeding one-quarter of total height, inner margin slightly arched, weakly crenulated, inner surface covered by numerous delicate spiral threads, nucleus not protruding. Outer surface slightly concave with three marginal ridges and three marginal grooves, outer ridges narrow with rounded backs, inner ridge broader with flat top separated from inner part of operculum by deep groove, only slightly narrower than ridge, central callus indistinct, inner margin straight, smooth.

Remarks: Umbilical features, operculum morphology and sculpture correspond well to *N. vitellus*, as re-described by Majima (1989). This species was already recorded from the Seria Formation by Nuttall (1961a) as *Natica rufa*, which is considered a subjective junior synonym of *N. vitellus* by Bouchet (2015a). The species is known from various outcrops of the Seria Fm. A specimen from the Penanjong beach outcrop was illustrated by Nuttall (in Sandal 1996, fig. 4.6 g). The species is also abundant in the Sibuti and Miri formations of Sarawak (lower to middle Miocene).

Distribution: A widespread extant IWP species, including NW Borneo, which appears already during the early Miocene in India and Indonesia (Pannekoek 1936, Van Regteren Altena 1941, Beets 1985b, Harzhauser 2014) and Malaysia (herein).

Genus *Neverita* Risso, 1826

Type species: *Neverita josephinia* Risso, 1826, by monotypy. Recent, Mediterranean Sea.

Neverita didyma (Röding, 1798)

(Plate 1, Figs 16–20)

1798 *Albula didyma* Röding, p. 20.
1905 *Natica* (*Neverita*) *ampla* Philippi – Martin, p. 262, pl. 39, figs 628–629.
1941 *Polinices* (*Neverita*) *didymus* (Roeding) – Van Regteren Altena, p. 63.
1989 *Glossaulax didyma didyma* (Röding, 1798) – Majima, p. 53, pl. 6, figs 4–18, pl. 7, figs 1-5, text-figs 5.6, 9.4, 9.5, 9.6, 15.2. 15.21, 20.1, 20.2, 20.3, 21, 22 (cum syn.).
2005 *Polinices* (*Glossaulax*) *didyma* (Röding, 1798) – Dharma, p. 342, pl. 136, fig. 8.
2008 *Neverita didyma* (Röding, 1798) – Hollmann, p. 484, pl. 187, fig. 8.
2014 *Glossaulax didyma* (Röding, 1798) – Cooper, p. 22, fig. 6J (cum syn.).

Material: 1 fragmentary specimen, which lacks the lower part of the last whorl, diameter: 22.4 mm (NHMW 2016/0283/0001, Plate 1, Figs 16–17). Three specimens (1 adult with height 36.8 mm) were collected at the Seria Fm. outcrop Tutong 8, leg. BPM (RGM.783423, Plate 1, Figs 18–20).

Description: Shell medium-sized, depressed, globose with very low conical spire and strongly convex periphery. Protoconch comprising 2.5 weakly convex, tightly coiled whorls. Teleoconch whorls rapidly expanding with weakly convex tops, suture narrowly incised. Parietal callus strongly thickened, passing into broad umbilical callus, divided medially by deep, narrow transverse groove. Umbilicus very wide, largely filled by callus, except for deep sulcus. Surface smooth, except for weak growth lines.

Remarks: The small size of the shell from Ambug Hill ranges well within the variability of extant specimens of *Neverita didyma* as shown by Majima (1989) and larger specimens are available from the Tutong 8 outcrop of the Seria Fm. Although the shells rather depressed outline corresponds to the Pliocene subspecies *N. d. dainichiensis* (Majima, 1989), the wide variability in outline and size of *N. didyma* does not warrant separation of the Miocene population as a distinct subspecies. Similarly, the umbilical features, such as the width of the sulcus and the extension of the bifid callus, are highly variable in extant specimens. Among the Neogene naticids described from Indonesia, the Pliocene *Neverita sulcifera* (Martin, 1905) differs in its conspicuous surface sculpture of numerous delicate spiral threads, the Pliocene *Polinices albumen* (Martin, 1905) has an even broader shell with a lower spire and its umbilical-callus is bordered by a broad, deep, groove, and *Polinices callosior* (Martin, 1879) differs in its globular shape and narrower spire.

Distribution: Widespread extant species in the Indo-West Pacific, abundant in NW Borneo. The species originated during the late Miocene and became common during the Pliocene and Pleistocene in Java (Martin 1905, Van Regteren Altena 1941, Dharma 2005) and Japan (Majima 1989). Cooper (2014) described this species also from the Pleistocene of South Africa.

Genus *Sinum* Röding, 1798

Type species: *Helix haliotoidea* Linnaeus, 1758, subsequent designation by Dall (1909). Recent, Indo-West Pacific.

Sinum eximium (Reeve, 1864)

(Plate 1, Figs 21–23)

1864 *Sigaretus eximius* Reeve, 15, *Sigaretus* pl. 5, sp. 22.
2001 *Sinum eximium* (Reeve, 1864) – Swennen et al., p. 121, no. 373, fig. 372.

Material: 1 specimen, height 15.3 mm diameter 16.4 mm, leg. R (RGM.1309457).

Description: Shell medium sized for genus, almost as high as wide, low spire, wide aperture and rapidly expanding convex whorls. Rounded, weakly angled periphery at about 3/5th from suture. Sculpture of numerous close-set, narrow, wavy spiral cords of irregular strength, interrupted by widely spaced, conspicuous axial growth lines. Broadly excavated columella, thickened and everted abapically, small parietal callus, inner lip very thin between columellar and parietal callus. Umbilicus narrow and partly covered by the callus.

Remarks: Several species of *Sinum* occur in the Miocene of NW Borneo. Nuttall (1961a) reported *Sinum eximium* (Reeve, 1864) and *Sinum laevigatum* (Lamarck, 1822) from the Miri Fm. in Brunei. The specimen from Tutong 13 was identified as *Sinum eximium* by Beets, written on a label with the lot, which is in a collection reviewed by Nuttall. Therefore, it is probable Nuttall's record of *Sinum eximium* also refers to this species. *Sinum eximium* is easily recognized, as it is higher than the other *Sinum* species known from the Miri Fm.: *Sinum laevigatum* is much

flatter, *Sinum neritoideum* (Linnaeus, 1758) is larger, wider and flatter in anterior view and has a more regular spiral sculpture. These shell characters correspond with the type of *Sinum eximium* from Malacca figured by Reeve and with the description given by Swennen et al. (2001). It cannot be confirmed for the specimen from Australia figured in Wilson (1993, pl. 36, fig. 2) as no front view is provided. *Sinum eximium* is a common species in the Miri Fm. of Sarawak. Several species of *Sinum* currently live in NW Borneo but thus far *S. eximium* has not been reported.

Distribution: Known from the middle to late Miocene of Sarawak and Brunei Darussalam and Recent from W Malaysia and E Thailand (Swennen et al. 2001) and Singapore.

Superfamily Rissooidea Gray, 1847
Family Rissoinidae Stimpson, 1865

Genus *Rissoina* d'Orbigny, 1840

Type species: *Rissoina inca* d'Orbigny, 1840, by monotypy. Recent, Indo-West Pacific.

Rissoina (s.l.) *tutongensis* n. sp.

(Plate 2, Figs 1–3)

Material: 15 specimens.
Holotype: RGM.783290, height: 4.7 mm, diameter: 1.7 mm, Seria oil field well 13, 1090–1100 m depth, Seria Fm.? (Plate 2, Figs 1–3).
Other material: 1 juvenile, Ambug Hill, leg. R (R F5328), 1 juvenile from Beraya-Bekenu road km 27.6 right, south of Miri, Sarawak, Miri Fm., leg. R, F4451: 3 specimens and 9 juveniles/fragments from the upper part of the Miri Fm. SW of Kampong Beraya, Sarawak, Malaysia, leg. R, F4277.
Stratum typicum: Seria Fm.?
Type locality: Seria oil field, well 13, Brunei Darussalam.
Age: Tortonian.
Name: refers to the village of Tutong, close to Ambug Hill.

Diagnosis: Small *Rissoina* species with multispiral protoconch, convex teleoconch whorls sculptured by close-set, sinuous, narrow opisthocline ribs and weaker spiral cords forming axially predominant cancellate pattern, outer lip strongly thickened by varix.

Description: Shell small, relatively slender consisting of six teleoconch whorls, spire angle about 35°. Protoconch multispiral, tall dome-shaped, consisting of 3.5 smooth, strongly convex whorls. Spire whorls moderately convex, suture deep. Axial sculpture of sinuous, opisthocline, narrow, rounded ribs half to one-third width of interspaces. Spiral sculpture of weak, narrow, spiral cords, developed only in interspaces between ribs, strengthening somewhat abapically. Last whorl convex, moderately constricted at base, bearing sinuous axial ribs adapically that weaken over base, where spirals become predominant, on base spiral sculpture strengthened, overriding and interrupting and/or beading axials, forming spirally predominant cancellate pattern. Aperture ovate, of moderate size, outer lip strongly thickened by varix, sinuous in profile, expanded abapically. Siphonal canal short, broad, open. Columella slightly twisted, anal canal narrow.

Remarks: The species was already recognized as undescribed by Beets who planned to name it *Rissoina tutongensis*. We have decided to maintain this name. Nuttall wrote on the label: "compare with *R. micans* Ad., probably not same." Indeed, the extant IWP species *R. micans* A. Adams, 1853 is very different with scalate whorls and fewer, stronger, straighter orthocline axial ribs. *Rissoina indrai* Beets, 1941 and *Rissoina semari* Beets, 1941, from the Miocene of Kalimantan, are larger, have straight axial ribs and straighter sided whorls. *Rissoina ramai* Beets, 1941 has straight axial ribs and *Rissoina ramai* sensu Beets, 1986a, from the lower Gelingseh beds of Kalimantan, differs in its broad and twisted fasciole and the prominent axial ribs on the last whorl. *Rissolina reticuspiralis* Reich & Wesselingh in Reich, Wesselingh & Renema, 2014, from the early Miocene of Indonesia, is superficially similar but differs in its blunt fasciole and wide spaced axial ribs.

Additional specimens were collected from the Miri Fm. in Sarawak, which show little intraspecific variability.

Distribution: Only known from the Tortonian of Brunei Darussalam and the middle Miocene of Sarawak.

Superfamily Calyptraeoidea Lamarck, 1809
Family Calyptraeidae Lamarck, 1809

Genus *Calyptraea* Lamarck, 1799

Type species: *Patella chinensis* Linnaeus, 1758, by monotypy. Recent, European Seas.

Calyptraea cf. *pellucida* (Reeve, 1859)

(Plate 2, Figs 4–8)

cf. 1859 *Trochita pellucida* Reeve, p. 11.
cf. 1905 *Calyptraea* (s. str.) *tudung* Martin, p. 251, pl. 41, fig. 676.
cf. 1941 *Calyptraea* (Calyptraea) *tudung* Martin – Van Regteren Altena, p. 37.
cf. 2003 *Calyptraea pellucida* (Reeve, 1859) – Robba et al., p. 66, pl. 8, fig. 6.

Material: 5 specimens (NHMW 2016/0282/0003), largest specimen: height: 4.6 mm, diameter: 14.4 mm.

Description: Erect, naticoid protoconch passing into depressed, coeloconoid whorl. Apex slightly subcentral, surface smooth aside from prominent and irregular growth lines. Outline of base irregular ovoid. Septum flat, poorly preserved in all specimens, septal margin concave.

Remarks: No differences have been observed between the extant specimens of *Calyptraea pellucida* from NW Borneo and the holotype of *Calyptraea tudung* Martin, 1905 (a specimen from unnamed beds from the Quaternary of Cimanceuri, Java). The smooth specimen from Ambug Hill is also very similar. *Calyptraea dunni* Dey, 1961, from the Burdigalian of S. India, is similar in size but differs in the depressed-convex shape and straight septal margin.

Calyptraeidae often reflect the sculpture of the substrate to which they attach. The specimen with external ridges could therefore be a specimen of *Calyptraea pellucida*, but it could also be a specimen of *Desmaulus extinctorium* (Lamarck, 1822). That species is easily identifiable based on its reflected internal septum forming a cone, but the part of the shell with the septum is missing in this specimen. *Desmaulus* occurs in the Miri Fm. of Sarawak, but more material is needed to confirm its presence in the Seria Fm.

Distribution: This is an extant species with distribution from the Persian Gulf to the Philippines and abundant in NW Borneo. It is known from Quaternary deposits and now also from the late Miocene of Brunei Darussalam.

Superfamily Ficoidea Meek, 1864 (1840)
Family Ficidae Meek, 1864 (1840)

Genus *Ficus* Röding, 1798

Type species: *Ficus communis* Röding, 1798 [= *Ficus ficus* (Linnaeus, 1758)], subsequent designation by Dall (1906). Recent, Indo-West Pacific.

Ficus parvissima n. sp.

(Plate 2, Figs 9–14)

Material: 6 specimens.
Holotype: Outcrop Tutong 8, height: 28.9 mm, diameter: 19.4 mm, leg. BPM (RGM.1309458, Plate 2, Figs 9–12).
Paratype: Outcrop Tutong 10, height: 18.5 mm, diameter: 12.7 mm, leg. BPM (RGM.783460).
Paratype: 1 fragmentary specimen from Ambug Hill, Seria Fm., height: 9.6 mm, diameter: 7.5 mm, NHMW 2016/0320/0001 (Plate 2, Figs 13–14).
Additional paratypes: 1 specimen, Tutong 8, Brunei, Seria Fm., leg. BPM (RGM.783420), 1 juvenile specimen, Tutong 9A, Brunei, Seria Fm., leg. BPM (RGM.783270), 1 specimen (mould), Brunei 01 (sample 75) W of Jerudong, Brunei, Miri Fm.?, leg. Dr. Wilhelm, BPM (RGM.41662).
Stratum typicum: Seria Fm.
Type locality: Tutong 8 outcrop, Brunei Darussalam.
Age: Tortonian.
Name: Refers to the small size.

Diagnosis: Small *Ficus* species, with broad moderately low spire, paucispiral protoconch of 1.75 smooth whorls, strong reticulate teleoconch sculpture of regularly spaced, narrow primary spiral cords with up to four weaker secondary and tertiary spiral cords, intersections bearing tiny beads.

Description: Shell small, relatively broad, protoconch broad conical, consisting of 1.75 strongly convex, broad whorls (dp = 1.9 mm). Spire moderately low, weakly gradate, top of first teleoconch whorl convex with maximum diameter at abapical suture, later teleoconch whorls weakly convex passing via rounded shoulder into convex periphery. Shallow subsutural concavity developed on last teleoconch whorl. Sculpture consisting of regularly spaced, narrow primary spiral cords with convex tops and up to four weaker secondary and tertiary spiral cords intercalated between each pair of primary cords below shoulder. Spiral sculpture crossed by narrow axial ribs slightly weaker than primary spiral cords. Tiny beads formed at intersections, resulting in axially elongated reticulate pattern on subsutural ramp to shoulder and quadratic on whorl periphery and base. Axial ribs sigmoidal, opisthocyrt on subsutural ramp.

Remarks: The fragmentary preservation of the specimen from Ambug Hill does not allow a clear identification, but further specimens are available from other outcrops of the Seria Fm. in Brunei (RGM). This species is much smaller than *Ficus ficus* with a higher spire, shorter siphonal canal and a stronger, reticulate sculpture. The specimens of *Ficus* from the Seria Fm. were identified as *Pyrula ficoides* Lamarck, 1822 (a synonym of *Ficus ficus*) by Martin and as *Ficus subintermedia* (d'Orbigny, 1852) by Beets. Nuttall (1965) mentioned *Ficus subintermedia* from the Pliocene Togopi Fm. of Borneo. *Ficus subintermedia* is a species from the European Miocene and the IWP specimens listed as *F. subintermedia* represent *Ficus ficus* (Linnaeus, 1758) (see Verhaeghe & Poppe 2000).

Few *Ficus* species have been described from the Neogene of Indonesia and adjacent areas (van der

Vlerk 1931). Of these, *Ficus latifasciata* (Martin, 1883) and *Ficus menengtengana* (Martin, 1899), from the Neogene of Java, have broad primary spiral cords and a densely spaced axial sculpture and *Ficus pamotanensis* (Martin, 1899), from the early Miocene of Java, differs in its high spire, slender outline and cancellate sculpture. The extant *Ficus variegata* Röding, 1798, described by Ladd (1977) from the Pliocene of Fiji and the Miocene of Java, has broad spiral cords with flat tops and densely spaced orthocline axial ribs in apical view (see Verhaeghe & Poppe 2000).

Distribution: Only known from the Tortonian of Brunei Darussalam.

Superfamily Xenophoroidea Troschel, 1852 (1840)
Family Xenophoridae Troschel, 1852 (1840)

Genus *Xenophora* Fischer von Waldheim, 1807

Type species: *Xenophora laevigata* Fischer von Waldheim, 1807, subsequent designation by Gray (1847). Recent, Caribbean.

Xenophora solarioides jezleri Cox, 1948

(Plate 2, Figs 15–17)

1948 *Xenophora jezleri* n. sp. Cox, p. 20, pl. 1, figs 11a–c.
1965 *Xenophora solarioides jezleri* Cox – Nuttall, p. 65.
1983 *Xenophora solarioides jezleri* – Ponder, p. 112, figs k–j.

Material: 1 moderately preserved specimen with remnants of the shell, height: 14.5 mm, diameter: 26.7 mm (NHMW 2016/0290/0001), 20 internal moulds, largest specimen: height: 15.5 mm, diameter: 34.9 mm (NHMW 2016/0290/0002).

Description: Shell small, depressed conical, apical angle approx. 100°. Spire whorls moderately high, convex, densely covered by agglutinated shell fragments, no spiral sculpture. Periphery with narrow flange, overhanging moderately convex base. Base sharply delimited, flattened, bearing strongly sinuous axial growth lines cut by concentric grooves forming squarish nodules. Umbilicus funnel-shaped, round-edged, delimited by end of concentric sculpture, bearing only crowded axial growth lines, very deep.

Remarks: Ponder (1983) and Ponder & Cooper (1983) considered *Xenophora jezleri* as chrono-subspecies and ancestor of the extant *Xenophora solarioides* (Reeve, 1845a), which is followed herein. An additional, poorly preserved specimen with the characteristic sculpture on its base is available from a sample taken at 1410–1420 m depth in well 15 in the Seria oil field (RGM.783331).

Distribution: Known from the Pliocene of the Dent Peninsula of Borneo (Cox 1948), the Miocene of Java (Ponder 1983) and the Tortonian of Brunei.

Superfamily Stromboidea Rafinesque, 1815
Family Strombidae Rafinesque, 1815

Genus *Dolomena* Wenz, 1940

Type species: *Strombus pulchellus* Reeve, 1851, by original designation. Recent, Indo-West Pacific.

Dolomena bruneiensis n. sp.

(Plate 2, Figs 18–23)

Material: 7 specimens.
Holotype: height: 24.2 mm, diameter: 13.0 mm, NHMW 2016/0284/0001 (Plate 2, Figs 18–20).
Paratypes: height: 21.2 mm, diameter: 9.6 mm (fragmentary specimen), NHMW 2016/0284/0002 (Plate 2, Fig. 21), height 24.0 mm, diameter: 13.9 mm, RGM.1309462 (Plate 2, Figs 22–23).
Additional specimens: 4 broken specimens R F5234.
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to Brunei Darussalam.

Diagnosis: Small slender Dolomena species, with smooth shell, except for distinct subsutural cord and low, broad axial ribs on adapical portion of last whorl, moderately wide wing, adapically broad, concave, internally lirate, stromboid notch broad, shallow, columella with lirae on adapical half and denticles in abapical half.

Description: Shell small with high, slender spire, apical angle 40°. Protoconch multispiral, broad conical comprising three smooth convex whorls. Early teleoconch whorls weakly convex, later whorls weakly shouldered. Spire whorls smooth, except for strong subsutural cord adjoined by distinct spiral groove. Last whorl subtrigonal in profile, moderately inflated abapically, with wing-like outer lip, sculptured by low, poorly delimited, rounded axial ribs, only clearly developed on subsutural ramp on dorsum, that weaken adapically, obsolete or almost so below shoulder, moderately constricted at base, base bearing regular, narrow spiral cords separated by deep, narrow groove. Outer lip wing-like, moderately wide, expanded and thickened adapically, tip rounded, narrowing and thinning abapically, bearing shallow, broad stromboid notch. Columella moderately broad and callused, thickened abapically, bearing seven denticles on anterior part and within siphonal canal, indistinct lirae and granules parietal portion. Siphonal canal concave between base

and moderately developed, rounded siphonal fasciole, strongly deflected abaxially and slightly posteriorly.
Remarks: The new species was assigned to *Dolomena* based on the relatively high spire, the strong subsutural cord, the axial plicae on the dorsal side and the presence of plicae in the adapertural side of the outer lip. The assignment to genera within the Strombidae is still undergoing revision, therefore the assignment of other species mentioned in this section reflects their original assignation.

The Pliocene *Strombus varingensis* Martin, 1899 and *Strombus martini* Oostingh, 1935 (which might be a synonym of the former), from Indonesia and Borneo, are fairly similar to the species from Brunei Darussalam, but differ in their broader outlines. Similarly, *Strombus karikalensis* Cossmann, 1903, from the Pliocene of Karaikal (India), has strongly reduced sculpture, is distinctly larger and is even more slender. *Strombus triangulatus* Martin, 1879 displays similar wing morphology, develops a similar spire and a prominent subsutural cord (see Beets 1986b, Leloux & Wesselingh 2009). Nevertheless, it is distinguished by its larger size, broader outline and the absence of axial ribs. Instead, it develops a large, blunt dorsal spine on the shoulder of the last whorl, resulting in a triangular cross-section in apical view. The holotype and only specimen of S*trombus glaber* Martin, 1879 is incomplete, but differs in being much larger, having a more marked shoulder, a rounded wing and no spiral sculpture near the base. Cox (1948) described seven strombid species from the late Miocene and Pliocene of Borneo. Of these, *Strombus* (*Labiostrombus*) *overbecki* Cox, 1948 is distinguished by its spiral sculpture on the spire whorls and the wing, which is attached to the last two spire whorls. This wing morphology allows also a separation from *Strombus* (*Labiostrombus*) *togopiensis* Cox, 1948. *Strombus* (*Labiostrombus*) *labiosus* Wood var. *teschi* Cox, 1948, currently seen as a valid species, develops dense axial sculpture on the spire, spiral sculpture on the surface of the wing and very prominent lirae within the outer lip. The Pliocene *Strombus fennemai* Martin, 1899, from Indonesia is much larger and its wing reaches much higher up the spire. The early Miocene *Strombus kemedjingensis* Martin, 1916 and the Pliocene *Strombus* (*Labiostrombus*) *rutteni* Van Regteren Altena, 1941, both from Indonesia, differ in their angulated and beaded spire whorls.
Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Rostellariidae Gabb, 1868

Genus *Varicospira* Eames, 1952

Type species: *Strombus cancellatus* Lamarck 1816, by original designation. Recent, Indo-West Pacific.

Varicospira cf. *javana* (Martin, 1879)

(Plate 2, Fig. 24)

1879 *Rostellaria javana* spec. nov. – Martin, p. 50-51, pl. 9, figs 7–7a.
2002 *Varicospira javana* (Martin, 1879) – Raven, p. 22, pl. 10 fig. 61.
2009 *Dientomochilus javanus* (Martin, 1879) – Leloux & Wesselingh, p. 117, pl. 225, fig 15, pl. 226, fig 1.

Material: 1 fragment from Ambug Hill (on photograph, not collected), height: ~13 mm. A fragment from Seria Fm. outcrop Tutong 11A (RGM.783487) can be identified with certainty.

Remarks: Only a photograph of a fragment is available. It has the typical aperture (elongate, smooth edge) of *V. javana*, but no details can be seen of the sculpture or anal canal. A much more complete fragment is available from the Seria Fm. outcrop Tutong 11a, which shows the typical sculpture on the last whorl with spiral cords weakening towards the base. The anal canal reaches the top of the penultimate whorl. The species is abundant in the middle Miocene Miri Fm. of northern Sarawak (Raven 2002). It is most likely that *Rimella* (*Dientomochilus*) cf. *cancellata* (Lamarck) subsp. indet reported by Nuttall (1961a) from the Seria Fm. in Brunei represents the same species.
Distribution: Middle Miocene of Borneo (Beets 1941, Beets 1985b) and late Miocene of Java (Leloux & Wesselingh 2009) and Brunei Darussalam.

Genus *Tibia* Röding, 1798

Type species: *Murex fusus* Linnaeus 1758, subsequent designation by Dall (1906). Recent, Indo-West Pacific.

Tibia melanocheilus (A. Adams, 1855)

(Plate 3, Figs 1–3)

1855 *Gladius* (*Rostellaria*) *melanocheilus* A. Adams, p. 42, pl. 27, fig. 9.
1941 *Tibia* (*Tibia*) *melanocheilos* (A. Adams, 1855) – Van Regteren Altena, p. 44.
1961a *Tibia* (*Tibia*) *fusus* (Linné) – Nuttall, p. 73 (*non* Linnaeus, 1758).
2002 *Tibia fusus* Linnaeus, 1758 – Raven, p. 22, pl. 10, figs 56a–b (*non* Linnaeus, 1758).

Material: 6 fragmentary specimens (3 NHMW 2016/0285, 3 R F5237), largest fragment: height: 47.9 mm, diameter: 20.5 mm (NHMW 2016/0285/0001, Plate 2, Figs 2–3).

Description: Only spire fragments available. Slender spire with an apical angle of 23°, early spire whorls with reticulate pattern of weakly opisthocyrt axial ribs and weaker spiral cords in interspaces between axial ribs with small nodules on intersections. Last three whorls glossy smooth, except for delicate growth lines. Whorls with maximum diameter in lower third, last whorl allometrically widening with prominent spiral cords on base.

Remarks: The identification of fossil *Tibia* shells from the Seria Fm. is challenging as thus far only a small number of fragments is available. The strongly convex lower teleoconch whorls and sculpture of the upper teleoconch with a reticulate pattern and small nodules on the intersections agree well with both *Tibia fusus* (Linnaeus, 1758) and *Tibia melanocheilus*. The small size and the angle of the suture (about 15°) demonstrate these fossils represent *Tibia melanocheilus*. In *Tibia fusus* the angle of the suture is about 20° resulting in a much faster gain in height. *Tibia verbeeki* (Martin, 1899) from the middle to late Miocene of Indonesia and NW Borneo has a much shorter spire with completely flat lower teleoconch whorls and a thickened and globose last whorl resulting in a narrow, but conspicuous ledge along the suture. The early teleoconch whorls are globose and have a rectangular grid of equally strong axial ribs and spiral cords, whereas the protoconch has four whorls with a smooth surface, the adapical ones flat, the abapical two rounded. *Tibia wenki* Cox, 1948 from the late Miocene or Pliocene of Borneo differs in its prominent spiral sculpture on the entire teleoconch. The extant *Tibia curta* (Sowerby, 1842) has a broader spire and is also much larger.

The specimens from the Seria Fm. (outcrops Tutong 8, RGM.783429 and Tutong 11A, RGM.783486) mentioned and illustrated in Raven (2002) lacked the upper whorls and were misidentified as *T. fusus*. Additional material from the Miri Fm. (outcrop Beraya-Bekenu Road km. 27.6 right, R F4458) confirms the identification as *T. melanocheilus*. The samples mentioned by Nuttall (1961a) might represent the same species.

Distribution: This extant IWP species is relatively common on the inner shelf of NW Borneo (Raven 2002). The species is known from the middle and late Miocene of NW Borneo (Sarawak and Brunei Darussalam) and the Pliocene and Pleistocene of Java (Van Regteren Altena 1941).

Family Seraphidae Gray, 1853

Genus *Terebellum* Lamarck, 1798

Type species: *Terebellum terebellum* (Linnaeus 1758), type by absolute tautonymy. Recent, Indo-West Pacific.

Terebellum cf. *terebellum* (Linnaeus, 1758)

(Plate 3, Figs 4–5)

cf. 1758 (*Conus*) *Terebellum* Linnaeus, p. 718.
cf. 1899 *Terebellum punctatum* Chemn. – Martin, p. 195, pl. 31, fig. 452.
cf. 1948 *Terebellum terebellum* (Linné) – Cox, p. 31, pl. 1, figs 6a–b.
cf. 2011 *Terebellum terebellum* (Linnaeus 1758) – Janssen et al., p. 424, pl. 20, fig. 1 (cum syn.).

Material: 1 internal cast, height: 19.5 mm, diameter: 5.5 mm (NHMW 2016/0286/0001).

Remarks: A single internal cast is available representing a slender bullet-shaped species with strongly oblique suture on the last whorl. Due to the fragmentary preservation, the identification may be debatable, but the general shape fits well to the wide spread *Terebellum terebellum*.

Distribution: Late Miocene and Pliocene of Borneo, Java, Sumatra and Timor (Cox 1948). The extant species is widespread in the Indo-West Pacific Region (Janssen et al. 2011), including NW Borneo.

Superfamily Tonnoidea Suter, 1913 (1825)
Family Bursidae Thiele, 1925

Genus *Bufonaria* Schumacher, 1817

Type species: *Bufonaria spinosa* Schumacher, 1817, subsequent designation by Herrmannsen (1846). Recent, Indo-West Pacific.

Bufonaria rana (Linnaeus, 1758)

(Plate 3, Figs 6–9)

1758 *Murex rana* Linnaeus, p. 748.
1884 *Ranella interrupta* Martin, p. 138, pl. 7, figs 138, 138a, b.
2005 *Bufonaria* (*Bufonaria*) *rana* (Linné, 1758) – Beu, p. 15, figs 23–26 (cum syn.).
2009 Ranella interrupta Martin, 1884 – Leloux & Wesselingh, p. 108, pl. 211, figs 13–15, pl. 212, figs 1–2.

Material: 6 specimens: 2 partly damaged specimens, height: 37.5 mm, diameter: 27.6 mm (NHMW 2016/0287/0001), 4 specimens (R F5239).

Description: Shell medium sized, solid with moderately high, conical spire. Protoconch of 2.2–3.3 smooth, strongly convex whorls, early teleoconch with multiple weak spiral cords with regularly placed weak beads, first varix appearing after 0.6–1.5 whorls, later

spire whorls angulated below mid-whorl, subsutural ramp straight to weakly concave. Sculpture consisting of about 16 regularly beaded primary spiral cords, delicately beaded below adapical suture, coarsely beaded below shoulder. Spiral cords separated by narrower interspaces with one or two weakly beaded secondary spiral threads intercalated in interspaces. Shoulder cord bearing spiral row of spiny nodes. Last whorl globose, base rapidly consitricting. Two prominent varices placed at either periphery, running continuous vertically uninterrupted, or slightly staggered, from apex to base, bearing three short spines. Aperture wide, ovate, outer lip strongly convex, flared abapically, with prominent lirae within. Columella strongly twisted and truncated close to siphonal canal. Columella broadly excavated, columellar callus thin, closely appressed so that sculpture of venter shows through, with irregular margin, bearing two prominent parietal denticles delimiting medial border of anal canal, numerous weaker wrinkled lirae on columella and close to siphonal canal. Anal canal deep, narrow, long, produced as open spine at adapical end of outer lip. Siphonal canal wide, partly missing.

Remarks: The specimens from Brunei Darussalam differ from typical *Bufonaria rana* (Linnaeus 1758) in the wider siphonal canal, well developed callus and the wide basal part of the outer lip. They are also much smaller than present-day specimens collected in Brunei and Sarawak (which reach a height of up to 7 cm). According to Alan Beu (pers. comm. 2016), however, the shells still fall within the range of the exceedingly variable *B. rana*. In apical view two of the specimens from Ambug Hill have the varices from either side of the shell clearly offset, whereas in the other specimens they are positioned in a single plane. Large samples of present-day specimens from Piasau beach, Miri, Sarawak demonstrate similar variability.

Distribution: *Bufonaria rana* appears during the late Miocene in Java and becomes ubiquitous during the Pliocene and Pleistocene in Indonesia and Japan (Beu 2005). The species is extant and widespread in the IWP including NW Borneo.

Genus *Bursina* Oyama, 1964

Type species: *Ranella nobilis* Reeve, 1844, by original designation. Recent, Indo-West Pacific.

Bursina cf. *ignobilis* (Beu, 1987)

(Plate 3, Figs 10–12)

1879 *Ranella elegans* G.B. Sowerby II, 1836 – Martin, p. 55, pl. 10, fig. 3, 3a (in part).

1987 *Bufonaria* (*Bufonaria*) *ignobilis* Beu, p. 344, figs 221, 257–263.

Material: 1 specimen with damaged last whorl, height: 39.6 mm, diameter 29.6 mm (R F5238).

Description: Shell medium sized, solid, with moderately high, conical spire. Protoconch 2.7 smooth, strongly convex whorls. Teleoconch whorls angulated below mid-whorl, suture irregular. Sculpture consisting of about 20 coarsely beaded spiral threads, beaded secondary spirals intercalated. Two prominent varices run uninterrupted from base to spire with two short, but distinct spines coinciding with a spiral row of spiny nodes (eight per whorl) and single weaker node behind each varix on lower spiral. Sculpture consisting of regularly beaded primary spiral cords, separated by narrower interspaces with one or two weakly beaded secondary spiral threads. Aperture wide, ovate, outer lip strongly convex, flared abapically, with prominent lirae within. Siphonal canal wide, partly missing. Columella strongly twisted and truncated close to siphonal canal.

Remarks: This is the only specimen collected from the Seria Fm. It is not certain whether this specimen is *B. nobilis* (Reeve, 1844) or *B. ignobilis* (even Alan Beu could not give a definitive identification). *Bursina ignobilis* is abundant in the Neogene of Indonesia whereas *B. nobilis* is very scarce (Beu 2005). These species are closely similar and even difficult to differentiate in recent specimens, nevertheless, *Bursina nobilis* can be much larger and has a more coarsely granulose exterior (Beu 2005, p. 26).

Distribution: Extant IWP species but thus far no recent specimens have been collected in NW Borneo. It typically lives further offshore whereas sampling of recent material has been restricted to shallow water.

Family Ranellidae Gray, 1854

Genus *Gyrineum* Link, 1807

Type species: *Gyrineum verrucosum* Link, 1807 (= *Murex gyrinus* Linnaeus, 1758), subsequent designation by Dall (1904). Recent, Indo-West Pacific.

Gyrineum bituberculare (Lamarck, 1816)

(Plate 2, Figs 13–14)

1816 *Ranella bitubercularis* Lamarck, p. 4, pl. 412, fig. 6.

2005 *Gyrineum bituberculare* (Lamarck, 1816) – Beu, p. 64, figs 164–167 (cum syn.).

Material: 2 specimens: 1 fragmentary specimen, height: 16.3 mm (NHMW 2016/0288/0001), 1 damaged specimen, height 14.9 mm (R F5244).

Remarks: The material from Ambug Hill represents a small species with a broad conical spire, prominent varices and sculpture consisting of broad, irregularly spaced axial ribs, crossed by primary and secondary spiral cords, without forming beads at intersections. The siphonal canal is narrow, well defined, moderately long. The apertural varix bears strongly raised primary cords and weaker secondaries in the wide interspaces. The small size is reminiscent of *Gyrineum lacunatum* (Mighels, 1845), which is also documented from the Neogene of Indonesia (Beu 2005) and the Miri Fm. of Sarawak (Raven in Wannier, 2011, plate 4.5.4d, fig. 17). The blunt axial ribs, however, differ markedly from the beaded sculpture of *G. lacunatum* and place it in *G. bituberculare*.

Distribution: Extant and wide-spread in the IWP-Region including NW Borneo, the species occurs during the middle and late Miocene in Java and becomes ubiquitous in Indonesia, Timor and the Philippines during the Pliocene and Pleistocene (see Beu 2005 for a detailed list). The species was mentioned by Nuttall (1961a) from the middle Miocene Miri Fm. in Brunei, whereas Nuttall in Sandal (1996, fig. 4.6a) figured a specimen from the Seria Fm. The species is known from the early-middle Miocene (Sibuti Fm.) and occurs in larger numbers in the middle Miocene Miri Fm. of northern Sarawak.

Family Tonnidae Suter, 1913 (1825)

Genus *Tonna* Brünnich, 1772

Type species: *Buccinum galea* Linnaeus, 1758, subsequent designation by Suter (1913). Recent, Mediterranean Sea.

Tonna sp.

(Plate 3, Fig. 15)

Material: 2 specimens: 1 internal cast, height: 38 mm, diameter: 38 mm (NHMW 2016/0289/0001), 1 internal cast of a juvenile specimen (GUBD).

Remarks: A poorly preserved internal cast of a subspherical shell is available, with a strongly convex last whorl, slightly raised spire and about 16 broad spiral cords. The adapical cords are separated by wider interspaces, which narrow on the lower half of the last whorl. The poor preservation does not allow a clear identification.

In his revision of the Neogene Indonesian Tonnoidea, Beu (2005) lists eight species of *Tonna*. Of these, *Tonna lischkeana* (Küster, 1857) is reminiscent of the fossil from Ambug Hill concerning the broad, subspherical last whorl. *Tonna allium* (Dillwyn, 1817) differs in having fewer spiral cords, although the specimens described by Shuto (1969) from the Pliocene of the Philippines (as *Tonna costata* Menke) are very similar to the fossil from Ambug Hill. *Tonna tessellata* (Lamarck, 1816) differs in its very short spire and in having fewer spiral cords.

Further material from this genus is available from Brunei: four specimens from Seria Fm. outcrop Tutong 8 (leg. BPM, RGM.783433 one specimen figured in Raven, 2008 fig. 2, herein Plate 3, Figs 16–17) which have 20-22 spiral cords and a juvenile specimen from Brunei (leg. BPM, RGM.783260), which is probably also from the Seria Fm. Alan Beu identified these as *Tonna sulcosa* (Born, 1778), an extant species still present in NW Borneo. None of these specimens has remnants of colour bands (also not in UV light). More material from Ambug Hill is required to determine whether this represents the same species.

Nuttall, 1961a reported *Tonna fasciata* Bruguière, 1798) from the Seria Fm. but it is unclear whether he had a specimen of *Tonna sulcosa* or a specimen of the taxon found at Ambug Hill.

Order Neogastropoda Wenz, 1938

Superfamily Cancellarioidea Forbes & Hanley, 1851
Family Cancellariidae Forbes & Hanley, 1851

Genus *Scalptia* Jousseaume, 1887

Type species: *Cancellaria obliquata* Lamarck, 1822, by original designation. Recent, Indo-West Pacific.

Scalptia verheckeni n. sp.

(Plate 3, Figs 18–24)

Material: 4 specimens.
Holotype: NHMW 2016/0291/0001: height: 9.3 mm, diameter: 6.3 mm (Pl. 3, Figs 18–20).
Paratype: NHMW 2016/0291/0002: height: 8.3 mm, diameter: 5.2 mm (Pl. 3, Figs 21–24).
Additional paratypes: 2 specimens (GUBD).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: In honour of André Verhecken and his great work on Cancellariidae.

Diagnosis: Small *Scalptia* species with multispiral protoconch, gradate spire, moderately convex last whorl, sculpture of prominent axial ribs and narrow, poorly developed spiral cords, strengthened over axial ribs forming horizontally elongated tubercles, broad subsutural canal with spoke-wheel like sculpture in apical view, umbilicus moderately wide and deep, bearing elevated axial ribs within.

Description: Shell small, solid, spire strongly gradate, last whorl moderately inflated. Protoconch multispiral, composed of 3.5 smooth strongly convex whorls separated by deep suture, last protoconch whorl strongly inflated, nucleus small (dp = 1.25 mm). Junction with teleoconch abrupt marked by beginning of axial sculpture. Teleoconch of three almost straight-sided whorls separated by deeply canaliculated suture. Spire whorls sharply angled at shoulder delimiting subsutural canal, weakly convex below, with periphery at abapical suture. Axial sculpture of raised, rounded prosocline ribs, 11 on last whorl, half width of interspaces, strongly elevated over subsutural canal, interspaces forming large deep pits. Spiral sculpture of narrow cords, five below shoulder on penultimate whorl, strengthened over axials, forming horizontally elongated tubercles. Last whorl straight-sided below shoulder, obtusely angled at base, base weakly concave, bearing moderately wide and deep umbilicus into which axial sculpture continues strongly elevated. Aperture subtrigonal, outer lip thickened by labial varix, strongly lirate within, anal sinus small, U-shaped, delimited medially by strong parietal tooth, siphonal canal narrow, short, open, pointing abapically. Columella bearing three oblique folds, upper fold subhorizontal to weakly oblique, lower two folds less prominent, closer-spaced and strongly oblique. Columellar callus erect abapically, forming medial border of and partly obscuring umbilicus, parietal callus moderately expanded and appressed over venter, thickened, sharply delimited.

Remarks: The illustrated paratype differs from the holotype in the absence of a parietal denticle and the lirae on the outer lip are weaker. These features are periodically formed in the aperture, e.g. *S. aliguayensis* in Verhecken (2008, pl. 1, figs 1, 4 versus fig. 3) and *S. crispatoides* in Verhecken (2008, pl. 2, figs 9–12 versus fig. 13). Several extant *Scalptia* species in the IWP-Region are reminiscent of the Miocene species in size and sculpture: *Scalptia crispatoides* Verhecken, 2008, from the Philippines, is much broader and has a wider umbilicus. Moreover, its protoconch is low conical. *Scalptia aliguayensis* Verhecken, 2008, from the Philippines, has similar sculpture to the Miocene fossil, but its last whorl is more convex, the umbilicus is wider and its paucispiral protoconch is high and more slender. *Scalptia laingensis* Verhecken, 1989 has a greater number of axial ribs and a wider umbilicus. *Scalptia textilis* (Kiener, 1841) is much larger and its spire whorls are higher and develop a slight mid-whorl convexity. *Scalptia articularis* (Sowerby, 1832) is also larger, has higher spire whorls and more numerous spiral threads. *Scalptia crossei* (Semper, 1861) develops a similar outline but is much larger, and differs in having a paucispiral protoconch with a large bulbous first whorl (see Verhecken 1995). The extant *Scalptia crenifera* (Sowerby, 1833), which is also recorded from the Pliocene of Indonesia, the Philippines and Fiji (Shuto 1969, Ladd 1982), is larger and is distinguished by its broader and more convex last whorl and in having far more numerous spiral threads forming closer-set elongated tubercles over the axial ribs. *Scalptia vangoethemi* Verhecken, 1995 differs in the higher number of axial ribs, the wider umbilicus and less strongly developed columellar callus.

Among the Neogene fossil species, *S. tegalensis* (Oostingh, 1938), from the Pliocene of Java, develops a similar outline but has a wider umbilicus and regular spiral sculpture equally strongly developed in the interspaces as over the ribs and *S. atjehensis* (Oostingh, 1938), from the Pliocene of Java, differs in its dense spiral sculpture and rounded shoulder. *Scalptia menadenis* (Schepman, 1907), from the Quaternary of Indonesia, is more ventricose and has a wider umbilicus.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Superfamily Buccinoidea Rafinesque, 1815
Family Costellariidae MacDonald, 1860

Genus *Costellaria* Swainson, 1840

Type species: *Mitra rigida* Swainson, 1821, by monotypy. Recent, Indo-West Pacific.

Costellaria teschi (Koperberg, 1931)

(Plate 4, Figs 20–23)

1915 *Turricula* (*Vulpecula*) *gembacana* K. Martin – Tesch, p. 49, pl. 80, figs 105a–b (non *Mitra* (*Turricula*) *gembacana* Martin, 1884).
1931 *Turricula* (*Costellaria*) *obeliscus* Reeve subpec. *Teschi* n. s.sp. Koperberg, p. 82.
1939 *Vexillum* (*Costellaria*) *obeliscus teschi* Koperberg – Oostingh, p. 50, pl. 12, fig. 214.
1941 *Vexillum* (*Costellaria*) *obeliscus teschi* (Koperb.) – Beets, p. 191.
1969 *Vexillum* (*Costellaria*) *obeliscus teschi* (Koperberg) – Shuto, p. 169, pl. 16, figs 15–16 (non fig. 12).

Material: 5 specimens, 4 specimens, height: 10.7 mm, diameter: 3.9 mm (NHMW 2016/0292/0001, Plate 4, Figs 20–21), height: 10.7 mm, diameter: 3.8 mm (NHMW 2016/0292/0002, Plate 4, Figs 22–23), 1 specimen (R F5308).

Description: Shell small, with high, weakly gradate spire, apical angle about 35°, moderately high, subcylindrical spire whorls, short, moderately convex to subcylindrical last whorl. Protoconch eroded. Early spire whorls with rounded axial ribs. Six broad spiral cords in interspaces between axial ribs, separated by deep grooves, grooves not cutting tops of axial ribs, except for most adapical cord, delimiting broader, indistinctly beaded subsutural cord. Suture impressed. Last whorl broadly convex, evenly constricted at base, moderately long, narrow siphonal canal. Axial ribs on last whorl sigmoidal, beaded over base. Aperture narrow, columella straight with four columellar folds. Upper fold prominent, weakly oblique, lower three folds successively weaker and more oblique. Siphonal fasciole broad, moderately swollen, with beaded spiral cords. Anal notch narrow, deep, bordered medially by blunt parietal denticle. Outer lip thin, without lirae.
Remarks: Among the Neogene species from Indonesia, *Costellaria gembacana* (Martin, 1884) is morphologically very close to the species from Brunei Darussalam, but is distinguished by the slightly ovoid outline and the weakly convex spire whorls. The Pliocene *Costellaria bataviana* (Martin, 1884) and *C. rajaensis* (Martin, 1895) differ in their more numerous, narrower axial ribs. Although this species was originally established as subspecies of the extant IWP-species *Costellaria obeliscus* (Reeve, 1844), the latter differs considerably by its greater number of axial ribs and more strongly incised suture.
Distribution: Middle Miocene of Java (Beets 1941), late Miocene of Brunei Darussalam, Pliocene of Java, Timor and the Philippines (Koperberg 1931, Oostingh 1939, Shuto 1969).

Costellaria sp.

(Plate 5, Figs 1–2)

Material: 2 specimens, R F5309, best specimen height: 10.2 mm, diameter: 3.8 mm (R F5309/001).

Description: Shell small, spire medium hight, apical angle of about 40°, moderately high, convex spire whorls, last whorl about half shell height. Protoconch incomplete, but multispiral. Early spire whorls with rounded axial with somewhat flattened tops. Seven spiral cords in interspaces between axial ribs, separated by deep grooves, grooves not cutting tops of axial ribs. Suture impressed, undulating. Last whorl convex, evenly constricted at base, moderately long, narrow siphonal canal. Axial ribs on last whorl strongly sigmoidal, beaded over base due to ribs being cut by spiral grooves. Aperture narrow, columella straight with four columellar folds, upper fold prominent, weakly oblique, lower three folds successively weaker and more oblique. Siphonal fasciole broad, moderately swollen, with beaded spiral cords. Anal notch narrow, deep, bordered medially by blunt parietal denticle. Outer lip thin, strongly lirate within, lirae commence a short distance within the lip margin and extend deeply into aperture.
Remarks: Compared to *Costellaria teschi* these specimens have a lower, non-gradate spire, more convex whorls, stronger curved axial ribs. They appear closely related to that species, but do not fit with any of the species discussed above.
Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Nassariidae Iredale, 1916 (1835)

Genus *Phos* Montfort, 1810

Type species: *Murex senticosus* Linnaeus. 1758, by original designation. Recent, Indo-West Pacific.

Phos bruneiensis n. sp.

(Plate 4, Figs 1–6)

Material: 7 specimens.
Holotype: NHMW 2016/0293/0001, height: 15.5 mm, diameter: 7.1 mm (Plate 4, Figs 1–2).
Paratype: NHMW 2016/0293/0002, height: 16.5 mm, diameter: 8.2 mm (Plate 4, Figs 3–5).
Paratype: NHMW 2016/0293/0003, height: 18.4 mm, diameter: 8.2 mm (Plate 4, Fig. 6).
Additional paratypes: 3 specimens (GUBD), 1 specimen (R F5255).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to Brunei Darussalam.

Diagnosis: Medium-sized *Phos* species, broad fusiform shell with moderately incised suture, convex last whorl, sculpture of rounded axial ribs, crossed by prominent primary spiral cords and 2–4 secondary and tertiary spiral cords, forming cancellate pattern with close-set axial growth lines.
Description: Shell medium-sized, broad fusiform, with five convex whorls and moderately incised suture. Protoconch multispiral, high conical, composed of 3.5 convex whorls, surface smooth, faint angulation in lower third, deep sinusigera with distinct rim marking transition into teleoconch (dp = 1.4 mm). Axial sculpture of teleoconch consisting of low axial ribs with wider interspaces, axial ribs on spire whorls

crossed by six to seven primary spiral cords, intercalated by two to four weaker, regularly spaced secondary and tertiary spiral cords of subequal strength. Closeset axial growth lines appear in spiral interspaces forming delicate, regularly cancellate pattern. Sculpture persisting on ovoid last whorl, with about 16–18 primary spiral cords. Axial ribs become weaken towards aperture. Low, spirally elongated beads formed where primary spirals overrun axial ribs on all whorls but most prominent on lower half of last whorl. Base moderately constricted, convex, not sharply delimited from siphonal fasciole. Siphonal fasciole broad, swollen, twisted, covered by prominent spiral cords. Aperture ovate, outer lip convex, narrowing abapically, strongly lirate within, anal canal poorly developed, siphonal canal of moderate length, open, narrow, twisted abapically, slightly recurved. Columella excavated in mid-portion, bearing three columellar folds, upper two reduced to elongated denticles, lower oblique, delimiting medial border of siphonal canal, weak parietal denticle developed in some specimens.

Remarks: The smooth multispiral protoconch places this species in *Phos* (Fraussen & Poppe 2005, Landau et al. 2013, 2016a). Moreover, the molecular phylogeny of the Nassariidae by Galindo et al. (2016) clearly showed that the IWP species of the Photinae belong to *Phos*, whereas *Antillophos* is restricted to the Caribbean.

Only a small number of *Phos* species have been described so far from the Neogene of Indonesia. Of these, the late Miocene *Phos cuspidatus* (Martin, 1879) differs in its densely spaced axial ribs and the reduced spiral sculpture. The late Miocene *Phos acuminatus* (Martin, 1879) lacks the cancellate sculpture and has more numerous axial ribs. *Phos woodwardianus* sensu Martin 1895 (non Martin, 1884), from the Pliocene of Java, differs in the higher spire the more densely spaced axial ribs and regular and dense spiral cords (*Phos woodwardianus* Martin, 1884 is an Eocene species and clearly unrelated with the late Miocene species). *Phos teschi* Koperberg, 1931, from the Miocene of Borneo and the Neogene of Timor, differs in its stout shape and beaded sculpture. *Phos seranus* Fischer, 1927, from the Pliocene of Seram, has a comparably cancellate sculpture in the interspaces between the axial ribs, but lacks primary spiral cords and is very slender. The slender outline and the densely crowded axial ribs distinguish also the Pliocene *Phos nodulosecostatus,* described by Fischer (1927) from Seram. *Phos borneensis* (Sowerby, 1859), recorded by Woodward (1880) from the Miocene of Nias, has much weaker spiral cords, an incised suture and prominent varices. The extant *Phos roseatus* (Hinds, 1844) is somewhat reminiscent of the Miocene fossil but differs clearly in its slender outline, the deeply incised sutures and the prominent varices. *Phos senticosus* (Linnaeus, 1758) is readily distinguished by its angulate last whorl and the very prominent, wide-spaced axial ribs.

Distribution: Only known from the Tortonian of Brunei.

Genus *Nassarius* Duméril, 1806

Type species: *Buccinum arcularia* Linnaeus, 1758, type by monotypy. Recent, Indo-Pacific.

Nassarius pseudoovum n. sp.

(Plate 4, Figs 7–13)

Material: 38 specimens.
Holotype: NHMW 2016/0294/0001, height: 11.9 mm, diameter: 7.0 mm (Plate 4, Figs 7–9).
Paratype: NHMW 2016/0294/0002, height: 12.4 mm, diameter: 7.1 mm (Plate 4, Fig. 11).
Paratype: NHMW 2016/0294/0003, height: 11.1 mm, diameter: 6.1 mm (Plate 4, Fig. 13).
Paratype: NHMW 2016/0294/0004, height: 11.4 mm, diameter: 6.1 mm (Plate 4, Figs 10, 12).
Additional paratypes: 16 specimens (NHMW 2016/0294/0005), 12 specimens (GUBD), 1 specimen (RGM.1309466) height 13.4 mm, diameter 7.5 mm.
Additional material: 3 specimens (F5257).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to the similarity with *Nassarius ovum* (Martin, 1879), from the Miocene of Java.

Diagnosis: Medium-sized *Nassarius* with gradate spire, weakly convex spire whorls, beaded subsutural cord and smooth, prosocline axial ribs, spiral sculpture reduced to narrow spiral grooves in interspaces between axial ribs, small aperture, outer lip strongly varicose, lirate within, columella with denticles and prominent parietal fold.

Description: Shell medium sized, with weakly gradate spire, angle about 50°. Protoconch multispiral, broad conical, consisting of about 3.5 smooth convex whorls with small nucleus (dp = 0.9 mm) (note that the weak suprasutural cord in Fig. 12 is probably caused by erosion). Transition to teleoconch not preserved. Teleoconch composed of five weakly convex gradate whorls, with periphery at abapical suture. Axial sculpture of rounded prosocline ribs, equal in with to their interspaces, 15 on penultimate whorl. Spiral sculpture consisting of conspicuous subsutural band

cutting and beading axial ribs, below which lie flattened spiral bands separated by narrow grooves that do not cross the axials, but remain restricted within the interspaces. Last whorl globose, rounded, base not sharply delimited, axials deeply cut on base by axial sculpture forming squarish beads, base sharply delimited from siphonal fasciole by groove. Aperture ovate, small, outer lip strongly thickened by varix adapically, thinning abapically, denticulate within, anal sinus small, narrow, deep U-shaped, delimited medially by parietal denticle, Siphonal canal short, wide, open, deep, sharply delimited internally, abapically twisted and slightly posteriorly recurved, notched at tip. Columella excavated in mid-portion, bearing numerous small denticles. Columella and parietal callus forming narrow callus rim. Siphonal fasciole flattened, bearing spiral sculpture.

Remarks: Several Miocene and Pliocene species from Java are superficially similar to the species from Brunei: *Nassarius tambacanus* (Martin, 1884) agrees in the beaded subsutural cord but lacks continuous axial ribs and has a channelled suture. *Nassarius angsananus* (Martin, 1921) develops distinct spiral sculpture and beaded axial ribs. *Nassarius ovum* (Martin, 1879) is highly reminiscent of the new species, but differs in the ovoid last whorl, which has the maximum diameter in a more adapical position, the broader spire, the slightly sigmoid axial ribs and denser spiral grooves. *Nassarius verbeeki* (Martin, 1895) is higher, with an elongate last whorl and lacks the spiral grooves between the axial ribs. Moreover, the anterior margin of the outer lip in that species widens abapically and is sometimes crenulated. Among the extant IWP species *Nassarius clarus* (Marrat, 1877) develops similar sculpture but differs in the smooth inner lip, the wider anal canal and the denser spiral grooves. *Nassarius novaehollandiae* (Reeve, 1845b) has beaded axial ribs on the spire whorls and *N. siquijorensis* (Adams, 1852) much denser axial ribs.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Columbellidae Swainson, 1840

Genus *Indomitrella* Oostingh, 1940

Type species: *Columbella puella* Sowerby, 1844, by original designation. Recent, Indo-West Pacific.

Indomitrella acuticonica n. sp.

(Plate 4, Figs 14–19)

Material: 36 specimens.

Holotype: NHMW 2016/0295/0001, height: 10.7 mm, diameter: 5.3 mm (Plate 4, Figs 14–15).
Paratype: NHMW 2016/0295/0002, height: 9.7 mm, diameter: 5.0 mm (Plate 4, Figs 16–17).
Paratype: NHMW 2016/0295/0003, height: 10.5 mm, diameter: 5.0 mm (Plate 4, Figs 18–19).
Additional paratypes from Ambug Hill: 3 specimens (NHMW 2016/0295/0004), 13 specimens (GUBD), 3 specimens (RGM.1309463).
Additional paratypes: 4 specimens from Seria oil field well 14, 2623–2636 m, Seria Fm.? (RGM.783301).
Additional material: 10 specimens (F5282).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: *acuticonica* (feminine), from Latin *acuta* (pointed) and *conica* (cone-shaped), referring to the acute-conical spire outline.

Diagnosis: *Indomitrella* species of medium-sized for genus, with acute conical to weakly coeloconoid spire, slightly gradate penultimate and last whorls, sculpture consisting of narrow, smooth orthocline axial ribs, progressively wider-spaced abapically and well-defined, indistinctly beaded subsutural cord.

Description: Shell medium-sized, fusiform, with conical spire, apical angle about 46°. Protoconch multispiral, tall, composed of three smooth convex whorls. Teleoconch of six to seven straight-sided whorls, regularly conical to slightly coeloconoid on penultimate whorl, weakly scalate due to thickened subsutural cord. Sculpture of narrow, orthocline rounded axial ribs, about one-third width of their interspaces and well developed narrow, thickened subsutural cord, beaded at ribs. Surface smooth, glossy. Last whorl relatively inflated, strongly constricted at base, axials overrun by narrow cords on base that strengthen abapically. Siphonal fasciole not sharply delimited from base, long, straight, bearing spiral cords. Aperture elongate-ovate, small, outer lip strongly thickened by external varix and internal callus in adapical portion, thinning abapically, bearing about six denticles within, anal canal narrow U-shaped, siphonal canal relatively long, open, narrow, slightly recurved, deeply notched at tip. Columella narrowly excavated in upper third, straight below, bearing row of tubercles that weaken abapically. Columellar callus thickened, narrow, sharply delimited, parietal callus thin, poorly delimited, expanded over venter.

Remarks: All recent *Indomitrella* species known to us, including its type species *I. puella* (Sowerby, 1844), lack the subsutural spiral cord characteristic to *Indomitrella acuticonica* n. sp. *Indomitrella haz-*

iersensis Drivas & Jay, 1990, from the Philippines, tends to form a somewhat accentuated subsutural area with weak nodes or slightly angulated axial ribs, but is much more slender. Among the Neogene Indonesian Columbellidae few species are comparable with the species from Brunei. Of these, the Pliocene *Indomitrella gracillima* (Martin, 1895) differs in its very slender outline and its axial ribs are restricted to early spire whorls. The late Miocene *Anachis herklotsi* (Martin, 1879) differs also in its slender shape and has a distinctly less constricted base, besides lacking a subsutural cord. The Pleistocene *Indomitrella mawsoni* (Ladd, 1982), from the New Hebrides, differs in having much broader axial ribs.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Fasciolariidae Gray, 1853

Genus *Clavilithes* Swainson, 1840

Type species: *Fusus noae* Holten, 1802, subsequent designation by Herrmannsen (1846). Eocene, France.

Clavilithes tjidamarensis (Martin, 1879)

(Plate 5, Figs 3–10)

1879 *Strombus* (?) *fusus* – Martin, p. 50, pl. 9, fig. 9.
1879 *Fusus tjidamarensis* Martin, p. 58, pl. 10, fig. 7.
1895 *Fusus* (*Clavella*) *tjidamarensis* Mart. – Martin, p. 86, pl. 13, figs 199–200.
1935 *Clavilithes verbeeki* Martin var. *acutangula* var. nov. – Wanner & Hahn, p. 248, pl. 18, figs 5–7.
1969 *Clavilithes* (*Clavilithes*) *tjidamarensis* (Martin) – Shuto, p. 154, pl. 10, figs 7, 10, 13–14.
2009 Clavilithes tjidamarensis (Martin, 1879) – Leloux & Wesselingh, p. 54, pl. 108, fig. 14 (cum syn.).

Material: 11 specimens: 9 fragmentary specimens (seven in NHMW 2016/0296/0001, two in R F5253) and two juvenile specimens (GUBD). Largest complete specimens: height: 27.8 mm, diameter: 12 mm (Plate 4, Figs 6–8) (NHMW 2016/0296/0002), height 32.9 mm, diameter unknown as specimen is incomplete (R F5253).

Description: Shell medium sized, fusiform, with high conical spire, apical angle 45–47°. Protoconch paucispiral, tall composed of two whorls with bulbous first whorl (dp = 0.8 mm) (surface strongly abraded in all specimens). Early teleoconch whorls with broad, swollen axial ribs crossed by three prominent spiral cords, 4th weaker undulating spiral suprasutural cord, bifid subsutural collar formed on 2nd to 3rd teleoconch whorl (= "twin-lirae" of Shuto, 1969). Subsutural collar separated from first spiral cord by broad, flat subsutural ramp. Last whorl bearing concave subsutural ramp, strongly inflated mid-whorl, strongly and rapidly constricted at base, axials rapidly weaken on last half penultimate to first quarter last whorl, absent thereafter, irregular spirals on subsutural ramp and base, subobsolete mid-whorl. Siphonal fasciole long, straight, bearing prominent cords.

Outer lip incomplete, bearing about ten thin lirae within, extending deeply within aperture, anal canal narrow, indistinct. Columella broadly excavated, transition with siphonal canal marked by weak columellar fold. Columellar callus moderately thickened and expanded, forming broad callus rim adherent to venter and siphonal fasciole, parietal callus poorly delimited, bearing weak fold.

Remarks: None of the available specimens develops the extremely thickened, barrel-shaped last whorl typical of adult shells of *Clavilithes tjidamarensis* (Martin, 1879). Nevertheless, the specimens from Brunei Darussalam do not differ in sculpture and spire morphology from subadult shells of *Clavilithes tjidamarensis* from Java, stored in the collection of the NHMW. The only difference is the constantly smaller size of the specimens from Brunei. They are also smaller than specimens of *C. tjidamarensis* described by Shuto (1969) from the Neogene of the Philippines. Therefore, the identification remains debatable and maybe the specimens from Brunei Darussalam represent a distinct geographic subspecies. This question can only be solved when fully grown specimens will be available.

Snyder (1999) placed the probably related Miocene *Fusus* (*Clavella*) *fennemai* Martin, 1906 in *Clavellofusus* Grabau, 1904. Beu & Marshall (2011) considered *Clavellofusus* to be a subjective junior synonym of *Clavilithes*, which is tentatively followed herein. Moreover, Couto et al. (2016) showed that the aberrant and *Clavilithes*-like *Cyrtulus serotinus* (Hinds, 1843) nested within *Fusinus* species in their molecular study. Therefore, Landau et al. (2016b) concluded that also some Miocene species with aberrant morphology, such as *C. fennemai*, might rather be highly derived *Fusinus* species.

Distribution: Early Miocene and undefined Miocene of Java (Wanner & Hahn 1935, Leloux & Wesselingh 2009), late Miocene or Pliocene of the Philippines (Shuto 1969) and late Miocene of Brunei Darussalam.

Clavilithes verbeeki (Martin, 1895)

(Plate 5, Figs 11–15)

1895 *Fusus* (*Clavella*) *Verbeeki* spec. nov. Martin, p. 85, pl. 12, figs 188–192, pl. 13, figs 193–198.

1915 *Fusus* (*Clavella*) *Verbeeki* K. Martin – Tesch, p. 52, pl. 80, fig. 111.
2005 *Clavilithes verbeeki* (Martin, 1895) – Dharma, p. 318, pl. 124, figs 1a–1e.
2009 Clavilithes verbeeki (Martin, 1895) – Leloux & Wesselingh, p. 55, pl. 108, fig. 15, pl. 109, figs 1–15, pl. 110, figs 1–15, pl. 111, fig. 1 (cum syn.).
2015 *Clavilithes verbeeki* (Martin, 1895) – Vermeij, p. 29, fig. 1.

Material: A single, fragmentary and slightly compressed specimen is available from Ambug Hill, height: 46 mm, diameter: 25 mm (NHMW 2016/0297/0001), an additional more complete specimen comes from Tutong 8 (RGM.783418a).

Description: Shell broad-fusiform, with conical spire of seven teleoconch whorls, protoconch surface strongly corroded. First teleoconch whorl straight-sided, with weak subsutural cord along upper suture, second and third teleoconch whorl with four spiral cords, narrower than interspaces. Indistinct spiral cords and axial nodes on first whorl, nodes and cords disappear by third to fourth whorl, suture irregular below. Abapically spire whorls smooth, increasingly concave subsutural ramp and inflated abapical half. Last whorl with concave subsutural ramp, rounded at shoulder, strongly inflated mid-whorl, strongly and rapidly constricted at base. Base not sharply delimited from siphonal fasciole, both bearing irregular cords. Aperture ovate, outer lip incomplete, anal canal narrow, siphonal canal open, narrow, very long, twisted. Columella broadly excavated, columellar and parietal callus poorly delimited.

Remarks: The reduced sculpture and the spire outline are reminiscent of the Indonesian Miocene to Pliocene *Clavilithes verbeeki*, which is a highly variable species. The subadult growth stage of the specimen from Ambug Hill lacks the thickened and barrel-shaped last whorl of fully grown *C. verbeeki*. Moreover, the spire is exceptionally smooth and convex compared to the Indonesian specimens described by Martin (1895) and Leloux & Wesselingh (2009) and the subsutural concavity is a rather atypical feature in *C. verbeeki.* However, Oostingh (1939) studied many specimens from multiple outcrops of the Pliocene in Java and found juvenile specimens very similar to those from Brunei (Oostingh 1939, pl. 12, fig. 217). Three specimens from outcrop Tutong 8 (of which one is illustrated in Plate 5, Figs. 11–12) are very similar to the specimen from Ambug Hill. Martin wrote a label "*Clavilithes Verbeeki* Martin" and a second label "*Hemifusus?* von Java nicht bekannt" (= *Hemifusus*? unknown from Java). Beets added a single label "*Clavilithes verbeeki* Martin" – it is assumed he merged the specimens originally separated by Martin. The specimen from Tutong 13 (RGM.783510) is the smallest juvenile known to us. Nuttall (1961a) mentioned a juvenile shell of *Clavilithes* cf. *verbeeki* from the Seria Fm. in Brunei.

The species from the Miri Fm. in northern Sarawak initially identified as *C. verbeeki* (Raven in Wannier et al. 2011, plate 4.5.4d, fig. 23) is a different species.

Distribution: *Clavilithes verbeeki* is a widespread species known from the early Miocene to Pliocene of Java, New Guinea and Timor (Tesch 1915, Beets 1986b, Dharma 2005, Leloux & Wesselingh 2009) and now also recorded from the late Miocene of Brunei.

Family Melongenidae Gill, 1871 (1854)

Genus *Hemifusus* Swainson, 1840

Type species: *Fusus colosseus* Lamarck, 1816, subsequent designation by Gray (1847). Recent, Indo-West Pacific.

Hemifusus charlieleei n. sp.

(Plate 5, Figs 16–24)

Material: 6 specimens.
Holotype: NHMW 2016/0298/0001, height: 47.2 mm, width: 17.8 mm (Plate 5, Figs 15–18).
Paratype: RGM.309470, height: 50.8 mm, width: 30.1 mm (Plate 5, Figs 22–24).
Other material: 3 specimens and a fragment of the apex from Ambug Hill (R F5252).
Doubtful assignment: NHMW 2016/0299/0001, height: 41.4 mm, width: 25.3 mm (Plate 5, Figs 19–21).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: In honour of Charlie Lee, friend of H.R, who discovered most outcrops in Sarawak and donated many of his specimens.

Diagnosis: Small *Hemifusus* species, with tall, scalate spire, angular spire whorls, ten rounded axial ribs forming tubercles at shoulder, subordinate primary and secondary spiral sculpture, last whorl elongate, spiral cords subobsolete mid-whorl.

Description: Shell medium-sized, slender fusiform, with tall conical spire, apical angle 55–70°. Protoconch poorly preserved, consisting of c. two high, moderately convex whorls. Teleoconch of five angular whorls separated by incised weakly undulating suture. Spire whorls with broad, weakly concave subsutural ramp, sharply angled at strengthened shoulder cord, convex below, with periphery just above adapical suture. Sculpture of broad rounded orthocline axial ribs,

equal in width to interspaced, forming horizontally elongated tubercles at shoulder (ten on last whorl), weakening on subsutural ramp towards adapical suture, strongly developed and elevated below shoulder. Spiral sculpture on subsutural ramp, three primary cords below shoulder, secondary cords intercalated from 3rd teleoconch whorl, separated by narrow interspaces. Last whorl with broad shallow-sloping subsutural ramp, angled at shoulder, convex and moderately inflated below, moderately constricted at base, bearing eight axial ribs, spiral sculpture obsolete mid-whorl. Long, slightly twisted siphonal fasciole, covered by numerous, oblique spiral cords of irregular strength. Aperture narrow, anal canal not preserved, siphonal canal very long, twisted. Columella weakly excavated, callus thin with spiral cords showing through.

Remarks: *Hemifusus* is represented by several species in the modern IWP-Region. The shells from the Seria Fm. are small for the genus, the largest specimen is incomplete but must have been about 6.5 cm in high, diameter 29.1 mm. In the smaller paratype the upper part of the outer lip is strengthened, suggesting this is an adult specimen. The Miocene species differs from *Hemifusus colosseus* (Lamarck, 1816) in the comparatively much broader shell and lower spire (see also Van Regteren Altena 1950). *Hemifusus ternatanus* (Gmelin, 1791) and *H. tuba* (Gmelin, 1791) differ by their spiny nodes along the shoulder, the broader spiral cords also present on the upper part of the whorl, the less marked axial ribs (especially on intermediate teleoconch whorls), their higher spire whorls and the lower sutural ramp angles (even in subadult specimens (e.g. Dharma 2005, pl. 123, fig. 7b). *Hemifusus carinifer* Habe & Kosuge, 1966 is overall quite similar to the Miocene species but can be distinguished based on the much stronger axial ribs on early spire whorls and the more angular carina on the shoulder. *Hemifusus elongatus* (Lamarck, 1822) is slender and lacks the prominent angulation on early spire whorls. *Hemifusus zhangyii* Kosuge, 2008 is also more slender and differs in its much steeper subsutural ramp. It is probable that *Pugilina* (*Hemifusus*) cf. *ternatanus* (Gmelin, 1791) reported by Nuttall (1961a) from the Miri Fm. in Brunei refers to this new species. A specimen of *Hemifusus* spec. reported by Martin (1931a/b) from the Seria Fm. outcrop Tutong 8 also refers to this species, but is missing from the RGM collection.

One damaged specimen from Ambug Hill (Plate 5, Figs. 19–21) may belong to the new species or may be a specimen of *Volegalea* Iredale, 1938. It has a broader outline, broader apical angle, lower elevation of spire whorls, low-angled sutural ramp, prominent subsutural spiral cords on the sutural ramp and sharper tubercles on the shoulder (best visible on the spire whorls). Nuttall (1961a) recorded a *Pugilina* spec. from the Seria Formation – all IWP species initially assigned to *Pugilina* Schumacher, 1817 are now considered to belong to the genus *Volegalea* (Vermeij & Raven, 2009).

Distribution: Only known from the middle and late Miocene of Brunei Darussalam.

Superfamily Muricoidea Rafinesque, 1815
Family Muricidae Rafinesque, 1815

Genus *Murex* Linnaeus 1758

Type species: *Murex tribulus* Linnaeus, 1758, subsequent designation by Montfort (1810). Recent, Indo-West Pacific.

Murex troscheli verbeeki Martin, 1895

(Plate 6, Figs 6–8)

1895 *Murex* (s. str.) *Verbeeki* spec. nov. Martin, p. 123, pl. 19, figs 278–281.
1969 Murex (Murex) troscheli verbeeki Martin – Shuto, p. 102, pl. 7, figs 4–5, pl. 8, fig. 12, text-figs 23–24.
2005 *Murex verbeeki* Martin, 1895 – Dharma, p. 334, pl. 132, figs 7a–d.
2009 Murex (Murex) troscheli verbeeki Martin, 1895 – Leloux & Wesselingh, p. 90, pl. 181, figs 5–15, pl. 182, figs 1–3 (cum syn.).
2011 *M.*[*urex*] (s.s.) *troscheli verbeeki* Martin, 1895 – Merle et al. p. 60.

Material: 1 specimen, height: 38.8 mm (without siphonal canal), width: 28.7 mm, NHMW 2016/0300/0001.

Description: Shell, medium sized, spire whorls convex with maximum diameter at abapical suture, sculpture consisting of low, wide-spaced axial ribs and three prominent varices. Later whorls angulated, coinciding with a prominent spiral cord accompanied by four weaker spiral cords on subsutural ramp and spiral cords on weakly convex whorl below shoulder. Axial sculpture becomes obsolete on last three whorls, aside from prominent varices. Last whorl subspherical with three primary spiral cords above base, slightly weaker secondary cord intercalated, two tertiary spirals in each interspace. Primary cords form very low, open spines on varices, much smaller spines appear on intersections with secondary cords, no spines formed by tertiary cords. Aperture and siphonal canal missing.

Remarks: Despite the poor preservation, the sculpture is well preserved and the short spines are not a

result of abrasion or fragmentation. No further specimens have been collected from the Seria Fm., but additional and better preserved specimens are available from the Miri and Sibuti formations in Sarawak. This taxon was treated as a subspecies of *Murex troscheli* Lischke, 1868 by Shuto (1969), which was followed by most subsequent authors (e.g. Leloux & Wesselingh 2009, Merle et al. 2011). *Murex troscheli troscheli* is characterized by its long and well developed spines and a weak angulation of the whorls. *Murex troscheli verbeeki*, in contrast, has always rather reduced or short spines and differs in its distinct shoulder. Therefore, its separation at least as chrono-subspecies seems to be justified.

Distribution: Early to middle Miocene of Sarawak, late Miocene of Brunei Darussalam, early Miocene, Pliocene and early Pleistocene of Java (Dharma 2005, Leloux & Wesselingh, 2009) and late Miocene and Pliocene of the Philippines (Shuto 1969).

Genus *Calotrophon* Hertlein & Strong, 1951
Subgenus *Panamurex* Woodring, 1959

Type species: *Murex* (*Phyllonotus*) *gatunensis* Brown & Pilsbry, 1911, original designation. Pliocene, Panama.

Calotrophon (*Panamurex*) sp.

(Plate 6, Figs 1–3)

Material: 1 specimen, height: 10.5 mm, width: 6.5 mm, NHMW 2016/0301/0001.

Description: Shell small, solid, squat with broad, low scalate spire. Protoconch and first teleoconch missing. Four angled teleoconch whorls preserved, with broad subsutural ramp, angled at shoulder, weakly convex below, with periphery just above abapical suture, separated by incised undulating suture. Spire whorls with nine broad, rounded, weakly opisthocline axial ribs, overrun by two prominent rounded spiral cords, adapical cord delimiting shoulder, placed mid-whorl, abapical cord placed short distance above suture. Single secondary spiral cord intercalated between primaries, additional weaker spirals developed on subsutural ramp on penultimate whorl. Fine axial growth lamellae most clearly developed on subsutural ramp make surface sculpture finely scabrous. Last whorl bearing broad subsutural ramp, roundly angled at shoulder, strongly convex below, rapidly and strongly constricted at base, sculpture of eight broad rounded axial ribs that persist onto base, overrun by five broad spiral cords, horizontally elongated swellings developed at intersections, most evident at shoulder. Siphonal fasciole broad, straight, delimited from base by three consecutive secondary cords in depression, bearing further five primary spirals with single secondary intercalated. Aperture small, ovate, outer lip strongly thickened by prominent labial varix, bearing seven elongated lirae with, anal canal not developed, siphonal relatively long, open straight, bent abaxially. Columella straight, moderately excavated in mid-portion, smooth except for two small denticles abapically. Columellar and parietal callus forming thin callus margin, not expanded.

Remarks: Extant *Calotrophon* (*Panamurex*) species are typically found in the western Atlantic (Merle et al. 2011). From the IWP Region, only *C.* (*P.*) *hemmenorum* (Houart & Mühlhäusser, 1990) was described from Somalia. It is distinguished from the Miocene species from Brunei by its larger size and higher spire. A second fossil IWP-species was described by Reich et al. (2014) from the Burdigalian of Java as *Calotrophon* (*Panamurex*) sp., it differs in its higher spire, longer spines along the shoulder and the distinctly narrower primary spiral cords.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Genus *Hexaplex* Perry, 1811

Type species: *Hexaplex foliacea* Perry, 1811, subsequent designation by Iredale (1915). Recent IWP.

Hexaplex sp.

(Plate 6, Figs 4–5)

Material: 2 specimens (R F5277), height: 53.2 mm, diameter: 65.5 mm (actual measure with preserved shell would give higher numbers).

Description: Large solid biconical shell, apical angle about 90°, preserved as internal cast with some remains of the original shell, both specimens overgrown by oysters. Slightly wider than high, 2.5 convex whorls preserved but impression of at least one earlier whorl visible. Last whorl with broad axial ribs, spiral sculpture of eight to nine broad, wavy primary cords with equally wide interspaces, both covered by secondary spiral cords. Knobby varices without spines.

Remarks: The preservation of these specimens is too poor for specific identification. The assignment to *Hexaplex* is based on the rounded shape and muricid sculpture with regularly placed varices. Size, sculpture and number of varices fits with *Hexaplex junghuhni* (Martin, 1879), which is common in the Miocene and Pliocene of Java (e.g. see Dharma 2005), but the specimens from Ambug Hill have no spines preserved. Such variation in sculpture is normal in the family and

the syntype RGM.9699a of *Hexaplex junghuhni* lacks spines as well. However, in *Hexaplex junghuhni* the spiral sculpture is not wavy. It is therefore likely the specimens from Ambug Hill represent an undescribed species.

Distribution: Only confirmed for the Tortonian of Brunei Darussalam.

Family Marginellidae Fleming, 1828

Genus *Prunum* Herrmannsen, 1852

Type species: *Voluta prunum* Gmelin, 1791, type by monotypy. Recent, Atlantic.

Prunum seriaense n. sp.

(Plate 6, Figs 18–24)

Material: 25 specimens.
Holotype: NHMW 2016/0302/0001, height: 8.6 mm, diameter: 4.3 mm (Plate 6, Figs 18–20).
Paratype: NHMW 2016/0302/0002, height: 8.5 mm, diameter: 4.3 mm (Plate 6, Figs 21–22).
Paratype: NHMW 2016/0302/0003, height: 8.7 mm, diameter: 4.2 mm (Plate 6, Figs 23–24).
Additional paratypes: 10 specimens from Ambug Hill, largest specimen: height: 10.2 mm, diameter: 4.7 mm (NHMW 2016/0302/0004), 2 specimens from Ambug Hill (GUBD), 2 damaged specimens from Ambug Hill (RGM.783421).
Additional material: 7 damaged specimens (R F5280) from Ambug Hill, 1 juvenile from Seria oil field well 16, 300–309 m depth, Miri or Seria Fm., leg. BPM (RGM.783337).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to the Seria Fm.

Diagnosis: Small *Prunum* species with moderately slender shell, elevated conical spire, last whorl roundly shouldered, slightly constricted mid-whorl, suture hardly callused, outer lip straight, moderate labial varix thickened mid-labrum, five prominent oblique columellar folds, moderately developed parietal pad.

Description: Shell small, solid, with elongate, subcylindrical last whorl and moderately high, conical spire. Spire whorls weakly convex, suture superficial, shallowly canaliculated, partially obscured by callus in fully adult specimens. Apex slightly deviated to right in apertural view. Last whorl roundly shouldered, smooth, glossy with distinct mid-whorl constriction close behind peristome. Outer lip bearing moderately thick, sharply delimited labial varix expanded adapically to mid-penultimate whorl, narrow incised anal notch, siphonal canal short, wide, open. Aperture narrow adapically, widening slightly in lower half, columella weakly excavated abapically with four stout, elongated, oblique columellar folds, fifth shorter weaker fold abapically. Columellar callus weakly thickened, expanded over base, in some specimens margin thickened forming radial ridge at outer end of the upper fold, parietal pad separated from columellar callus, moderately expanded, not extending abapically beyond point of insertion of outer lip.

Remarks: This species is highly reminiscent of the extant eastern Atlantic *Prunum olivaeformis* (Kiener, 1834), which differs in its larger size and the strongly callused suture. Several Marginellidae have been described from the Neogene of Indonesia by Martin (1879, 1884, 1906, 1921) and Beets (1941). Of these, three species are comparable in size and apertural features with the species from Brunei but differ from it in distinct conchological features: the early Miocene *Prunum angsananum* (Martin, 1921) has a much weaker shoulder and a higher and more acute spire and the late Miocene *Prunum tambacanum* (Martin, 1884) is distinctly more slender. The Pliocene *Prunum sangiranense* (Martin, 1906) has a lower spire and a slender outline (*Cryptospira sangiranensis* in Cossignani 2006, might represent another species and should be placed in *Prunum*). In all species, the sutures are sealed. Nuttall (1961a) lists *Cryptospira*? sp. nov. from the Seria Fm. but it is not clear which of the marginellids from the Seria Fm. he refers to.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Volutidae Rafinesque, 1815
Subfamily Amoriinae Gray, 1857

Genus *Cymbiola* Swainson, 1831

Type species: *Voluta cymbiola* Gmelin, 1791, type by absolute tautonymy. Recent, Indo-West Pacific.

Cymbiola ambugensis n. sp.

(Plate 7, Figs 1–11)

1961a *Voluta* (*Aulica*) *multiplicata* Pannekoek – Nuttall, p. 74 (non Voluta multiplicata Pannekoek, 1936).
1996 *Voluta multiplicata* Pannekoek – Nuttall in Sandal, fig. 4.6h (non *Voluta multiplicata* Pannekoek, 1936).
2008 *Athleta multispinosa* – Raven, p. 60, fig. 3 (non *Athleta* (*Volutospina*) *multispinosa* Newton, 1922).
2011 *Cymbiolum multiplicatum* – Raven in Wannier et al., pl. 4.5.4d, fig. 27 (non *Voluta multiplicata* Pannekoek, 1936).

Material: 15 specimens from Ambug Hill, 41 specimens from other outcrops.

Holotype: Subadult specimen: height: 62.9 mm, diameter: 34.5 mm, NHMW 2016/0303/0001 (Plate 7, Figs 5–7).
Paratypes: Ambug Hill, height: 25.2 mm, diameter: 15.4 mm (fragmentary specimen), NHMW 2016/0303/0002 (Plate 7, Fig. 8), broken adult, Beraya-Tusan seacliffs, km. 8.3 (3.55), Sarawak, Malaysia, Miri Fm., leg. Lee (RGM.1309469), height: 88.0 mm, juvenile, Beraya-Tusan seacliffs, km. 8.3 (3.60), Sarawak, Malaysia, Miri Fm. leg. R (RGM.1309467), height: 36.3 mm, diameter 23.6 mm (Plate 7, Figs 1–4, Wannier et al. 2011, pl. 4.5.4d, fig. 27), juvenile, Beraya-Tusan seacliffs, km. 8.3 (3.60), Sarawak, Malaysia, Miri Fm., leg. R (RGM.1309468), height: 17.6 mm, diameter 11.1 mm.
Additional material from Ambug Hill: 3 columellar fragments (NHMW 2016/0303/0003), 5 specimens (GUBD), 1 specimen and 4 fragments (R F5233).
Other occurrences: Tutong 8. Brunei, Seria Fm.: 1 specimen, leg. BPM (RGM.783445) (figured in Raven 2008, fig. 3), Beraya-Tusan seacliffs, Sarawak, Malaysia, Miri Fm.: km 11.4 (0.4) 1 juvenile (R F4731), km 11.2 (0.6) 1 fragment (R F4730), km 9.9 (2.0) 1 juvenile and 1 specimen (R F4735), km 9.5 (2.35) 1 specimen (R F4978), km 8.4 (3.45) 1 juvenile (R F4979), km 8.3 (3.55) 1 juvenile, 1 specimen and 1 fragment (R F4980), km 8.2 (3.60) 8 juveniles and 3 fragments (R F4062), km 8.2 (3.65) 1 juvenile (R F4981), outcrops along the Beraya-Bekenu road, Sarawak, Malaysia, Miri Fm.: km 27.6 right 1 juvenile (R F4465), 27.8 left 2 juveniles and 3 fragments (R F4496), km 28.4 left 1 juvenile (R F4314), km 28.4 right – not collected, km 28.5 left 3 juveniles and 3 fragments (R F4230), km 29.7 left – not collected, km 30.1 left 4 juveniles (R F4354), km 30.1 right not collected, Tanjung Batu, NW of Bekenu, Sarawak, Malaysia: 1 columellar fragment probably from the Miri Fm. (RGM.41673).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to Ambug Hill.

Diagnosis: *Cymbiola* species with low spire, conical last whorl with concave subsutural ramp, sculpture of irregular axial folds, some developed into hollow spines at shoulder, broad fasciole, columella with six to nine prominent columellar folds, upper three to five sub-horizontal, lower three to four oblique.
Description: Shell of medium size and thickness, with low, broad conical spire, apical angle 70°, conical last whorl. Protoconch low dome-shaped, composed of 3.5 smooth whorls with small nucleus (dp = 6.3–6.9 mm). Teleoconch of 2.5 whorls. First half teleoconch whorl low, convex. Abapically, whorls further depressed, rapidly develop very broad subsutural platform, shoulder at suture, short, open, wide-spaced spines developed at shoulder undulating impressed suture. Axial sculpture of irregular axial growth line and folds, most strongly developed below suture. Last whorl narrow conical, basal angle 30°, with concave subsutural platform, spinous shoulder, nine spines on last whorl, placed high, straight-sided below, hardly constricted at base, sculptured by very irregular axial folds, siphonal fasciole broad, concave in fully grown specimens. Aperture elongate, narrow, outer lip almost straight, outer lip strong and reflected, uppermost part curved backwards with very shallow adapical canal, siphonal canal relatively long, straight, open. Columella straight, with six to nine columellar folds, present from earliest growth stages, arranged in two groups: adapical group of three to five subhorizontal folds, narrow and weakly developed in some specimens, abapical group of three to four well-developed, thicker, strongly oblique folds. Lower two folds most prominent, continuing as ridge over fasciole. Under UV light colour pattern preserved of pale-yellow background covered by numerous dark purple triangles, yellowish spiral bands and spots on spines, aperture and columella dark yellow.
Remarks: The holotype represents a subadult specimen and most specimens are juveniles, often only comprising the protoconch and the first few tiny spines. A further columellar fragment suggests a size of up to ~110 mm in height for fully grown specimens. Most probably Nuttall (1961a) had this species at hand when he listed "*Voluta multiplicata*" from the Miri and Seria formations of Brunei. Beets (unpublished) recognized another specimen from the Seria Fm. and a fragment from the Miri Fm. in Sarawak as a new species, which he planned to describe as *Voluta* (*Voluta*) *bruneiana,* together with several other new Volutidae. The specimen he selected as future holotype was illustrated by Raven (2008, fig. 3). A juvenile specimen from the Miri Fm. was illustrated by Raven in Wannier et al. (2011, pl. 4.5.4d, fig. 27 (Plate 7, Figs 9–10 herein).

A closely similar species from the middle Miocene of Indonesia was illustrated by Dharma (2005, pl. 131, figs 6a–b) in open nomenclature as *Cymbiola* sp. This specimen might be conspecific with the shells from Brunei. Three *Cymbiola* species were described by Pannekoek (1936) from the early Miocene of Indonesia. Of these, *Cymbiola rembangensis* (Pannekoek, 1936) differs in its higher protoconch, *Cymbiola transverseplicata* (Pannekoek, 1936) has a lower spire, a broad last whorl and only four columellar plaits. *C. multiplicata* (Pannekoek, 1936) has ten columellar plaits which are less oblique and more crowded.

Cymbiola gedinganensis (Martin, 1895), from the Pliocene of Indonesia, is smooth and ovoid and

Cymbiola tjilonganensis (Martin, 1906) from the middle Miocene of Borneo and the late Miocene of Indonesia, differs also in its weak sculpture and fewer columellar plaits (4–5). *Cymbiola scapha ponderosa* (Martin, 1895) (= *Cymbiola nobilis* [Lightfoot, 1786]), from the Pliocene of Indonesia, is readily distinguished by its smooth shell and stout outline. *Cymbiola molengraaffi* (Cox, 1948), from the late Miocene (or Pliocene) of Borneo, differs in its pyriform outline, the broader fasciole and the much more prominent third columellar plait, which forms a marked ridge on the base. The elongate pyriform shape allows also a separation from *Cymbiola monocoronata* (Fischer, 1927) from the Pliocene of Timor. *Melo persolida* Beets, 1986, from the late Miocene of Borneo, is much larger, very robust, develops densely spaced spines and bears four columellar folds of equal strength (see Beets 1986a). The extant *Cymbiola cymbiola* (Gmelin, 1791) differs in its even more elongate last whorl, the lower spire, the less concave subsutural ramp and the low number of columellar plaits (4).

The colour pattern of the new species appears similar to that of *Cymbiola chrysostoma* (Swainson, 1824).

Distribution: Known from the middle and late Miocene of northern Sarawak and Brunei Darussalam.

Cymbiola tjilonganensis (Martin, 1906)

(Plate 7, Figs 12–14)

1906 *Voluta* (*Vespertilio*) *tjilonganensis* Martin, p. 302, pl. 44, fig. 718.

2009 *Cymbiola tjilonganensis* (Martin, 1906) – Leloux & Wesselingh, p. 187, pl. 177 figs 3–4.

Material: 2 specimens of which one is broken (R F5325, F5325/001), largest specimen: height 33.5 mm, diameter 17.6 mm.

Description: Small *Cymbiola* species, relatively low spire, elongate last whorl. Low, broad, smooth, dome-shaped protoconch of 2.8–3.0 whorls (dp = 7.6–8.4 mm). Teleoconch of two whorls, first whorl high, weakly convex with numerous axial wrinkles, forming short spines at sutures. Last whorl with strongly concave subsutural ramp, angled at shoulder, convex below, evenly constricted at base, bearing axial wrinkles at adapical suture, ten low trigonal spines along shoulder, smooth below, apart from marked growth lines. Base not sharply delimited, siphonal fasciole broad, concave in fully grown specimens, bearing two sharp elevated folds. Aperture elongate, outer lip thin, columella straight with five prominent columellar folds, becoming increasingly oblique abapically. Under UV light the shell displays a colour pattern consisting of small dark triangles.

Remarks: The holotype (from Java, RGM.8824) is very similar, except for the weaker sculpture on the penultimate whorl. This species is similar to the extant *Cymbiola verpertilio* (Linnaeus, 1758) but is narrower at its base and has a larger number of columellar folds.

Distribution: Late Miocene of Java (Martin, 1906) and Brunei Darussalam.

Family Mitridae Swainson, 1829

Genus *Ziba* H. Adams & A. Adams, 1853

Type species: *Mitra carinata* Swainson, 1824, subsequent designation by Wenz (1943). Recent, Indo-West Pacific.

Ziba waltercernohorskyi n. sp.

(Plate 7, Figs 15–18)

Material: 7 specimens of which one from Ambug Hill.

Holotype: NHMW 2016/0304/0001, height: 26.3 mm, diameter: 9.2 mm (Plate 7, Figs 15–16).

Paratypes: RGM.1309419, 4 specimens from Beraya-Bekenu road km 28.5 left, south of Miri, Sarawak, Miri Fm., leg. R, RGM.1309419a: largest specimen, height: 24.9 mm, diameter 8.4 mm (Plate 7, Figs 17–18).

Other material: 1 specimen Beraya-Bekenu road km 30.1 right, south of Miri, Sarawak, Miri Fm., leg. R (R F4431), 1 specimen from Beraya-Tusan seacliffs, km 8.4 (3.45), south of Miri, Sarawak, Miri Fm., leg. R (F5306).

Stratum typicum: Seria Fm.

Type locality: Ambug Hill, Brunei Darussalam.

Age: Late Miocene, Tortonian.

Name: In honour of Walter O. Cernohorsky for his invaluable contributions to malacology.

Diagnosis: Medium-sized *Ziba* species, with elongate fusiform shell, strongly raised primary spiral cords, single intercalated secondary, dense axial growth lamellae cutting secondary cord, forming fine reticulated pattern of beads and pits in interspaces between primary cords.

Description: Shell medium-sized, fusiform-biconic, with high spire, apical angle about 40°. Protoconch high conical, > 2 whorls, transition to teleoconch eroded. Teleoconch of six convex whorls with periphery just above abapical suture. Suture linear, impressed. Sculpture of four raised, rounded primary spiral cords, fifth just appearing above suture, single intercalated secondary, dense axial growth lamellae cutting secondary cord, forming fine reticulated pattern of beads and pits in interspaces between primary cords. Last whorl broadly convex, moderately constricted at base,

bearing 16 primary spirals, secondary spiral slightly closer to preceding primary, siphonal fasciole poorly delimited from base. Aperture elongate, narrow, outer lip not thickened, edge corrugated by spiral sculpture, anal canal poorly delimited notch, siphonal canal relatively short, slightly twisted. Columella with three prominent oblique columellar folds, weakening abapically, fourth weaker fold delimits transition into siphonal canal.

Remarks: The extant Mitridae were revised in detail by Cernohorsky (1976, 1991), who discussed also some fossil species. Two species from the early Miocene of Java are reminiscent of *Ziba waltercernohorskyi*. Of these, *Ziba sokkohensis* (Martin, 1916) differs in its regular spiral sculpture, which lacks the intercalations of a beaded secondary spiral cord. Moreover, most specimens have a broader last whorl (see Leloux & Wesselingh 2009). *Ziba sucabumiana* (Martin, 1906) has secondary spiral cords but these are broader and consequently the interspaces reduced to narrow grooves and its spire is higher. Both Javanese fossil species were assigned to the genus *Vexillum* by Leloux & Wesselingh (2009) but obviously should be placed in *Ziba* (Cernohorsky, 1991). The Pliocene *Ziba fijiensis* (Ladd, 1934), from Fiji, is another morphologically closely related species, which differs from *Ziba waltercernohorskyi* in the more slender outline, the less convex spire whorls, the narrower, sharper, spiral cords, the concave interspaces between the primary spirals and the secondary spiral that never quite develops into a raised cord, the axial growth lines finely beading the secondary cord and interspaces. *Nebularia sowerbyi* (D'Orbigny, 1852), from the early Miocene of India, is broader and has much wider spiral cords (see Cernohorsky 1976, Harzhauser 2014). The same features distinguish the Miocene *Nebularia molengraaffi* (Martin, 1916) from *Ziba waltercernohorskyi* (*Mitra mitrai* Beets, 1941 is a junior synonym of *Nebularia molengraaffi* according to Cernohorsky 1976).

Distribution: Only known from the middle Miocene of Sarawak and late Miocene of Brunei Darussalam.

Ziba fijiensis (Ladd, 1934)

(Plate 7, Figs 19–20)

1934a *Mitra* (*Tiara*) *fijiensis* Ladd, p. 227, pl. 40, fig. 7.
1941 *Mitra* (*Cancilla*) *menkrawitensis* Beets, p. 116, pl. 6, figs 239–240.

Material: 3 specimens (R F5307), largest specimen height: 18.7 mm, diameter: 6.3 mm.

Description: Shell small, fusiform-biconic, slender with high spire, apical angle almost 40°. Protoconch high conical, abraded in all Ambug Hill specimens, transition to teleoconch not preserved. Spire whorls slightly convex, with maximum diameter above the mid-whorl, no shoulder. Sculpture on early spire whorls consisting of four sharp, raised spiral cords, separated by relatively broad interspaces. Interspaces comprise two spiral grooves separating flat middle band from sloping outer bands whilst numerous axial grooves create a cancellate pattern. Last whorl weakly convex, with 11–13 primary spiral cords, hardly constricted at base, siphonal fasciole indistinct, siphonal canal short. Columella with three prominent columellar folds, several weaker folds mark transition into siphonal canal. Spirals appear as narrow bright yellow lines under UV light, aperture is dark yellow.

Remarks: This species is present in the early-middle Miocene Sibuti Fm. and is frequent in the middle Miocene Miri Fm. of Sarawak. *Mitra* (*Cancilla*) cf. *flammea* Quoy from the Miri Fm. in Brunei, mentioned by Nuttall (1961a) might represent this species. Based on the material from Sarawak it is clear, that this species is quite variable in either having just three flat bands separated by grooves between the primary spiral cords or the middle band developing into a beaded secondary spiral. The slender outline and lack of a shoulder separate it from *Ziba flammea* (Quoy & Gaimard, 1833) and the very similar *Ziba sokkohensis* (Martin, 1916).

Distribution: Miocene of Sarawak, Brunei Darussalam, Miocene of Kalimantan (Beets 1941), Pliocene of Fiji.

Superfamily Olivoidea Latreille, 1825
Family Ancillariidae Swainson, 1840

Genus *Amalda* H. Adams & A. Adams, 1853

Type species: *Ancillaria tankervillii* Swainson, 1825, subsequent designation by Cossmann (1899). Recent, Caribbean Sea.

Amalda bruneiana n. sp.

(Plate 6, Figs 9–14)

Material: 37 specimens.
Holotype: NHMW 2016/0305/0001, height: 9.2 mm, diameter: 4.1 mm (Plate 6, Figs 9–10).
Paratype: NHMW 2016/0305/0002, height: 12.0 mm, diameter: 5.0 mm (Plate 6, Figs 11–12).
Paratype: NHMW 2016/0305/0003, height: 9.6 mm, diameter: 4.1 mm (Plate 6, Figs 23–14).
Paratype: NHMW 2016/0305/0004, height: 8.8 mm, diameter: 4.0 mm.

Additional paratypes: from Ambug Hill 7 specimens (GUBD), 5 specimens from Seria Fm. outcrop Tutong 6A, leg. BPM (RGM.783393), 1 specimen from Seria Fm. outcrop Tutong 5, leg. BPM (RGM.783.372).
Additional material: 20 specimens from Ambug Hill (R F5254), largest specimen height: 13.2 mm, diameter: 5.5 mm.
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to Brunei Darussalam.

Diagnosis: Small, elongate-ovate *Amalda* with mammillate apex, slightly asymmetrical, cyrtoconoid spire, low aperture with broad rounded anal canal, on last whorl broad band wide, ancillid band narrow, posterior fasciolar band wider than ancillid band, adjoined by narrow deep posterior fasciolar groove.
Description: Small, elongate-ovate shell with conspicuously mammillate apex, elongate cyrtoconoid spire of somewhat asymmetrical outline. Protoconch consisting of 1.8 whorls, first whorl low dome-shaped, second whorl high, weakly convex (dp = 700 μm). Suture of first teleoconch whorl weakly incised, later obscured by callus. Spire smooth with thin spire callus. Transition from spire to last whorl marked by faint concavity representing suture. Last whorl evenly convex, periphery slightly below mid-whorl, broad band wide, attaining about 30 % of shell height, ancillid band narrow, weakly depressed. Posterior fasciolar band wider than ancillid band, adjoined by narrow posterior fasciolar groove. Anterior fasciolar band broad, strongly widening adjoined by very deep and broad anterior fasciolar groove. Columellar pillar twisted with two prominent plaits. Aperture moderately narrow and low, attaining about half of the shell height, anal canal bluntly rounded, poorly delimited, siphonal canal short, deeply incised, wide. Inner lip thin, narrow, sharply delimited from base. (Terminology follows Landau & Marques da Silva 2006).
Remarks: This species is characterized by its peculiar mammillate and slightly asymmetrical spire**.** From the Indonesian Neogene, only *Amalda javana* (Martin, 1879) is reminiscent of this species. *Amalda javana* was originally based on a single fragmentary specimen from the late Miocene of Java (see Leloux & Wesselingh 2009, pl. 170, figs 13–14). Later, Martin (1906) described a complete specimen of this species and compared it with the extant *Amalda mucronata* (Sowerby, 1830). The Javanese species agrees with *Amalda bruneiana* in its mammillate apex and general outline but is larger (18–22 mm in height), has a distinctly constricted base, a longer siphonal canal and a broader ancillid band. *Amalda stupaeformis* (Beets, 1942), from the Late Miocene (or Pliocene) of Buton, differs in its stout cyrtoconoid spire and the higher and acute aperture.

Among the recent *Amalda* species with mammillate apex, *Amalda utopica* Ninomiya, 1987 and *Amalda mucronata* (Sowerby, 1830) differ in their broader outlines, larger size and higher and/or broader apertures. *Amalda montrouzieri* (Souverbie, 1860) is also comparable on shape and especially in the callused posterior part of the aperture, but is more slender, larger and lacks the deep fasciolar groove.
Distribution: Only known from the Tortonian of Brunei Darussalam.

Amalda sp.

(Plate 6, Figs 15–17)

Material: 2 specimens of which one is a fragment (R F5260), height: 11.8 mm (with apex restored about 12.4 mm), diameter: 4.7 mm.

Description: Shell small, elongate with pointed apex, elongate spire. Protoconch consisting of one low whorl. Suture of first teleoconch whorl weakly incised, later obscured by callus. Spire tall, smooth with straight sides. Last whorl evenly convex, with periphery below mid-whorl, broad band wide, slightly less than 30 % of shell height, ancillid band narrow, weakly depressed, separated from broad band by narrow ancillid groove. Posterior fasciolar band slightly wider than ancillid band, adjoined by narrow posterior fasciolar groove. Anterior fasciolar band broad, strongly widening adjoined by broad anterior fasciolar groove. Columellar pillar narrow and twisted with four plaits, weakening abapically. Aperture moderately narrow and about 40 % of the shell height. Posterior part of aperture bluntly rounded poorly defined anal canal. Siphonal canal short, deeply incised, wide. Columella weakly excavated mid-whorl. Columellar callus thin, narrow, sharply delimited.
Remarks: Based on its pointed, non-mammillate apex, this species can easily be differentiated from *A. bruneiana*. *Amalda allani* (Olson, 1956), from the Eocene of New Zealand, is superficially similar but differs in its less oblique ancillid band and narrower siphonal canal (see Michaux 1991).
Distribution: Only known from the Tortonian of Brunei Darussalam.

Superfamily Conoidea Fleming, 1822
Family Borsoniidae Bellardi, 1875

Genus *Tomopleura* Casey, 1904

Type species: *Pleurotoma nivea* Philippi, 1851, original designation. Recent, Indo-Pacific.

Tomopleura furcata n. sp.

(Plate 8, Figs 2–3)

Holotype: RGM.1309429, height: 13.6 mm, diameter: 9.3 mm.
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to the broad groove between carina and suture.

Diagnosis: Medium-sized *Tomopleura* species, with relatively broad fusiform shell, bifid subsutural spiral cord, five additional spiral cords on spire whorls, middle one most prominent forming periphery, prominent, crowded lamellar growth lines visible only in interspaces form dense, reticulate pattern, siphonal canal relatively short, notched.

Description: Shell medium-sized, relatively broad, fusiform, conical spire, apical angle around 35°. Protoconch missing. Teleoconch of seven whorls, spire whorls with bifid subsutural spiral cord, below shell concave with two narrow, faintly beaded spiral cords, prominent spiral cord mid-whorl, forming periphery, two weaker cords below. Prominent, crowded lamellar growth lines visible only in interspaces form dense, reticulate pattern, strongly prosocline in interspaces above periphery, weakly opisthocline to orthocline below. Last whorl evenly convex, weakly shouldered at peripheral cord, bearing six further cords on base with single secondary in interspaces. Aperture moderately narrow, outer lip damaged, five sharp lirae within, anal sinus asymmetric U-shaped, with apex on lower half of subsutural ramp. Siphonal canal moderately short, notched at tip, Columella sharply excavated below upper third, abapically swollen, strongly twisted. Columellar callus forming depressed smooth area on venter, parietal callus not developed.

Remarks: The extant species *Tomopleura coffea* (Thiele, 1925) is more slender, has straight sides and lacks a strong subsutural cord. The extant *T. vertebrata* (Smith, 1875) has a very similar arrangement of spiral cords, but is larger, more slender and has a single spiral ridge inside the aperture. Nuttall (1961) reports *Asthenotoma* spec. from the Seria Fm., which may well refer to this species.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Turridae H. Adams & A. Adams, 1853 (1838)

Genus *Unedogemmula* MacNeil, 1961

Type species: *Pleurotoma unedo* Kiener, 1839, original designation. Recent, Indian Ocean.

Unedogemmula nuttalli n. sp.

(Plate 8, Figs 4–8)

Material: 2 specimens.
Holotype: RGM.1309460, Seria oil field well 1 1330–1340 m depth height 20.1 mm, diameter 7.9 mm, leg. BPM (Plate 8, Figs 4–6).
Paratype: NHMW 2016/0306/0001, height: 20.7 mm, diameter: 8.1 mm, Ambug Hill (Plate 8, Figs 7–8).
Stratum typicum: Seria Fm.
Type locality: Seria oil field well 1 1130–1340 m, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: In honour of Clive Patrick Nuttall who was a pioneer in the study of Neogene molluscs from Brunei Darussalam and who correctly identified the paratype as representative of the genus *Unedogemmula*.

Diagnosis: Medium-sized *Unedogemmula* with wide apical angle, beaded bifid cord just below mid-whorl on early spire whorls, later whorls with bifid subsutural band and bifid cord placed slightly below mid-whorl forming periphery, three and two spiral threads in concave spaces above and below bifid mid-whorl cord, siphonal canal moderately long, straight, last whorl and base covered by numerous sharp spiral cords.

Description: Medium-sized, fusiform shell, broad conical spire, apical angle around 40°. Protoconch high conical comprising 2.5 convex whorls (dp = 0.9 mm, hp = 1.1 mm) with closely spaced riblets, initially opisthocline, later part opisthocyrt. Teleoconch of seven whorls separated by weakly impressed suture. Early whorls low, with prominent subsutural cord and bifid beaded cord just below mid-whorl. Abapically, subsutural cord becomes bifid and further raised, beads on bifid mid-whorl cord weaken, smooth by third teleoconch whorl, irregular secondary spiral threads develop, three between subsutural and mid-whorl bifid cords, one increasing to three on penultimate whorl, below. Whorl profile concave above and below mid-whorl bifid cord. Last whorl with narrow concave subsutural ramp, weakly angled at bifid shoulder cord, inflated and convex below, strongly constricted at base, base weakly concave, bearing weaker spiral cords. Siphonal canal straight, long, terminal

part broken off in both specimens, bearing spiral cords of similar strength to mid-whorl. Aperture ovate, outer lip damaged, anal sinus deeply U-shaped with apex placed at lower of two subsutural cords.

Remarks: The generic assignment follows Powell (1964) who emphasized that the gemmate keel on early spire whorls separates *Unedogemmula* from *Lophiotoma*. Only a small number of species placed in *Unedogemmula* are described so far from the IWP Neogene, e.g. *Unedogemmula koolhoveni* (Oostingh, 1938), *U. sondeiana* (Martin, 1895) and *U. bemmeleni* (Oostingh, 1941) from the Pliocene of Java. The species from Brunei Darussalam differs from all these species and others as revised by Powell (1964) in its comparatively broad outline and the regular spiral cords on the last whorl. The new species also can be distinguished by its shorter siphonal canal, corroborated based on growth lines on the holotype. Nuttall reviewed the specimen from the Seria oil field and correctly noted: "genus *Unedogemmula* note gemmules on early whorls".

Distribution: Only known from the Tortonian of Brunei Darussalam.

Genus *Gemmula* Weinkauff, 1875

Type species: *Pleurotoma gemmata* Hinds, 1843 (= *Gemmula hindsiana* Berry, 1958), subsequent designation by Cossmann (1896). Recent, Eastern Pacific.

Gemmula sculpturata n. sp.

(Plate 8, Figs 9–12)

1961a *Turris coronifera* (Martin non Bellardi) – Nuttall, p. 73 (non *Turris coronifera* Martin, 1879)

1996 *Gemmula imitatrix* (Martin) – Nuttall in Sandal, fig. 4.6f.

Material: 38 specimens.

Holotype: NHMW 2016/0307/0001, height: 19.2 mm, diameter: 7.0 mm (Plate 8, Figs 9–10).

Paratype: NHMW 2016/0307/0002, height: 18.7 mm, diameter: 6.5 mm (Plate 8, Figs 11–12).

Additional paratypes: 10 specimens from Ambug Hill (NHMW 2016/0307/0003), 6 specimens from Ambug Hill (RGM.1309471), 3 specimens from Seria Fm. outcrop Tutong 6A, leg. BPM (RGM.783395).

Further material: 17 specimens from Ambug Hill (R F5279).

Stratum typicum: Seria Fm.

Type locality: Ambug Hill, Brunei Darussalam.

Age: Late Miocene, Tortonian.

Name: Referring to the prominent spiral sculpture of the shell.

Diagnosis: Small *Gemmula* species, strongly sculptured, strongly raised subsutural cord, prominent bifid, gemmate mid-whorl carina, two weaker equal primary cords below, irregular secondary spiral sculpture, whorl profile concave either side of mid-whorl carina, siphonal fasciole long, straight, slightly bent to left.

Description: Small, fusiform shell, with tall conical spire, apical angle c. 35°. Protoconch multispiral, high conical (surface eroded in all specimens). Teleoconch of seven biconcave whorls, angled by prominent mid-whorl carina that forms periphery. Suture linear, impressed. First teleoconch whorl with distinct subsutural cord, elevated, gemmate mid-whorl carina, weaker suprasutural cord. Mid-whorl carina bifid 2nd to 3rd teleoconch whorl, increasingly elevated abapically, bearing 20–23 elongate gemmules. Abapically, single narrow cord develops between suture and elevated subsutural cord, 3–4 secondary thread appear below to mid-whorl carina, two equal cords, intermediate in strength, below to suture. Last whorl short, with strongly concave subsutural ramp, angled a bifid shoulder cord, convex below, strongly constricted at base, base delimited by slightly stronger peribasal cord, about sic further cords weakening medially. Siphonal fasciole again delimited by stronger cord, straight, slightly bent to left, bearing close-set, subequal spiral cords. Aperture small, ovate, outer lip simple, edge damaged in all specimens, anal sinus symmetrically U-shaped, deep, with apex on mid-whorl carina. Colour pattern of dark yellow on carina and spiral cords under UV light.

Remarks: This species is among the most common species at Ambug Hill and displays little variability in size and sculpture, suggesting that the specimens attained only about 22 mm in height as adult specimens. Its overall sculpture indicates a relation to *Gemmula speciosa* (Reeve, 1843a) and allied species. This small size distinguishes the Miocene fossil from the much larger Pliocene to Recent *Gemmula speciosa* (Reeve, 1843a) and *G. kieneri* (Doumet, 1840), as revised by Powell (1964). Similarly, *Gemmula woodwardi* (Martin, 1884), from the Pliocene of Java (which could be a synonym of *kieneri* – see Powell 1964), is much larger, the gemmate keel is broader and the gemmules stand out more from the keel. The syntypes of that species also comprise other taxa, but none resemble *G. sculpturata*. *Gemmula karangensis* (Martin, 1895), from the Miocene of Java, is of similar size but has a more slender spire (30°) and the gemmate keel consists of two undulating spiral bands without connecting gemmules. *G. karangensis* sensu Tesch (1915), from the Pliocene of Timor, is much larger

and has a higher and steeper sutural ramp. Nuttall (1961a) most probably had this species at hand when he listed *Turris coronifera* (Martin) from the Seria Fm. in Brunei. This Miocene Javanese species, however, is larger, more slender and its bifid gemmules are axially elongated.

Nuttall in Sandal (1996, fig. 4.6f) figured a specimen from the Penanjong beach outcrop as *Gemmula imitatrix* (Martin). The syntypes of that species (RGM.7851–7859) include more than one species as can be seen from a comparison of the specimens illustrated in Leloux & Wesselingh 2009 (pl. 120, figs. 4–14, pl. 121, figs. 1–2), but not all syntypes have been listed (lots RGM.7854 and 7855 were overlooked) or figured. Jon Todd (Natural History Museum, London) was the first to observe that the syntypes represent more than one species, as is reflected in his notes with the lots of the various syntypes. The specimen figured in the original description (Martin 1916, pl. 1, fig. 13, RGM.7851a, Leloux & Wesselingh 2009, pl. 121, figs. 1–2) has a similar sculpture to *G. sculpturata* but is slightly larger (height 22.6 mm) and much more slender (apical angle 25°, diameter 7.3 mm) whilst having four prominent primary spiral cords below the carina vs. three in *G. sculpturata* (both species have another strong spiral cord below, but with a wider interspace). The other specimen from the same lot (RGM.7851) has the protoconch preserved, the last whorl of which is swollen and has axial riblets. Remnants of the original colour pattern are also preserved, consisting of rows of yellow dots on the spiral cords, most notable on the subsutural cord.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Gemmula sp.

(Plate 8, Fig. 1)

Material: 1 specimen, height: 14.0 mm, diameter: 5.1 mm, R F5326.

Description: Broken specimen missing lower half of shell, small, fusiform, with tall conical spire, apical angle c. 30°. Protoconch poorly preserved, multispiral, high conical. Teleoconch of 7.5 biconcave whorls, angled by prominent mid-whorl carina forming periphery. Suture linear, impressed. First teleoconch whorl with distinct subsutural cord, mid-whorl axially elongated knobs develop into prominent, gemmate carina bearing about 20 elongate gemmules. Abapically, elevated subsutural cord strengthens and migrates a short distance below suture, 3-4 secondary thread appear below to mid-whorl carina, two cords, intermediate in strength, below to suture, cord just below mid-whorl strongest. Elevated growth lines equal in strength to secondary cords form fine reticulated pattern above and below mid-whorl carina, most strongly developed on subsutural ramp. Last whorl short, with steep concave subsutural ramp, angled a bifid shoulder cord, convex below, base not preserved, but delimited by slightly stronger peribasal cord. Anal sinus symmetrically U-shaped, deep, with apex on mid-whorl carina.

Remarks: Although the sculptural elements are similar to those of *Gemmula sculpturata* nov. sp., *Gemmula* sp. is more slender, resulting in a steeper subsutural ramp, the gemmules are more prominent and wider spaced, and in the mid (3rd to 5th) teleoconch whorls the gemmate keel is more prominent. The axial growth lines are more strongly developed in *Gemmula* sp., forming a reticulated pattern especially evident over the subsutural ramp, this is not clearly developed in *Gemmula sculpturata* nov. sp. *Gemmula karangensis* (Martin, 1895) and *G. woodwardi* (Martin, 1884), from the Miocene of Java, both have a broader spire and deeper subsutural concavity.

Distribution: Known from the Tortonian of Brunei Darussalam.

Family Drilliidae Olsson, 1964

Genus *Clathrodrillia* Dall, 1918

Type species: *Murex gibbosus* Born, 1778, by original designation. Recent, Western Atlantic.

Clathrodrillia *kutaiana* Beets, 1985

(Plate 9, Figs 13–14)

1985a *Clathrodrillia kutaiana* spec. nov. Beets, p. 22, pl. 1, figs 14–15.

Material: 2 specimens, height: 17.9 mm, diameter: 7.1 mm (NHMW 2016/0308/0001), height, 15.0 mm, diameter, 5.5 mm (R F5295).

Description: Shell slender fusiform, of c. seven teleoconch whorls separated by weakly undulating suture, apical angle of 35°. Protoconch multispiral comprising c. 3 smooth whorls. Spire whorls with steep concave subsutural ramp that broadens abapically, roundly angled at shoulder, convex below, with periphery below mid-whorl. Sculpture consisting of wide-spaced, slightly opisthocline, rounded axial ribs, weakening over subsutural ramp towards adapical suture, strongest below shoulder, crossed by weak primary and secondary spiral cords, subsutural ramp with three wavy secondary cords, three primaries below

shoulder, slightly strengthened over ribs, with single secondary in interspaces. Single mid-strength wavy subsutural cord appears on later whorls. Last whorl with broad, steep concave subsutural ramp, roundly angled at shoulder, weakly convex below, moderately constricted at base, bearing eight axial ribs that persist, albeit narrowing over base, siphonal fasciole moderately long, straight, bearing spiral cords of alternate strength. Aperture ovate-elongate, outer lip damaged, anal sinus wide, deep U-shaped with apex mid-subsutural ramp. Columella weakly excavated just above mid-aperture, straight below. Columellar and parietal callus narrow, sharply delimited forming narrow callus edge.

Remarks: The specimens agree well with *Clathrodrillia kutaiana* Beets, 1985, from Kalimantan in Borneo, in size and sculpture. The Pliocene Indonesian *Clathrodrillia bantamensis* (Martin, 1895) and *C. losariensis* (Martin, 1895) are distinctly larger and more slender.

Distribution: Known from the Tortonian of Brunei Darussalam and the late Miocene of Kalimantan in Borneo (Beets 1985a).

Clathrodrillia sp. 1

(Plate 9, Fig. 12)

Material: 1 fragmentary specimen, height: 15.7 mm, diameter: 5.2 mm (NHMW 2016/0309/0001).

Description: Shell small, slender fusiform, apical angle of 35°, protoconch not preserved. Six teleoconch whorls preserved, spire whorls with steep weakly concave subsutural ramp that broadens abapically, indistinctly angled at shoulder, convex below, with periphery below mid-whorl. Axial sculpture consisting of wide-spaced, opisthocline, narrow, continuous ribs, subobsolete over subsutural ramp. Spiral sculpture of weak subsutural cord and five weak narrow primary cords below shoulder that overrun axials. Last whorl elongate with steep concave subsutural ramp, weakly rounded at shoulder, weakly convex below, moderately constricted at base, bearing axials that weaken and narrow over base, widely spaced spiral cords, base delimited by slightly strengthened peribasal cord, siphonal fasciole long, straight, bearing spiral cords. Aperture and lip not preserved, anal sinus wide, shallow U-shaped with apex mid-subsutural ramp. Columella weakly excavated mid-aperture, straight below. Columellar and parietal callus narrow, sharply delimited forming narrow callus edge.

Remarks: Despite the poor preservation (dorsal side is strongly abraded), the characteristic sculpture of axial ribs, which are continuous vertically along the length of the spire, is well preserved. The Pliocene Indonesian *Clathrodrillia losariensis* (Martin, 1895) is superficially similar but has distinctly more convex spire whorls. We are not aware of any other species with such sculpture.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Clathrodrillia sp. 2

(Plate 9, Figs 15–16)

Material: 3 specimens, 1 specimen height: 10.8 mm, diameter: 4.3 mm (NHMW 2016/0310/0001), 2 damaged specimens, height largest specimen: 13.4 mm (R F5297).

Description: Shell small, stout, fusiform, with broad spire, apical angle c. 40°. Multispiral protoconch high, turreted, with weakly convex whorls, surface strongly abraded. Teleoconch consisting of five whorls with moderately narrow, strongly concave subsutural ramp, roundly angled at shoulder, weakly convex below, with periphery below mid-whorl on early whorls, migrating adapically on later whorls. Suture deeply impressed, weakly undulating. Axial sculpture consisting of broad, orthocline axial ribs, 12 on penultimate whorl, equal in width to their interspaces, weakening to subobsolete over subsutural ramp. Spiral sculpture consisting of five narrow cords, delicate secondary intercalated in interspaces, poorly defined subsutural band immediately below suture accentuates suture. Last whorl moderately inflated, with narrow concave subsutural ramp, roundly angled at high-placed shoulder, strongly convex below, evenly constricted at base, sculpture of ten axial ribs narrowing and weakening over base, overrun by narrow, wide-spaced spiral cords with secondary in interspaces, base and siphonal fasciole not sharply delimited, siphonal fasciole moderately short, straight, with similar spiral sculpture to base. Aperture narrow-elongate, outer lip simple, anal sinus shallow, appressed to suture. Columella moderately excavated below upper third, straight below, slightly twisted. Columellar and parietal callus thickened, sharply delimited forming moderate callus band, small parietal pad.

Remarks: *Agladrillia nakazaensis* MacNeil, 1961, from the late Miocene or Pliocene of Okinawa, is similar but is more slender.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Superfamily Pseudomelatomidae Morrison, 1966

Genus *Crassispira* Swainson, 1840

Type species: *Pleurotoma bottae* Valenciennes in Kiener, 1839, subsequent designation by Herrmannsen (1847). Recent, Eastern Pacific.

Crassispira molengraaffi (Martin, 1916)

(Plate 8, Figs 13–14)

1916 *Drillia* (*s. str.*) *Molengraaffi* – Martin, p. 230, pl. 1, fig. 14.
1931 *Drillia molengraaffi* Martin – Van der Vlerk, p. 217.
1936 *Drillia molengraaffi* Martin – Pannekoek, p. 23.
1969 *Inquisitor (Inquisitor) molengraaffi* (Martin) – Shuto, p. 198.
2009 *Crassispira molengraaffi* (Martin, 1916) – Leloux & Wesselingh p. 64, pl. 128, figs 12–13.

Material: 1 specimen, height: 22.2 mm, diameter: 8.4 mm (R F5281).

Description: Shell medium sized, fusiform, solid, apical angle c. 35°. Protoconch missing and surface of first whorls of teleoconch abraded. Teleoconch composed of 7 or 8 whorls with narrow concave subsutural ramp, convex below, separated by weakly impressed undulating suture. Axial sculpture of very broad, orthocline ribs, seven on penultimate whorl, weakening on subsutural ramp towards suture. Spiral sculpture of elevated, sharp, undulating subsutural cord and four narrow, rounded cords placed below ramp, abapical cord slightly weaker, second cord forming shoulder, separated by narrow interspaces. Last whorl ovoid, with broad-based, sharp-edged, subsutural cord taking up almost the whole subsutural ramp, round shouldered at periphery, weakly convex below, hardly constricted at base, seven broad ribs, equal in width to interspaces, weakening and obsolete over base, overrun by 12 narrow spirals with single secondary thread in some interspaces on base. Siphonal fasciole short, not sharply delimited, slightly twisted. Aperture narrow ovate, outer lip damaged, smooth within, anal sinus asymmetrically U-shaped with apex immediately below subsutural cord, siphonal canal short, open narrow. Columella strongly excavated in upper third, straight and smooth below. Columellar and parietal callus strongly thickened, sharp-edged. Aperture dark yellow under UV light.

Remarks: The species was described based on a single specimen (height 15.7 mm, diameter 5.9 mm, about 9 whorls) from the lower Miocene near Kembang Sokkoh (Java, Indonesia RGM.7920). It is closely similar to the specimen from Ambug Hill. A further specimen is known from the middle Miocene Miri Fm. of Sarawak. For comparison see under next species.

Distribution: Early Miocene of Indonesia and late Miocene of the Philippines (Leloux & Wesselingh 2009), middle Miocene of Sarawak and late Miocene of Brunei Darussalam.

Crassispira strangulata n. sp.

(Plate 9, Figs 7–10)

Material: 4 specimens.
Holotype: NHMW 2016/0311/0001, height: 10.0 mm, diameter: 3.7 mm (Plate 9, Figs 7–8).
Paratypes: NHMW 2016/0311/0002, height: 9.7 mm, diameter: 4.1 mm (Plate 9, Figs 9–10), RGM.1309461, height: 8.8 mm, diameter: 3.7 mm.
Other material: 2 additional specimens (R F5296).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to the strangulated outline of the whorls due to the deeply concave subsutural area.

Diagnosis: Small *Crassispira* species with stout fusiform shell, multispiral dome-shaped protoconch, sculpture of nine broad, rounded axial ribs, strongly developed subsutural cord, narrow, concave subsutural ramp, weak spiral sculpture below, last whorl short with moderately long twisted siphonal canal.

Description: Shell small, stout fusiform, solid, apical angle c. 36–38°. Protoconch multispiral, dome-shaped, comprising three smooth whorls, first post-nuclear whorl strongly convex, bulbous, second protoconch whorl high, weakly convex. Teleoconch composed of six whorls with narrow, strongly concave subsutural ramp, convex below, separated by weakly impressed undulating suture. Axial sculpture of very broad, orthocline ribs, eight on penultimate whorl, most strongly developed at shoulder, obsolete, or almost so, on subsutural ramp. Spiral sculpture of elevated, rounded, undulating subsutural cord, strengthening further abapically, and three weak, narrow, rounded cords placed below ramp, separated by broad interspaces. Last whorl squat, with broad-based, round-edged, subsutural cord, narrow, strongly concave subsutural ramp, shoulder rounded, placed high, whorl periphery convex below, moderately constricted at base, nine broad ribs, slightly narrower than interspaces, weakening and obsolete over base, overrun by 9–10 weak, narrow spirals. Siphonal fasciole moderately long, not sharply delimited, slightly twisted. Aperture narrow ovate, outer lip slightly reinforced,

smooth within, anal sinus symmetrically U-shaped with apex mid subsutural cord, siphonal canal moderately long, open, narrow. Columella strongly excavated in upper third, straight and smooth below. Columellar and parietal callus thickened, sharp-edged, moderate parietal pad.

Remarks: This species is reminiscent of the European Miocene *Crassispira pustulata* (Brocchi, 1814) in its blunt sculpture, which differs from the herein described species in its much larger size, conical last whorl and less protruding axial ribs (see Landau et al. 2013). Biogeographically, a relation with Neogene IWP species is more likely. Of these, only *Crassispira ferenuda* (Cossmann, 1900), from the Pliocene of Karaikal in S-India, develops comparably inflated axial ribs and attains the same height, but differs in the overall more slender shape and the even more nodelike axial ribs. *Crassispira molengraaffi* (Martin, 1916) is morphologically also somewhat comparable but differs in its much larger size, more slender outline, higher last whorl, prominent spiral cords and the less compressed appearance of the spire whorls. The late Miocene *Crassispira tjemoroensis* (Martin, 1906) is much more slender and has a longer siphonal canal. *Crassispira dammermani* (Oostingh, 1938), from the Pliocene of Timor, has considerably less swollen axial ribs, a shallow subsutural concavity and a well-developed siphonal fasciole. *Crassispira macneili* Ladd, 1982, from the Pliocene of Fiji, is much larger, very slender and the subsutural concavity comparatively narrow and shallow. The extant *Crassispira pulchrepunctata* Stahlschmidt & Bozzetti, 2007, from the Philippines, is also a relatively small species with exceptionally blunt and swollen axial ribs, but is distinguished by its higher, spire, more slender outline and wider siphonal canal. Similarly, *Crassispira bruehli* Stahlschmidt & Fraussen, 2014 is a tiny species with blunt axial ribs, but is more slender, has a narrower subsutural concavity and prominent spiral cords. *Crassispira somalica* Morassi & Bonfitto, 2013 is another morphologically similar species with blunt axial ribs but has a higher last whorl and a broader, convex base.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Crassispira sp. 1

(Plate 8, Figs 15–16)

Material: 1 specimen, height: 14.7 mm, diameter: 5.3 mm (R F5294).

Description: Shell small, fusiform, apical angle c. 30°. Protoconch multispiral, tall dome-shaped, comprising 3.2 smooth whorls, last half whorl with opisthocline axial riblets. Teleoconch composed of 5.5 whorls with narrow, strongly concave subsutural ramp, convex below, separated by impressed undulating suture. Axial sculpture of rounded orthocline ribs, eight on penultimate whorl, about half width of their interspaces, most strongly developed at shoulder, obsolete, or almost so, on subsutural ramp. Spiral sculpture of elevated, rounded, undulating subsutural cord, two weaker cords placed on subsutural ramp, and three broader rounded cords placed below shoulder, separated by narrow interspaces. Last whorl with narrow concave subsutural ramp, convex below, weakly constricted at base, with nine rounded ribs, strongest at periphery, weakening over base, overrun by 11 irregular narrow spirals, spiral at periphery slightly strengthened. Siphonal fasciole moderately long, not sharply delimited, slightly twisted, bearing spiral cords. Aperture narrow ovate, outer lip thin, smooth within, anal sinus symmetrically U-shaped with apex mid subsutural cord, siphonal canal moderately long, open, narrow. Columella not preserved. Spiral cords slightly brighter than interspaces under UV light.

Remarks: Based on this single specimen no firm identification has yet been possible. Specimens of several unidentified species of *Crassispira* are available from the middle Miocene Miri Fm. in Sarawak but all are different from this specimen from Ambug Hill.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Crassispira sp. 2

(Plate 8, Figs 17–18)

Material: 1 specimen, height: 10.4 mm, diameter: 4.0 mm (R F5298).

Description: Shell small, solid, stout fusiform, apical angle c. 30°. Protoconch paucispiral, dome-shaped, comprising 1.2 smooth whorls. Teleoconch composed of 5.5 whorls with narrow, strongly concave subsutural ramp, roundly angled at shoulder, convex below, separated by impressed undulating suture. Axial sculpture of very broad, orthocline ribs, eight on penultimate whorl, most strongly developed at shoulder, obsolete, or almost so, on subsutural ramp. Spiral sculpture of elevated, rounded, undulating subsutural cord, strengthening further abapically, about six weak cords placed on subsutural ramp, strengthening towards shoulder, five narrow cords below shoulder

separated by broad interspaces, shoulder cord slightly strengthened. Last whorl squat, with broad-based, round-edged, subsutural cord, narrow, strongly concave subsutural ramp, shoulder rounded, indistinct, whorl periphery convex below, strongly constricted at base, nine broad ribs, slightly narrower than interspaces, weakening and obsolete over base, overrun by narrow spirals, with secondaries in some interspaces, base delimited by slightly strengthened peribasal cord. Siphonal fasciole moderately short, not sharply delimited, slightly twisted, bearing spiral cords. Aperture narrow ovate, outer lip incomplete, anal sinus broad symmetrically U-shaped with apex mid subsutural cord, siphonal canal moderately long, open, narrow. Columella strongly excavated in upper third, straight and smooth below. Columellar and parietal callus thickened, sharp-edged, small parietal pad.

Remarks: Based on this single specimen no firm identification has yet been possible. This species is closely similar to *C. strangulata* nov. sp. in shape and sculpture, but differs in having a paucispiral protoconch, that of *C. strangulata* is multispiral, the spiral cords are more strongly developed and far more numerous than in *C. strangulata* and the shoulder is more rounded. Specimens of several unidentified species of *Crassispira* are available from the middle Miocene Miri Fm. in Sarawak but all are different from this specimen from Ambug Hill.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Crassispira sp. 3

(Plate 9, Figs 1–2)

Material: 1 specimen, height: 11.2 mm, diameter: 3.8 mm (R F5332).

Description: Shell small, slender fusiform, with tall spire and long siphonal canal, apical angle c. 30°. Protoconch paucispiral, comprising 1.3 smooth whorls. Teleoconch composed of seven whorls with narrow, concave subsutural ramp, roundly angled at shoulder, convex below, separated by impressed weakly undulating suture. Axial sculpture of broad, opisthocline ribs, seven on penultimate whorl, most strongly developed at shoulder, obsolete, or almost so, over subsutural ramp. Spiral sculpture of elevated, rounded, weakly undulating subsutural cord, five or six narrow cords cover entire whorl surface, of roughly alternating strength, separated by narrow groove. Last whorl with prominent weakly undulating subsutural cord, weakly concave subsutural ramp, shoulder rounded, indistinct, whorl periphery convex below, moderately constricted at base, seven broad ribs, slightly narrower than interspaces, weakening and obsolete over base, overrun by narrow spirals of alternating strength separated by narrow grooves, base and siphonal fasciole not delimited, siphonal fasciole long, straight, covered in spiral cords. Aperture narrow elongate, outer lip incomplete, anal sinus shallow symmetrically U-shaped with apex mid subsutural cord, siphonal canal long, open, narrow, slightly twisted at tip. Columella strongly excavated in upper third, twisted mid-aperture, smooth below. Columellar callus thickened abapically, parietal callus bearing small pad and tooth, area between thinly callused so that spiral sculpture on venter shows through callus.

Remarks: *Crassispira* sp. 3 differs from all its congeners discussed herein in having a long siphonal canal. *Crassispira tjemoroensis* (Martin, 1906), known from the Miri Fm. in Sarawak, is larger and has more and straighter axial ribs.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Crassispira? sp. 4

(Plate 9, Figs 5–6)

Material: 1 specimen, height: 10.4 mm, diameter: 4.3 mm, leg. R (R F5334).

Description: Small fusiform shell with broad spire, apical angle c. 40°. Protoconch lost. Five slightly convex teleoconch whorls, suture shallow, on later whorls with very fine wavy subsutural spiral cord, sutural ramp smooth. Axial sculpture of broad, straight, slightly opisthocline ribs, weakening adapically on subsutural ramp, not reaching suture. Last whorl high with six broad axial ribs, weakening over base. Spiral sculpture of numerous fine spiral cords on last whorl, overrunning axial ribs. Outer lip damaged, anal sinus symmetrically U-shaped, with apex mid subsutural ramp, siphonal canal short, narrow. Columella straight, inner lip relatively narrow, bearing small parietal pad.

Remarks: "*Ptychobela*" *neglecta* (Martin, 1895), from the early Miocene of Java, is superficially similar but has a less wavy suture and has narrower and opisthocline axial ribs. *Crassispira strangulata* nov. sp. differs in its stronger subsutural cord, spiral cords, deep subsutural concavity and broader outline, but it cannot be excluded this is a large and smooth specimen of that species.

Distribution: Late Miocene of Brunei Darussalam.

Genus *Carinodrillia* Dall, 1919

Type species: *Clathrodrillia halis* Dall, 1919, by original designation. Recent, Eastern Pacific.

Carinodrillia sp.

(Plate 9, Figs 3–4)

Material: 1 specimen, height: 8.1 mm, diameter: 3.7 mm (R F5333).

Description: Shell small, fusiform, with tall, slender spire, apical angle c. 30°. Protoconch not preserved. Teleoconch of six biangular whorls, with steep, straight-sided subsutural ramp, sharply angled at shoulder cord forming periphery and abapical cord, tapering towards suture. Suture linear, superficial. Axial sculpture of narrow, weakly opisthocline axial ribs, weakening over subsutural ramp. Spiral sculpture of two narrow, elevated cords, forming small tubercles at intersections with ribs, a third appearing above suture on penultimate whorl. Last whorl sharply angled at shoulder and base, bearing 12 axial ribs and three narrow primary cords with single secondary spiral thread in interspaces, cords on base and siphonal fasciole interrupted forming irregular rows of beads. Aperture elongate, outer lip not preserved, anal sinus shallow U-shape with apex on subsutural ramp. Columella twisted, poorly preserved.

Remarks: The extant species *Carinodrillia quadrilirata* (Smith, 1882) from the Philippines is similar but is much broader and has fewer axial ribs per whorl.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Genus *Funa* Kilburn, 1988

Type species: *Drillia laterculoides* Barnard, 1958, by original designation. Recent, Indo-West Pacific.

Funa sp.

(Plate 9, Fig. 11)

? 1915 *Pleurotoma* (*Drillia*) *nodilirata* Smith – Tesch, p. 31, pl. 78, figs 64a–b (non *Pleurotoma* (*Drillia*) *nodilirata* Smith, 1877).

Material: 2 fragmentary specimens: height: 22.2 mm (NHMW 2016/0312/0001, Plate 6, Fig. 11), diameter: 5.1 mm (2016/0312/0002).

Description: Shell small, fusiform with moderately slender spire, apical angle 40°. Protoconch multispiral, high conical, comprising c. three convex whorls (surface eroded). Teleoconch whorls weakly shouldered with concave sutural ramp, convex below. Sculpture of opisthocline axial ribs, slightly narrower than their interspaces, forming indistinct tubercle at shoulder, weakening over subsutural ramp. Spiral sculpture consisting of undulating subsutural cord of moderate strength, weak threads on subsutural ramp and six narrow cords below. Last whorl elongate, slowly contracting, with prominent sigmoidal axial ribs weakening over base and numerous narrow spiral cords. Aperture and outer lip not preserved, anal sinus broad U-shaped, with apex on subsutural ramp. Columella strongly excavated in upper third, straight and smooth below. Columellar and parietal callus thickened, sharp-edged, forming narrow callus band, small parietal pad.

Remarks: The fragmentary preservation makes definitive identification difficult. Size, outline, sculpture – especially the opisthocline axial ribs on the spire and sigmoidal ribs on the last whorl – are reminiscent of "*Pleurotoma nodilirata*" sensu Tesch, 1915 from the Pliocene of Timor. "*Ptychobela" neglecta* (Martin, 1895) differs in its more slender outline and the less undulating suture. The generic assignment is tentative, *Funa* Kilburn, 1988 develops a very similar anal canal and parietal denticle. Although most species are rather slender, the genus also comprises broader species, such as *Funa jeffreysii* (Smith, 1875) and *F. cretea* Li, Kilburn & Li, 2010 (see Li et al. 2010). *Ptychobela* Thiele, 1925 (type species *Clavatula crenularis* Lamarck, 1816), as revised by Kilburn (1989), has a higher and more slender spire.

Distribution: Late Miocene of Brunei Darussalam and probably Pliocene of Timor (Tesch, 1915).

Family Horaiclavidae Bouchet, Kantor, Sysoev & Puillandre, 2011

Genus *Paradrillia* Makiyama, 1940

Type species: *Drillia dainichiensis* Yokoyama, 1923, original designation. Pliocene, Japan.

Paradrillia pachyspira n. sp.

(Plate 9, Figs 17–18, Plate 10, Figs 1–2)

Material: 3 specimens.

Holotype: NHMW 2016/0321/0001, height: 15.3 mm, diameter: 5.8 mm (Plate 9, Figs 17–18).

Paratype: leg. R, RGM.1309472, height: 16.6 mm, diameter: 5.8 mm (Plate 10, Figs 1–2).

Further material: 1 broken specimen R F5302.

Stratum typicum: Seria Fm.

Type locality: Ambug Hill, Brunei Darussalam.

Age: Late Miocene, Tortonian.

Name: From παχύς (ancient Greek for broad, bulky), referring to the comparatively stout spire.

Diagnosis: Medium sized *Paradrillia* species with broad shell for genus, prominent, bifid, beaded mid-whorl carina, bifid subsutural spiral cord, concave sutural ramp, angulated last whorl and granulose spiral cords on base.

Description: Shell moderately broad fusiform, apical angle of c. 35°. Surface of protoconch and early teleoconch whorls abraded. Teleoconch consisting of six whorls with concave subsutural ramp, shouldered mid-whorl, straight-sided below tapering towards suture. Suture deeply impressed. Spiral sculpture of prominent bifid subsutural cord, lower cord double thickness of upper, subsutural platform bearing 2–3 fine spiral cords, bifid elevated beaded mid-whorl cord forming periphery, two fine cords below, lower placed at abapical suture. Indistinct axial growth lines interrupt subsutural and spiral cords irregularly beading them also. Last whorl with broad concave subsutural ramp, angled at carina placed just above mid-whorl, convex below, moderately constricted at base, below shoulder seven primary spiral cords, more strongly beaded, with single secondary in interspaces. Base not sharply delimited, siphonal fasciole moderately long, delimited from base by deeper groove, bearing seven strengthened spiral cords. Aperture ovate, outer lip incomplete, anal sinus broadly U-shaped, with apex on lower half of subsutural ramp. Columella strongly excavated in upper third, straight and weakly twisted below. Columellar callus narrow.

Remarks: The beaded mid-whorl carina, somewhat irregularly granulose subsutural cord and characteristic granulose spiral cords on the base place this species in *Paradrillia* Makiyama, 1940, as revised by Powell (1964). Nevertheless, it differs from most Miocene to recent species, such as *Paradrillia dainichiensis* (Yokoyama, 1923), *P. djocdjocartae* (Martin, 1884), *P. patruelis* (Smith, 1875), *P. inconstans* (Smith, 1875), *P. consimilis* (Smith, 1879) and *P. melvilli* Powell, 1969, in its wider and comparatively lower spire. Similarly, stout *Paradrillia* species are *P. kakegawensis* (Makiyama, 1927) and *P. himea* (Makiyama, 1927), both from the Pliocene of Japan and *Paradrillia ermelingi* (Martin, 1884), from the Miocene of Java. The Japanese species differ in their strongly axially oriented nodes on the carina. The Javanese species, however, agrees with *P. pachyspira* in outline and the bifid carina, but differs in its more distinctly beaded subsutural cord, the cancellate sculpture of the last whorl and its smaller size. Leloux & Wesselingh (2009, pl. 165, figs 4–5) illustrated a specimen as holotype of *Paradrillia ermelingi*, which differs from the illustrated specimen in Martin (1884, pl. 4, fig. 70) in its smaller size, more slender outline and weakly constricted base. Later, Martin (1919, p. 118) explained that the figure with his original description was erroneous ("unrichtig") and therefore replaced it by new figures (Martin 1919, pl. 3, fig. 17). The photos in Leloux & Wesselingh correspond with those new figures.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Family Conidae Fleming, 1822

Genus *Conasprella* Thiele, 1929

Type species: *Conus pagoda* Kiener, 1847, subsequent designation by Tucker & Tenorio (2009). Recent, Indo-West Pacific.

Conasprella sondeiana (Martin, 1895)

(Plate 10, Fig. 3)

1895 *Conus sondeianus* spec. nov. Martin, p. 14, pl. 1, figs 16–17.
1915 *Conus sondeianus* K. Martin – Tesch, p. 18, pl. 73, fig. 12.
1927 *Conus sondeianus* K. Martin – Fischer, p. 105, pl. 215, figs 90–91.
2009 Conus sondeianus Martin, 1895 – Leloux & Wesselingh, p. 70, pl. 143, figs 14–15, pl. 144, figs 1–6 (cum syn.).
2009 (*Conasprella*) *sondeiana* Martin, 1895 – Tucker & Tenorio, p. 140.

Material: 1 damaged specimen (R F5274), height: 12.5 mm, diameter: 9.0 mm.

Description: The damaged shell is small, elongate biconical, with high coeloconoid spire. Protoconch and initial teleoconch whorls not preserved. Remaining four teleoconch whorls with broad, straight to weakly concave subsutural ramp, periphery placed a very short distance above suture. Subsutural ramp bearing delicate spiral threads crossed by densely spaced, opisthocyrt growth lines intersect spiral grooves, shoulder smooth. Subsutural flexure moderately deep, symmetrically curved. Last whorl strongly angular at shoulder, elongate conical with numerous spiral cords, separated by narrow punctate spiral grooves that widen and deepen abapically, base missing. Aperture narrow, outer lip missing.

Remarks: Shape, sculpture and morphology of the subsutural flexure support a placement in *Conasprella* Thiele, 1929, which was also proposed by Tucker & Tenorio (2009). *Conasprella juttingae* (Pannekoek, 1936), from the early Miocene of Indone-

sia, differs in its beaded spiral cords on last whorl. *Conasprella stigandi* (Cox, 1948) from the late Miocene (or Pliocene) of Borneo, differs in its lower spire and rounded shoulder.

Distribution: The species is common in the middle Miocene Miri Fm. of Sarawak and known from the late Miocene of Brunei Darussalam. Wide-spread during the Pliocene when it is documented from Java, Seram and Timor (Tesch 1915, Fischer 1927, Van der Vlerk 1931, Leloux & Wesselingh 2009).

Conasprella paupera n. sp.

(Plate 10, Figs 12–18)

1996 *Conus acutangulus* (Lamarck) – Nuttall in Sandal, fig. 4.6d.

Material: 7 specimens.
Holotype: RGM.783449, height: 15.5 mm, diameter: 9.1 mm, from the Seria Fm. outcrop Tutong 9A, leg. BPM (Plate 10, Figs 12–14).
Paratypes: RGM.783411, height: 14.4 mm, diameter: 9.6 mm, from the Seria Fm. outcrop Tutong 8, leg. BPM (Plate 10, Fig. 15), R F5256/001 (Plate 10, Figs 16–18).
Additional material: 4 specimens from Ambug Hill (R F5256), 1 broken specimen from the Sibuti Fm. (Langhian, middle Miocene) at Tanjung Batu, N of Bekenu, Sarawak (R F5272).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to the small size of the species.

Diagnosis: Small *Conasprella* species with broad, stout shell, low spire, beaded shoulder, and sculpture of well-developed spiral cords separated by broad grooves, with strong, opisthocyrt growth lines visible in grooves. Subsutural flexure shallow, symmetrically curved.

Description: Shell small, solid, squat, broad biconic, with moderately low spire. Protoconch missing or largely abraded. Teleoconch comprising up to 8.5 whorls with narrow, weakly concave subsutural ramp, periphery placed just above suture, exposing well-defined, rounded to slightly spirally elongate beads at shoulder. Spire whorls with three or four finely granulated spiral cords on subsutural ramp, axial sculpture covering spiral cords and interspaces. Subsutural flexure shallow, symmetrically curved. Last whorl angular at shoulder, slightly convex below, hardly constricted at base, bearing about 20 flattened spiral cords separated by relatively wide interspaces, crossed by densely spaced, opisthocyrt growth lines that are strongest in interspaces, but in some specimens override spiral cords. Siphonal fasciole short, not delimited, weakly recurved. Aperture narrow with parallel margins. Spiral cords slightly lighter coloured than interspaces under UV light, especially beaded cord along periphery.

Remarks: Martin and Beets identified this taxon as *Conus acutangulus* (Lamarck, 1810) and Nuttall in Sandal (1996) figured a specimen from the Seria Fm. at Penanjong beach under the same name. *Conasprella acutangulus* is an extant species well represented also in the SE Asian Miocene. It is much larger and juveniles the size of the Seria Fm. specimens are much narrower with a higher more pointed spire and have spiral grooves instead of relatively wide interspaces. *Conasprella gembacana* Martin, 1884 from unnamed Miocene beds at Ngembak in Java is more slender, has a higher straight-sided spire, has larger nodes on the shoulder, has spiral cords with nodes and lacks the spiral furrows.

Distribution: Only known from the middle Miocene of Sarawak and the late Miocene of Brunei Darussalam.

Conasprella trianginodus n. sp.

(Plate 10, Figs 9–11, 19–21)

Material: 7 specimens.
Holotype: height: 19.6 mm, diameter: 7.4 mm, NHMW 2016/0313/0001 (Plate 10, Figs 9–11), height: 19.6 mm, diameter: 7.4 mm.
Paratype: height: 15.9 mm, diameter: 7.0 mm, RGM.1309422 (Plate 10, Figs 19–21), leg. R.
Additional material: height: 13.5 mm, diameter: 6.0 mm, NHMW 2016/0313/0002, 2 specimens (GUBD), 2 juvenile specimens (R F5275).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: Referring to the triangular nodes along the periphery.

Diagnosis: Small *Conasprella* species with slender biconical shell, tall, coeloconoid, scalariform spire, striate sutural ramp and triangular, rounded beads along shoulder, last whorl elongate conical, strongly beaded at shoulder, with numerous broad spiral cords separated by narrow grooves, axial growth lines in interspaces. Subsutural flexure moderately shallow, slightly asymmetrically curved.

Description: Shell small, elongate biconical, with tall, coeloconoid, scalariform spire. Protoconch partly missing. Teleoconch consisting of seven whorls, with broad, flat to weakly concave subsutural ramp, periphery placed a short distance above suture below whorl tapering in towards abapical suture, resulting in sca-

lariform spire, strongly beaded along shoulder, beads triangular in side view, rounded in apical view. Spire whorls with four narrow spiral cords, interrupted and finely beaded by densely spaced opisthocyrt growth lines. Subsutural flexure moderately deep, asymmetrically curved. Last whorl strongly angular at shoulder, elongate conical, bearing 25–30 broad flattened spiral cords of irregular width, separated by interspaces widening abapically. Axial sculpture consisting of densely spaced growth lines, most prominent in interspaces, rarely interrupting and beading spiral cords. Weakly constricted at base with long, weakly recurved siphonal fasciole hardly delimited from base. Aperture narrow with parallel margins, outer lip incomplete. Spiral cords slightly lighter than interspaces under UV light, especially beaded cord along shoulder.

Remarks: This species is reminiscent of *Conasprella sondeiana* (Martin, 1895), but differs inthe less numerous, much coarser and triangularbeads on carina and shoulder and the broader interspaces between the spiral cords of the last whorl. Moreover, it has delicate beads on the sutural ramp. The extant *Conasprella insculpta* (Kiener, 1847), which occurs already during the late Miocene and Pliocene in the IWP (Tesch 1915, Shuto 1969), differs in its higher spire, the much more elongate last whorl and the regular spiral sculpture. The late Miocene species from Brunei Darussalam belongs to the *Conasprella orbignyi* complex as defined by Puillandre et al. (2011). *Conasprella orbignyi* (Audouin, 1831), from the Plio-Pleistocene of the Philippines (Helwerda 2017) has a higher and straighter spire, with a larger distance between periphery and suture, less (13 vs. 15 on last whorl) and sharper beads on the shoulder, broader spaced growth lines and broader interspaces between the spiral cords of the last whorl.

Distribution: Only known from the late Miocene of Brunei Darussalam.

Genus *Asprella* Schaufuss, 1869

Type species: *Conus asper* Lamarck, 1810, by typification of replaced name. Recent, Indo-West Pacific.

Asprella ornatissima (Martin, 1883)

(Plate 10, Figs 4–8)

1883 *Conus ornatissimus* nov. spec. Martin, p. 313, pl. 10, fig. 20.
1895 *Conus ornatissimus* Martin – Martin, p. 12, pl. 1, figs 8–10.
1969 *Asprella* (*Asprella*) *ornatissima* (Martin) – Shuto, p. 221, pl. 22, figs 1,2,4, 11–14.
2009 Asprella (Asprella) ornatissima (Martin, 1883) – Leloux & Wesselingh, p. 65, pl. 125, fig. 15, pl. 130, figs 1–4 (cum syn.).
2009 (*Phasmoconus*) *ornatissimus* Martin, 1883 – Tucker & Tenorio, p. 76.

Material: 2 specimens (NHMW 2016/0314/0001), height: 34.7 mm, diameter: 20.2 mm and height: 23.6 mm, diameter: 11.9 mm.

Description: Shell medium sized, elongate with low conical spire, apical angle 125° weakly ventricose last whorl, early spire coeloconoid, whorl tops flat to distinctly concave with six spiral cords, two cords along adapical suture slightly raised, overlapping preceding spire whorl, suture wavy due to low shoulder nodes embedded in suture. Subsutural flexure moderately shallow, symmetrical, forming granulose sculpture with spiral cords. Last whorl with slightly rounded nodular shoulder, weakly ventricose below, periphery at about one-quarter whorl height, base weakly constricted, bearing broad spiral cords separated by narrower interspaces, single secondary spiral intercalated on lower half of last whorl, growth lines form densely spaced axial ridges in pitting spiral grooves. Siphonal canal moderately long, narrow, slightly twisted, siphonal fasciole indistinct. Aperture moderately narrow with subparallel margins.

Remarks: This species was placed in *Asprella* by Shuto (1969) and Leloux & Wesselingh (2009) but listed as *Phasmoconus* by Tucker & Tenorio (2009). As discussed by most workers (e.g. Tesch 1915, Shuto 1969), *Asprella ornatissima* is morphologically closely related with the Recent *Asprella sulcata* (Hwass in Bruguière, 1792). This species is a synonym of *Conus asper* Lamarck, 1810, which is the type species of *Asprella* (Puillandre et al. 2014). Consequently, we reject the placement in *Phasmoconus*. Tucker & Tenorio (2009) state a deep anal notch as typical for *Asprella* but *Asprella sulcata*, like the Miocene-Pliocene *A. ornatissima*, has a shallow subsutural flexure. Under UV light the specimens from the Miri Fm. in Sarawak show a yellow coloured aperture and yellow lines along the spiral cords.

Distribution: This species has been reported in the palaeontological literature from the late Miocene of Indonesia (Leloux & Wesselingh 2009) and becomes very common in Indonesia, the Philippines, Timor, Seram and Taiwan during the Pliocene (Tesch 1915, Fischer 1927, Nomura 1935, Shuto 1969). However, the species is known from various outcrops of the middle Miocene Miri Fm. of Sarawak and now also from the late Miocene of Brunei Darussalam.

Genus *Dendroconus* Swainson, 1840

Type species: *Conus betulinus* Linnaeus 1758, subsequent designation by Herrmannsen (1847). Recent, Indo-West Pacific.

Dendroconus buxeus loroisii (Kiener, 1846)

(Plate 11, Figs 1–3)

1846 *Conus Loroisii* Kiener, p. 91, pl. 65, fig. 1.
1895 *Conus Loroisii* Kien. – Martin, p. 21, pl. 3, fig. 52.
1922 *Conus loroisii* Kiener – Dickerson, p. 224, pl. 2, fig. 14.
2005 *Conus loroisii* Kiener, 1845 – Dharma, pl. 126, figs 1a–b.

Material: 1 dorsally compressed specimen, height: 69 mm, diameter: 49 mm, NHMW 2016/0315/0001.

Description: Shell moderately large, with strongly depressed to flat spire, slightly protruding apex. Spire whorls weakly convex, only penultimate whorl weakly concave, suture narrowly incised, no spiral sculpture. Subsutural flexure shallow, moderately asymmetrical. Last whorl broad, rounded at high-placed shoulder, straight-sided to weakly ventricose below, maximum diameter slightly below shoulder, weakly constricted at base. Aperture moderately wide, broadening abapically. Adapical part of aperture extending slightly above shoulder of penultimate whorl. Siphonal fasciole broad, rounded. Irregular grooves on base separating slightly broader spiral cords.
Remarks: *Dendroconus loroisii* (Kiener, 1846) was considered a subspecies of *D. buxeus* (Röding, 1789) by Tucker & Tenorio (2009) and Bouchet (2015b), which is followed herein. The early Miocene Indonesian *Dendroconus pamotanensis* (Martin, 1916) differs in its strongly contracting base and narrow aperture and siphonal canal, *Lithoconus vandijki* (Martin, 1916) has a strongly angulated shoulder and spiral cords on the spire whorls. *Lithoconus hardi* (Martin, 1879), as illustrated in Martin (1895 pl. 3, fig. 38), is very similar in outline but bears spiral striae on the spire whorls. Moreover, other specimens of *L. hardi* are distinctly more slender (see Leloux & Wesselingh 2009, pl. 147, figs 3–4).
Distribution: This extant Indo-West Pacific species is described from the late Miocene and Pliocene of Java (van der Vlerk 1931) and from the late Miocene (or Pliocene) of the Philippines (Dickerson 1922). Further Pliocene occurrences are documented by Tesch (1915) from Timor and by Siemon (1929) from New Guinea. Dharma (2005) described this species from the middle Miocene of Java. Occurrences from the early Miocene, mentioned by Martin (1916), need confirmation.

Genus *Phasmoconus* Mörch, 1852

Type species: *Conus radiatus* Gmelin, 1791, subsequent designation by Cotton (1945). Recent, Indo-West Pacific.

Phasmoconus sp.

(Plate 11, Figs 4–5)

Material: 1 broken specimen, height: 14.4 mm, diameter: 10.9 mm (R F5273).

Description: Fragment lacking early spire whorls and lower half of last whorl, spire low conical, whorl tops flat to weakly concave with four spiral grooves, suture and shoulder weakly undulating. Last whorl with periphery at shoulder, sharply angled, adapical quarter below shoulder subcylindrical, obtusely angled at quarter-height, elongate conical below, sculptured by wide-spaced shallow spiral grooves.
Remarks: As this is a damaged and probably juvenile specimen, it is impossible to give a firm identification. The general shape and sculpture are reminiscent of several Recent IWP-species of *Graphiconus* da Motta, 1991 (e.g. *Conus iodostoma* Reeve, 1843b, *Conus laterculatus* Sowerby, 1870, *Conus purissimus* Filmer, 2011), which is currently considered to be a subjective junior synonym of *Phasmoconus* Mörch, 1852 (Puillandre et al., 2014).
Distribution: Known from the late Miocene of Brunei Darussalam.

Family Terebridae Mörch, 1852

Genus *Triplostephanus* Dall, 1908

Type species: *Terebra triseriata* Gray, 1834, by original designation. Recent, Indo-West Pacific.

Triplostephanus wilfordi n. sp.

(Plate 11, Figs 14–15)

Material: 5 specimens.
Holotype: height: 36 mm, diameter: 7.2 mm (NHMW 2016/0316/0001) (Plate 11, Figs 14–15).
Paratype: fragmentary specimen: height: 11.5 mm, diameter: 5.9 mm (NHMW 2016/0316/0002).
Additional paratypes: 2 specimens (GUBD), 1 specimen (RGM.309427).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: In honour of G.E Wilford, a pioneer in the study of the geology of Borneo.

Diagnosis: Medium sized *Triplostephanus* species, with slender shell, bipartite whorls with broad, raised,

beaded, bifid subsutural band, adapical component twice width abapical one, whorl profile concave below to suture, bearing four narrow spiral cords and weak axial ribs finely beading cords.

Description: Shell medium sized, slender, consisting of > 13 bipartite teleoconch whorls. Early spire whorls develop two elevated spiral cords of axially elongated beads. Adapical cord broadens, beads elongate axially, separated by deep, narrow groove from abapical beaded cord, which remains narrower. Below spire whorls weakly concave with up to four narrow spirals, secondary threads intercalated on last two whorls. Concave lower part of whorl bearing weak orthocline axial ribs, with small beads developed at intersections with cords. Last whorl short, with very broad adapical subsutural cord, strongly beaded abapical subsutural cord, weakly convex below bearing spiral cords of alternating strength, base strongly constricted, delimited by slightly strengthened peribasal cord, strongly twisted siphonal canal columella.

Remarks: *Triplostephanus jenkinsi* (Martin, 1879), from the late Miocene of Java, is comparable with *T. wilfordi* n. sp., but has almost straight-sided whorls, the two subsutural cords are nearly equally wide and the spiral threads on the abapical half of the spire whorls bear coarser beads. *Triplostephanus pamotanensis* (Martin, 1906), from the Miocene of Java, differs in its narrower adapical subsutural cord and the distinct axial ribs. Tesch (1915) described two species from the Pliocene of Timor, which are reminiscent of the Miocene species from Brunei: *Triplostephanus pamotanensis* of Tesch (1915) (non *Terebra pamotanensis* Martin, 1906) is distinguished by the broad, subquadratic nodes on the adapical subsutural cord, the larger and subquadratic beads on the abapical subsutural cord and the less concave whorls. *Terebra* aff. *cumingii* of Tesch (1915) agrees largely in the morphology of the two subsutural cords, but differs in its distinctly cancellate sculpture. *Strioterebrum* sp. sensu Beets (1986a), from the Pliocene of Borneo, is broader, has a narrower adapical subsutural cord and lacks the beads on the abapical subsutural cord. *Terebra javana* Martin, 1879, from the late Miocene of Java, has only one subsutural cord and develops a cancellate sculpture of beads. The extant *Cinguloterebra cumingii* (Deshayes, 1857), which was also described from the Pliocene of Java, Timor and India by Martin (1906), Cossmann (1900) and Fischer (1927), is readily distinguished by the delicately beaded spiral threads and the poorly defined nodes on the subsutural spiral cords. *Triplostephanus kyudawonensis* (Vredenburg, 1921), from the Miocene of Myanmar, has beaded subsutural cords of equal strength and a more gradate spire due to the deep concavity of the whorls close to the abapical suture and the broad diameter of the adapical subsutural cord. *Triplostephanus euglyptica* (Vredenburg, 1921), from the Miocene of Myanmar, has weaker subsutural cords, which are separated by a broader groove and develops beaded spiral threads.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Genus *Duplicaria* Dall, 1908

Type species: *Buccinum duplicatum* Linnaeus 1758, by original designation. Recent, Indo-West Pacific.

Duplicaria aequalis n. sp.

(Plate 11, Figs 16–17)

Material: 4 specimens.

Holotype: height: 15.3 mm, diameter: 4.7 mm, NHMW 2016/0317/0001 (Plate 11, Figs 16–17).

Paratypes: fragmentary specimen: height: 7.6 mm, diameter: 2.6 mm, NHMW 2016/0317/0002, 2 specimens RGM.1309428.

Stratum typicum: Seria Fm.

Type locality: Ambug Hill, Brunei Darussalam.

Age: Late Miocene, Tortonian.

Name: *aequalis* (Latin) meaning equal, referring to the nearly equal width of the spiral bands.

Diagnosis: Small *Duplicaria* species with two broad spiral bands separated by narrow spiral groove, adapical band slightly narrower, sharp, widely spaced prosocline axial ribs, slightly less inclined on adapical band, ribs not aligned vertically.

Description: Shell small, moderately slender, of > nine bipartite teleoconch whorls. Protoconch and earliest teleoconch eroded. Whorls bearing two broad spiral bands, separated by distinct narrow groove, adapical band slightly narrower. Suture weakly undulating, impressed. Axial sculpture of sharp, widely spaced prosocline axial ribs, slightly less inclined on adapical band, ribs not aligned vertically. Fine, close-set, superficial spiral grooves appear in interspaces between axial ribs on last two whorls. Last whorl low, abapical band somewhat inflated, ribs weakening, subobsolete on last half whorl, base rapidly constricting, passing into short, slightly twisted siphonal canal, siphonal fasciole distinct, delimited by two spirals, adapical raised, keel-like, abapical reduced to thread.

Remarks: Several species from the Miocene of Java are comparable with the species from Brunei without being conspecific: the early Miocene *Duplicaria*

smithi (Martin, 1884) and *Duplicaria angsanana* (Martin, 1921) differ in the narrower adapical band and the higher last whorl of *D. smithi* and the slightly convex whorls of *D. angsanana*. *Duplicaria bandongensis* (Martin, 1879) differs in the strongly reduced axial sculpture. *Clathoterebra woodwardiana* (Martin, 1884) has a much narrower adapical band and a higher last whorl. Similarly, the late Miocene *Terebra herklotsi* (Martin, 1879) differs in its narrow adapical band and its axial ribs are densely spaced. The early Miocene *Duplicaria sundaica* (Wanner & Hahn, 1935) is more slender and has straight axial ribs. *Duplicaria arundinea* (Vredenburg, 1921), from the Miocene of Myanmar, differs in its straight, aligned axial ribs forming continuous ridged that cross the spiral groove separating ad- and abapical spiral bands. Among the extant representatives of this genus, the Australian *D. crakei* (Burch, 1965) and *D. bernardii* (Deshayes, 1857) are somewhat reminiscent of the Miocene fossil but differ in their regular, straight and more numerous axial ribs.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Subclass Heterobranchia Burmeister, 1837

Unassigned order

Superfamily Architectonicoidea J.E. Gray in M.E. Gray 1850

Family Architectonicidae J.E. Gray in M.E. Gray 1850

Genus *Architectonica* Röding, 1798

Type species: *Trochus perspectivus* Linnaeus 1758, subsequent designation by Gray (1847). Recent, Indo-West Pacific.

Architectonica beetsi n. sp.

(Plate 11, Figs 6–13)

1996 *Architectonica perspectiva* (Linnaeus, 1758) – Nuttall in Sandal, fig. 4.2i.
2008 *Architectonica perspectiva* – Raven, fig. 4
2011 *Architectonica perspectiva* (Linnaeus, 1758)– Raven in Wannier et al., pl. 4.5.4d, fig. 28.

Material: 30 specimens.
Holotype: Ambug Hill, height: 10 mm, diameter: 27.2 mm (last whorl largely missing), NHMW 2016/0318/0001.
Paratypes: 6 specimens from the Beraya-Bekenu seacliffs, Sarawak, Malaysia, Miri Fm., km 11.4–9.5 km (0.4–2.35), leg. Charlie Lee (RGM.1309473), largest specimen height: 11.1 mm, diameter 33.6 mm (Plate 11, Fig. 6–9, RGM.1309473a), 2 specimens from Tutong 8 outcrop of the Seria Fm., RGM.783400 (one figured by Raven 2008, fig. 4).
Other material: from the Beraya-Bekenu seacliffs, Sarawak, Malaysia, Miri Fm., km 10.7 (1.2), 2 juveniles, leg. R (R F4040), km 9.5 (2.35) 1 specimen, leg. Lee (R F4788), km 8.4 (3.45) 3 juveniles, leg. R (R F5328), km 8.2 (3.60) 9 juveniles and 2 specimens, leg. R & Lee (R F5329), km 8.2 (3.65) 1 juvenile, leg. R (R F5330), from the outcrops along the Beraya-Bekenu road, Sarawak, Malaysia, Miri Fm., km 28.4 right, 1 juvenile, leg. R (R F4259), km 28.5 left 1 juvenile, leg. R (R F4670), km 30.1 left 1 juvenile, leg. R (R F4358).
Stratum typicum: Seria Fm.
Type locality: Ambug Hill, Brunei Darussalam.
Age: Late Miocene, Tortonian.
Name: In honour of Cornelis Beets, a great palaeontologist who much expanded the knowledge of fossil molluscs from Borneo, including the Seria Fm. in Brunei Darussalam.

Diagnosis: Medium sized *Architectonica* species of the *A. perspectiva* group sensu Bieler (1993) characterized by a small protoconch, dense teleoconch sculpture with beaded subsutural rib, broad undivided midrib area, formed by numerous, crowded, well-defined axial ribs, narrow, strongly beaded upper peripheral rib and weakly beaded lower peripheral rib, broad basal field with weak axial sculpture, beaded proxumbilical rib and prominent umbilical crenae. (For terminology see Bieler, 1993, p. 9 and loose unnumbered text-fig).

Description: Shell medium sized, depressed trochiform. Protoconch paucispiral, small, smooth consisting of 1.2 protoconch whorls (dp = 0.95 mm). Teleoconch comprising 7.5 strongly flattened, weakly convex whorls (parts of last whorl missing). First teleoconch whorl bears beaded subsutural rib (SSR), Second teleoconch whorl with prominent beads on SSR and blunt beads in midrib area, beaded upper peripheral rib (UPR) develops. Abapically, midrib area undivided, beads lengthen into prosocline axial ribs, beads on PR strengthen. Last whorl with prominent SSR bearing densely spaced, elongate to crescent shaped beads separated by deep prosocline to reverse comma-shaped grooves on last part of last whorl, deep narrow groove separates SSR from broad midrib area. Midrib axial ribs prosocline, well-defined, densely spaced, deep narrow groove separates midrib area from narrow, strongly beaded UPR. Lower peripheral rib (LPR) weakly beaded, separated from UPR by deep groove.

Infraperipheral rib (IPR) only faintly beaded. Broad basal field with weak axial ribs, beaded proxumbilical rib (PUR) and prominent umbilical crenae (UC). Broad evenly coloured light band below SSR, narrowly interrupted light band on UPR under UV light.

Few small light spots on UPR, larger ones on UC including PUR.

Remarks: The undivided midrib area places this species in the *Architectonica perspectiva*-group sensu Bieler (1993), which comprises three extant IWP species: *Architectonica perspectiva* (Linnaeus, 1758), *A. trochlearis* (Hinds, 1844) and *A. perdix* (Hinds, 1844). Of these, *A. trochlearis* has a much larger protoconch of > 1 mm (Bieler, 1993) and *A. perdix* differs clearly in its strongly reduced sculpture. *Architectonica perspectiva* differs in it the generally coarser sculpture and especially in the less numerous and coarser mid-whorl axial ribs, the broader UPR, narrower interspaces between the ribs. It also has a white subsutural rib with an ever wider brown band above it on later whorls. The midrib area in *A. perspectiva* is flat with fine grooves, whereas in *A. beetsi* the axial riblets in the midrib area are elevated and somewhat rounded in profile, and can appear stacked like roof tiles. Moreover, *A. perspectiva* attains a much larger size (diameter of up to about 6 cm). These features allow also a separation from Miocene and Pliocene specimens from Indonesia placed in *A. perspectiva* by Martin (1905). The Pliocene and Pleistocene specimens from the Mijnwezen collection at NBC were also correctly identified by Van Regteren Altena, (1938, p. 311) as *A. perspectiva,* as confirmed both by sculpture and UV colours. It therefore appears *A. beetsi* is restricted to the Miocene. In the inverted photograph the light-coloured bands and spots of *A. beetsi* are dark, the slightly different (bright green) colouring of the subsutural rib and the interspaces of the upper peripheral rib indicates these may have had a cream colour, but not as bright as in *A. perspectiva* as is shown by inversed UV photographs of fossils of that species.

Bieler & Petit (2005) list numerous Architectonicidae from the Neogene of the Indonesian region. Most of these species differ from the herein described species by their divided midrib area, e.g.: *A. angsanana* (Martin, 1922), *A. javanum* (Martin, 1879), *A. sedanensis* (Martin, 1905), *A. plana* (Wanner & Hahn, 1935) and *A. rutteni* Cox, 1948. Several other of the Indonesian Architectonicidae species listed by Bieler & Petit (2005) have to be placed in other genera such as *Discotectonica, Granosolarium* or *Heliacus* (e.g. "*Solarium*" *sokkohense* Martin, 1916, "*S.*" *songoense* Martin, 1914, "*S.*" *martini* Haanstra & Spiker, 1932a, "*S*". *granulata* Haanstra & Spiker, 1932b, "*S.*" *palembangensis* Haanstra & Spiker, 1932b, "*T.*" *mitrai* Beets, 1941, "*A.*" *asphaltodes* Beets, 1942 and "*A.*" *ickeae* Beets, 1986). *Architectonica yokoyamai* Oyama in Taki & Oyama, 1954, from the Pleistocene of Japan, develops a comparably crowded axial ribbing on the midrib, but is generally much smoother and it lacks a well-defined proxumbilical rib.

Distribution: Known from the middle Miocene of Sarawak and the late Miocene of Brunei Darussalam.

Superfamily Mathildoidea Dall, 1889
Family Mathildidae Dall, 1889

Genus *Mathilda* Semper, 1865

Type species: *Turbo quadricarinatus* Brocchi, 1814, subsequent designation by De Boury (1883). Pliocene, Mediterranean Sea.

Mathilda sp.

(Plate 11, Figs 22–23)

Material: 1 fragmentary specimen, height: 8.4 mm, diameter: 2.6 mm (NHMW 2016/0319/0001).

Description: Shell small, slender turreted with deeply incised suture, apical angle 18°. Five angular teleoconch whorls preserved, with broad concave subsutural ramp, strongly angled at ad- and abapical primary spiral cords, tapering in to suture below. Sculpture consisting of two prominent raised primary spiral cords, adapical cord placed slightly above mid-whorl delimiting subsutural ramp, abapical cord a short distance above suture. Single secondary spiral cords appear below suture and just above adapical primary cord. Two weaker tertiary spiral threads on sutural ramp between secondary spirals, an additional tertiary spiral cord intercalated between primary cords and one between abapical primary cord and suture. Densely-spaced, weakly opisthocyrt axial ribs in interspaces between all spiral elements, resulting in delicate cancellate pattern and faintly beaded intersections. Last whorl sculpture same as that of spire whorls, base delimited by strong peribasal cord, base bearing further strong cords.

Remarks: The shell shape and especially the pair of prominent primary spiral cords are reminiscent of subadult shells of the extant IWP species *Mathilda amanda* Thiele, 1925 [= *Mathilda japonica* (Kuroda & Habe, 1971)]. The coarser cancellate sculpture of *M. amanda*, however, distinguishes that species from the Miocene one. The second extant IWP species, which is reminiscent of the species from Brunei, is *Mathilda carystia* Melvill & Standen, 1903, which differs in the much stronger primary spiral cords, of

which the adapical one usually corresponds with the maximum diameter, and the coarser and wider-spaced axial ribs.

Mathilda njalindungensis Martin, 1922, from the early Miocene of Java, differs in the much denser axial sculpture, the convex whorls and the regular spiral cords (see also Shuto 1974). *Mathilda bonneti* Cossmann, 1910, from the Pliocene of Karaikal in S-India, differs in the much weaker axial sculpture and the dominant spiral cords and *Mathilda loochooensis* MacNeil, 1961, from the late Miocene or Pliocene of Okinawa, has a much wider apical angle. In *Mathilda insulindae* Fischer, 1927, from the Pliocene of Seram, the keel is adjoined by a second prominent spiral cord, forming a prominent pair of spiral cords below the subsutural ramp.

Thus, the specimen from Brunei Darussalam seems to represent a new species, but due the fragmentary preservation and the probably subadult growth stage we refrain from formally describing it as new species.

Distribution: Only known from the Tortonian of Brunei Darussalam.

Superfamily Ringiculoidea Philippi, 1853
Family Ringiculidae Philippi, 1853

Genus *Ringicula* Deshayes in Lamarck, 1838

Type species: *Auricula ringens* Lamarck, 1804, subsequent designation by Gray (1847). Eocene, France.

Ringicula seriaensis Beets, 1986

(Plate 11, Figs 18–21)

1986a *Ringicula seriaensis* sp. nov. – Beets, p. 44, pl. 5, figs 1–4.

Material: 5 specimens (NHMW 2016/0282/0003), largest specimen: 3.2 mm height, 2.1 mm diameter, 2 broken specimens R F5328.

Remarks: This species was described in detail by Beets (1986a), it is one of the few new species from Brunei for which Beets published a formal description. The holotype is from the Seria oil field well 15 1570–1580 m height: 2.2 mm, diameter 1.4 mm (RGM.312074), the paratype from the Sangkulirang area in Kalimantan. He states the holotype is from the Miri Fm. but in the Seria oil field these deposits are overlain by the Seria Fm., which can be up to 2 km thick. Although the specimen is from quite deep in the well it remains uncertain from which formation this specimen originated. *R. turrita* Martin, 1884, from the late Miocene of Java, is much larger (height: 4.5 mm, most specimens of *R. seriaensis* are smaller than 2 mm), has a wider aperture and a much thinner labrum (Beets 1986a). Only the drawing in Martin (1884, pl. 4, fig. 45) is available as the holotype and only specimen has since broken (Leloux & Wesselingh 2009, pl. 85, fig. 4 illustrate the largest fragment). *Ringicula pygmaea* (Martin, 1884), from the early Miocene of Java, is highly reminiscent concerning outline, sculpture and columellar folds but differs in its much more delicate outer lip (see Leloux & Wesselingh 2009).

Ringicula opima Helwerda, 2015, from the Plio-Pleistocene of the Philippines, differs mainly by its subsutural cord, which is adjoined by a deep abapical spiral groove.

Distribution: Known from the late Miocene of Brunei Darussalam and Kalimantan.

4. Discussion & Conclusions

In total, the Ambug Hill outcrop yielded 443 gastropod specimens, representing 62 species (Table 1). Among these, *Rhinoclavis pulcherrima* n. sp. is the most abundant species (~19 %), followed by *Nassarius pseudoovum* n. sp. (~8 %), *Gemmula sculpturata* n. sp. (~8 %), *Indomitrella acuticonica* n. sp. (~7 %), *Amalda bruneiana* n. sp. (7 %), *Natica vitellus* (Linnaeus, 1758) (~6 %), *Xenophora solarioides jezleri* Cox, 1948 (~5 %), and *Prunum seriaense* n. sp. (~6 %). All other species are rare and often documented only by single specimens. This pattern suggests that the fauna is undersampled and a higher diversity can be expected. Material collected from other outcrops of the Seria Fm. comprises numerous other species. The material from Ambug Hill alone already allows some considerations concerning the depositional environment of this part of the Seria Fm.

4.1 Paleoecology and depositional environment

Rhinoclavis species are detritus-algal feeders (Houbrick 1978, Morton & Morton 1983) and settle in a broad range of habitats from the intertidal down to sublittoral environments of several tens of meter water depth (Houbrick 1978). The extent *Rhinoclavis sordidula* (Gould, 1849), which is morphologically close to *R. pulcherrima*, occurs around 40 m water depth on mud (Janssen et al. 2011). *Natica vitellus* is still living in the IWP-Region and is a predatory soft-bottom dweller in shallow subtidal habitats (Poutiers 1998). The ecological preferences of the extinct *Nassarius pseudoovum* are unknown, Nassariidae occupy nearly

Table 1. List of described gastropod species from the Tortonian of Brunei Darussalam (AH = Ambug Hill, Brunei = additional outcrops and wells, N = Nuttall collection (at Natural History Museum, London), R = J.G.M. Raven). The known stratigraphic ranges are given on the right, dark grey is based on material from NW Borneo, light grey refers to material from elsewhere in the IWP and literature data.

	Seria Formation		Miri Formation		Miocene			Pliocene	Pleistocene	Holocene	Recent
Species	Ambug Hill	Tutong outcrops	Brunei	Sarawak	E	M	L				
Rhinoclavis pulcherrima n. sp.	82										
Natica vitellus (Linnaeus, 1758)	27	N		R							
Neverita didyma (Röding, 1798)	1	RGM									
Sinum eximium (Reeve, 1864)	1	RGM, N	N	R							
Rissoina tutongensis n. sp.	1	RGM		R							
Calyptraea cf. *pellucida* (Reeve, 1859)	5										
Ficus parvissima n. sp.	1	RGM									
Dolomena bruneiensis n. sp.	7										
Xenophora solarioides jezleri Cox, 1948	21	RGM									
Varicospira cf. *javana* (Martin, 1879)	1	RGM, N	N	R							
Tibia melanocheilus A. Adams, 1855	6	RGM, N	N	R							
Terebellum cf. *terebellum* (Linnaeus, 1758)	1										
Bufonaria rana (Linnaeus, 1758)	6										
Bursina cf. *ignobilis* (Beu, 1987)	1			R							
Gyrineum bituberculare (Lamarck, 1816)	2	N	N	R							
Tonna sp.	2										
Scalptia verbeekeni n. sp.	4										
Costellaria teschi (Koperberg, 1931)	5	RGM									
Costellaria sp.	2										
Phos bruneiensis n. sp.	7										
Nassarius pseudoovum n. sp.	36										
Indomitrella acuticonica n. sp.	32	RGM									
Clavilithes tjidamarensis (Martin, 1879)	11										
Clavilithes verbeeki (Martin, 1895)	1	RGM, N									
Hemifusus charlieleei n. sp.	6	RGM	N								
Murex troscheli verbeeki Martin, 1895	1			R							
Calotrophon (*Panamurex*) sp.	1										
Hexaplex (*Hexaplex*) sp.	2										
Prunum seriaense n. sp.	24	RGM									
Cymbiola ambugensis n. sp.	15	RGM, N	N	R							
Cymbiola tjilonganensis (Martin, 1906)	2										
Ziba waltercernohorskyi n. sp.	1			R							
Ziba fijiensis (Ladd, 1934)	3			R							
Amalda bruneiana n. sp.	31	RGM									
Amalda sp.	2										
Tomopleura furcata n. sp.	1	N									
Unedogemmula nuttalli n. sp.	2										
Gemmula sculpturata n. sp.	35	RGM									
Gemmula sp.	1										
Clathrodrillia kutaiana Beets, 1984	2										
Clathodrillia sp. 1	1										
Clathodrillia sp. 2	3										
Crassospira molengraaffi (Martin, 1916)	1			R							
Crassispira strangulata n. sp.	4										
Crassispira sp. 1	1										
Crassispira sp. 2	1										
Crassispira sp. 3	1										
Crassispira ? sp. 4	1			R							
Carinodrillia sp.	1										
Funa sp.	2										
Paradrillia pachyspira n. sp.	3										
Conasprella sondeiana (Martin, 1895)	1			R							
Conasprella paupera n. sp.	2	RGM, N									
Conasprella trianginodus n. sp.	7										
Asprella ornatissima (Martin, 1883)	2			R							
Phasmoconus sp.	1										
Dendroconus luxeus loroisii (Kiener, 1846)	1										
Triplostephanus wilfordi n. sp.	5										
Duplicaria aequalis n. sp.	4										
Architectonica beetsi n. sp.	1	RGM, N	N	R							
Mathilda sp.	1										
Ringicula seriaensis Beets, 1986	7	RGM									

all marine habitats, but are most frequent on mud and sand flats, intertidally to subtidally and all are scavengers (Cernohorsky 1982). The deposit feeding *Xenophora solarioides solarioides* (Reeve, 1845), nominate subspecies of the Miocene to Pliocene *X. s. jezleri*, is found from 1–170 m water depth in muddy sand (Ponder 1983). Janssen et al. (2011) reported this species from muddy sand around 40–50 m water depth and it was collected from subtidal sand (about 20 m water depth) in NW Borneo (own data H.R.). The species of *Gemmula* largely occur in deeper habitats from 50–500 meters water depth (Heralde et al. 2011). Thus, the assemblage is strongly dominated by carnivorous, scavenging and detritus feeding species, suggesting a medium deep sublittoral mud-bottom environment with very limited vegetation in some tens of meters water depth. This interpretation fits well with modern assemblages from sandy mud in 30–40 m water depth with abundant *Xenophora solarioides*, *Natica vitellus, Phos senticosus* along with various turrids and fusinids along the seaward side of islands of the Dampier Archipelago in Western Australia described by Taylor & Glover (2004).

This interpretation is further confirmed by preliminary data regarding the foraminifera assemblage, which also points to organic rich muddy seabottom with very little light penetration and characterized by eutrophic and oligophotic settings (own data A.B., L.K.).

The fauna from the Seria Fm. at Ambug Hill is generally small-sized. Several species are small compared to congeneric species (e.g. *Dolomena bruneiensis* n. sp., *Ficus parvissima* n. sp., *Hemifusus charlieleei* n. sp., *Scalptia verheckeni* n. sp., *Costellaria teschi* (Koperberg, 1931), *Prunum seriaense* n. sp., *Amalda bruneiana* n. sp., *Gemmula sculpturata* n. sp., *Clathrodrillia kutaiana* Beets, 1985, *Paradrillia pachyspira* n. sp., *Conasprella paupera* n. sp.). Others are small compared to conspecific specimens or only recorded by subadult specimens (e.g. *Gyrineum bituberculare* (Lamarck, 1816), *Bufonaria rana* (Linnaeus, 1758), *Clavilithes tjidamarensis* (Martin, 1879), *Clavilithes verbeeki* (Martin, 1895), *Calotrophon* (*Panamurex*) sp.). This pattern might point to phases of suboptimal environmental conditions along the inner shelf of northern Borneo during the late Miocene.

4.2 Biostratigraphy and biogeography

About 60 % (35/58) of the gastropod species are until now only known from the middle and late Miocene of Brunei Darussalam and Sarawak (four of the taxa identified herein to genus level may represent known species and are excluded from the calculations: *Tonna* sp., *Hexaplex* sp., *Gemmula* sp., *Phasmoconus* sp.). About ~40 % (23/58) of the documented species are herein formally described as new species (Table 1). Therefore, all these species are only known from the middle and late Miocene of the South China Sea and might reveal as biostratigraphically significant. About 17 % (10/58) of the fauna, almost all Vetigastropoda and Caenogastropoda, originated during the Miocene and are still present in the IWP-Region, e.g.: *Natica vitellus* (Linnaeus, 1758), *Neverita didyma* (Röding, 1798), *Terebellum terebellum* (Linnaeus, 1758), *Bufonaria rana* (Linnaeus, 1758) and *Gyrineum bituberculare* (Lamarck, 1816). Their biostratigraphic and biogeographic value is therefore rather limited. Another 81 % (47/58) of the species, mostly Neogastropoda, are restricted to the Miocene and Pliocene, e.g.: *Clavilithes tjidamarensis* (Martin, 1879), *Costellaria teschi* (Koperberg, 1931), *Conasprella sondeiana* (Martin, 1895) and *Asprella ornatissima* (Martin, 1883). Only *Clathrodrillia kutaiana* Beets, 1985, has been documented exclusively from coeval assemblages from the late Miocene of Kutai in Kalimantan of Borneo and is unknown so far from Pliocene deposits. Many of the newly described species appear to have very limited stratigraphic ranges, but if they only occur in NW Borneo their value for correlations will be limited. Overall, the assemblage has thus surprisingly little relation with other Neogene assemblages from Indonesia and other parts of Borneo, respectively. Only about 3.5 % (2/58) are also known from the middle Miocene Menkrawit Fm. as described by Beets (1941) and about 3.5 % (2/58) are also known from the Pliocene Togopi Fm. as described by Cox (1948) and Nuttall (1965). The relation with the faunas of the coeval upper Miocene Gelingseh Fm. as described by Beets (1985b, 1986a) is even lower.

This pattern could be explained by a major biogeographic separation of the faunas of the South China Sea (north-western coast of Borneo) from those of the Java Sea, the Makassar Strait and the Celebes Sea (southern and north-eastern coasts). This is confirmed in the paleogeographic maps in Lohman et al. (2011), which show that from Oligocene to Pliocene a landmass stretched from the Asian mainland across Borneo, during middle Miocene to Pliocene reaching the northern tip of the island. The dominant

water flow from the Pacific towards the Indian Ocean, i.e. away from the South China Sea, further complicated migration of species from the hot spot area in Java/Sumatra into this area.

The spotty record from the Seria Fm. might also represent a paleoenvironment, which is not covered by samples from elsewhere in Borneo. This would easily explain why the mud bottom assemblage from Ambug Hill has no species in common with the coeval fauna from coral carpets described by Kusworo et al. (2015).

Additionally, based on the strike direction of the Ambug Hill layers (~N-S) and of similar nearby outcrops, these will definitely continue toward the coast line and they might have been cropping out at Penanjong beach in the 1920's and 1930's where fossil rich outcrops were available. These coastal outcrops are considered to represent the younger Liang Fm. by Sandal (1996). The similarities between the fauna described from Penanjong and that from Ambug Hill seem to confirm that the Penanjong fauna belongs to the Seria Fm.

Currently much more (unpublished) information is available on the mollusc fauna from the Miri Fm. in Sarawak than from the undersampled Miri Fm. outcrops in Brunei. Despite its proximity in geography and age only a remarkably small number of species (15) occurs in both the Miri Fm. in Sarawak and the Seria Fm. in Brunei. Several of those became much larger (sometimes even large for the genus) in the Miri Fm.: for example, the large specimen of *Melongena gigas* (Martin, 1883) figured in Vermeij & Raven 2009) or the large species *Volema goliath* Vermeij & Raven, 2009 of which two adults have been collected from the Miri Fm. but only a juvenile from the Seria Fm. The Miri Fm. in Sarawak received its sediment from the recently formed Rajang Mountains resulting in a mid-shelf depositional environment favourable to mollusc life (the fossils were collected from the transgressive/highstand claystone intervals). The Seria Fm. at Ambug Hill formed at a similar water depth but in a muddier environment, which appears to have been a harsher environment for molluscs. Thus, the strange endemic flair of the Ambug Hill fauna was probably caused by a combination of paleoenvironment and biogeographic separation. Tentatively, we assume that undersampling of Neogene IWP-faunas is a major problem for biogeographic analyses – sufficiently large samples are required from different basins and a range of depositional environments.

Acknowledgements

This study was supported by the grant UBD/PNC2/2/RG/1(326), additional support came from UBD/PNC2/2/RG/1(325) and the Austrian Science Fund (FWF) project P 29158 "Oligo-Miocene Faunal patterns in the Indian Ocean". We are thankful to Amajida Roslim, Sulia Goeting, Hazirah Razak, Ali A. Alizul, Rosnani Kusli and Aqil Johari for their contributions in the field work during the last three years of campaign. Many thanks to Rory Effendy Yahkup (Total, Brunei) who alerted Han Raven to the existence of the quarry, to Alan Beu (GNS Science, New Zealand), Gijs Kronenberg (Eindhoven), Didier Merle (Muséum national d'Histoire naturelle, Paris), André Verhecken (Royal Belgian Institute of Natural Sciences, Brussels), Marta deMaintenon (University of Hawaii at Hilo), and Phillip J. Fallon (Academy of Natural Sciences of Philadelphia) for the information, pre-reviews and comments.

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Explanations of the Plates

Plate 1

Rhinoclavis pulcherrima n. sp. – **1–2**, holotype, NHMW 2016/0281/0001.
Rhinoclavis pulcherrima n. sp. – **3–4**, paratype, NHMW 2016/0281/0002.
Rhinoclavis pulcherrima n. sp. – **5–6**, paratype, NHMW 2016/0281/0003.
Natica vitellus (Linnaeus, 1758) – 7–**10**, NHMW 2016/0282/0001.
Natica vitellus (Linnaeus, 1758) – **11–13**, NHMW 2016/0282/0003.
Natica vitellus (Linnaeus, 1758) – **14–15**, operculum, NHMW 2016/0282/0002.
Neverita didyma (Röding, 1798) – **16–17**, NHMW 2016/0283/0001.
Neverita didyma (Röding, 1798) – **18–20**, RGM.783423a, Tutong 8, Seria Fm.
Sinum eximium (Reeve, 1864) – **21–23**, RGM.1309457.

All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

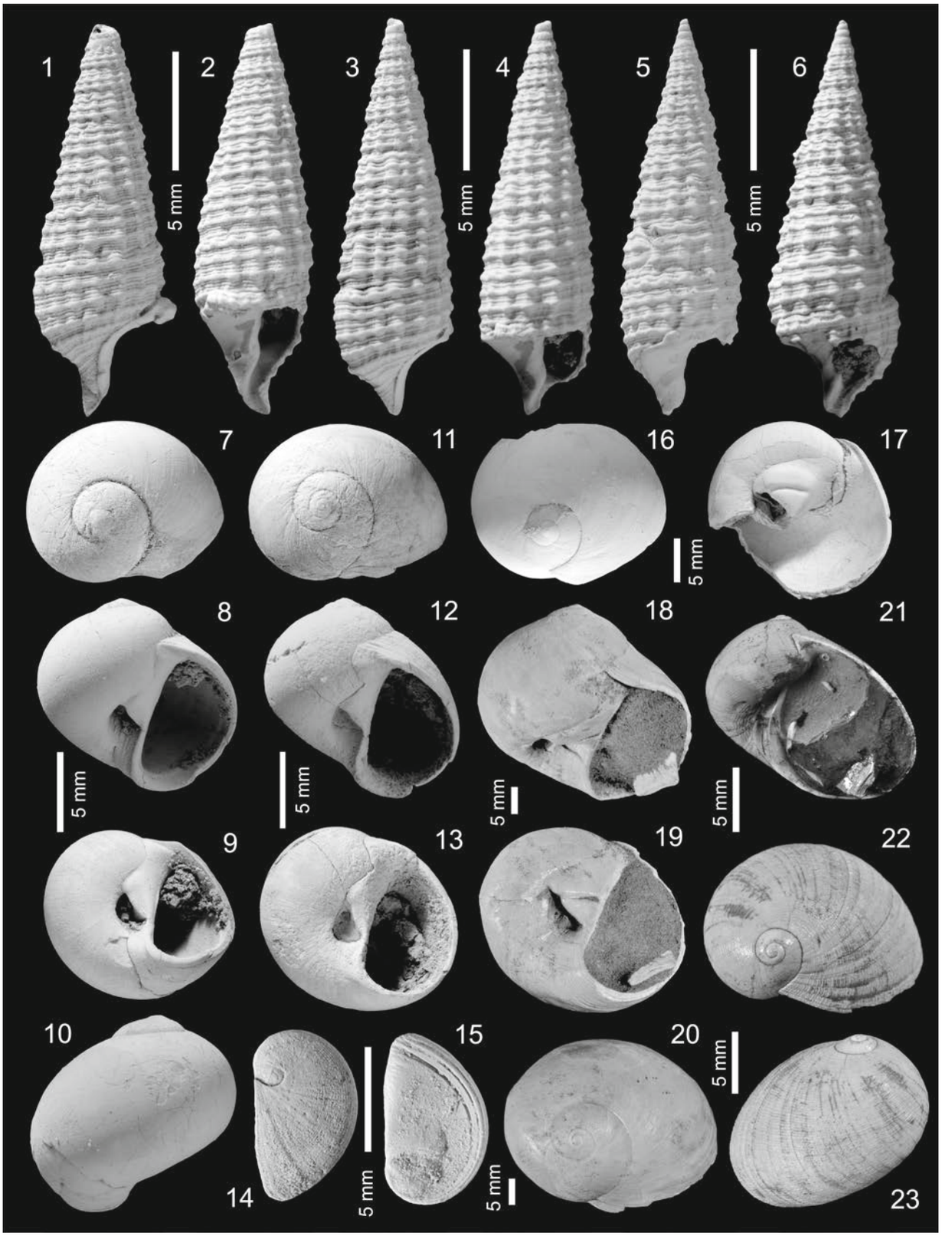
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Plate 2

Rissoina tutongensis n. sp. – **1–3**, holotype, RGM.783290, Seria oil field well 13, 1090–1100 m depth, Seria Fm.?
Calyptraea cf. *pellucida* (Reeve, 1859) – **4–6**, NHMW 2016/0282/0003.
Calyptraea cf. *pellucida* (Reeve, 1859) – **7–8**, NHMW 2016/0282/0003.
Ficus parvissima n. sp. – **9–12**, holotype, RGM.1309458, Tutong 8, Seria Fm.
Ficus parvissima n. sp. – **13–14**, paratype, NHMW 2016/0320/0001.
Xenophora solarioides jezleri Cox, 1948–**15–17**, NHMW 2016/0290/0001.
Dolomena bruneiensis n. sp. – **18–20**, holotype, NHMW 2016/0284/0001.
Dolomena bruneiensis n. sp. – **21**, paratype, NHMW 2016/0284/0002.
Dolomena bruneiensis n. sp. – **22–23**, paratype, RGM.1309462.
Varicospira cf. *javana* (Martin, 1879) – **24** (field picture).

All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

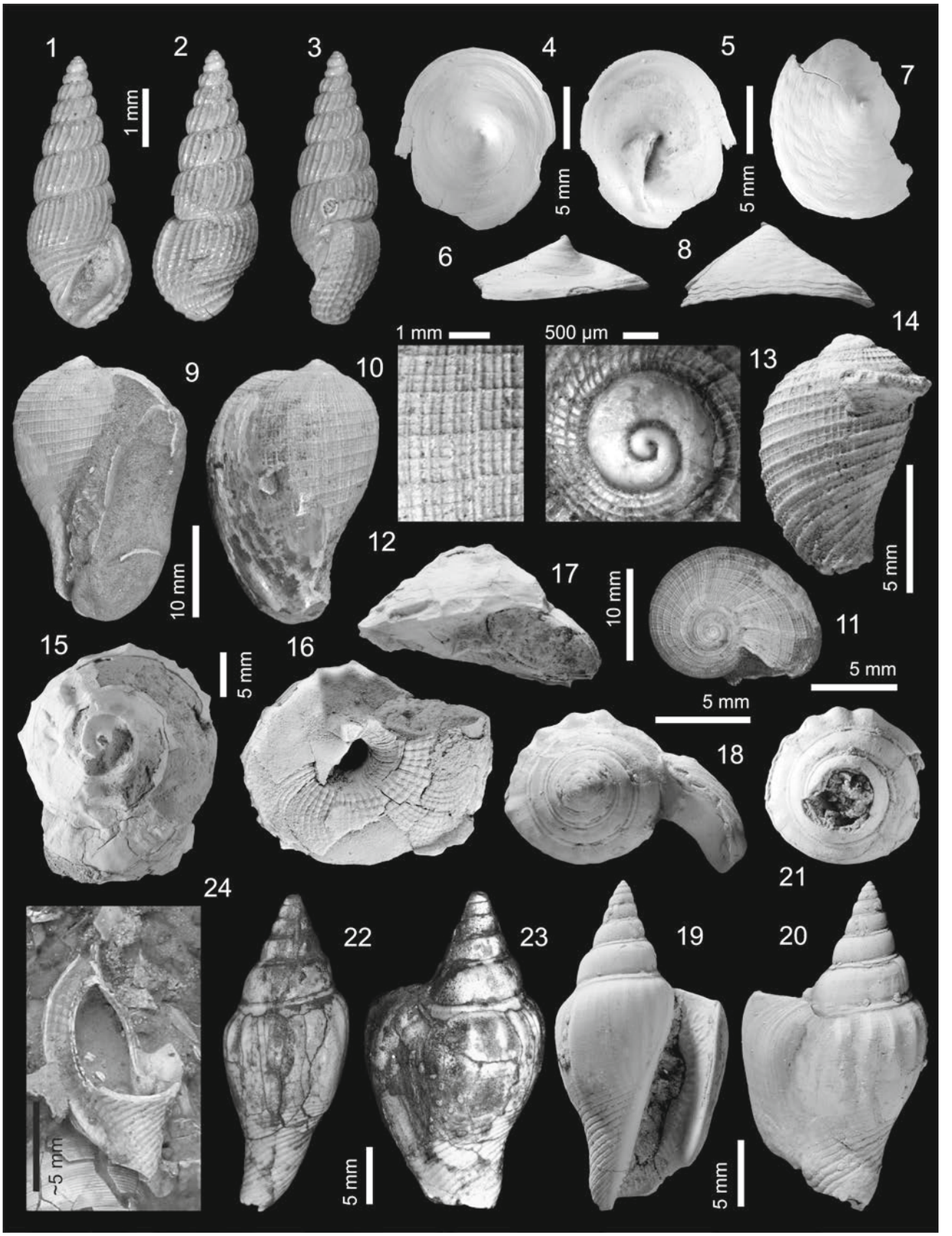
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Plate 3

Tibia melanocheilus (A. Adams, 1855) – **1**, R F5237/001.
Tibia melanocheilus (A. Adams, 1855) – **2**–**3**, NHMW 2016/0285/0001.
Terebellum cf. *terebellum* (Linnaeus, 1758) – **4**–**5**, NHMW 2016/0286/0001.
Bufonaria rana (Linnaeus, 1758) – **6**, NHMW 2016/0287/0001.
Bufonaria rana (Linnaeus, 1758) – **7**–**9**, R F5239/0001.
Bursina cf. *ignobilis* (Beu, 1987) – **10**–**12**, R 5238.
Gyrineum bituberculare (Lamarck, 1816) – **13**–**14**, R F5244.
Tonna sp. – **15**, NHMW 2016/0289/0001.
Tonna sulcosa (Born, 1778) – **16**–**17**, RGM.783433, Tutong 8, Seria Fm.
Scalptia verheckeni n. sp. – **18**–**20**, holotype, NHMW 2016/0291/0001.
Scalptia verheckeni n. sp. – **21**–**24**, paratype, NHMW 2016/0291/0002.
All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

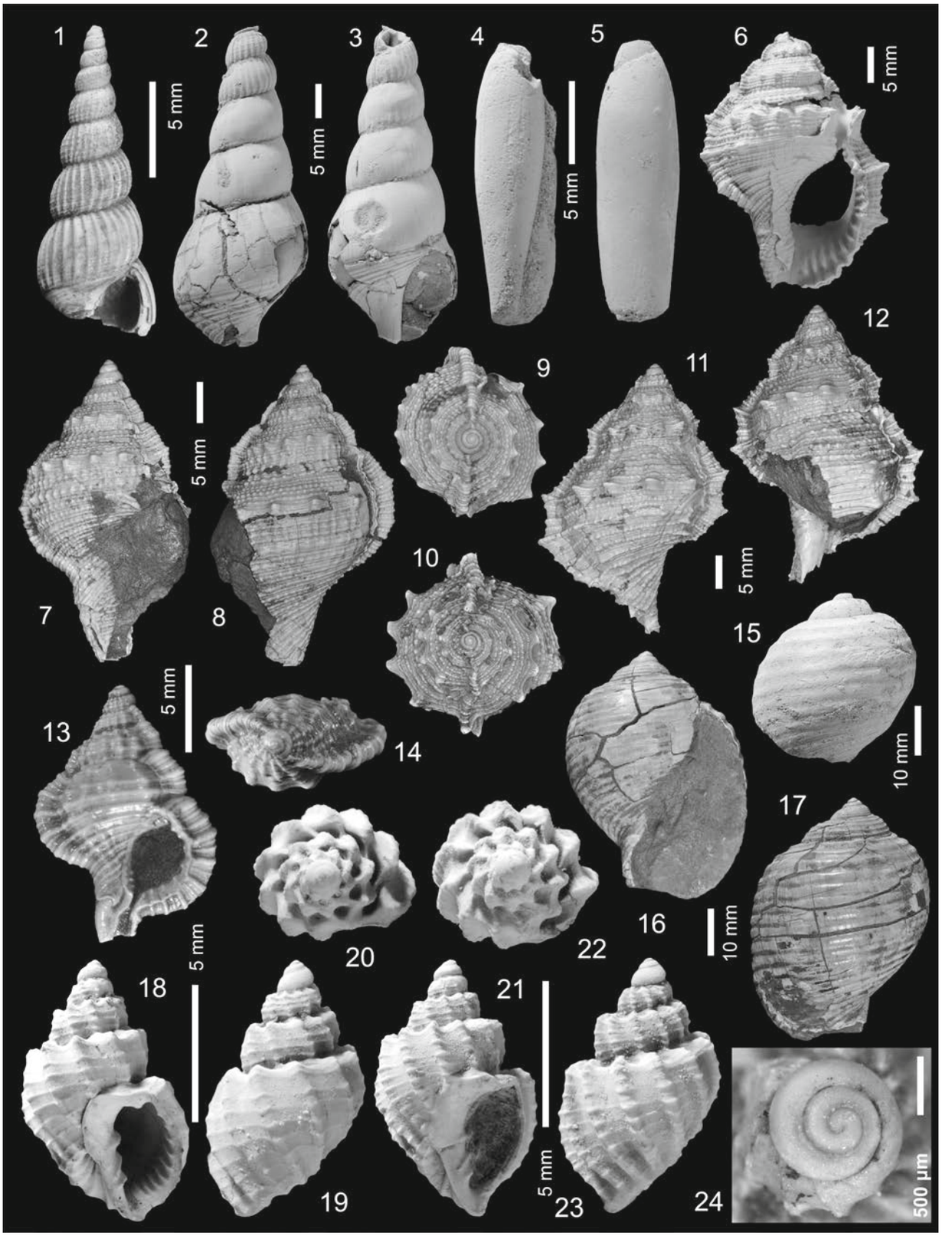
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Plate 4

Phos bruneiensis n. sp. – **1–2**, holotype, NHMW 2016/0293/0001.
Phos bruneiensis n. sp. – **3–5**, paratype, NHMW 2016/0293/0002.
Phos bruneiensis n. sp. – **6**, paratype, NHMW 2016/0293/0003.
Nassarius pseudoovum n. sp. – 7–**9**, holotype, NHMW 2016/0294/0001.
Nassarius pseudoovum n. sp. – **10**, **12**, paratype, NHMW 2016/0294/0004.
Nassarius pseudoovum n. sp. – **11**, paratype, NHMW 2016/0294/0002.
Nassarius pseudoovum n. sp. – **13**, paratype, NHMW 2016/0294/0003.
Indomitrella acuticonica n. sp. – **14–15**, holotype, NHMW 2016/0295/0001.
Indomitrella acuticonica n. sp. – **16–17**, paratype, NHMW 2016/0295/0002.
Indomitrella acuticonica n. sp. – **18–19**, paratype, NHMW 2016/0295/0003.
Costellaria teschi (Koperberg, 1931) – **20–21**, NHMW 2016/0292/0001.
Costellaria teschi (Koperberg, 1931) – **22–23**, NHMW 2016/0292/0002.
All specimens from Ambug Hill (Seria Fm.).

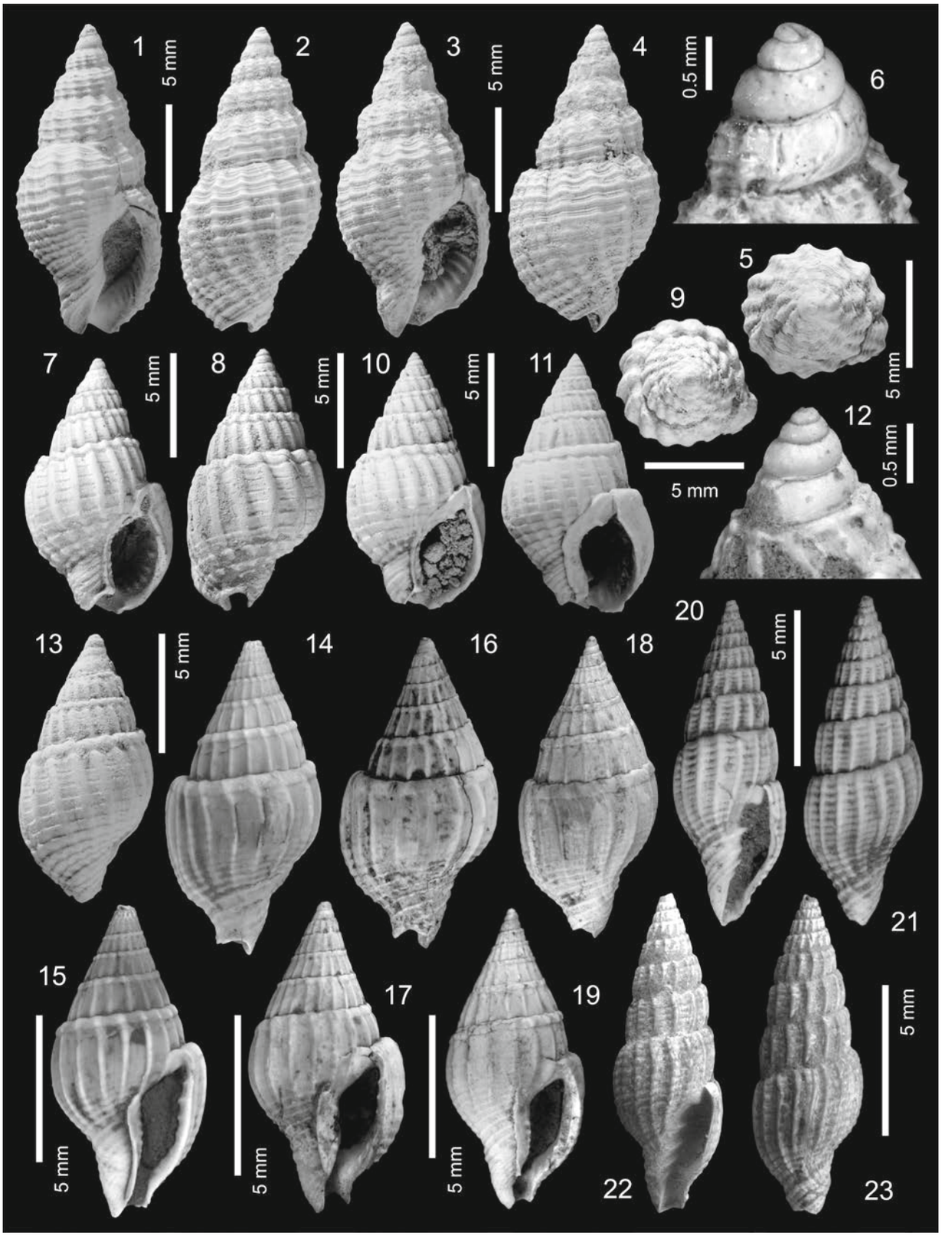
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Plate 5

Costellaria sp. – **1–2**, R F5309/001.
Clavilithes tjidamarensis (Martin, 1879) – **3–5**, NHMW 2016/0296/0001a.
Clavilithes tjidamarensis (Martin, 1879) – **6–8**, NHMW 2016/0296/0002.
Clavilithes tjidamarensis (Martin, 1879) – **9–10**, NHMW 2016/0296/0001b.
Clavilithes verbeeki (Martin, 1895) – **11–12**, RGM.783418a, Tutong 8, Seria Fm.
Clavilithes verbeeki (Martin, 1895) – **13–15**, NHMW 2016/0297/0001.
Hemifusus charlieleei n. sp. – **16–18**, holotype, NHMW 2016/0298/0001.
Hemifusus charlieleei n. sp. – **19–21**, NHMW 2016/0299/0001.
Hemifusus charlieleei n. sp. – **22–24**, paratype, RGM.1309470.

All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

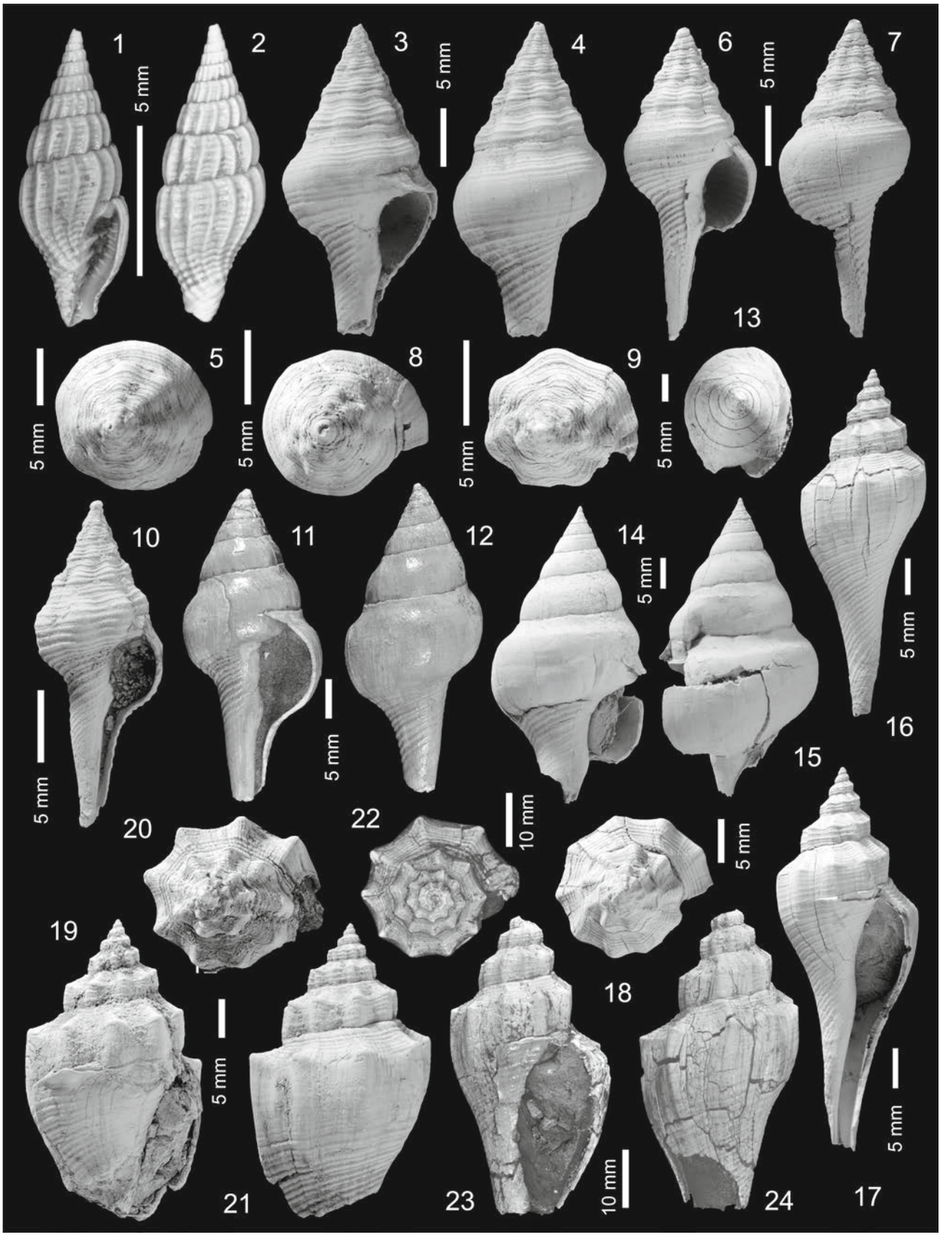
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Plate 6

Calotrophon (*Panamurex*) sp. – **1–3**, NHMW 2016/0301/0001.
Hexaplex sp. – **4–5**, R F5277/001.
Murex troscheli verbeeki Martin, 1895 – **6–8**, NHMW 2016/0300/0001.
Amalda bruneiana n. sp. – **9–10**, holotype, NHMW 2016/0353/0001.
Amalda bruneiana n. sp. – **11–12**, paratype, NHMW 2016/0353/0002.
Amalda bruneiana n. sp. – **13–14**, paratype, NHMW 2016/0353/0003.
Amalda sp. – **15**, R. F5260/002.
Amalda sp. – **16–17**, R. F5260/001.
Prunum seriaense n. sp. – **18–20**, holotype, NHMW 2016/0302/0001.
Prunum seriaense n. sp. – **21–22**, paratype, NHMW 2016/0302/0002.
Prunum seriaense n. sp. – **23–24**, paratype, NHMW 2016/0302/0003.

All specimens from Ambug Hill (Seria Fm.).

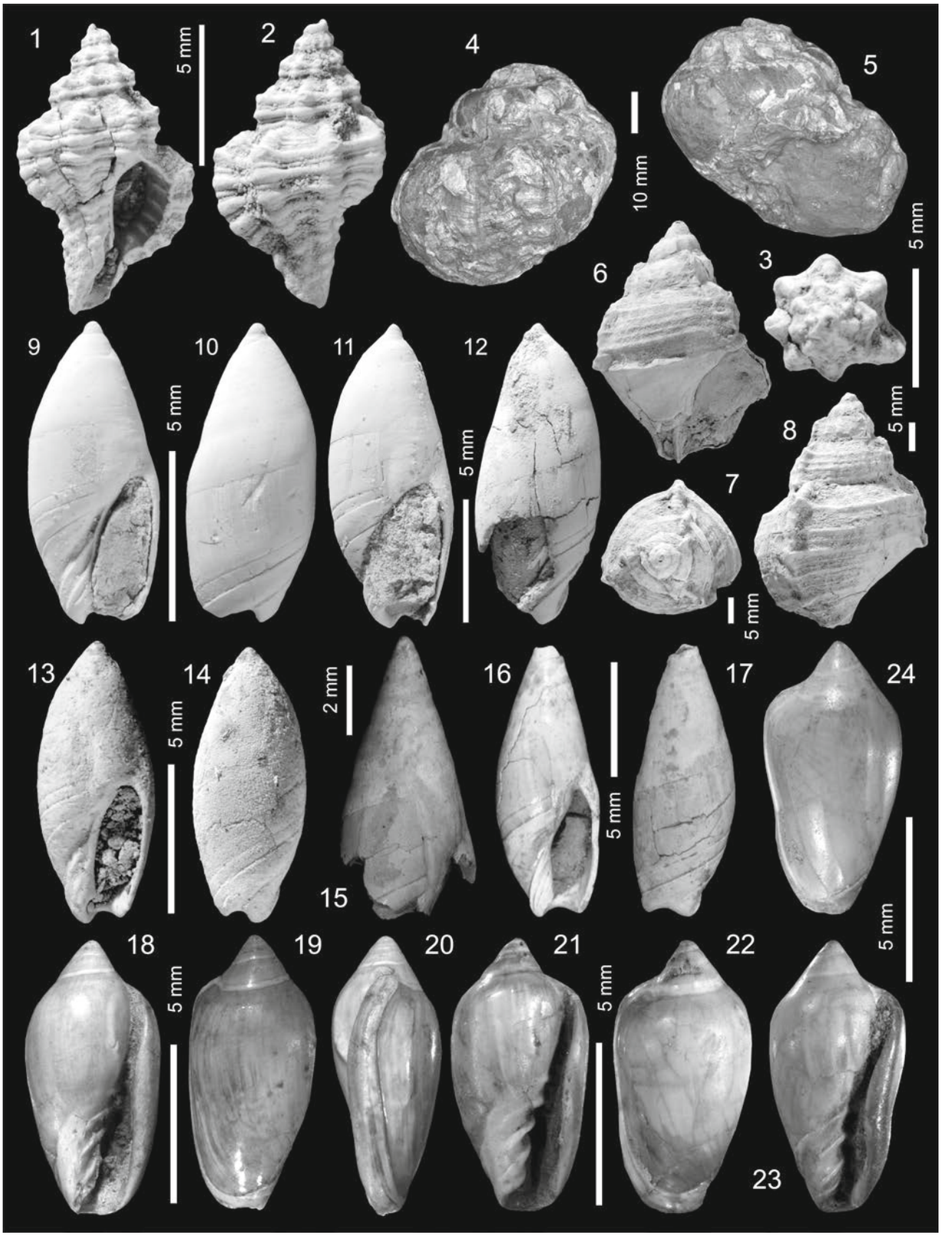
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Plate 7

Cymbiola ambugensis n. sp. – **1–4**, paratype, RGM.1309467, Beraya-Tusan seacliffs, Sarawak, Miri Fm., **3**, UV-light photo, inverted.
Cymbiola ambugensis n. sp. – **5–7**, holotype, NHMW 2016/0303/0001.
Cymbiola ambugensis n. sp. – **8**, paratype, NHMW 2016/0303/0002.
Cymbiola ambugensis n. sp. – **9–10**, paratype, juvenile, RGM.1309648, Beraya-Tusan seacliffs, Sarawak, Miri Fm.
Cymbiola ambugensis n. sp. – **11**, paratype, RGM.1309469, Beraya-Tusan seacliffs, Sarawak, Miri Fm.
Cymbiola tjilonganensis –**12–14**, R F5325/001.
Ziba waltercernohorskyi n. sp. – **15–16**, holotype, NHMW 2016/0304/0001.
Ziba waltercernohorskyi n. sp. – **17–18**, paratype, RGM.1309419a, Beraya-Bekenu road km 28.5 left, Sarawak, Miri Fm.
Ziba fijiensis (Ladd, 1934) – **19–20**, R F5307/001.

All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

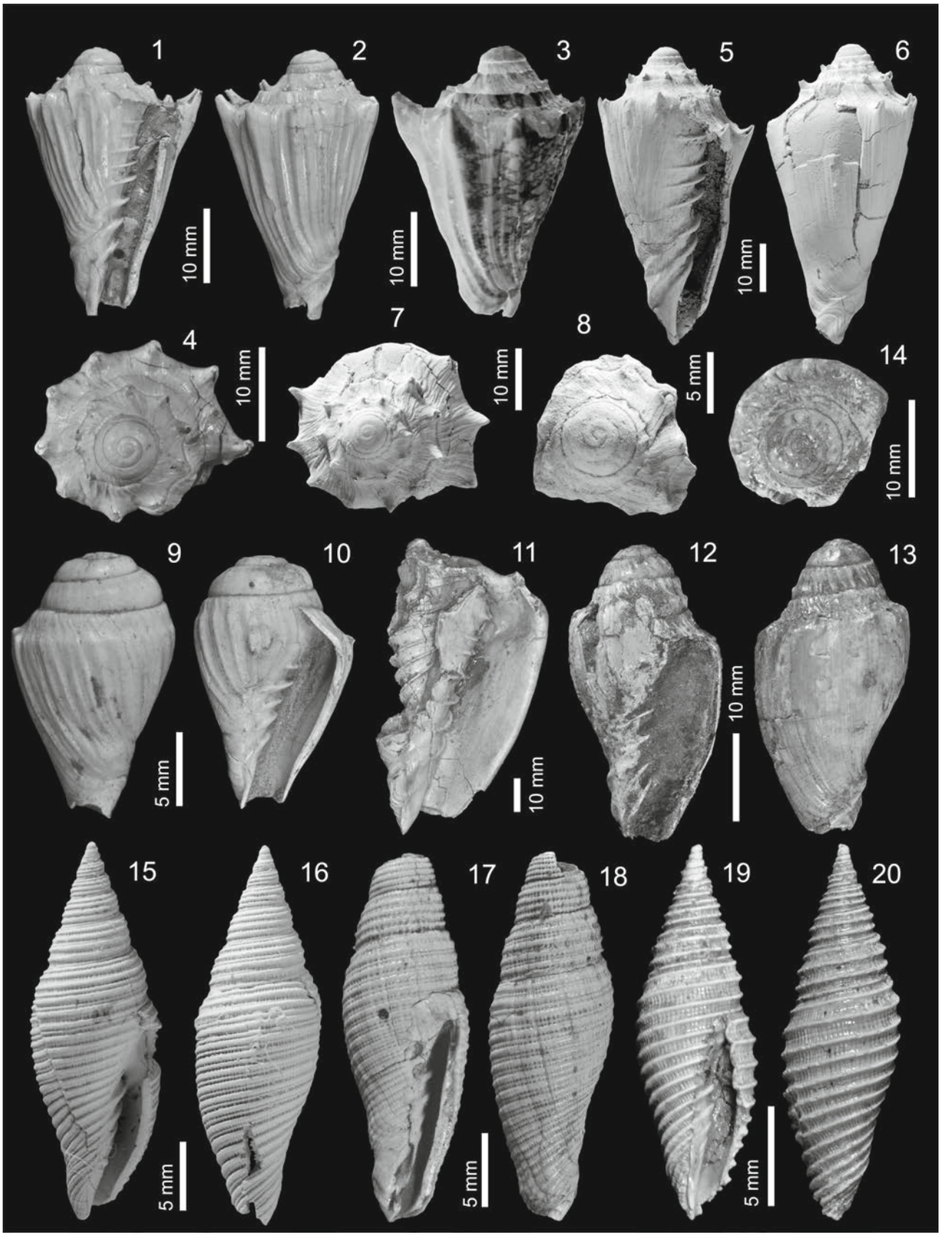
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Plate 8

Gemmula sp. – **1**, R F5326.
Tomopleura furcata –**2–3**, holotype, RGM.309429.
Unedogemmula nuttalli n. sp. – **4–6**, holotype, RGM.1309460, Seria oil field well 1 1330–1340 m depth, Seria Fm.
Unedogemmula nuttalli n. sp. – **7–8**, paratype, NHMW 2016/0306/0001.
Gemmula sculpturata n. sp. – **9–10**, holotype, NHMW 2016/0307/0001.
Gemmula sculpturata n. sp. – **11–12**, paratype, NHMW 2016/0307/0002.
Crassispira molengraaffi (Martin, 1916) – **13–14**, R F5281.
Crassispira sp. 1–**15–16**, R F5294.
Crassispira sp. 2–**17–18**, R F5298.
All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

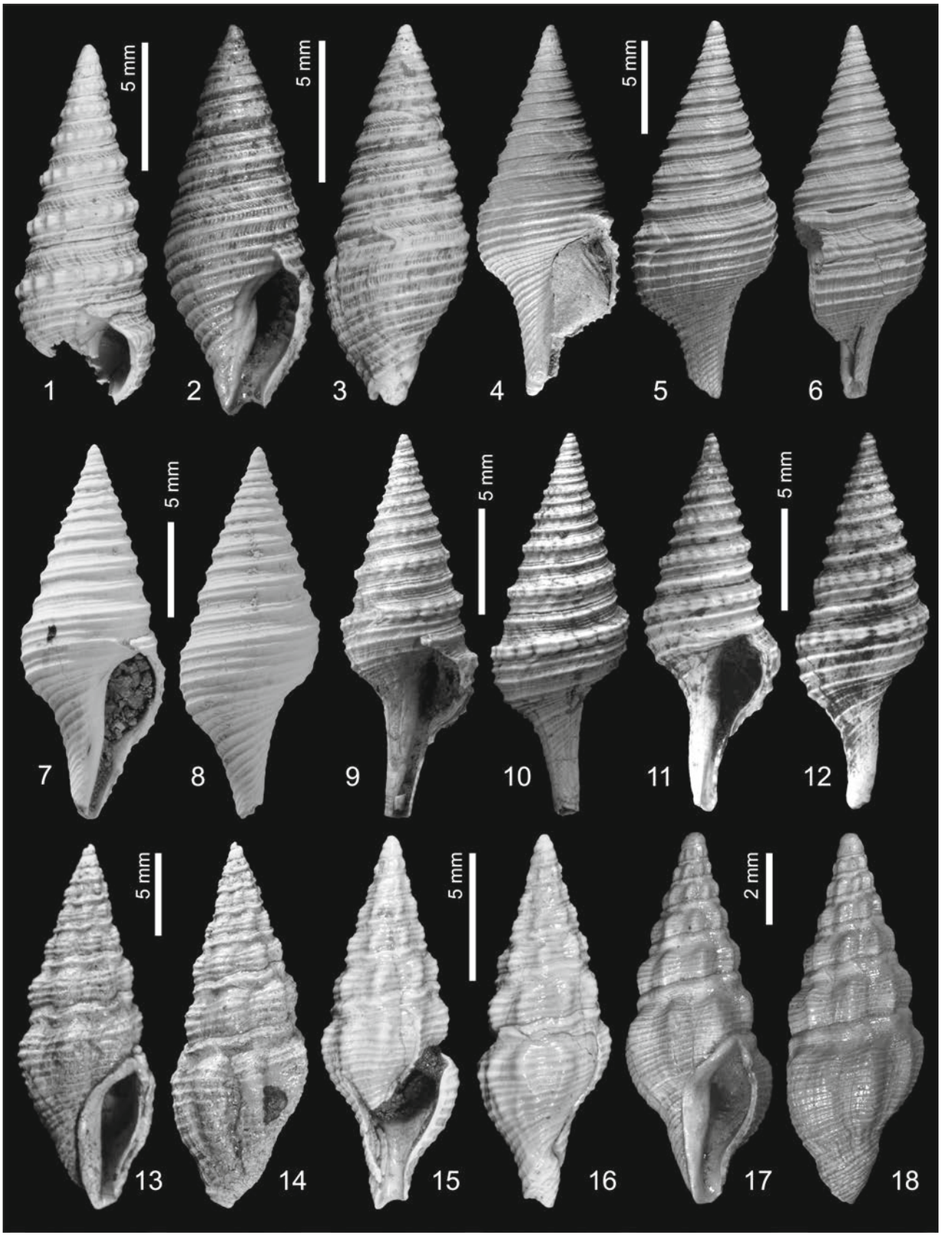
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Plate 9

Crassispira sp. 3–**1–2**, R F5332.
Carinodrillia sp. – **3–4**, R F5333.
Crassispira ? sp. 4–**5–6**, R F5334.
Crassispira strangulata n. sp. – 7–**8**, holotype, NHMW 2016/0311/0001.
Crassispira strangulata n. sp. – **9–10**, paratype, NHMW 2016/0311/0002.
Funa sp. – **11**, NHMW 2016/0312/0001.
Clathrodrillia sp. 1–**12**, NHMW 2016/0309/0001.
Clathrodrillia kutaiana Beets, 1985a –**13–14**, NHMW 2016/0308/0001.
Clathrodrillia sp. 2–**15–16**, NHMW 2016/0310/0001.
Paradrillia pachyspira n. sp. – **17–18**, holotype, NHMW 2016/0321/0001.
All specimens from Ambug Hill (Seria Fm.).

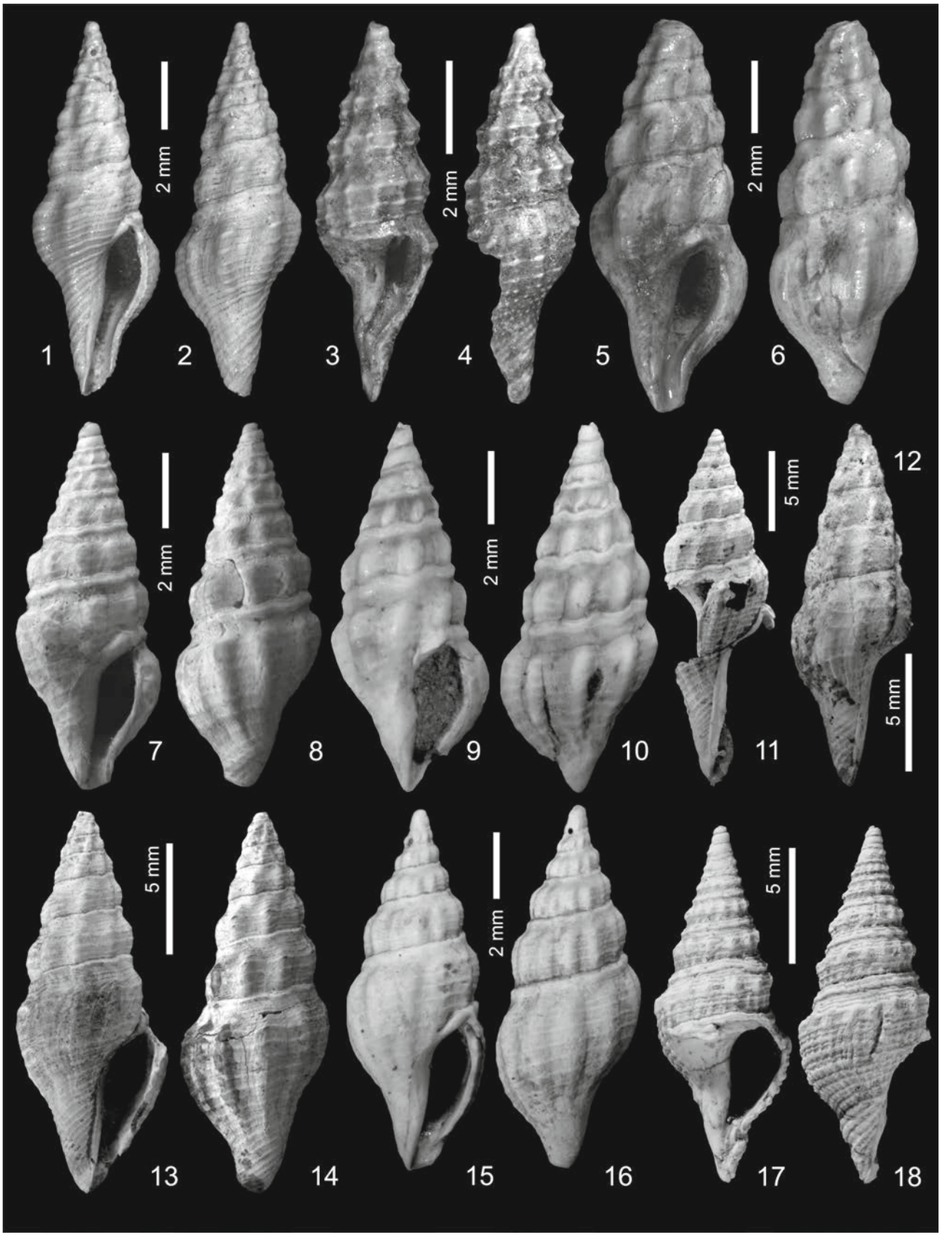
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Plate 10

Paradrillia pachyspira n. sp. – **1–2**, paratype, RGM.1309472.
Conasprella sondeiana (Martin, 1895) – **3**, R F5274.
Asprella ornatissima (Martin, 1883) – **4–5**, NHMW 2016/0313/0001.
Asprella ornatissima (Martin, 1883) – **6–8**, NHMW 2016/0313/0001.
Conasprella trianginodus n. sp. – **9–11**, holotype NHMW 2016/0314/0001.
Conasprella paupera n. sp. – **12–14**, holotype, RGM.783449, Tutong 9A, Seria Fm.
Conasprella paupera n. sp. – **15**, paratype, RGM.783411, Tutong 8, Seria Fm.
Conasprella paupera n. sp.– **16–18**, R F5256/001.
Conasprella trianginodus n. sp.– **19–21**, paratype (RGM.1309422).

All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.

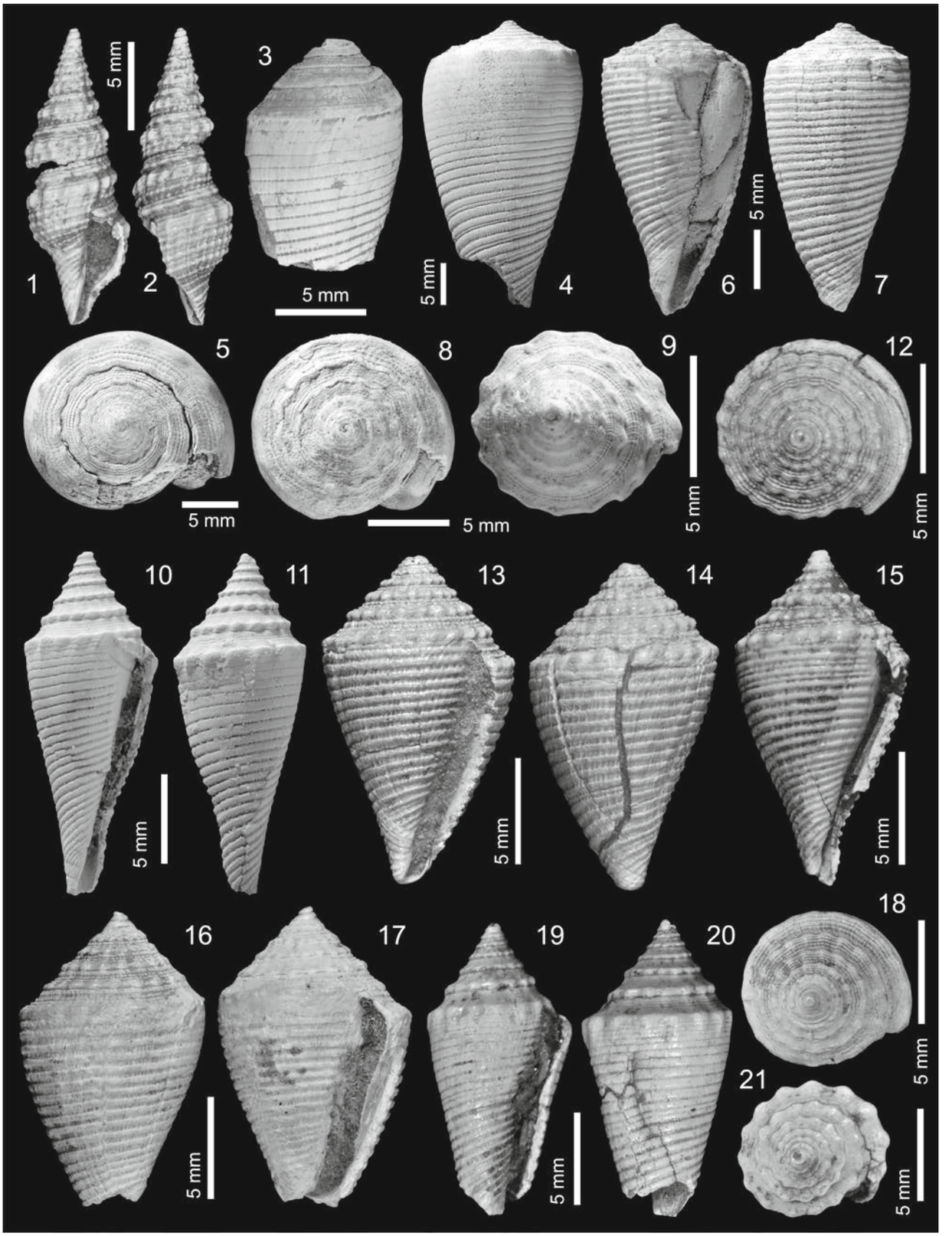
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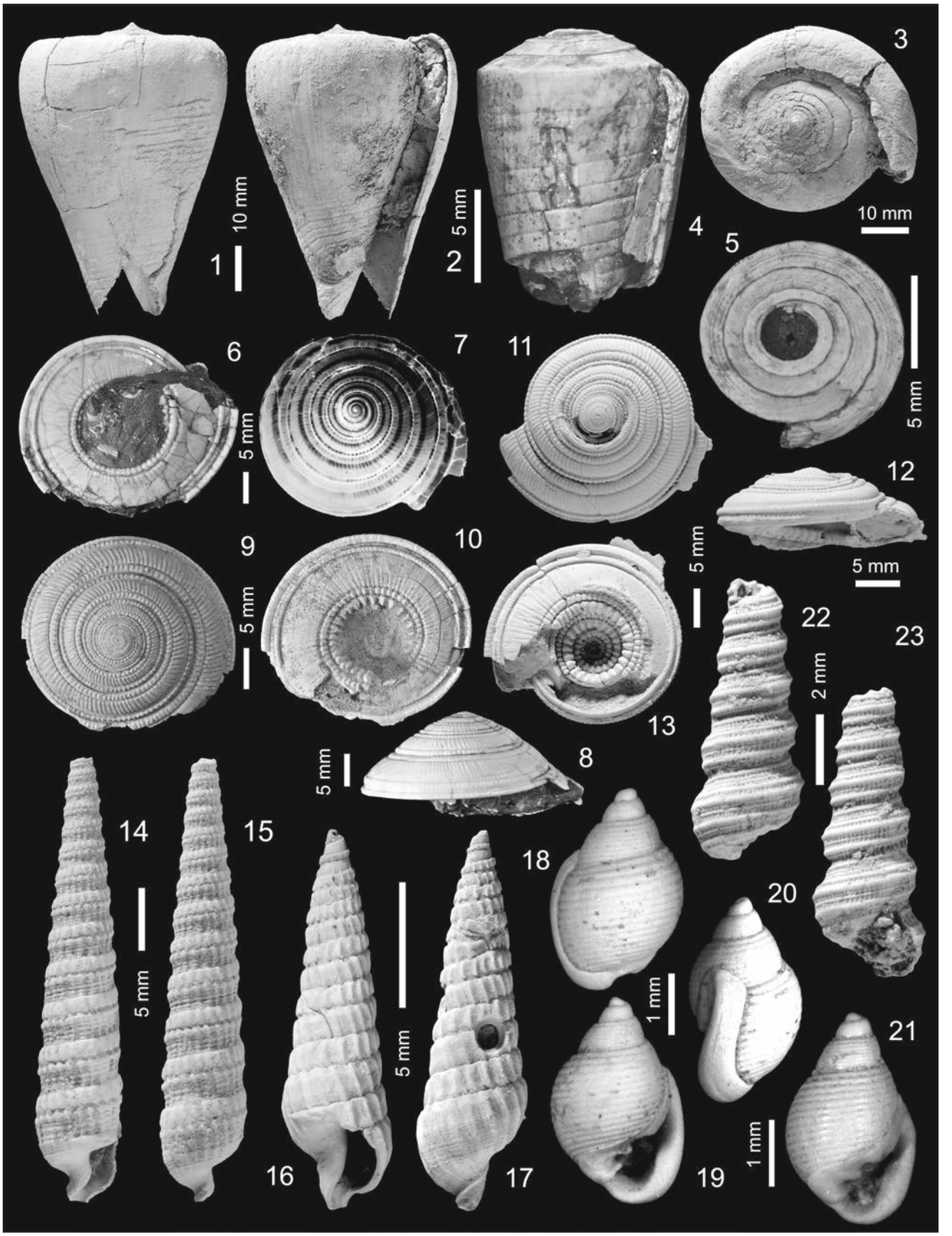
Plate 11

Dendroconus buxeus loroisii (Kiener, 1846) – **1–3**, NHMW 2016/0315/0001.
Phasmoconus sp. – **4–5**, R F5273.
Architectonica beetsi n. sp. – **6–8**, paratype, RGM.1309473a, Beraya-Tusan seacliffs, 11.4–9.5 km, Sarawak, Miri Fm., 7 UV-light photo, inverted.
Architectonica beetsi –**9–10**, paratype, RGM.783400a, Tutong 8, Seria Fm.
Architectonica beetsi n. sp. – **11–13**, holotype**,** NHMW 2016/0318/0001.
Triplostephanus wilfordi n. sp. – **14–15**, holotype, NHMW 2016/0316/0001.
Duplicaria aequalis n. sp. – **16–17**, holotype, NHMW 2016/0317/0001.
Ringicula seriaensis Beets, 1986–**18–20**, NHMW 2016/0282/0003).
Ringicula seriaensis Beets, 1986–**21**, NHMW 2016/0282/0003).
Mathilda sp. – **22–23**, NHMW 2016/0319/0001.

All specimens from Ambug Hill (Seria Fm.) if not stated otherwise.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