A new genus for Indo-Pacific fossil strombids, and two new species from the Miocene of Java and Borneo (Caenogastropoda, Strombidae)

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A new strombid genus (*Spinatus* gen. nov.) is described from the Miocene of Indonesia. Two new species of *Spinatus* from the middle and upper Miocene of Indonesia are described: *S. echinatus* spec. nov. and *S. wonosariensis* spec. nov. The former is selected as the type species of *Spinatus*. A third species, *Strombus* (*Strombus*) *tjilonganensis* Martin, 1899, is here assigned to the new genus. Notes are given on the genus *Persististrombus* Kronenberg & Lee, 2007 as its species show the highest similarity with *Spinatus*. Furthermore, a characterization is given of the fossil-rich, but previously unknown, Miocene assemblage from the area of Wonosari (Java).

Key words: Strombidae, *Spinatus*, new genus, new species, Miocene, Langhian, Wonosari, Indonesia.

INTRODUCTION

The Neogene fossil assemblages of Indonesia are known mainly from the work of Dutch geologists working in the area at the end of the 19th century and beginning of the 20th century. The pioneer in Indonesia fossil mollusc research was Martin, who published numerous papers (1879-1932), work continued by Tesch (1915-1920), Oostingh (1923-1941), Koperberg (1931), Haanstra & Spiker (1932), Pannekoek (1936), van Regteren Altena (1938-1972) and Beets (1941-1986). These works are supplemented by a handful of works by non-Dutch researchers (Wanner & Hahn, 1935; Cox, 1948; Nuttall, 1961-1965). For a full bibliography of the above mentioned authors see Leloux & Wesselingh (2009). For the most part, material amassed by the Dutch workers is housed in the Naturalis Biodiversity Center, Leiden (The Netherlands), which has the most important collection of Indonesian fossils known. Martin's type material from this collection was recently catalogued, photographed and updated by Leloux & Wesselingh (2009).

Since then, sporadic papers have added to our knowledge of these rich Neogene assemblages (i.e. Vermeij & Raven, 2009; Raven, 2016; Harzhauser et al., 2018). Photographs of undescribed fossil shells in popular books, such as Dharma (2005), hint at a much greater diversity than so far known.

Major family-level revisions on the assemblages are so far lacking, with the notable exception of Beu's (2005) work of the tonnoidean gastropods of Indonesia and Robba's (2013) revision on the pyramidelloidean gastropods.

In this work we focus on an as yet unpublished fossil assemblage from the area of Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, Java, Indonesia. This locality might have been mentioned in the literature before, spelled 'Wirosari' (Martin, 1881: 123; Leloux & Wesselingh, 2009: 172) and three species were described from these deposits including *Strombus* (*Strombus*) *preoccupatus* Finlay, 1927 (see Leloux & Wesselingh, 2009). However, all three species are represented by 'steinkerns', whereas the plentiful material we have seen is all well preserved, the shells filled with soft matrix. Therefore, although the historical material figured by Leloux & Wesselingh might be from the same area, they are certainly not from the same beds.

This assemblage shows remarkable diversity of fossil gastropods and the preservation is unusually good. Here, we concentrate on two new strombid species. We hope to follow this with a series of systematic taxonomic papers describing the rest of this assemblage.

MATERIAL AND METHODS

The material described here is deposited in the Natural History Museum Vienna (NHMW). The Beets (1941) material is deposited in the Naturalis Biodiversity Center, Leiden, The Netherlands (RGM coll.). The systematics follow Bouchet et al. (2017).

Matrix for geological dating was taken from three samples at random. Preparation for smear slides followed the standard method described by Perch-Nielsen (1985a, b). Nannofossil identifications were made using light-microscopy (Leica DMLP). All samples were investigated under 1000× magnification with parallel and crossed nicols. Biostratigraphic assignments were made in accordance with the nannoplankton zonation of Martini (1971).

Abbreviations. — NHMW = Natural History Museum Vienna (Vienna, Austria); RGM = Rijksmuseum voor Geologie en Mineralogie, now part of Naturalis Biodiversity Center, Leiden, The Netherlands; VL = Virgilio Liverani private collection.

GEOLOGICAL SETTING

The material originates from the area around the village of Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, 40 km SE of Yogyakarta, Java, Indonesia. The exact locality is unknown, but the deposits outcrop on the banks of a river or stream. The collection was donated to the Natural History Museum Vienna (NHMW) in the framework of an exchange with K. Martin. Although this situation is far from ideal, the collection deposited represents the best-preserved middle Miocene Indonesian assemblage we have seen, with many species that remain undescribed. The preservation of the fossils, and the attached matrix, is similar for the whole collection. Matrix was removed from three specimens and examined for microfossils. All three samples were identical in their microfossil content, and we are therefore quite certain they all come from the same locality.

Miocene calcareous nannofossils were investigated by Renema et al. (2015) from the Kutai Basin and Marshall et al. (2015) from the Mahakam Delta. Sediments from Mahakam Delta contains a nannofossil assemblage identical to that seen in the assemblages from the three samples investigated in our study. This section was dated as Langhian (NN4/NN5) based on planktic foraminifera, larger benthic foraminifera and calcareous nannofossils.

All three investigated samples contain rare, moderately preserved calcareous nannofossils accompanied by common ascidian spicules. The nannofossil assemblages are dominated by *Reticulofenestra minuta* Roth, 1970 and *Umbilicosphaera jafari* Muller, 1974. Also occurring are: *Calcidiscus leptoporus* (Murray & Blackman, 1898) Loeblich & Tappan, 1978, *Calciosolenia fossilis* (Deflandre *in* Deflandre & Fert, 1954) Bown, *in* Kennedy et al., 2000, *Coronosphaera mediterranea* (Lohmann, 1902) Gaarder, in Gaarder & Heimdal, 1977, *Cyclicargolithus floridanus* (Roth & Hay, *in* Hay *et al.*, 1967) Bukry, 1971, *Discoaster deflandrei* Bramlette & Riedel, 1954, *Discoaster exilis* Martini & Bramlette, 1963, *Discoaster variabilis* Martini & Bramlette, 1963, *Helicosphaera carteri* (Wallich, 1877) Kamptner, 1954 and *Umbilicosphaera rotula* (Kamptner, 1956) Varol, 1982. The stratigraphic important zone marker *Sphenolithus heteromorphus* Deflandre 1953 occurs frequently in all three samples. Reworked fossils from older sediments were not observed.

Based on the presence of *S. heteromorphus*, and the absence of *Helicosphaera ampliaperta* Bramlette & Wilcoxon, 1967 all three investigated samples can be attributed to the NN5 zone (Martini, 1971), which comprises the upper Langhian and the lowermost Serravallian. Although the absence of *H. ampliaperta* can be caused by paleoenvironmental conditions, based on the similarity with the nannofossils association described by Marshall et al. (2015) our assemblages can be dated as Langhian (upper NN4/NN5).

Common occurrences of small reticulofenestrids (*Reticulofenestra minuta*) and ascidian spicules together with discoasters point to shallow, well stratified, warm marine water.

SYSTEMATIC PART

Subclass Caenogastropoda Cox, 1960
Order Littorinimorpha Golikov & Starobogatov, 1975
Superfamily Stromboidea Rafinesque, 1815
Family Strombidae Rafinesque, 1815

Genus *Spinatus* gen. nov.

Type species (by original designation). — *Spinatus echinatus* spec. nov. (Langhian portion of NN5, middle Miocene, Indonesia).

Etymology. — Latin, 'spino, -are, -avi, -atus', spiny or crowned with thorns, from the solid pointed tubercles or spines present in all species of this group.

Diagnosis. — Shell of moderate size for the Strombidae family, compact and robust, with a row of robust spines on the shoulder of the last whorl, and two or three other rows of smaller pointed knobs on the dorsum. Slightly expanded outer lip, in some species very thickened but with thin slightly rounded border, and a triangular adapical extension parallel to axis, smooth or plicate within, a vertical thickened ridge placed some distance within outer lip in some species; callused columella smooth, columellar and parietal calluses moderately thickened, fused. Siphonal canal short and straight, posterior canal absent, stromboid notch and posterior sinus deep.

Other species included. — *Strombus* (*Strombus*) *tjilonganensis* Martin, 1899 (original description Martin, 1889: 177-178, pl. 28 figs 410, 410a, 411, pl. 39 figs 412, 412a; syntypes figured by Leloux & Wesselingh, 2009: pl. 232 fig. 15, pl. 233 figs 1-7), and *Spinatus wonosariensis* spec. nov.

Remarks. — *Spinatus* gen. nov. is most similar to the genus *Persististrombus* Kronenberg & H.G. Lee, 2007 (type species, by original designation, *Strombus granulatus* Swainson, 1822, Recent, Panamic Pacific), which was erected for a group of strombid species characterised by the moderate size, fusiform shape, distinct knobs (with rounded tips) on the shoulder of the last whorl, outer lip moderately expanded, without extensions, with a thin unglazed rim, divided callus on columella, no posterior canal, inside of lip may be smooth, plicate or granulate. However, *Spinatus* gen. nov. differs in having a shorter last whorl, sharp instead of rounded spines, a more strongly thickened outer lip with an adapical extension of the lip that is absent in all species of *Persististrombus*, an elevated ridge placed some distance within the outer lip in some species, and an undivided columellar callus. We are uncertain of the placement of several Neogene Indo-Pacific species, such as *Strombus bernielandaui* Harzhauser, 2007, *Strombus quilonensis* Dey, 1962 and *Persististrombus kronenbergi* Harzhauser, 2009. They may be closer to *Spinatus* gen. nov. than to *Strombus* Linnaeus, 1758 or *Persististrombus*, but we currently exclude them from the new genus, awaiting further studies.

Following this generic revision, the oldest record of *Persististrombus* is *P. radix* (Brongniart, 1823), from the Atlantic Oligocene of France (Lozouet & Maestrati, 1986). During the lower Miocene *P. nodosus* (Borson, 1820) (*Strombus bonellii* Brongniart, 1823 is a synonym) is the most widespread member of the genus, recorded from Italy, France and Greece (Borson, 1820; Lozouet et al., 2001; Harzhauser & Kronenberg, 2013), but other forms like *P. praecedens* (Schaffer, 1912) described from Austria (Schaffer, 1912; Harzhauser & Kronenberg, 2013) and *P. gijskronenbergi* Harzhauser, 2007 (Aquitanian, south Oman) are present in the lower Miocene too. In the middle Miocene *P. inflexus* (Eichwald, 1830) was widespread along the European Atlantic frontage, Paratethys and Proto-Mediterranean of Turkey (Glibert, 1949; Landau et al., 2013; Harzhauser & Kronenberg, 2013), and again local species such as *P. exbonellii* (Sacco, 1893), *P. lapugyensis* (Sacco, 1893) and *P. pannonicus* Harzhauser & Kronenberg, 2013 occurred in the Paratethys (Harzhauser & Kronenberg, 2013). These Miocene species often have two rows of smaller knobs below the shoulder on the dorsum of the last whorl. During the middle-late Miocene, after the closure of the Tethyan seaway that connected the Proto-Mediterranean Sea to the Indian Ocean, the species *P. inflexus* became widespread and predominant in the Paratethys and Proto-Mediterranean Sea, living along with some other short-lived local species, probably spreading also along the nearby West African coast (Harzhauser & Kronenberg, 2013). From one of these Miocene species evolved the Pliocene *P. coronatus* (Defrance, 1827), widespread in the Mediterranean Sea until the late Pliocene cooling event (Landau et al., 2004). The present-day representatives of this genus are *P. latus* (Gmelin, 1791) along the West coast of Africa, and extending into the Mediterranean during the warm Pleistocene interglacials MIS 7 and 5 (De Torres et al., 2006), which is very similar to *P. coronatus*, and *P. granulatus* (Swainson, 1822), whose ancestors were already present in the Miocene-Pliocene in the Caribbean (Jung & Heitz; 2001; Landau & Silva, 2010). The origin of these Miocene Caribbean forms is not known. *P. granulatus* is today confined to the Panamic Pacific, but prior to the closure of the Central American Seaway it was also present in the Caribbean until at least the early Pliocene (Landau & da Silva, 2010).

At present little can be said about the history of *Spinatus* gen. nov., which is currently known only to occur in middle and upper Miocene strata of Indonesia. *Strombus* (*Strombus*) *tjilonganensis* Martin, 1899 from the upper Miocene of Cilonggan (Java) is shorter spired than the other two members of this group described herein, but shares the sharp spines, strongly thickened outer lip and very short anterior canal, which suggest it should be included in *Spinatus*. This group has no living representatives.

Spinatus echinatus spec. nov.

Figs 1-5

Strombus (*Strombus*) *preoccupatus* Finl. – Beets, 1941: 67, pl. 3 figs 123-144 (non Finlay, 1927).

Type series and dimensions (Tables 1 & 2). — All fully adult specimens, unless stated otherwise.

Other material. — nhmw 1901/0034/0017 (3): Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, Java, Indonesia. rgm.312370-373 (4 juveniles), rgm.312374 (1), rgm.312377-379 (3), rgm.312386 (9 incomplete), rgm.312387 (10 adults), rgm.312388 (9 adults), rgm.312389 (43 juveniles), rgm.312390 (24 incomplete adults), rgm.312391 (23 incomplete adults), rgm.312392 (68 incomplete juveniles), rgm.312391 (13 incomplete adults), rgm.312394 (80 incomplete juveniles), rgm.312395 (123 incomplete juveniles), rgm.312396 (27 fragments), rgm.312397 (51 incomplete juveniles): all samples upper Miocene, Sungai Menkrawit, Mangkalihat Peninsula, East Kalimantan Province (Kalimantan Timur), Borneo Island, Indonesia.

Etymology. — Latin '*echinus, -i*' noun meaning sea urchin, name reflecting the numerous spines, akin to an urchin. *Spinatus* gender masculine.

Type locality. — Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, Java, Indonesia.

Type stratum. — Langhian portion of nn5, middle Miocene.

Diagnosis. — *Spinatus* species of average size for genus, very solid, relatively long spire with row of sharp spines placed just above suture, short last whorl with sharp spines developed at shoulder and mid-whorl, further weaker rows of spines produced in some specimens at base and between mid-whorl and base, outer lip strongly thickened with smooth or lirate ridge within, stromboid notch narrow, deep, columellar and parietal calluses fused, thickened.

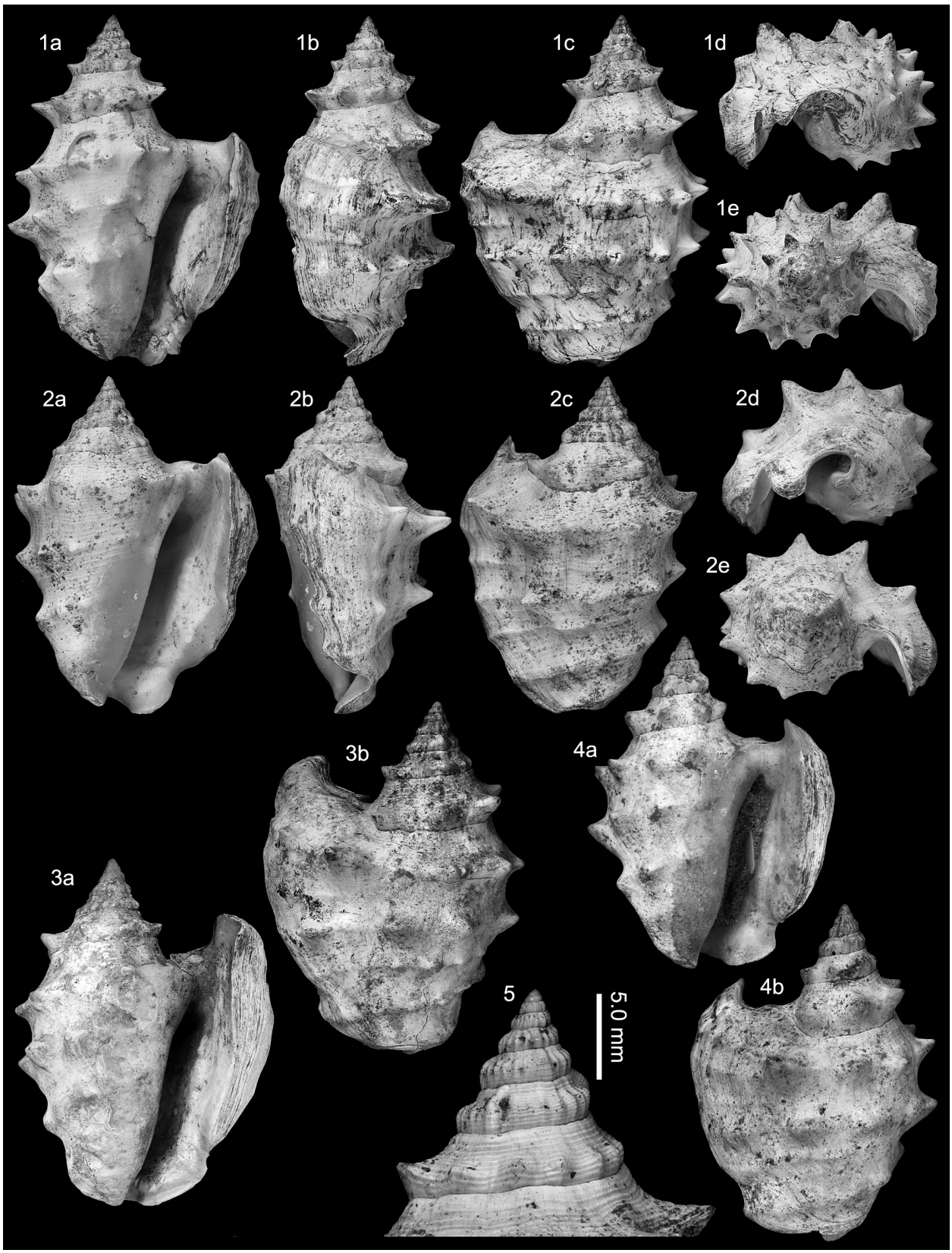
Description. — Shell medium sized, solid, stocky. Protoconch multispiral. Junction not well preserved. Teleoconch of six whorls. Spire broadly conical, of medium height. Early teleoconch whorls sculptured by 10-12 axial ribs, three on each whorl varicose at distance of 120°. Spiral sculpture indistinct, slightly more prominent in subsutural portion. Abapically ribs weaken leaving pointed spines at shoulder on last three whorls, placed at about one-third whorl height. Whorl profile biconcave above and below shoulder. Last whorl relatively short, with row of 8-12 sharp spines at shoulder, second row of spines mid-whorl, of which spines on venter and over lip weaker or subobsolete, third row of smaller spines delimiting base, placed at level of stromboid notch. Further rows of small spines or spiral cords between these three major spinous rows in some specimens. Fine spiral threads cover entire surface. Aperture narrow, elongated; posterior canal wide, deeply U-shaped; anterior canal short, open, straight. Outer lip strongly flared and thickened, lip border thin, undulating in correspondence

Specimen	Height in mm	Width in mm
Holotype nhmw 1901/0034/0005	53.6	37.4
Paratype 1 nhmw 1901/0034/0006	48.2	35.0
Paratype 2 nhmw 1901/0034/0007	53.4	42.3
Paratype 3 nhmw 1901/0034/0008	44.5	33.5
Paratype 4 nhmw 1901/0034/0009	37.8 (spire fragment incomplete)	
Paratype 5 nhmw 1901/0034/0010	42.1	33.2
Paratype 6 nhmw 1901/0034/0011	39.1	27.4
Paratype 7 nhmw 1901/0034/0012	41.0	31.0
Paratype 8 nhmw 1901/0034/0013	43.1	30.4
Paratype 9 nhmw 1901/0034/0014	35.6	30.9
Paratype 10 nhmw 1901/0034/0015	55.7	41.4
Paratype 11 nhmw 1901/0034/0016	57.3	45.9

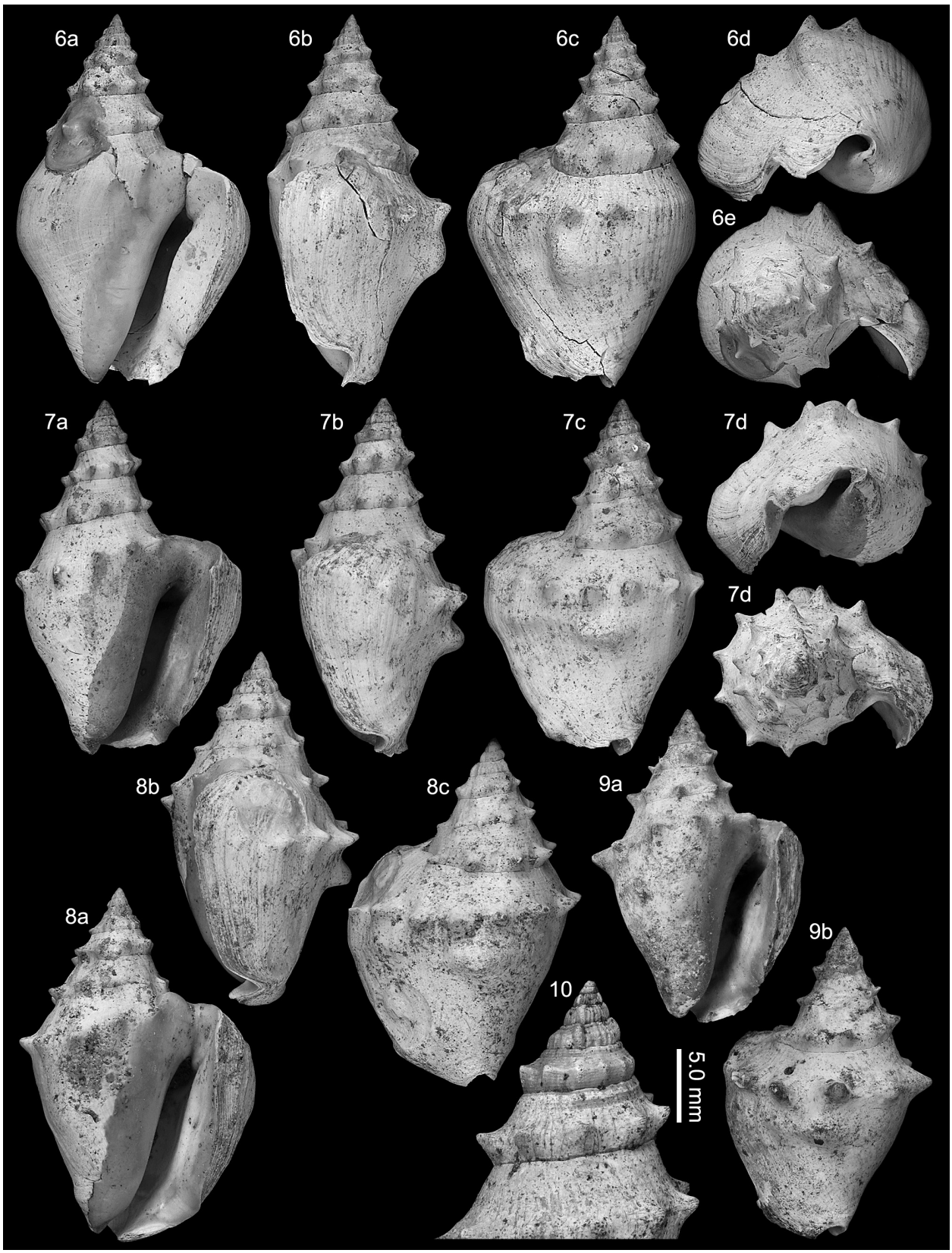
Table 1. *Spinatus echinatus* spec. nov., types from Wonosari, Yogyakarta, central Java. All fully adult specimens, unless stated.

Specimen	Height in mm	Width in mm
Paratype 12 rgm.312374 (Beets, 1941: figs 128-129)	59.1	46.0
Paratype 13 rgm.312376 (subadult) (Beets, 1941: figs 131-132)	45.3	32.4
Paratype 14 rgm.312380 (Beets, 1941: figs 136-137)	53.9	36.8
Paratype 15 rgm.312381 (Beets, 1941: figs 138, 143)	47.4	34.1
Paratype 16 rgm.312382 (Beets, 1941: figs 139, 144)	53.0	40.3
Paratype 17 rgm.312383 (Beets, 1941: fig. 140)	42.6	30.4
Paratype 18 rgm.312384 (Beets, 1941: fig. 141)	50.6	32.2
Paratype 19 rgm.312385 (subadult) (Beets, 1941: fig. 142)	41.6	29.3

Table 2. *Spinatus echinatus* spec. nov., types from Sungai Menkrawit, Mangkalihat Peninsula, East Kalimantan Province (Kalimantan Timur), Borneo Island, Indonesia. All fully adult specimens, unless stated.



Figs 1-5. *Spinatus echinatus* spec. nov. **1**. Holotype, NHMW 1901/0034/0005, height 53.6 mm, width 37.4 mm. **2**. Paratype 1, NHMW 1901/0034/0006, height 48.2 mm, width 35.0 mm. **3**. Paratype 2, NHMW 1901/0034/0007, height 53.4 mm, width 42.3 mm. **4**. Paratype 3, NHMW 1901/0034/0008, height 44.5 mm, width 33.5 mm. **5**. Paratype 4, NHMW 1901/0034/0009, height 37.8 mm (spire fragment); detail of protoconch and early teleoconch whorls. All specimens from Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, Java, Indonesia, Langhian, lower middle Miocene.



Figs 6-10. *Spinatus wonosariensis* spec. nov. **6**. Holotype, NHMW 1901/0034/0018, height 65.7 mm, width 41.2 mm. **7**. Paratype 1, NHMW 1901/0034/0019, height 60.9 mm, width 38.6 mm. **8**. Paratype 2, NHMW 1901/0034/0020, height 51.3 mm, width 34.9 mm. **9**. Paratype 3, NHMW 1901/0034/0021, height 52.3 mm, width 35.1 mm. **10**. Paratype 4, NHMW 1901/0034/0022, height 37.1 mm (spire fragment); detail of protoconch and early teleoconch whorls. All specimens from Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, Java, Indonesia, Langhian, lower middle Miocene.

with major spiral cords, alate apically extending a short distance above aperture, stromboid notch deeply U-shaped. Elevated vertical ridge placed within outer lip at apertural edge bearing indistinct to weak denticles. Columella straight, smooth. Columellar and parietal callus fused, strongly thickened, sharply delimited, and extending irregularly over apertural half of venter.

Variation. — The squat shape and spiny sculpture make this species quite recognisable, although like many strombs, it is highly variable in sculptural detail. Full adult size (height) can vary from 34 mm to 59 mm. The main variable element is the number of spiny rows on the last whorl; all specimens have at least the shoulder and mid-whorl rows, most have the peribasal row and some have four to five spiny rows. With ontogeny the shell and especially the outer lip get progressively thicker. The population from Sungai Menkrawit (paratypes 12-19) in the Naturalis collection, identified by Beets (1941: pl. 3 figs 123-144) as *Strombus preoccupatus*, is just as variable as that found at Wonosari. In general, the shell is less solid and the shoulder spines are longer than in the Wonosari specimens. These differences probably reflect differences in habitat.

Remarks. — *Spinatus echinatus* spec. nov. is a striking species, with its squat spiny solid shell. Beets (1941: 67, pl. 3 figs 123-144) recorded and illustrated it from the upper Miocene of east Borneo as *Strombus preoccupatus* Finlay, 1927. However, *S. preoccupatus* (nom. nov. pro *Strombus* (*Strombus*) *spinosus* Martin, 1881 [1899: sic!] non Linnaeus, 1767) from unnamed beds from the Tertiary of Yogyakarta, Podjok and Wirosari as based on 'steinkerns'. The syntypes illustrated by Leloux & Wesselingh (2009: 120, pl. 232 figs 4-12) show a fusiform spiny stromb with two rows of spines. However, the internal moulds of the spines suggest they are relatively larger and wider spaced than in *S. echinatus*. If anything, these steinkerns might represent the internal mould of the shell illustrated by Dharma (2005: pl. 116 fig. 12) as *Strombus* (*Tricornis*) *maximus* Martin, 1883. The shells illustrated by Dharma (2005: pl. 116 fig. 8a-b) as *S. preoccupatus* roughly correspond in size and appearance to *S. echinatus*, and also come from Java, but are incomplete and cannot be identified with certainty. The specimens illustrated by Beets (1941) from east Borneo fall well within the variability of *S. echinatus* from Wonosari. One of the specimens (Beets, 1941: figs 128-129) has a more expanded outer lip than any Javanese *S. echinatus*, but signs of crab predation and repair that might have distorted the shape of the outer lip are visible (fig. 128). Indeed, signs of repair following crab predation is also seen in many of the specimens from Java.

The incomplete specimen illustrated by Ladd (1972: pl. 18 fig. 9) as *Strombus* (*Lentigo*) cf. *S. preoccupatus*, given the size of 90 mm is to be referred to *Strombus maximus* Martin, 1883. It agrees closely with incomplete specimens in the Martin collection at Naturalis Leiden (figured in Leloux & Wesselingh, 2009: pl. 231 figs 14-15), and specimens in VL coll. (figured http://www.stromboidea.de/?n=Species.TricornisMaximus).

Spinatus wonosariensis spec. nov.

Figs 6-10

Type series and dimensions (Table 3). — All fully adult specimens, unless stated.

Other material. — Known only from the type series.

Etymology. — Named after Wonosari, central Java, the administrative centre in Indonesia of the type locality. *Spinatus* gender masculine.

Type locality. — Wonosari, Gunung Kidul Regency, Special Region of Yogyakarta, Java, Indonesia.

Type stratum. — Langhian portion of NN5, middle Miocene.

Diagnosis. — *Spinatus* species of average to large size for genus, very solid, long spire with row of sharp spines placed just above suture, short last whorl with single row of sharp spines developed at shoulder, small dorsal tubercle placed just below shoulder, outer lip strongly thickened with smooth or lirate ridge within, stromboid notch moderately deep, columellar and parietal calluses fused, thickened.

Description. — Shell medium sized, solid. Protoconch abraded in all specimens, but multispiral. Junction not well preserved. Teleoconch of seven whorls. Spire tall, conical. First two teleoconch whorls sculptured by about 30

Specimen	Height in mm	Width in mm
Holotype NHMW 1901/0034/0018	65.7	41.2
Paratype 1 NHMW 1901/0034/0019	60.9	38.6
Paratype 2 NHMW 1901/0034/0020	51.3	34.9
Paratype 3 NHMW 1901/0034/0021	52.3	35.1
Paratype 4 NHMW 1901/0034/0022	37.1 (spire fragment incomplete)	
Paratype 5 NHMW 1901/0034/0023	52.8	36.2
Paratype 6 NHMW 1901/0034/0024	53.5	38.7
Paratype 7 NHMW 1901/0034/0049	49.3	35.0
Paratype 8 NHMW 1901/0034/0050	48.5	34.8
Paratype 9 NHMW 1901/0034/0051	55.5	32.9
Paratype 10 NHMW 1901/0034/0052	52.3	37.4

Table 3: *Spinatus wonosariensis* spec. nov., type series and dimensions. All fully adult specimens, unless stated.

close-set axial ribs, three on each whorl varicose at distance of 120°, on third whorl about 20 ribs. Spiral sculpture weak. On fourth whorl ribs rapidly weaken leaving pointed spines at shoulder on last four whorls, placed just above suture. Whorl profile weakly concave above spines. Last whorl relatively short, with row of 10-12 sharp spines at shoulder, below which a small, horizontally elongated rounded tubercle develops mid-dorsum in most specimen. Fine spiral threads cover entire surface. Aperture narrow, elongated; posterior canal wide, deeply U-shaped; anterior canal short, open, recurved. Outer lip strongly flared and thickened, border thin and straight, stromboid notch moderately deeply U-shaped. Elevated vertical ridge placed within outer lip at apertural edge indistinctly denticulate. Columella straight, smooth. Columellar and parietal callus fused, strongly thickened, sharply delimited, and extending over apertural half of venter.

Variation. — This species is remarkably constant for a stromb. Full adult size (height) varies little (49-66 mm). The shoulder row of spines is similarly developed in all specimen, although in the most gerontic specimens the spines are only present on the last half whorl, and no further secondary rows of spines are present in any specimens. The main variable feature is the mid-dorsal tubercle; well-developed in most specimens, but absent in others. With ontogeny the shell and especially the outer lip get progressively thicker.

Remarks. — *Spinatus wonosariensis* spec. nov. is easily differentiated from *Spinatus echinatus* spec. nov. in having a single row of spines on the last whorl, whereas *S. echinatus* has 2-4 rows of spines. *Spinatus wonosariensis* also has a tubercle mid-dorsum, absent in *S. echinatus* and the outer lip is not alate apically as it is in *S. echinatus*. These shell characters could be of generic significance. However, what is also striking are the similarities between the two species; both have spines on the abapical portion of the spire whorls, spiral sculpture is much reduced, the outer lip is strongly thickened, the labial denticles are placed on an internal ridge placed at the apertural edge, and the columellar and parietal callus are fused into one thickened continuous callus pad along the entire medial border of the aperture.

Spinatus wonosariensis is closely similar to another upper Miocene species from Java, *Spinatus tjilonganensis* (Martin, 1899). That species is also very thick shelled, with a broad outer lip that is non-alate, a single row of spines develops at the shoulder, almost no spiral sculpture, a ridge bordering the aperture within the labrum, and a very short siphonal canal. It differs in being much stockier, with a lower conical spire in which the spines on the spire whorls are engulfed by the suture.

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