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Notes on terrestrial molluscs of the island of Sulawesi. 3. The genera *Palaina*, *Arinia* and *Opisthostoma* (Gastropoda, Prosobranchia, Diplommatinidae), with descriptions of a dozen new taxa

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This paper deals with the systematics of the genera *Palaina*, *Arinia* and *Opisthostoma* (Diplommatinidae) of Sulawesi. Twelve species are described as new to science: *Palaina altumbilicata*, *P. monticola*, *P. tondokensis*, *P. wezendonki*, *P. adonisi*, *Arinia kessneri*, *A. toradjensis*, *A. bantimurungensis*, *A. wasupondensis*, *A. dilatata*, *A. hoeksemai*, *Opisthostoma henki*. A neotype is designated for *Arinia minahassae* Kobelt.

Key words: Gastropoda, Prosobranchia, Diplommatinidae, *Palaina*, *Arinia*, *Opisthostoma*, taxonomy, Indonesia, Sulawesi.

INTRODUCTION

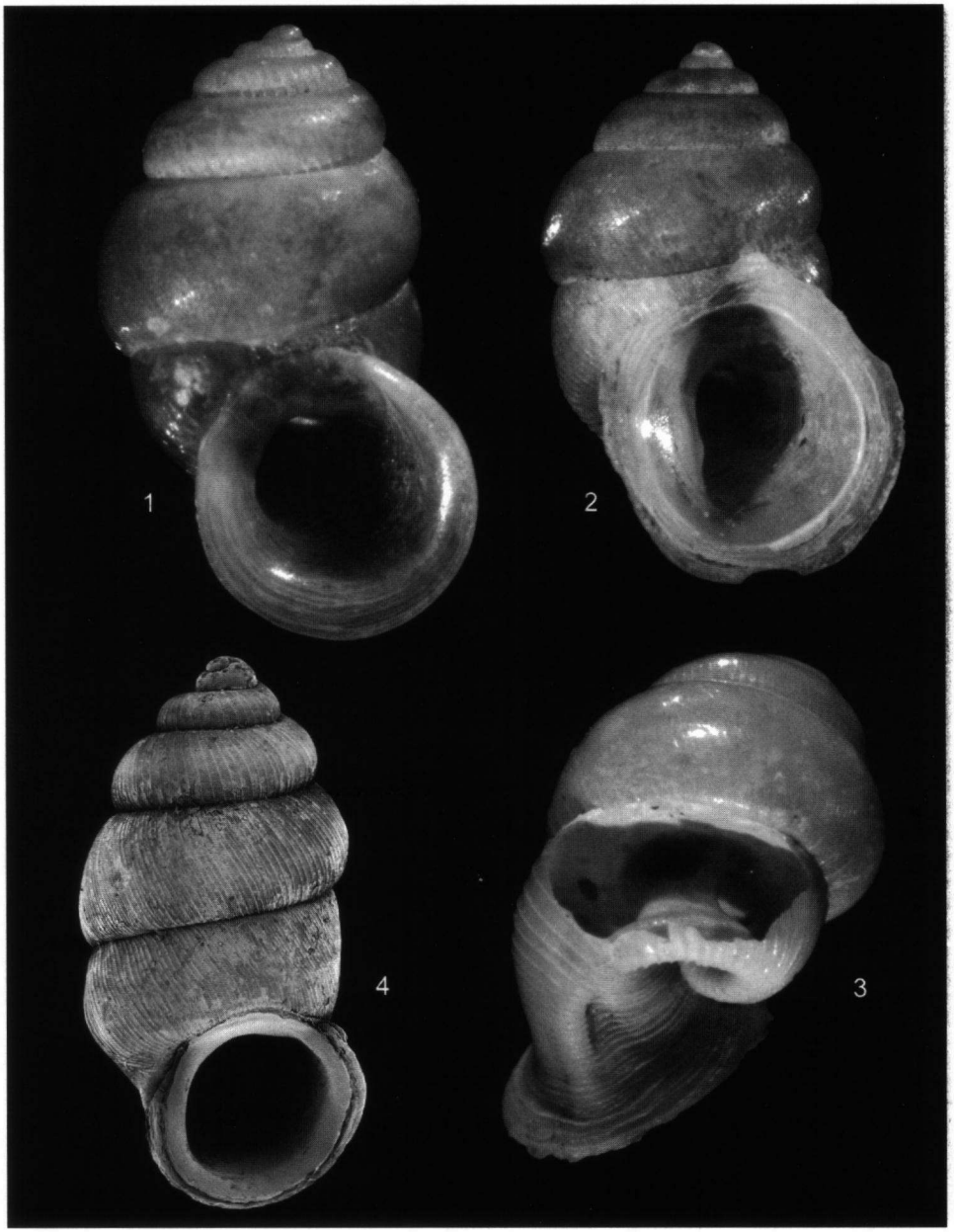
During collecting activities by the author in 1995, 2001 and 2002 in Sulawesi, Indonesia, material representing a fairly large number of species of land molluscs was collected. Important material was received on loan from Dr. P. Bouchet, Paris (1991), from K. & T. Kittel, Wiesthal (1991 and 1995) and from Dr. J. J. Vermeulen, Singapore (1985 and 2002). This is the third publication (Maassen & Kittel, 1996; Maassen, 1998) on these samples. This paper gives figures of all Sulawesian species and a somewhat simplified key to identify them. For the terminology used, see Gittenberger (1995) and Vermeulen (1996).

Up to now (Sarasin & Sarasin, 1899; Van Benthem Jutting, 1959) only the following species of these genera are known from Sulawesi: *Palaina moellendorffi* (Fulton, 1899), *P. tumens* (Fulton, 1899), *Arinia minahassae* Kobelt, 1897, and *Opisthostoma aspastum* Van Benthem Jutting, 1951. It turned out that *Palaina tumens* is a synonym of *P. moellendorffi* and *Opisthostoma aspastum* a synonym of *O. javanicum*. In the material now studied another twelve species were discovered, all of which new to science. These are described in this paper. For *Arinia minahassae* a neotype is designated.

In view of the limited number of collecting localities, the total number of existing species must be much higher. Especially as long as there are still many extensive limestone areas in Sulawesi to explore, a fairly high number of new species can be expected from there. From the two large eastern peninsulas, where large limestone areas are known to exist, not a single diplommatinid species is known.

As Vermeulen (1993: 5) noted, Sulawesi does not share any taxa with Borneo. It turned out that, with *Opisthostoma javanicum* as the exception, this is also the case with Java.

Paratypes will be deposited in the collections mentioned under abbreviations and in the reference collection of Dr. J. J. Vermeulen (Singapore). The total number of specimens per locality is indicated after a slash. The material now in the reference collection of the author will eventually be deposited in the collection of the National Museum of Natural History, Leiden. Unless stated otherwise, the specimens mentioned under mate-



Figs 1-4. *Palaina* spec. 1, *P. moellendorffi* (Fulton, 1899), South Sulawesi, National Park Bantimurung, actual height 5.5 mm (RMNH 95607); 2-3, *P. altumbilicata* spec. nov., holotype (RMNH 95573), South Sulawesi, National Park Bantimurung, actual height 4.5 mm; 4, *P. monticola* spec. nov., holotype (MHN), South Sulawesi, Mount Bawa Kraeng, 1900-2100 m alt., actual height 4.4 mm. Photographs by J. Goud, Leiden and S. Kars, Amsterdam.

rial for the new species are to be considered paratypes.

Abbreviations for shell characters: B, width; H, height. For collections: BMNH, British Museum (Natural History), London; KW, K. Kittel, Wiesthal; MD, W. J. M. Maassen, Duivendrecht (to be deposited in RMNH); MNHN, Muséum National d'Histoire Naturelle, Paris; MZB, Museum Zoologicum Bogoriense, Bogor; RMNH, Nationaal Natuurhistorisch Museum, Leiden (formerly: Rijksmuseum van Natuurlijke Historie); VS, Dr. J. J. Vermeulen, Singapore; ZMA, Zoölogisch Museum, Universiteit van Amsterdam, Amsterdam.

SYSTEMATIC PART

Family Diplommatinidae
Genus *Palaina* Semper, 1865

Palaina moellendorffi (Fulton, 1899) (fig. 1)

Diplommatina (Palaina) moellendorffi Fulton 1899: 216, pl. 11 fig. 18 ("Makassar"). Sarasin & Sarasin, 1899: 228.
Diplommatina (Palaina) tumens Fulton 1899: 217, pl. 11 fig. 4 ("Makassar"). Sarasin & Sarasin, 1899: 228.
Palaina (Palaina) möllendorffi; Kobelt, 1902: 400.
Palaina (Palaina) tumens; Kobelt, 1902: 400.
Palaina (Palaina) moellendorffi; Zilch, 1953: 11.
Palaina moellendorffi; Maassen, 1997: 44.
Palaina tumens; Maassen, 1997: 45.

Material. – South Sulawesi: Makassar (BMNH 1995209/2 syntypes *D. (P.) moellendorffi*, ZMA/2 syntypes, RMNH/2 syntypes); Makassar (BMNH 998223/holotype *D. (P.) tumens*); Maros karst, Balocci, leaf litter among limestone blocks in open forest, 150 m alt., leg. P. Bouchet 7.ix.1991 (MNHN/8); Camba-pass near Makassar, leg. G. A. Tammes-Bolt 12.viii.1948 (ZMA/1); Bantimurung National Park, 20 km E of Maros, leaf litter, v.1995 (RMNH 95607/2, MZB/1, VS/1, MD/10); Ujung Lamuru-Watampone road near km-mark 140, near tunnel, leaf litter in limestone area, v.1995 (MD/4); pass in limestone mountains between Ujung Lamuru and Watampone, leg. G. A. Tammes-Bolt 28.ix.1948 (ZMA/1); road Ujung Lamuru to Watampone, leg. G. A. Tammes-Bolt 18.viii.1948 (ZMA/1); limestone rocks near "Nymphenbad" near Pangkajene, leg. G. A. Tammes-Bolt 5.vi.1948 (ZMA/10); same locality, leg. G. A. Tammes-Bolt 14.x.1948 (ZMA/6); 3 km from main road Makassar in direction north, 3 km in direction Tonasa, 04°48.57"S 119°33.83"E, 1.viii.2002 (MD/7).

Remarks. – Known from the limestone areas near Bantimurung and Watampone. Examination of the holotype of *Palaina tumens* shows it to be an abnormal specimen of *P. moellendorffi*, caused by a disturbance in the middle of the penultimate whorl, as already indicated by Fulton in his description of the species. There is a variation in the striation between the different populations. The type-lot and the sample of Ujung Lamuru have distinct, low and rounded radial ribs on the ultimate und penultimate whorls whereas the specimens of Bantimurung are smooth with only a indication of ribs near the suture.

Palaina altumbilicata spec. nov. (figs 2-3)

Material. – South Sulawesi, Maros Karst, Bantimurung National Park, 20 km E of Maros, leaf litter, v.1995 (RMNH 95573/holotype, MD/2).

Description. – Shell dextral, fusiform, pale yellow; sides convex. Whorls 6, very convex, with radial ribs which are low and rounded on the middle of the whorls, sharp and thin near the suture, and inconspicuous on the penultimate whorl. Suture impressed. Constriction level on the columellar side of the aperture with a transverse palatalis and a more or less prominent bulge or protuberance to the left; tuba 1/2 whorl. Penultimate whorl slightly broader than the body whorl, the latter flat on the columellar side. Aperture almost circular; peristome double, white, thin, broadly expanded, and continued over the parietal wall of the last whorl up to the suture with the penultimate whorl. Umbilicus open, deep, wide, showing the penultimate whorl. There is a distinct thickening, beginning on the columellar side of the aperture up to the columella of the ultimate whorl.

Dimensions: H 4.5 mm; B 2.6 mm.

Derivatio nominis. – The name refers to the deep umbilicus (*alt-umbilicata*), which is very characteristic for this species.

Remarks. – Known only from the type-locality. So far species with such a peculiar umbilicus have not been found in the studied literature.

Palaina monticola spec. nov. (fig. 4)

Material. – South Sulawesi, Mount Bawa Karaeng, north face above Lembana village, closed forest, 1900-2100 m alt., leaf litter, leg. P. Bouchet 12.ix.1991 (MNHN holotype, MNHN/4); Volcano Gunung Bawa Karaeng, NW-slope opposite Malino, 2000 m alt., v.1995 (RMNH 95574/1, MZB/1, MD/2)

Description. – Shell dextral, fusiform, pale yellow and opaque, with oblique topwhorls; sides convex, with a deep suture. Whorls 5.75-6.25, increasing gradually in width and height; body whorl somewhat flattened above the aperture and at the right side. Constriction at the columellar side of the aperture with a transverse palatalis and a more or less prominent, quite sharp bulge or protuberance to the left; tuba 1/2 whorl. Apical whorls without ribs, only pitted; next whorls with very densely placed, fine, and sharp radial ribs (24-27 ribs/mm). There is no spiral striation. Penultimate whorl slightly broader than the body whorl. Peristome double, somewhat expanding, with a protruding edge at the columellar side. Inner aperture almost circular, continuous, surrounded by a wide, oval lip, hardly expanded by a thin callus on the penultimate whorl. Umbilicus closed, along the umbilicus a ridge-like basal keel runs up to the peristome.

Dimensions: H 3.6-4.0 mm; B 1.8-2.1 mm.

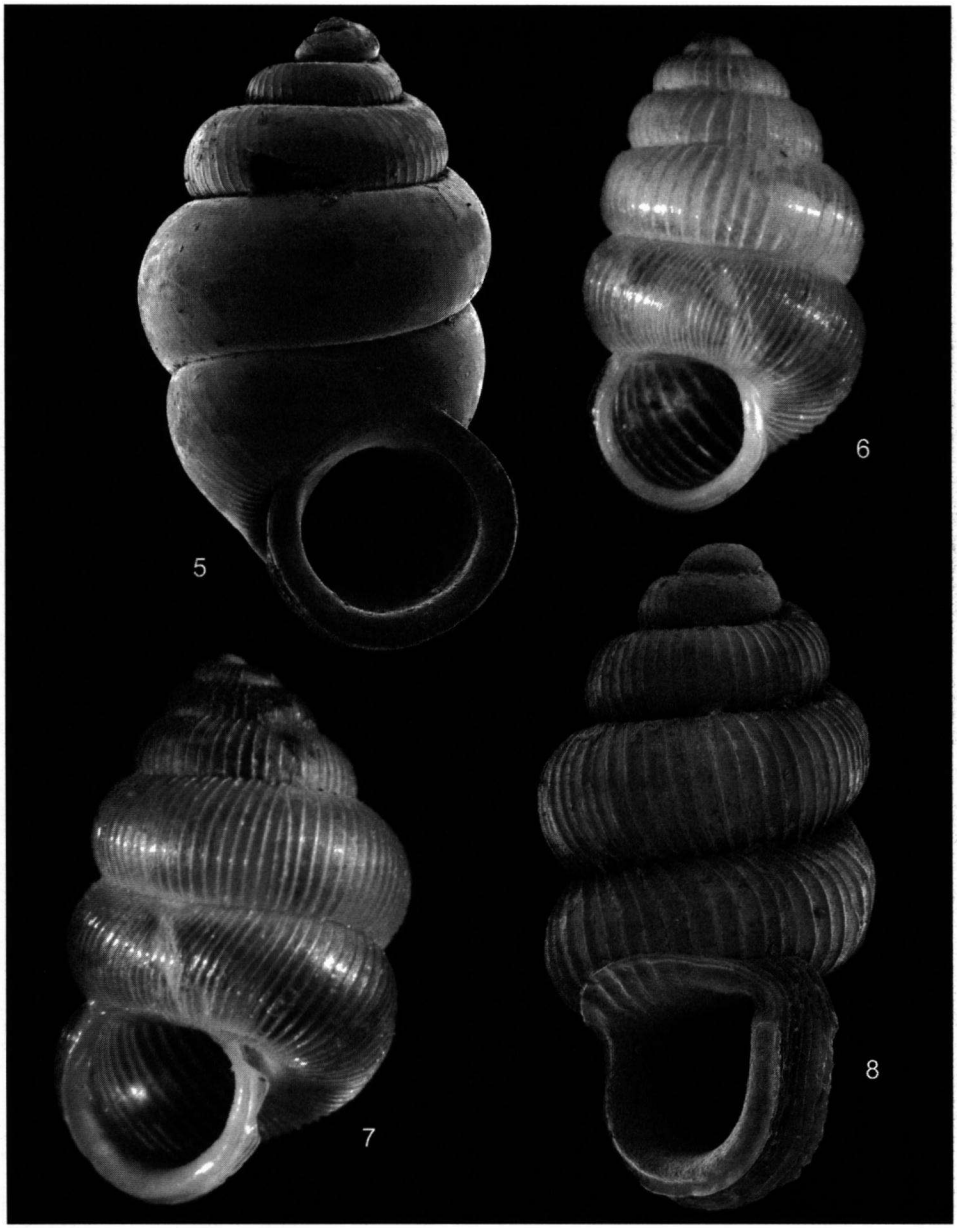
Derivatio nominis. – The name *monticola* refers to the fact that this species seems to be an inhabitant of mountain cloud forests.

Remarks. – Known only from the type-locality. Similar species are known from some islands east of Sulawesi. The only similar Sulawesian species is *P. tondokensis*, which differs in being smaller, and by the last two whorls being smooth.

Palaina tondokensis spec. nov. (fig. 5)

Material. – North Sulawesi, leaf litter on E-shore Tondok Lake, 12.5 km E of Kotamobagu, 00°43.44'N 124°26.40'E, 28.vii.2001 (RMNH 95608 holotype).

Description. – Shell dextral, fusiform, pale orange, transparent, with oblique topwhorls; sides convex, with a deep suture. Whorls 6, the top whorls increasing rapidly in width. The body whorl somewhat flattened above the aperture at the place of the con-



Figs 5-8. Diplommatinidae. 5-7, *Palaina* spec. 5, *Palaina tondokensis* spec. nov., holotype (RMNH 95608), North Sulawesi, E-shore Tondok Lake, actual height 2.8 mm; 6, *P. wezendonki* spec. nov., paratype (RMNH 95609), South Sulawesi, W of Rantepao, actual height 4.2 mm; 7, *P. adonisi* spec. nov., holotype (RMNH 95578), South Sulawesi, 6 km W of Wasuponda, actual height 5.0 mm. 8, *Arinia minnahassae* Kobelt, 1897, neotype (RMNH 95606), North Sulawesi, 7 rkm Kotamobagu to N-coast, actual height 2.1 mm. Photographs by J. Goud, Leiden and S. Kars, Amsterdam.

striction. Constriction between the columellar and the angular edge, close to the angular edge. Tuba 3/4 whorl. Apical whorls without ribs, only pitted; next whorls with very densely placed, flattened ribs, which disappear towards the penultimate whorl. Both the penultimate and the body whorl without ribs, smooth. There is no spiral striation. Penultimate whorl distinctly broader than the body whorl. Peristome double, somewhat expanding, with an indistinctly protruding edge at the columellar side. Inner aperture almost circular, its border continuous by a thin callus between the angular and the columellar edge. Umbilicus closed.

Dimensions: H 2.8 mm; B 1.6 mm.

Derivatio nominis. – The name *tondokensis* refers to the type-locality near Tondok Lake, where there are some remains of forest on limestone.

Remarks. – Known only from the type-locality. For differences with *P. monticola* see the remarks on that species.

Palaina wezendonki spec. nov. (fig. 6)

Material. – Central Sulawesi: W Tentena, forest near Siuri Cottages, 19.viii.1995 (KW/2); W Tentena, Saluopa waterfall near Tonusu, 18.viii.1995 (KW/1); Lake Poso, Bancea, "Orchid" forest, 13.viii.1995 (KW/3); Lake Poso, Pendolo-Boé, Makilo, 700 m alt., 14.viii.1995 (KW/1). South Sulawesi: Tanah Toraja, Palatokke, near Rantepao, 810 m alt., limestone outcrop, leg. P. Bouchet 26.ix.1991 (MNHN/13); surroundings of Rantepao, 700 m alt., v.1995 (RMNH 95576/holotype, BMNH/1, MZB/1, MD/13); Tampolang, 1.5 km W of Rantepao, 750 m alt., 02°57.18"S 119°53.63"E, 28.vii.2002 (MD/4); 1/2 km SW of Rantepao, 750 m alt., 02°58.23"S 119°53.51"E, 11.vii.2002 (MD/1); Buntu Pune, 4 km SE of Rantepao, 800 m alt, 02°59.51"S 119°54.09"E, 8.vii.2002 (MD/10); Silanen, 3 km W of Mebali, 750 m alt., 03°12.09"S 119°51.53"E, 7.vii.2002 (MD/2); Silanen, 3 km W of Mebali, 750 m alt. (VS/12)

Not paratypes. – South Sulawesi, Bantimurung National Park, v.1995, one badly damaged specimen with open umbilicus (MD/1), Ujung Lamuru-Watampone road near km-mark 140, near tunnel, leaf litter in limestone area, v.1995, 4 damaged specimens with a different striation (MD/4).

Description. – Shell sinistral, fusiform, pale yellow and opaque, with oblique apical whorls; sides convex, with a deep suture. Whorls 5.75-6.25, increasing gradually in width and height. Constriction at the columellar side of the aperture with a transverse palatalis and a longitudinal ridge just above the columellar edge. Tuba 3/4 whorl. Apical whorls without ribs, only pitted; next whorls with very densely placed, fine, and sharp radial ribs (7-11 ribs/mm on the penultimate whorl, 13-19 ribs/mm on the body whorl). There is no spiral striation. Body whorl slightly broader than the penultimate one. Peristome double, somewhat expanding, with a indistinct edge at the columellar side. Inner aperture more or less oval, continuous, surrounded by a small, oval lip, hardly expanded by a thin callus on the penultimate whorl. Umbilicus closed, covered by the outer peristome.

Dimensions: H 3.6-4.2 mm; B 2.5-2.8 mm.

Derivatio nominis. – The name refers to Mr. J. Wezendonk, manager of a well-known travel agency in Makassar. Thanks his help our 2002 journey became a success.

Remarks. – The only comparable species is *Palaina nubigena* Von Moellendorff, 1897, from Java. This species, however, is smaller, and possesses a distinct kind of striation: closely placed in the older whorl, wider apart on the last one. In *P. wezendonki* it is just the opposite. The two lots not considered paratypes may represent new taxa, but that damaged and eroded material is not suitable for a formal description.

Palaina adonisi spec. nov. (fig. 7)

Material. – South Sulawesi: 6 km W of village Wasuponda, 33 km W of Saroako; 19.vii.2002; 02°37.34"S 121°13.58"E (RMNH 95578/holotype, MD/1).

Description. – Shell sinistral, fusiform, pale yellow and opaque, with oblique apical whorls; sides convex, with a deep suture. Whorls 5.75-6.25, increasing gradually in width and height. Constriction at the columellar side of the aperture with a transverse palatalis and two longitudinal ridges just above the columellar edge. Tuba 3/4 whorl. Apical whorls without ribs, only pitted; next whorls with very densely placed, fine, and sharp radial ribs (9-10 ribs/mm on the penultimate whorl, 12-13 ribs/mm on the body whorl). There is no spiral striation. Body whorl slightly broader than the penultimate one. Peristome double, somewhat expanding, with an indistinct edge at the columellar side. Inner aperture more or less oval, continuous, surrounded by a small, oval lip, hardly expanded by a thin callus on the penultimate whorl. Umbilicus open, sometimes partly covered by the outer peristome.

Dimensions: H 4.6-5.1 mm; B 2.9-3.1 mm.

Derivatio nominis. – The name *adonisi* refers to my brother in law, Don Remkes, a devoted ornithologist, to keep an old promise.

Remarks. – Clearly different from *P. wezendonki* by the presence of a distinct sharp edge at the outer peristome at the columellar side, and by the open umbilicus.

Genus *Arinia* H. & A. Adams, 1897

Arinia minahassae Kobelt 1897 (fig. 8)

Arinia minahassae Kobelt 1897: 39, pl. 4 fig. 33 ("Nord Celebes"). Sarasin & Sarasin, 1899: 59. Kobelt, 1902: 392. Zilch, 1953: 8 ("Belegstücke fehlen"). Maassen, 1997: 45. Neotype, designated here: RMNH 95606 (N-arm Sulawesi, Bolaäng Mongondow, km 7 road Kotamobagu to N coast, 400 m alt., low and dense primary forest on slope of limestone ridge, dead in recent landangs).

Material. – North Sulawesi: N-arm Sulawesi, Bolaäng Mongondow, Dumoga Valley, confluence of rivers Tumpah and Topaut, ladangs in remnants of primary forest mixed with secondary vegetation (bekular), 300 m alt. (VS/75); N-arm Sulawesi, Bolaäng Mongondow, Dumoga Valley, N slope Gunung Mogogonipa, ladangs in undisturbed primary forest, 500 m alt. (VS/1); N-arm Sulawesi, Bolaäng Mongondow, mouth R. Mongondow, W side, 1 km N of Solor, uplifted coral reef with dense, low primary forest, 20 m alt., among limestone rocks (VS/10); N-arm Sulawesi, Bolaäng Mongondow, road from Kotamobagu to N coast, village Talimandongan, humid limestone cliffs in dense, low part, disturbed primary forest, 300 m alt. (VS/3); N-arm Sulawesi, Bolaäng Mongondow, km 7 road Kotamobagu to N coast, 400 m alt., low and dense primary forest on slope of limestone ridge, dead in recent landangs (RMNH 95606 neotype, VS/60); limestone hills about 25 km N of Gorontalo, on the road to Kawang, leg. J. Burley 1990 (VS/24); limestone area, W of Lobang, W of Kotamobagu, 150 m alt., 00°45,90' N, 124°15,91' E, 27.vii.2001 (MD/14). Central Sulawesi: Mountain between Tawaeli and Tobili, 30 km NE of Palu, leg. H. Menkhorst viii.1997 (MD/1); Tomado, Lake Lindu, Islet Bolai, 5.viii.1995 (KW/3). South Sulawesi, Tanah Toraja: Rantepao, Se'pom, c. 500 m N of Gunung Singki, under the tau-tau on the E side, 2°58"S 119°58"E, degraded forest on limestone hill, leg. H. Turner 21.x.1992 (VS/2); Silanen, 3 km W of Mebali, 750 m alt., 7.vii.2002 (VS/70); Silanen, 3 km W of Mebali, 750 m alt., 03°12.70"S 119°51.01"E, 7.vii.2002 (MD/4); Silanen, 3 km W of Mebali, 750 m alt., 03°12.09"S 119°51.53"E, 7.vii.2002, (MD/15); near Bamba Puang, 58 km S of Makale, N of Enrekang, 03°27.71"S 119°47.16"E, 7.vii.2002 (MD/1); 5 km N of Rantepao along Sadan River in direction Pangli, 750

m alt., 02°57.05"S 119°56.10"E, 13.vii.2002 (MD/1). South Sulawesi, Malili Lakes area: Wasuponda, between Malili and Soroako, forest on limestone hill, 290 m alt., leg. P. Bouchet 17.ix.1991 (MNHN/1).

Remarks. – The species exhibits quite a large distribution area from Minahassa up to Tanah Toradja and further east to the Malili district. The species is quite variable in shape, but all populations possess a widely spaced striation and a distinct notch in the aperture at the angular corner. The species was described after a single specimen (Kobelt, 1897: 39) from Minahassa (North Sulawesi). The figure with the description is somewhat schematic and does not show all the necessary characters to separate the species from some new ones described in this paper. Zilch (1953: 8) states that the specimen could not be found in the collection of SMF and must be considered lost. To stabilize the nomenclature of the Sulawesian *Arinia* species, it is necessary to define *A. minahassae* unequivocally. This we did by selecting a neotype (see above) and, as a consequence, also a (restricted) type-locality.

Arinia kessneri spec. nov. (figs 9-10)

Material. – North Sulawesi: Minahassa, Manado Bay, Pulau Bunaken, vine thicket in leaf litter, leg. V. Kessner 10.xi.1991 (VS/4); W-side Bunaken Isl., 1 km N of Bunaken village, in coastal forest, 50 m alt., 012°36,25' N, 124°46,42 E, 14.vii.2001 (RMNH 95583/holotype, RMNH 95610/1, BMNH/1, MZB/1, MD/6); 2 km E of Desa Kakaskasen II, leaf litter in remains of forest; 600 m alt., 01°21,39' N, 124°50,95' E, 21.vii.2001 (MD/5).

Description. – Shell dextral, conical with convex sides, opaque and white, quite solid, with 5 convex whorls with a deep suture; last two whorls widest; with sharp and, in fresh specimens, high ribs (8-10 ribs/0.5 mm on penultimate whorl; 7-11 ribs/0.5 mm above the aperture). Spiral striation absent. Umbilicus open, up to 0.06 mm wide. Aperture more or less rounded, not turned upwards. Palatal side of the peristome not or hardly protruding beyond the penultimate whorl, columellar side not sinuous. Inner peristome distinctly protruding beyond the outer, flaring over the parietal side; angular edge without notch, its outer surface between inner and outer peristome with distinct lamellae.

Dimensions: H 1.5-1.7 mm; B 0.9-1.0 mm.

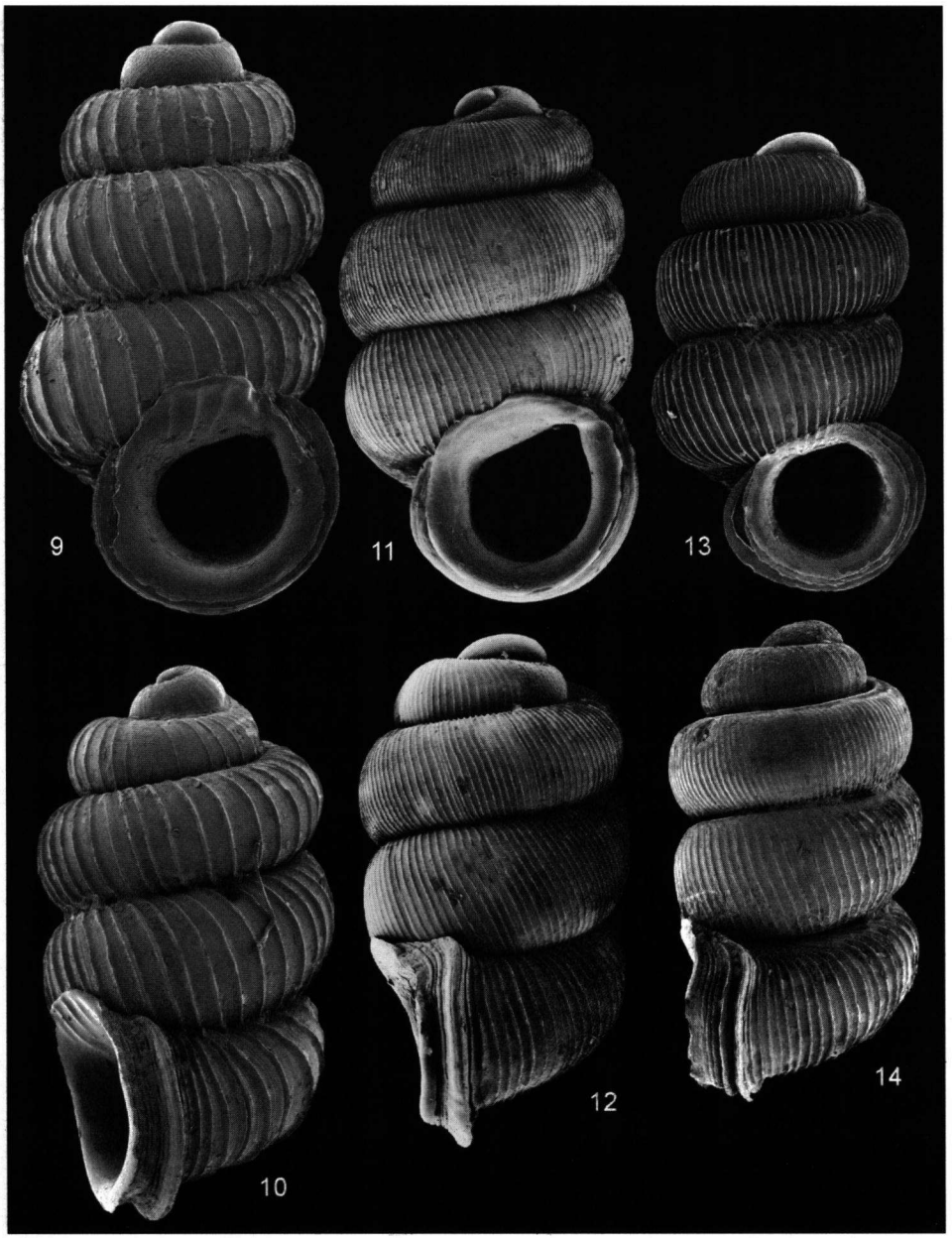
Derivatio nominis. – Named in honour of Vince Kessner (Adelaide, Australia), an enthusiastic collector, who brought to light the first sample of this species.

Remarks. – Distinguished from *A. minahassae*, its nearest relative, in being smaller, and most of all by the absence of a notch in the upper angular edge. This species seems to be restricted to the extreme north of Sulawesi, an area without any limestone.

Arinia toradjensis spec. nov. (figs 11-12)

Material. – South Sulawesi: Tanah Toraja, omgeving Rantepao, 700 m alt., v.1995 (RMNH 95579/holotype, RMNH 95611/1, BMNH/1, MZB/1, MD/6); 1/2 km SW of Rantepao, 750 m alt., 02°58.23"S 119°53.51"E, 11.vii.2002 (MD/3).

Description. – Shell dextral, more or less cylindrical with convex sides, opaque and white, very fragile, with 5 convex whorls with a deep suture; the penultimate whorl widest; with very fine, very densely placed ribs (20-21 ribs/0.5 mm on penultimate whorl; 20-21 ribs/0.5 mm above the aperture). Spiral striation absent. Umbilicus open, up to 0.1 mm wide. Aperture more or less rounded, not turned upwards. Palatal side of the



Figs 10-14. *Arinia* spec. 10, *A. kessneri* spec. nov., paratype (RMNH 95610), North Sulawesi, Bunaken island, Bunaken village, actual height 1.6 mm; 11-12, *A. toradjensis* spec. nov., paratype (RMNH 95611), South Sulawesi, Rantepao, actual height 1.5 mm; 13-14, *A. bantimurungensis* spec. nov., paratype (RMNH 95612), South Sulawesi, National Park Bantimurung, actual height 1.2 mm. Photographs by J. Goud, Leiden and S. Kars, Amsterdam.

peristome not or hardly protruding beyond the penultimate whorl; columellar side not sinuous. Inner peristome distinctly protruding beyond the outer, flaring over the parietal side. Angular edge wit a distinct notch. Palatal and basal side with a lip parallel to the margin, its outer surface between inner and outer peristome with a few lamellae.

Dimensions: H 1.4-1.6 mm; B 0.9 mm.

Derivatio nominis. – Named after its type-locality, the region Tanah Toraja (in older literature Toradja).

Remarks. – The most similar species is *A. minahassae*, but *A. toradjensis* is smaller, more cylindrical, more fragile and densely striated.

Arinia bantimurungensis spec. nov. (figs 13-14)

Material. – South Sulawesi: Maros karst: Bantimurung National Park, leaf litter in open forest, 30 m alt., leg. P. Bouchet 9.ix.1991 (MNHN/4); Bantimurung National Park, 20 km E of Maros, v.1995 (RMNH 95580/holotype, RMNH 95612/1, BMNH/2, MZB/2, MD/15); Bantimurung National Park, at the foot of limestone cliffs, leg. W. F. Prud'homme van Reine 1990 (VS/6).

Description. – Shell dextral, more or less cylindrical with convex sides, opaque and white, quite fragile. With 4.5-5.25 convex whorls with a deep suture, with very fine, very densely placed ribs (16-20 ribs/0.5 mm on penultimate whorl; 13-18 ribs/0.5 mm above the aperture); penultimate whorl widest. Spiral striation absent. Umbilicus open, up to 0.08 mm wide. Aperture more or less rounded, except for the parietal side which is more or less straight, not turned upwards. Palatal side of the peristome protruding somewhat beyond the penultimate whorl; columellar side not sinuous. Inner peristome distinctly protruding beyond the outer, flaring over the parietal side; angular edge without notch, its outer surface between inner and outer peristome with only a few distinct lamellae.

Dimensions: H 1.3-1.6 mm; B 0.8-0.9 mm.

Derivatio nominis. – Named after its type-locality, the well known Bantimuring National Park, famous for its butterflies and also the type-locality for a number of terrestrial molluscs.

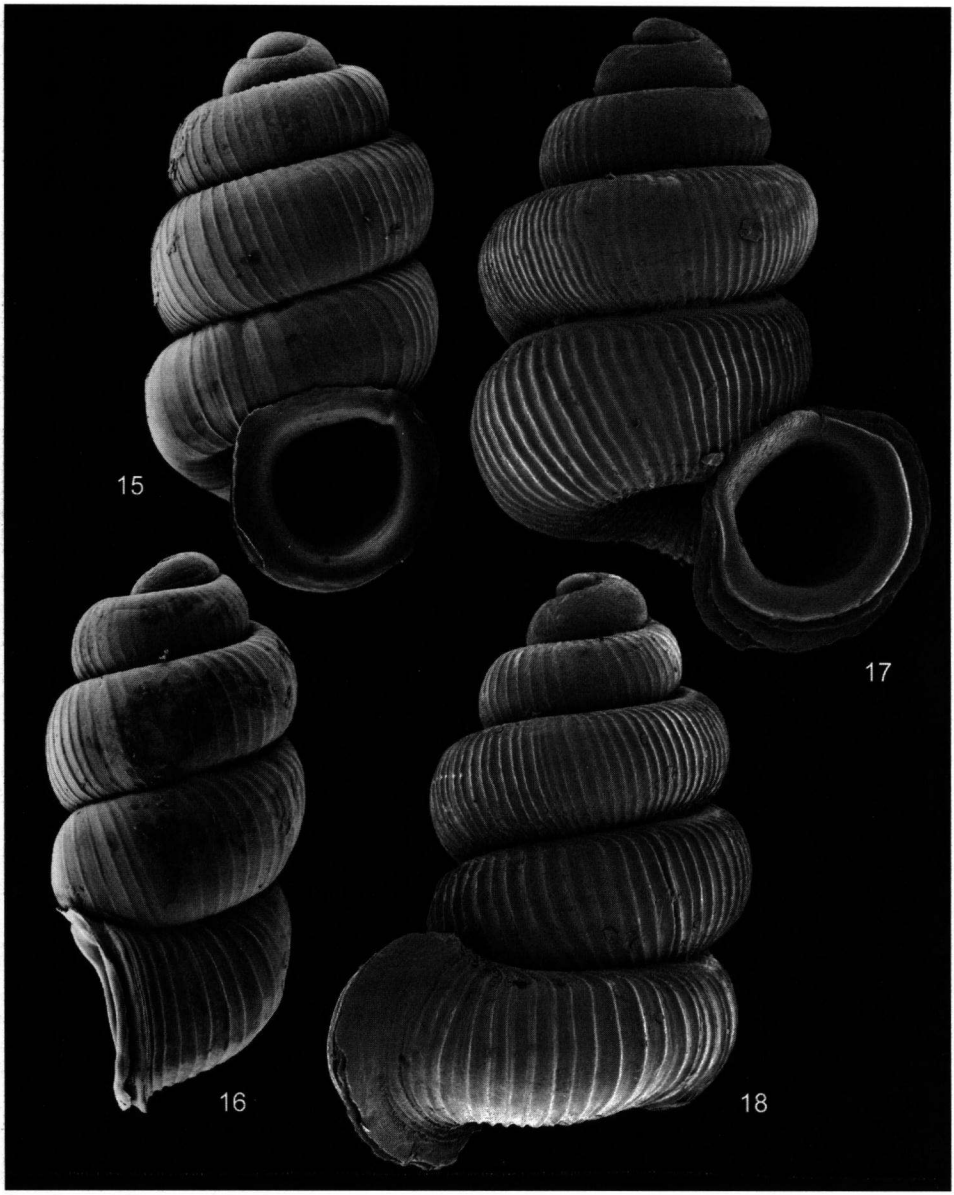
Remarks. – Next to *A. wasupondensis* (see remarks under this species) the most similar species on Sulawesi is *A. toradjensis*. It differs from the latter species most clearly by the absence of a notch in the angular edge.

Arinia wasupondensis spec. nov. (figs 15-16)

Material. – South Sulawesi: 6 km W of village Wasuponda, 33 km W of Saroako, 02°37.34"S 121°13.58"E, 19.vii.2002 (RMNH 95581/holotype, MZB/1, MD/4).

Description. – Shell dextral, more or less high cylindrical with convex sides, opaque and white, very fragile. With 4.5-5.0 convex whorls with a deep suture; last two whorls widest; with fine, densly placed ribs (12 ribs/0.5 mm on penultimate whorl; 8-10 ribs/0.5 mm above the aperture). Spiral striation absent. Umbilicus closed. Aperture more or less rounded with the exception of the more or less straight parietal side, not turned upwards. Palatal side of the peristome not protruding beyond the penultimate whorl; columellar side not sinuous. Inner peristome hardly protruding beyond the outer, flaring over the parietal side; angular edge without notch, its outer surface between inner and outer peristome without distinct lamellae.

Dimensions: H 1.4-1.6 mm; B 0.7-0.8 mm.



Figs 15-18. *Arinia* spec. 15-16, *A. wasupondensis* spec. nov., holotype (RMNH 95581), South Sulawesi, 6 km W of Wasuponda, actual height 1.6 mm; 17-18, *A. dilatata* spec. nov., paratype (RMNH 95613), South Sulawesi, National Park Bantimurung, actual height 1.9 mm. Photographs by J. Goud, Leiden and S. Kars, Amsterdam.

Derivatio nominis. – Named after the type-locality, the easternmost area, from where *Arinia* species are known so far from Sulawesi.

Remarks. – The most similar species seems to be *A. bantimurungensis*; both species share the absence of a notch in the angular edge, but *A. wasupondensis* has a closed umbilicus, the outer peristome is hardly double and the species is extremely fragile and transparent.

Arinia dilatata spec. nov. (figs 17-18)

Material. – South Sulawesi, Maros karst, Bantimurung National Park, 20 km E of Maros, leaf litter in open forest, 30 m alt., leg. P. Bouchet 9.ix.1991 (MNHN/11); Bantimurung National Park, 20 km E of Maros, leaf litter under limestone rocks, v.1995 (RMNH 95582/holotype, RMNH 95613/1, BMNH/1, MZB/1, VS/1, MD/9).

Description. – Shell dextral, high conical with convex sides, opaque and white, quite solid. With 5 convex whorls with a deep suture; penultimate whorl widest; with sharp and, in fresh specimens, densely placed high ribs (12 ribs/0.5 mm on penultimate whorl; 9-11 ribs/0.5 mm above the aperture). Spiral striation absent. Umbilicus up to 0.1 mm wide. Aperture more or less rounded, turned upwards. Palatal side of the peristome distinctly protruding beyond the penultimate whorl, columellar side not sinuous. Inner peristome distinctly protruding beyond the outer, spreading a short distance over the parietal side; angular edge without notch, its outer surface between inner and outer peristome with distinct lamellae.

Dimensions: H 1.8-2.0 mm; B 1.0 mm without outer peristome, 1.4 mm including outer peristome.

Derivatio nominis. – The name refers to the flaring (*dilatatus*) nature of the aperture.

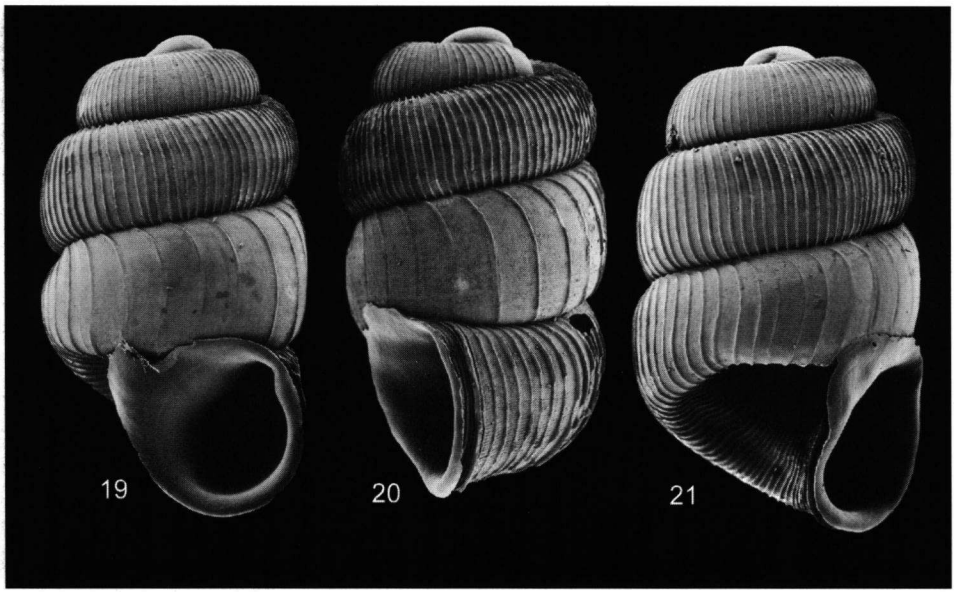
Remarks. – Only known from its type-locality, amongst the Sulawesian *Arinia* species the only one with a turned upwards, and flaring aperture.

Arinia hoeksemai spec. nov. (figs 19-21)

Material. – South Sulawesi: 3 km from main road Makassar in direction north, 3 km in direction Tonasa, 04°48.57"S 119°33.83"E, 1.viii.2002 (RMNH 95575/holotype, RMNH 95614/2, BMNH/2, MZB/2, VS/2, MD/65); limestone rocks near "Nymphenbad" near Pangkajene, leg. G. A. Tammes-Bolt 5.vi.1948 (ZMA/3); Tanah Toraja, burial caves near Suaya, E of Makale, 03°05.63"S 119°54.17"E, 23.vii.2002 (MD/2).

Description. – Shell dextral, almost low cylindrical with convex sides, opaque and white, very fragile, with 4.25-4.50 somewhat flattened whorls with a shallow suture; last two whorls widest; with densely placed, fine ribs on the penultimate whorl (15-18 ribs/0.5 mm); the ribs on the body whorl almost absent above the aperture (if present 4-8 ribs/0.5 mm). Spiral striation absent. Constriction consisting of a transverse lamella and a very short longitudinal tooth at its left side. Umbilicus open, up to 0.1 mm wide. Aperture more or less rounded at the basal and palatal side; from the angular to the columellar edge more straight, not turned upwards. Palatal side of the peristome not protruding beyond the penultimate whorl; columellar side not sinuous. Inner peristome hardly protruding beyond the indistinct outer one, spreading all over the parietal side, partly covering the umbilicus; angular edge with a notch, its outer surface between inner and outer peristome without lamellae.

Dimensions: H 1.1-1.3 mm; B 0.6-0.8 mm.



Figs 19-21. *Arinia hoeksemai* spec. nov., paratype (RMNH 95614), South Sulawesi, 3 km in direction Tonasa from coastal main road, actual height 1.3 mm. Photographs by J. Goud, Leiden.

Derivatio nominis. – Named in honour of Dr. Bert Hoeksema, head of the Evertebrata Department of the Natural History Museum Leiden, as thanks for his support.

Remarks. – So far this is the only Sulawesian *Arinia* species with a longitudinal tooth in its constriction. Even though the two specimens of Tanah Toraja were collected in an area far from the type-locality, they are considered to belong to the same species as no differences could be found.

Genus *Opisthostoma* Blanford, 1860

Opisthostoma henki spec. nov. (fig. 22)

Material. – South Sulawesi: 3 km from main road Makassar in direction north, 3 km in direction Tonasa, 04°48.57"S 119°33.83"E, 1.viii.2002 (RMNH 95577/holotype).

Description. – Shell sinistroid, white, slightly translucent. Whorls approximately 3 1/2 (tuba not included); apical whorls distinctly oblique, moderately to distinctly elevated. The penultimate whorl widest, convex or somewhat angular, with the suture well impressed. Constriction distinct, quite abrupt. Tuba consisting of approximately 3/4 whorl, touching the body whorl over its entire length, approximately circular in section. Shell with smooth top whorls, the next ones with rather wide, thin and sharp, distinct radial ribs, which are widely spaced on the penultimate whorl (5 ribs/0.5 mm). Ribs crossed by a fine, spiral striation. Umbilicus widely open (0.3 mm wide), deep, showing the previous whorls. Aperture tilted 45° with regard to the coiling axis, its upper margin clearly below

the level of the apex, without apertural teeth. Peristome double. Outer peristome spreading beyond the inner one, but gradually narrowed towards the right side of the aperture, where it is absent; inner peristome somewhat spreading, distinctly protruding beyond the outer one and on the right side of the aperture free of the whorls.

Dimension: H 1.0 mm; B 1.6 mm (including tuba), B 1.0 mm without tuba.

Derivatio nominis. – Named in honour to my long-standing friend and fellow-malacologist Henk Menkhorst, in recognition of the importance of his many collecting activities all over the world.

Remarks. – Even though this species is known only from a single, worn specimen, a formal description is given because of its peculiar appearance. It is hardly possible to confuse this species with any other described *Opisthostoma* species. Similar species are: *O. secretum* Maassen, 2002, from Sumatra (smaller, umbilicus much narrower); *O. asyndeton* Vermeulen, 1994, from Borneo (somewhat smaller, the tuba not attached to the whorls at all); *O. aetheroscopa* Vermeulen, 1991, from Borneo (smaller, the tuba is attached at the whorls over its entire lenght).

Opisthostoma javanicum Van Benthem Jutting, 1932 (figs 23-24)

Opisthostoma javanicum Van Benthem Jutting, 1932: 203, fig. 8a-d ("Java, Ciampea near Bogor"). Vermeulen 1991: 160, fig. 10a. Maassen, 1997: 45.
Opisthostoma aspastum Van Benthem Jutting, 1951: 30, fig. 1a-d ("Celebes, Pankadjene near Makassar").

Material. – South Sulawesi: Maros karst: Bantimurung National Park, 20 km E of Maros, leaf litter in open forest, 30 m alt., leg. P. Bouchet 9.ix.1991 (MNHN/2); same locality, leaf litter near limestone rocks, v.1995 (RMNH 95615/2, MD/50); same locality, 5.vii.2002, 05°00.96"S 119°40.91"E, 5.vii.2002 (MD/5); 3 km from main road Makassar in direction north, 3 km in direction Tonasa, 04°48.57"S 119°33.83"E, 1.viii.2002 (MD/4); 2 km N of Pangkajene near Mantampa, N of Makassar, 04°40.76"S 119°32.05"E, 1.viii.2002 (MD/10); Bone karst: Nengo village, Lilina Ajeng Ale district (Maros-Bone road), secondary forest, 450-500 m alt., leg. P. Bouchet 10.ix.1991 (MNHN/14); Bone Karst: Gua (cave) Mampu, 34 km NNE of Watampone, 4 km SW of Uloe, leaf litter among boulders, 50 m alt., leg. P. Bouchet 10.ix.1991 (MNHN/12); same locality, v.1995 (MD/10); Ujung Lamuru-Watampone road near km-mark 140, near tunnel, leaf litter under limestone rocks, v.1995 (MD/6); same locality, 04°32.04"S 120°05.00"E, 5.vii.2002 (MD/2).

Remarks. – Vermeulen (1991: 160) considered *O. aspastum* a synonym of *O. javanicum*, because he could not find any differences between specimens from Borneo, Sulawesi and Java. In this paper Vermeulen's opinion is followed.

Figs 22-24. *Opisthostoma* spec. 22, *O. henki* spec. nov., holotype (RMNH 95577), South Sulawesi, 3 km in direction Tonasa from coastal main road, actual height 1.0 mm; 23-24, *O. javanicum* Van Benthem Jutting, 1932, South Sulawesi, National Park Bantimurung, actual height 1.0 mm (RMNH 95615). Photographs by S. Kars, Amsterdam.

KEY TO THE SULAWESIAN SPECIES OF *ARINIA, PALAINA* AND *OPISTHOSTOMA*

1a Shell sinistroid 2
1b Shell dextral or sinistral 3

2a Shell with narrow umbilicus ..... *O. javanicum*
2b Shell with very wide umbilicus ..... *O. henki*

3a Shell either sinistral or dextral and over 4 mm high ..... *Palaina* [4]
3b Shell dextral and less than 3 mm high ..... *Arinia* [8]

4a Dextral, very wide umbilicus ..... *P. altumbilicata*
4b Dextral or sinistral, with closed to narrow umbilicus 5

5a Dextral 6
5b Sinistral 7

6a Densely ribbed, normal peristome ..... *P. monticola*
6b Almost smooth, normal peristome ..... *P. tondokensis*
6c More or less ribbed, very wide peristome ..... *P. moellendorffi*

7a With closed umbilicus ..... *P. wezendonki*
7b With a narrow umbilicus ..... *P. adonisi*

8a Peristome with "notch" at angular edge 9
8b Peristome without "notch" at angular edge 10

9a H more than 1.5 mm ..... *A. minahassae*
9b H less than 1.3 mm ..... *A. toradjensis*

10a H more than 1.5 mm, protruding peristome ..... *A. dilatata*
10b H more than 1.5 mm, normal peristome ..... *A. kessneri*
10c H less than 1.3 mm, normal peristome 11

11a Extremely wide umbilicus ..... *A. hoeksemai*
11b Normal umbilicus 12

12a Densely ribbed ..... *A. bantimurungensis*
12b Widely ribbed ..... *A. wasupondensis*

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REFERENCES

BENTHEM JUTTING, W.S.S. VAN, 1932. Notes on land Mollusca of the Malay Archipelago. – Journal of Conchology 19: 195-210.

BENTHEM JUTTING, W.S.S. VAN, 1951. On a new species of *Opisthostoma* from Celebes (*Opisthostoma* (*Opisthostoma*) *aspastum* nov. spec.). – Basteria 15: 30-31.

FULTON, H. C., 1899. Land Mollusca from the Malay Archipelago. – Proceedings of the Malacological Society of London 3: 212-219.

GITTENBERGER, E., 1995. On the one hand. – Nature 373: 19.

KOBELT, W., 1897. Land- und Süsswasserconchylien (der Molukken). – Abhandlungen Senckenbergische Naturforschende Gesellschaft 24: 19-92.

KOBELT, W., 1902. Cyclophoridae. – Das Tierreich 16: I-XXXIX, 1-663, Berlin.

MAASSEN, W.J.M., 1997. A preliminary checklist of the terrestrial molluscs of Sulawesi, Indonesia. A new start? – De Kreukel 33: 29-102.

SARASIN, P., & F. SARASIN, 1899. Die Landmollusken von Celebes. – Materialien zur Naturgeschichte der Insel Celebes 2: I-VIII, 1-248.

VERMEULEN, J.J., 1991. Notes on the non-marine molluscs of the island of Borneo 2. The genus *Opisthostoma* (Gastropoda Prosobranchia: Diplommatinidae). – Basteria 55: 139-163.

VERMEULEN, J.J.,1996. Notes on the non-marine molluscs of the island of Borneo 8. The genus *Arinia*; additions to the genera *Diplommatina* and *Opisthostoma* (Gastropoda Prosobranchia: Diplommatinidae). – Basteria 60: 87-138.

ZILCH, A., 1953. Die Typen und Typoide des Natur-Museums Senckenberg, 9: Mollusca, Cyclophoridae, Diplommatininae. – Archiv für Molluskenkunde 82: 1-47.