

A TAXONOMIC UPDATE OF THE TYPHINAE (GASTROPODA: MURICIDAE) WITH A REVIEW OF NEW CALEDONIA SPECIES AND THE DESCRIPTION OF NEW SPECIES FROM NEW CALEDONIA, THE SOUTH CHINA SEA AND WESTERN AUSTRALIA

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urn:lsid:zoobank.org:pub:13DC36F9-186B-48F8-ADAC-31D2B03DBF35

Abstract The classification of the subfamily Typhinae is revised based on a molecular phylogenetic analysis. The genera *Typhina* Jousseaume, 1880, *Typhisopsis* Jousseaume, 1880 and *Typhisala* Jousseaume, 1881 are here treated as synonyms, and *Typhina* is given precedence over *Typhisopsis*. *Trubatsa* Dall, 1889 is confirmed as a separate, valid genus, based on morphological shell characters and molecular analysis. *Choreotyphis* Iredale, 1936 is also regarded as a valid genus but still requires validation by molecular analysis. An appendix of Recent Typhinae includes a short description of each genus. The list of Typhinae recorded from New Caledonia is updated. The validity of *Trubatsa lozoueti* (Houart, 1991), a species so far known only from the empty collected holotype, is confirmed by the morphological and molecular analysis of a second specimen.

New species: *Monstrotyphis adelos* n. sp., *M. maestratii* n. sp. and *Trubatsa alinkios* n. sp. from New Caledonia, *Siphonochelus hasegawai* n. sp. from the South China Sea, and *Typhina clarksoni* n. sp. from Western Australia.

New record from New Caledonia: *Typhinellus oclusus* (Garrard, 1963) and four still unidentified species, *Laevityphis* sp., *Monstrotyphis* sp., *Siphonochelus* cf. *S. arcuatus* and *Trubatsa* sp.

New combinations: *Choreotyphis erythrostroma* (Keen & Campbell, 1964) (ex *Siphonochelus*); *Choreotyphis pavlova* (Iredale, 1936) (ex *Siphonochelus*); *Typhina carolskoglundae* (Houart & Hertz, 2006) (ex *Typhisopsis*); *T. clarki* (Keen & Campbell, 1964) (ex *Typhisala*); *T. claydoni* (Houart, 1988) (ex *Typhisopsis*); *T. coronatus* (Broderip, 1833) (ex *Typhisopsis*); *T. grandis* (A. Adams, 1855) (ex *Typhisala*); *T. lamyi* (Garrigues & Merle, 2014) (ex *Typhinellus*); *Typhis virginiae* Houart, 1986 and all other species previously classified as *Siphonochelus* (*Trubatsa*) are assigned to *Trubatsa*.

Key words Gastropoda, Muricidae, Typhinae, genetic analysis, classification, new species

INTRODUCTION

The subfamily Typhinae (Gastropoda: Muricidae) is morphologically well defined. All the species are characterized by their small size, rarely exceeding 25mm in length, occasionally by an additional, smooth, whitish intritacalx, a whitish or light brown coloured shell and by the presence of ventrally sealed anal tubes, situated between each pair of varices, closer to the preceding or to the succeeding varix, or situated midway of each pair, or directly originating from the succeeding varix, or connected to it. The last tube is the only functional one, the others being closed progressively by the animal during shell growth. Other characteristics are the ventrally sealed siphonal

canal, the 4 (rarely 5) varices per whorl, and, in some genera, the presence of a laminar extension (called “partition” in recent publications, e.g., Gertman 1969; Radwin and D’Attilio 1976; D’Attilio and Hertz 1988; Houart 2002) connecting the P2 shoulder spine of the last varix to the preceding teleoconch whorl (Fig. 1).

The classification of Typhinae has been the subject of numerous papers. After the first catalogue for the entire subfamily by Keen (1944), Vella (1961) produced a revision of the Australasian taxa; Gertman (1969) studied and illustrated the fossil species from the Western Atlantic, Radwin & D’Attilio (1976) treated the subfamily in their book on Muricidae; and D’Attilio & Hertz (1988) published an illustrated catalogue.

The number of valid species steadily increased since Keen's (1944) revision. Taking into account that some names are now placed in synonymy and some genera are assigned to the subfamily Tripterotyphinae, Keen (1944) recorded only 21 living species of Typhinae dispatched in seven genera. Radwin & D'Attilio (1976), if we respect the same criteria as for Keen (1944) and keep only those species currently considered valid, listed 32 species in 10 genera but did not mention or synonymized species now considered valid. D'Attilio & Hertz (1988) treated the Typhinae as a distinct family (as Typhidae) and divided it into Typhinae and the new subfamily Tripterotyphinae and listed all names of fossil and living species, totalling 48 Recent living species, of which 3 are now considered synonyms. Many studies have expanded this total to 80 through articles by Absalão & Santos (2003), Bozzetti (2007), Garrigues & Merle (2014), Hertz (1995), Houart (1991a, 1991b, 1994, 1999, 2002, 2013, 2015, 2017a, 2017b), Houart & Chino (2016), Houart *et al.* (2015, 2017), Houart & Héros (2015), Houart & Hertz (2006), Houart & Marshall (2012), Houart & Rosado (2019) and Garrigues (2021).

Houart (2018) recognized 13 genera and subgenera, while 5 additional genera are known from the fossil record only. In this paper we accept 11 Recent genera and 85 species including five newly described herein.

In the first molecular phylogeny of the family Muricidae Barco *et al.* (2010) recovered a monophyletic Typhinae clade, and confirmed that they are defined by a clear diagnostic character, the development of an anal tube on the subsutural ramp of the shell and its preservation on all teleoconch whorls. However, in Barco *et al.*'s topology the genera *Typhis* and *Siphonochelus* are not monophyletic, asking for a revision of the generic limits in the subfamily.

In the present paper,

(1) The classification of the subfamily Typhinae is revised based on a molecular phylogenetic analysis;

(2) The Recent Typhinae of the world are catalogued, with a short description of each genus;

(3) New species are described and new records are reported from New Caledonia, the South China Sea, and Western Australia;

(4) The list of Typhinae recorded from New Caledonia is updated.

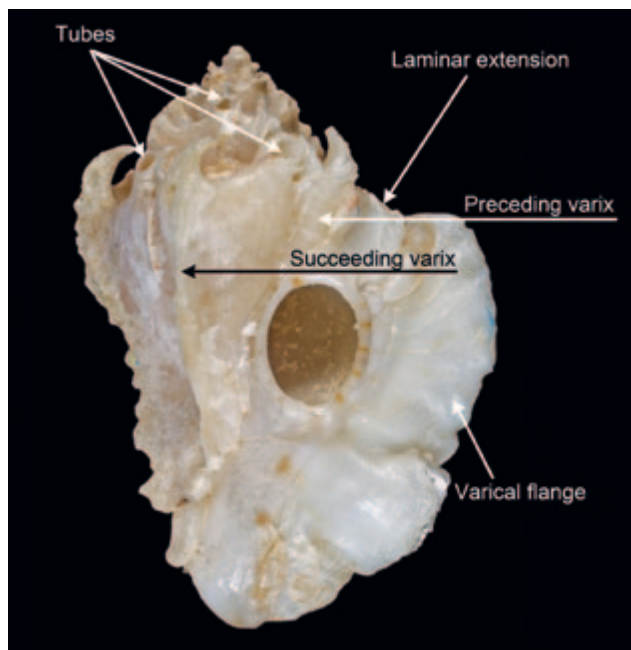


Figure 1 Shell morphology in *Typhina neocaledonica* (Houart, 1987)

MATERIALS AND METHODS

Sources of material examined

The studied material includes specimens collected on various cruises conducted by the MNHN/IRD. Other specimens are from the personal research collection of the first author.

Specimens of Typhinae were collected in New Caledonia during the following expeditions of the MNHN/IRD (not all of them mentioned in the systematics section, but the material has been examined over the years and their geographical and bathymetric distribution are evidently taken into account here).

VAUBAN, 1978–79, LAGON, 1985–93, BIOCAL, 1985, (doi.org/10.17600/85002911), MUSORSTOM 4, 1985 (doi.org/10.17600/85009111), CHALCAL 2, 1986 (doi.org/10.17600/86006511), MUSORSTOM 5, 1986 (doi.org/10.17600/86006611), BIOGEOCAL, 1987 (doi.org/10.17600/87001811), SMIB 3, 1987, CEDB, 1987 (Campagne d'essais drague épibenthique); MUSORSTOM 6, 1989 (doi.org/10.17600/89004811), BERYX 11, 1992 (doi.org/10.17600/9200501), SMIB 8, 1993 (doi.org/10.17600/93000640), BATHUS 1, 1993 (doi.org/10.17600/93000350), BATHUS 2, 1993 (doi.org/10.17600/93000360), BATHUS 3, 1993 (doi.org/10.17600/93000370), MONTROUZIER, 1993 HALIPRO 1, 1994 (doi.org/10.17600/94100010), BATHUS

4, 1994 (doi.org/10.17600/9410003), PALEO SURPRISE, 1999 (doi.org/10.17600/99100040), LITHIST, 1999 (doi.org/10.17600/99100080), NORFOLK 1, 2001 (doi.org/10.17600/1100050), NORFOLK 2, 2003 (doi.org/10.17600/3100030), EBISCO, 2005 (http://dx.doi.org/10.17600/5100080), CONCALIS, 2008 (http://dx.doi.org/10.17600/8100010), TERRASSES, 2008 (http://dx.doi.org/10.17600/8100100), EXBODI, 2011 (http://dx.doi.org/10.17600/11100080), KANACONO, 2016 (doi.org/10.17600/16003900), KANADEEP, 2017 (doi.org/10.17600/17003800), KOUMAC 2.3, 2018.

Material from three other expeditions in the Pacific have been studied: RAPA, 2002 in the Austral Archipelago, PAPUA NIUGINI, 2012 (doi.org/10.17600/18000841) in Papua New Guinea and DongSha 2014, in the South China Sea.

The material studied is housed in MNHN, unless otherwise stated.

Morphological analysis

The characters used to describe shell morphology in Typhinae address the general aspect of the shell including its shape, size, and colour, the shape of the spire including the number and features of the protoconch and teleoconch whorls, details of the suture and of the subsutural ramp, the structure and pattern of the intritacalx, details of axial and spiral sculpture, the form, the position of the anal tubes on the shell and the angle formed by the tubes with its axis, the aperture, the siphonal canal, and when available, the characters of the operculum and radula.

The method used to determine diameter and height, and to count the number of protoconch whorls, follows Bouchet & Kantor (2004) as shown in Fig. 2. The morphology of the radula is described starting from the rachidian tooth, followed by the lateral teeth (Fig. 3). The species descriptions are based on the holotype and paratypes. The bathymetric ranges are the inner values of the recorded depths: the deepest minimum and the shallowest maximum of each recorded depth range.

Terminology used to describe the spiral cords (after Merle 2001, 2005) (Figs 12L & 18I)

ABP: abapertural primary cord on the siphonal canal; **ADP:** adapertural primary cord on the siphonal canal; **MP:** median primary cord on

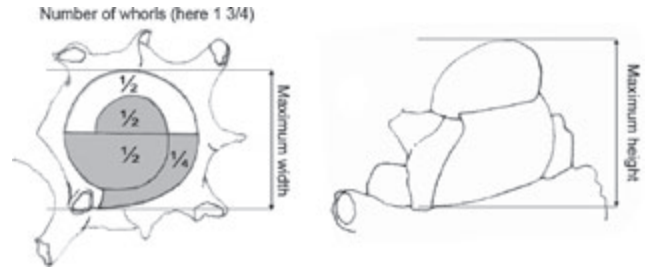


Figure 2 Method for determining diameter, height and counting the number of protoconch whorls, here *Monstrotyphis maestratii* n. sp.

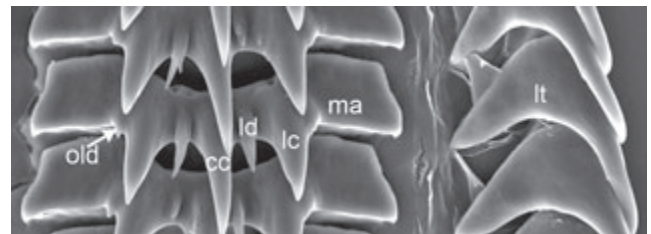


Figure 3 Terminology used to describe the radula, here *Monstrotyphis maestratii* n. sp.

cc: central cusp; **ld:** lateral denticle; **lc:** lateral cusp; **lt:** lateral teeth; **ma:** marginal area; **old:** outer lateral denticle (following Kool 1993)

the siphonal canal; **P:** primary cord; **P1:** shoulder cord; **P2–P6:** primary cords of the convex part of the teleoconch whorl; **s:** secondary cord (s2=secondary cord between P2 and P3; s2=secondary cord between P3 and P4).

Radula

Radula characters in Typhinae are very diverse (Figs 8–10) and unlike other groups they do not have constant characters. The position, the shape and the number of denticles and cusps of the rachidian tooth are sometimes different within the same genus.

The radula is muricine-like with a rachidian tooth that supports a long, narrow or broad central cusp and quite long lateral cusps, even occasionally reaching larger dimensions than the central cusp.

Lateral denticles are quite variable in size and number, even within the same species or on the ribbon of the same specimen. The lateral denticles may occasionally be simple or sometimes are duplicated or split, of different lengths, or with small outer lateral denticles (**old**) (Fig. 3). Marginal denticles are occasionally present, also without any specific or regular shapes.

Lateral teeth have a similar sickle shaped form similar to that in other Muricidae.

Protoconch

The protoconch in living Indo-West Pacific, and *ipso facto* in New Caledonian species of Typhinae is always paucispiral, consisting of 1.5 to 2 rounded whorls denoting a lecithotrophic larval development.

MOLECULAR ANALYSES

We analyzed the phylogenetic relationships in the subfamily Typhinae using 75 specimens assigned to 23 species and 6 genera (see Table 1). The dataset includes also 46 species belonging to other subfamilies, largely selected following Barco *et al.* (2010, 2012, 2015).

Total genomic DNA was extracted using the Qiagen DNA Mini Kit or the Macherey-Nagel NucleoSpin 96 Tissue Kit and following the manufacturer's protocol.

We amplified three fragments, the 658 bp barcode portion of the mitochondrial cytochrome oxidase I (COI) with primers LCO1490 and HCO2198 (Folmer *et al.* 1994), a 505–522 bp portion of the large ribosomal subunit (16S) with primers 16SA and 16SB (Kessing *et al.* 1989), and a 703–1305 bp portion of the nuclear large ribosomal subunit (28S), with primers 28S-C1 (Jamieson *et al.*, 2002) and 28S-ChiR1 (new primer: 3'-CCC ACAGCGCCAGTTCTGCTTACCA-5').

Newly obtained sequences were deposited in GenBank and BOLD (Barcode of Life Datasystem) (Table 1).

The three genes were aligned with DNASTAR. After exclusion of four regions in the ribosomal genes that could not be aligned unambiguously (78 bp in total), the three genes were combined into a single dataset of 2457 bp (COI: 658 bp, 16S: 478 bp, 28S: 1321 bp). The dataset was analyzed under the maximum likelihood criterion, using RAxML-HPC2 (Stamatakis 2006), implemented on CIPRES portal (Miller *et al.*, 2010). We selected a GTR+ +I model and random starting tree, with empirical base frequencies and estimated α -shape parameters and GTR-rates. Nodal support was estimated using 100 bootstrap replicates.

ABBREVIATIONS

AMS Australian Museum, Sydney, Australia
 MNHN Muséum national d'Histoire naturelle, Paris, France
 RH Collection of the first author
 WAM Western Australian Museum, Perth, Australia

IRD Institut de Recherche pour le Développement (formerly ORSTOM)
 CP Chalut à perche (beam trawl);
 DC Drague Charcot (Charcot dredge)
 DR Drague à roches (rocks dredge)
 DW Drague Warén (Warén dredge)
 dd empty shell(s)
 juv juvenile specimen(s)
 lv live collected specimen(s)

RESULTS*Molecular phylogeny*

The phylogenetic analysis recovered a monophyletic Typhinae clade in the Maximum Likelihood tree (Fig. 4) but the basal node has a no support and the clade relationships within the Muricidae remain largely unresolved. Although some of the subfamilies identified by Barco *et al.* (2010) are here recovered monophyletic (Pagodulinae, Haustrinae, Muricinae, Ocenebrinae), the subfamilies Muricopsinae, Aspellinae and Trophoninae are paraphyletic, and other genera form distinct lineages, not belonging to any accepted subfamily (*Actinotrophon*, *Bouchetia*, *Flexopteron*, *Homalocantha*, *Pterynotus*, *Timbellus*, *Vitularia*). The association of the lineage Typhinae with the genera *Flexopteron*, *Bouchetia*, *Actinotrophon* has not been suggested before, must be considered only tentative and needs to be confirmed with a larger dataset.

Two major lineages form the clade Typhinae, one consisting of the sister genera *Typhina* and *Typhinellus*, the other with *Monstrotyphis*, *Siphonochelus*, *Typhis* and *Trubatsa*. All genera are strongly supported (bootstrap values ≥ 71). The division in two lineages matches a major morphological trait, the presence of a laminar extension in *Typhina* and *Typhinellus* vs its absence in the other genera.

All species form strongly supported, monophyletic lineages, generally with modest intraspecific genetic variability, with the exception of *Monstrotyphis maestratii*, where one specimen (MNHN-IM-2009-8449: Argo Bank) differs by 6.3% (COI *p*-distance) from two other specimens collected on the Chesterfield Plateau, and *Siphonochelus rosadoi*, where a single specimen collected at a deeper station (1092–1195m : MNHN-IM-2009-5605) differ by 4.5% (COI *p*-distance) from the others, all obtained in 443–638m.

Table 1 Specimens used in the molecular phylogenetic analysis, followed by the Genbank and BOLD accession numbers. For the MNHN material we indicate the expedition and the station where the specimens were collected, for other samples/sequences obtained from Genbank we report the collection locality as indicate in the corresponding publication.

Taxon	Accession N	Origin	COI	BOLD	16S	28S
Subfamily Typhinae						
<i>Monstrotypophis adelos</i> sp.n.	MNHN IM-2013-68865	KANACONO – DW4677	MZ364554	MUBA910-21	MZ364622	MZ364686
<i>Monstrotypophis adelos</i> sp.n.	MNHN IM-2013-69415	KANACONO – DW4715	MZ364555	MUBA916-21	MZ364623	MZ364687
<i>Monstrotypophis carolinae</i> (Houart, 1987)	MNHN IM-2009-4573	TERRASSES – DW3078	MZ364584	MPOM001-10	MZ364649	MZ364717
<i>Monstrotypophis carolinae</i> (Houart, 1987)	MNHN IM-2013-49551	KANACONO – DW4703	MZ364609	MUBA919-21	MZ364671	MZ364742
<i>Monstrotypophis carolinae</i> (Houart, 1987)	MNHN IM-2013-69186	KANACONO – DW4703	MZ364571	MUBA906-21	MZ364637	MZ364702
<i>Monstrotypophis maestratii</i> sp.n.	MNHN IM-2009-5141	EBISCO 2005 – CP2595	MZ364581	MUBA896-21	-	MZ364712
<i>Monstrotypophis maestratii</i> sp.n.	MNHN IM-2009-8449	EBISCO – DW2528	GU575389	MPOM178-10	FN651933	FN651999
<i>Monstrotypophis maestratii</i> sp.n.	MNHN IM-2013-65600	KANADEEP – DW4977	MZ364602	MUBA918-21	MZ364666	MZ364735
<i>Monstrotypophis singularis</i> Houart, 2002	MNHN IM-2019-9150	KANADEEP_2 – KL36	MZ364547	MUBA920-21	MZ364616	MZ364680
<i>Siphonochelus boucheti</i> Houart, 1991	MNHN IM-2009-5041	NORFOLK 2 – DW2081	GU575387	MPOM160-10	-	FN651994
<i>Siphonochelus hasegawai</i> sp.n.	MNHN IM-2013-50304	DongSha 2014 – CP4130	MZ364561	MUBA899-21	MZ364628	MZ364693
<i>Siphonochelus hasegawai</i> sp.n.	MNHN IM-2013-50305	DongSha 2014 – CP4130	MZ364559	MUBA898-21	-	MZ364691
<i>Siphonochelus hasegawai</i> sp.n.	MNHN IM-2013-50327	DongSha 2014 – CP4131	MZ364586	MUBA900-21	MZ364651	MZ364719
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5601	MAINBAZA – CC3152	MZ364569	NEOGA1033-10	MZ364634	MZ364699
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5602	MAINBAZA – CC3152	MZ364574	NEOGA1034-10	MZ364640	MZ364705
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5604	MAINBAZA – CC3172	MZ364566	NEOGA1036-10	-	-
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5605	MAINBAZA – CP3139	MZ364563	NEOGA1037-10	MZ364630	MZ364695
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5610	MAINBAZA – CC3164	MZ364582	NEOGA1041-10	-	MZ364713
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5611	MAINBAZA – CC3164	MZ364553	NEOGA1042-10	-	MZ364685
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5612	MAINBAZA – CC3164	MZ364607	NEOGA1043-10	-	MZ364740
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5614	MAINBAZA – CP3142	MZ364606	NEOGA1044-10	MZ364670	MZ364739
<i>Siphonochelus rosadoi</i> Houart, 1999	MNHN IM-2009-5618	MAINBAZA – CC3154	MZ364565	NEOGA1048-10	-	-
<i>Trubatsa alinkios</i> sp.n.	MNHN IM-2013-68291	KANACONO – DW4714	MZ364568	MUBA908-21	MZ364633	MZ364698
<i>Trubatsa alinkios</i> sp.n.	MNHN IM-2013-69028	KANACONO – DW4700	MZ364596	MUBA912-21	MZ364660	MZ364729
<i>Trubatsa alinkios</i> sp.n.	MNHN IM-2013-69293	KANACONO – DW4713	MZ364600	MUBA915-21	MZ364664	MZ364733
<i>Trubatsa longicornis</i> (Dall, 1888)	MNHN IM-2013-61233	KARUBENTHOS 2 – DW4622	MW497156	MUBA895-21	MZ364678	MZ364750
<i>Trubatsa lozoueti</i> (Houart, 1991)	MNHN IM-2009-22828	EXBODI – CP3799	MZ364548	MUBA001-15	MZ364617	-
<i>Trubatsa</i> sp.	MNHN IM-2009-8590	EBISCO – DW2632	GU575388	MPOM180-10	FN651929	FN651995
<i>Trubatsa undulata</i> (Houart, 1991)	MNHN IM-2013-68961	KANACONO – DW4695	MZ364552	MUBA911-21	MZ364621	MZ364684
<i>Trubatsa undulata</i> (Houart, 1991)	MNHN IM-2013-69206	KANACONO – CP4709	MZ364598	MUBA907-21	MZ364662	MZ364731
<i>Trubatsa unicornis</i> (Houart, 1991)	MNHN IM-2013-68579	KANACONO – DW4666	MZ364592	MUBA905-21	MZ364657	MZ364725
<i>Trubatsa unicornis</i> (Houart, 1991)	MNHN IM-2013-68627	KANACONO – DW4666	MZ364550	MUBA909-21	MZ364619	MZ364682
<i>Trubatsa unicornis</i> (Houart, 1991)	MNHN IM-2013-69086	KANACONO – DW4698	MZ364611	MUBA913-21	MZ364674	MZ364745
<i>Trubatsa unicornis</i> (Houart, 1991)	MNHN IM-2013-69452	KANACONO – DW4711	MZ364573	MUBA917-21	MZ364639	MZ364704
<i>Trubatsa virginiae</i> (Houart, 1986)	MNHN IM-2013-69222	KANACONO – DW4703	MZ364579	MUBA914-21	MZ364644	MZ364710

Taxon	Accession N	Origin	COI	BOLD	16S	28S
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22971	EXBODI – CP3827	MZ364560	MUBA897-21	MZ364627	MZ364692
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22972	EXBODI – CP3795	MZ364587	MUBA517-15	MZ364652	MZ364720
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22973	EXBODI – CP3795	MZ364576	MUBA518-15	-	MZ364707
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22975	EXBODI – CP3824	MZ364599	MUBA520-15	MZ364663	MZ364732
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22978	EXBODI – CP3823	MZ364593	MUBA523-15	MZ364658	MZ364726
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22980	EXBODI – CP3825	MZ364570	MUBA524-15	MZ364635	MZ364700
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22988	EXBODI – CP3814	MZ364567	MUBA530-15	MZ364632	MZ364697
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22990	EXBODI – CP3828	MZ364572	MUBA531-15	MZ364638	MZ364703
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22991	EXBODI – CP3814	MZ364590	MUBA532-15	MZ364655	MZ364723
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22992	EXBODI – CP3814	MZ364612	MUBA533-15	MZ364675	MZ364746
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22993	EXBODI – CP3814	MZ364614	MUBA534-15	MZ364676	MZ364748
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22997	EXBODI – CP3810	MZ364594	MUBA537-15	-	MZ364727
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-22998	EXBODI – CP3834	MZ364578	MUBA538-15	MZ364643	MZ364709
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23027	EXBODI – CP3807	MZ364588	MUBA558-15	MZ364653	MZ364721
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23028	EXBODI – CP3807	MZ364601	MUBA559-15	MZ364665	MZ364734
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23029	EXBODI – CP3807	MZ364589	MUBA560-15	MZ364654	MZ364722
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23030	EXBODI – CP3807	MZ364558	MUBA561-15	MZ364626	MZ364690
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23039	EXBODI – CP3821	MZ364608	MUBA565-15	-	MZ364741
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23040	EXBODI – CP3821	MZ364551	MUBA566-15	MZ364620	MZ364683
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23041	EXBODI – CP3821	MZ364591	MUBA567-15	MZ364656	MZ364724
<i>Trubatsa wolffi</i> (Houart, 2013)	MNHN IM-2009-23042	EXBODI – CP3821	MZ364597	MUBA568-15	MZ364661	MZ364730
<i>Typhina coronatus</i> (Broderip, 1833)	BAU00396	Isla San José, Panama	FN651951		FN651930	FN651996
<i>Typhina expansa</i> (Sowerby, 1874)	MNHN IM-2013-56076	GUYANE 2014 – CP4353	MW497155	MUBA894-21	MZ364648	MZ364716
<i>Typhina expansa</i> (Sowerby, 1874)	MNHN IM-2013-56943	GUYANE 2014 – CP4352	MW497154	MUBA893-21	MZ364646	MZ364714
<i>Typhina grandis</i> (A. Adams, 1855)	BAU00376	Isla San José, Panama	FN651952		FN651931	FN651997
<i>Typhina lamyi</i> (Garrigues & Merle, 2014)	MNHN IM-2013-71437	MADIBENTHOS – AD261	MK308502	MUBA833-18	MZ364673	MZ364744
<i>Typhina lamyi</i> (Garrigues & Merle, 2014)	MNHN IM-2013-7776	KARUBENTHOS 2012 – GD35	KJ591665	BOMGA015-14	-	-
<i>Typhinellus androyensis</i> Bozzetti, 2007	MNHN IM-2009-14730	ATIMO VATAE – BS12	MZ364562	MUBA201-15	MZ364629	MZ364694
<i>Typhinellus androyensis</i> Bozzetti, 2007	MNHN IM-2009-14737	ATIMO VATAE – BS12	MZ364564	MUBA404-15	MZ364631	MZ364696
<i>Typhinellus constrictus</i> Houart & Heros, 2015	MNHN IM-2009-14446	ATIMO VATAE – BS09	MZ364610	MUBA731-15	MZ364672	MZ364743
<i>Typhinellus constrictus</i> Houart & Heros, 2015	MNHN IM-2009-22522	ATIMO VATAE – BP22	KP697991	BOMGA027-15	MZ364636	MZ364701
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	BAU00181	Borj el Mussar, Tunisia	FN651953		FN651932	FN651998
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	MNHN IM-2019-4486	CORSICABENTHOS 1 – CS01	MZ364580	MUBA921-21	MZ364645	MZ364711
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	MNHN IM-2019-4704	CORSICABENTHOS 1 – CS07	MZ364615	MUBA922-21	MZ364677	MZ364749

Taxon	Accession N	Origin	COI	BOLD	16S	28S
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	MNHN IMI-2019-5912	CORSICABENTHOS 1 – CS21	MZ364575	MUBA923-21	MZ364641	MZ364706
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	MNHN IMI-2019-6219	CORSICABENTHOS 1 – CS25	MZ364603	MUBA924-21	MZ364667	MZ364736
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	MNHN IMI-2019-6220	CORSICABENTHOS 1 – CS25	MZ364549	MUBA925-21	MZ364618	MZ364681
<i>Typhinellus labiatus</i> (Cristofori & Jan, 1832)	MNHN IMI-2019-6279	CORSICABENTHOS 1 – CB07	MZ364556	MUBA926-21	MZ364624	MZ364688
<i>Typhis ramosus</i> Habe & Kosuge, 1971	MNHN IMI-2013-61722	ZhongSha 2015 – CP4135	MZ364577	MUBA903-21	MZ364642	MZ364708
<i>Typhis ramosus</i> Habe & Kosuge, 1971	MNHN IMI-2013-61724	ZhongSha 2015 – CP4135	MZ364557	MUBA904-21	MZ364625	MZ364689
Subfamily Haustrinae						
<i>Bedeova patuae</i> (Crosse, 1864)	AMS C458273	Isthmus Bay, Bruny I., Tasmania, Australia	FN677412		FN677437	FN677466
<i>Bedeova vinosa</i> (Lamarck, 1822)	AMS C458268	NE of Scamander, Tasmania, Australia	FN677413		FN677435	FN677468
<i>Haustrum haustorium</i> (Gmelin, 1791)	UO HH-PB	Pakerua Bay, New Zealand	FN677410		FN677443	FN677464
<i>Haustrum lacunosum</i> (Bruguière, 1789)	UO LL2-SC	St Clair, Dunedin, New Zealand	FN677411		FN677442	FN677465
Subfamily Muricinae						
<i>Chicomurex laciniatus</i> (G.B. Sowerby II, 1841)	MNHN IMI-2009-4958	SANTO 2006 – FR35	GU575369	MPOM091-10	FN651897	FN651963
<i>Chicomurex axicornis</i> (Lamarck, 1822)	MNHN IMI-2009-4962	SANTO 2006 – EP24	GU575370	MPOM095-10	FN651898	FN651964
<i>Chicomurex brunneus</i> (Link, 1807)	MNHN IMI-2009-4902	PANGLAO 2004 – B3	GU575371	MPOM061-10	FN651899	FN651965
<i>Haustellum haustellum</i> (Linnaeus, 1758)	MNHN IMI-2009-4909	PANGLAO 2004 – N3	GU575380	MPOM066-10	FN651902	FN651968
<i>Murex pecten</i> Lightfoot, 1786	MNHN IMI-2009-5043	AURORA 2007 – CP2653	GU575382	MPOM162-10	FN651903	FN651969
<i>Naquetia cumingii</i> (Adams, 1853)	MNHN IMI-2009-4914	PANGLAO 2004 – B16	GU575383	MPOM070-10	FN651904	FN651970
<i>Vokesimurex dentifer</i> (Watson, 1883)	MNHN IMI-2009-4876	CONCALIS – DW2986	GU575392	MPOM044-10	FN651909	FN651975
Subfamily Muricopsinae/Aspellinae						
<i>Muricopsis cristata</i> (Brocchi, 1814)	BAU00352	San Pietro I, Sardinia, Italy	FN651943		FN651917	FN651983
<i>Attiliosa nodulifera</i> (G.B. Sowerby II, 1841)	MNHN IMI-2009-4955	SANTO 2006 – EP36	GU575368	MPOM088-10	FN651896	FN651962
<i>Dermomurex neglectus</i> (Habe & Kosuge, 1970)	MNHN IMI-2009-4908	PANGLAO 2004 – P4	GU575372	MPOM065-10	FN651900	FN651966
<i>Dermomurex wareni</i> Houart, 1990	MNHN IMI-2009-5031	NORFOLK 2 – DW2156	GU575373	MPOM151-10	FN651901	FN651967
<i>Favartia balteata</i> (Beck, 1841)	MNHN IMI-2009-5021	SANTO2006 – FB90	GU575374	MPOM144-10	FN651910	FN651976
<i>Favartia jeanae</i> Bertsch & D'Attilio, 1980	MNHN IMI-2009-4929	PANGLAO 2004 – L46	GU575375	MPOM076-10	FN651912	FN651978
<i>Favartia mactanensis</i> (Emerson & D'Attilio, 1979)	MNHN IMI-2009-4931	PANGLAO 2004 – P1	GU575376	MPOM077-10	FN651913	FN651979
<i>Favartia maculata</i> (Reeve, 1845)	MNHN IMI-2009-4933	PANGLAO 2004 – P1	GU575377	MPOM078-10	FN651914	FN651980
<i>Favartia ponderi</i> Myers & D'Attilio, 1976	MNHN IMI-2009-4940	PANGLAO 2004 – B20	GU575378	MPOM081-10	FN651915	FN651981

Taxon	Accession N	Origin	COI	BOLD	16S	28S
<i>Favartia rosaminae</i> (D'Attilio & Myers, 1985)	MNHN IM-2009-5024	SANTO2006 – FB90	GU575379	MPOM181-10	FN651916	FN651982
Subfamily Ocenebrinae						
<i>Acanthina monodon</i> (Pallas, 1774)	NHMUK 19990298	W side Isla Rojas, Region IX, Chile	EU391583		FN677445	EU391562
<i>Eupleura nitida</i> (Broderip, 1833)	BAU00283	Las Perlas, Panama	FN651944		FN651919	FN651985
<i>Nucella lapillus</i> (Linnaeus, 1758)	BAU00187	Portobello, United Kingdom	FN651945		FN651920	FN651986
<i>Ocenebrellus inornatus</i> (Récluz, 1851)	NHMUK 20080007	Mashike Fishing Port, Hokkaido, Japan	FN677403		FN677454	FN677457
<i>Urosalpinx cinerea</i> (Say, 1822)	NHMUK 20080059	Whitstable, Kent, UK	FN677423		FN677440	FN677478
<i>Xanthochorus cassidiformis</i> Blainville, 1824	BAU00190	La Rinconada, NE Antofagasta Bay, Chile. Intertidal	FN651948		FN651924	FN651990
Subfamily Pagodulinae						
<i>Trophonella longstaffi</i> (E. A. Smith, 1907)	BAU00949	Tethys Bay, Ross Sea, Antarctica	FN651950		FN651927	FN651993
<i>Zeatrophon pulcherrimus</i> Finlay, 1930	M.284120	New Zealand, Challenger Plateau	HE804838		HE804814	HE804828
Subfamily Trophoninae						
<i>Leptotrophon surprisensis</i> Houart, 1995	MNHN IM-2009-8589	EBISCO 2005 – DW2610	GU575381	MPOM179-10	FN651925	FN651991
<i>Nipponotrophon gorgon</i> (Dall, 1913)	NHMUK 20080034	Jogashima, Miura City, Kanagawa Pref., Japan	FN677420		FN677436	FN677475
<i>Trophon geversianus</i> (Pallas, 1774)	BAU00910	Playa Larralde, Chubut Province, Argentina	FN651949		FN651926	FN651992
<i>Trophon plicatus</i> (Lightfoot, 1786)	NHMUK 19990293	Islet, NE shore of Isla Huemules, Region XI, Chile	EU391578		FN677439	EU391547
Subfamily not assigned						
<i>Actinotrophon actinophorus</i> (Dall, 1889)	MNHN IM-2013-60570	KARUBENTHOS 2 – DW4556	MZ364604	MUBA902-21	MZ364668	MZ364737
<i>Actinotrophon fragilis</i> (Houart, 1996)	MNHN IM-2013-44160	NanHai 2014 – DW4102	MZ364583	MUBA700-15	MZ364647	MZ364715
<i>Actinotrophon tenuis</i> (Houart, 2001)	MNHN IM-2009-23034	EXBODI – CP3854	MZ364613	MUBA562-15	-	MZ364747
<i>Bouchetia hystericina</i> (Dall, 1889)	MNHN IM-2013-60438	KARUBENTHOS 2 – DW4549	MZ364585	MUBA901-21	MZ364650	MZ364718
<i>Bouchetia waereni</i> Houart R. & Héros V. (2015)	MNHN IM-2007-36979	MIRIKY – CP3183	KP697988	BOMGA024-15	MZ364679	MZ364751
<i>Flexopteron poppei</i> (Houart, 1993)	MNHN IM-2009-5046	AURORA 2007 – CC2744	MZ364595	MPOM164-10	MZ364659	MZ364728
<i>Flexopteron primanova</i> (Houart, 1985)	MNHN IM-2007-36939	MIRIKY – CP3189	MZ364605	MUBA132-15	MZ364669	MZ364738
<i>Homalocantha pele</i> (Pilsbry, 1918)	MNHN IM-2009-4949	PANGLAO 2004 – B3	GU991548	MPOM085-10	FN651918	FN651984
<i>Pteryonotus elongatus</i> (Lightfoot, 1786)	MNHN IM-2009-4916	PANGLAO 2004 – B39	GU575385	MPOM072-10	FN651906	FN651972
<i>Pteryonotus marinetanus</i> (Röding, 1798)	MNHN IM-2009-5011	SANTO 2006 – FR45	GU575384	MPOM135-10	FN651905	FN651971
<i>Timbellus fulgens</i> Houart, 1988	MNHN IM-2009-5038	NORFOLK 2 – DW2147	GU575386	MPOM157-10	FN651907	FN651973
<i>Vitularia miliaris</i> (Gmelin, 1791)	MNHN IM-2009-5030	SANTO 2006 – DR84	GU575391	MPOM150-10	FN651922	FN651988
<i>Vitularia salebrosa</i> (King & Broderip, 1832)	BAU00291	Venado, Panama	FN651947		FN651923	FN651989

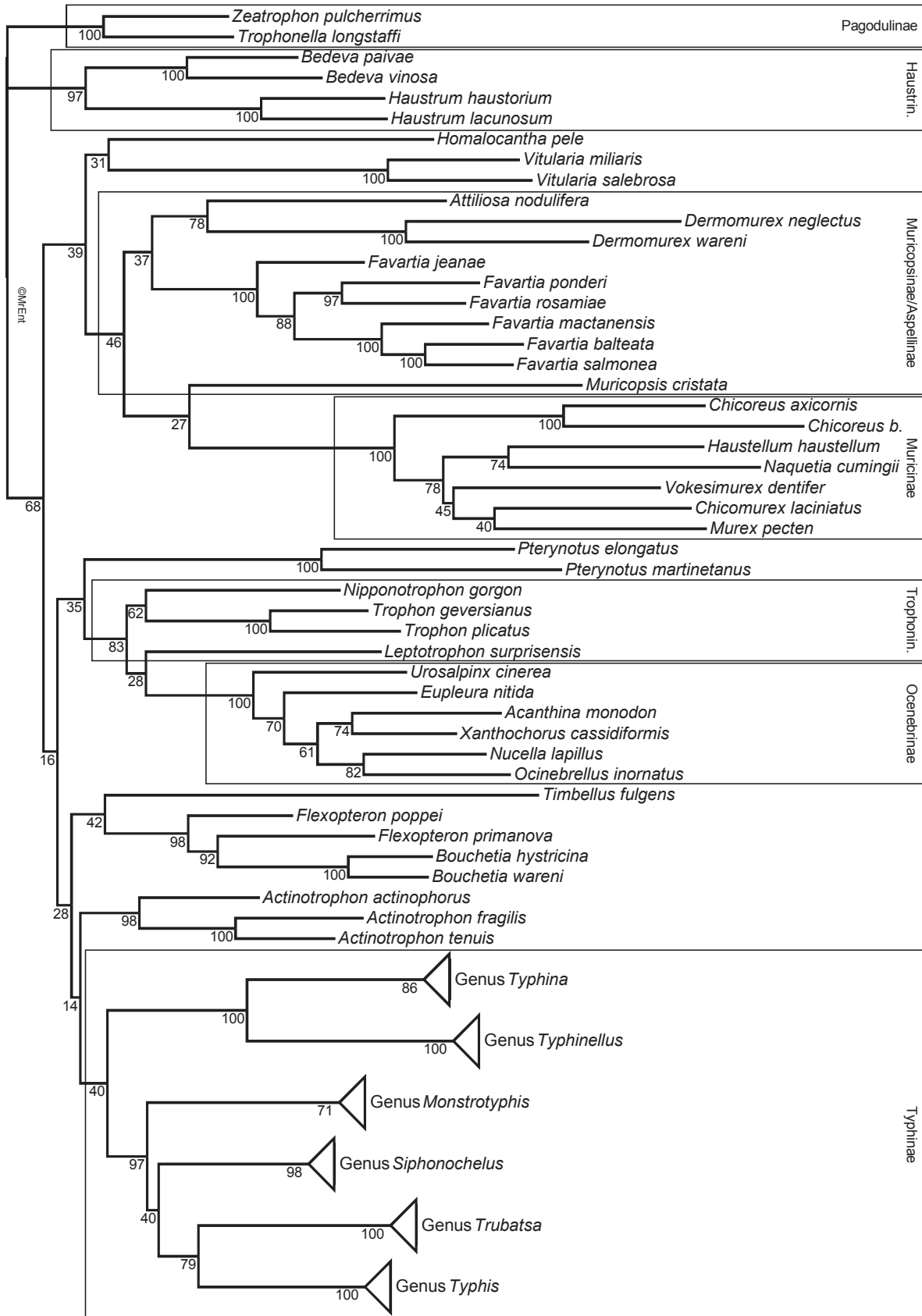


Figure 4 Phylogenetic relationships (Maximum Likelihood) of Typhinae. Clades in the Typhinae have been compressed to highlight the generic relationships within the subfamily and in regard to the other subfamilies/lineages in the Muricidae. Bootstrap values are indicated at the nodes.

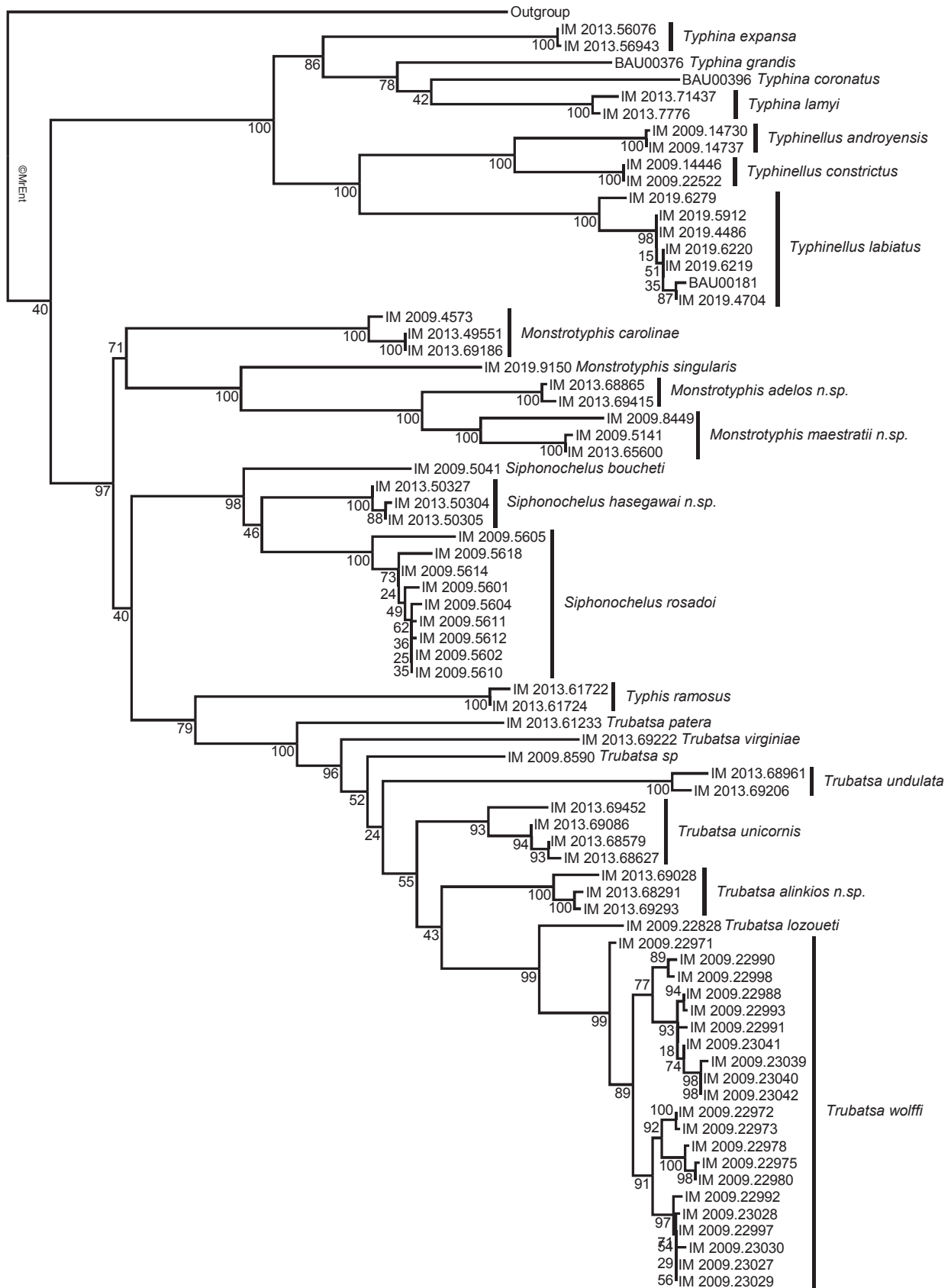


Figure 5 Phylogenetic relationships (Maximum Likelihood) of Typhinae. The topology has been trimmed to show only the Typhinae clade. Bootstrap values are indicated at the nodes. The tree has been edited in MrEnt v.2.5 (Zuccon & Zuccon, 2014).

TAXONOMIC DESCRIPTIONS

Family Muricidae Rafinesque, 1815

Subfamily Typhinae Cossmann, 1903

Genus *Laevityphis* Cossmann, 1903

Type species by original designation: *Typhis coronarius* Deshayes, 1865=*T. muticus* J. Sowerby, 1834, Eocene, France

Remarks The type species of *Laevityphis*, *Typhis coronarius* Deshayes, 1865, is based on a small fossil shell from the Eocene of France and England. It has a hollow varical shoulder spine and a multispiral, conical protoconch consisting of 3.5 whorls.

The other fossil species currently included in *Laevityphis* by Campbell (1969) fit well the type species (excluding the multispiral protoconch). For example *L. linguiferus* (Dall, 1890) from the Miocene of Florida or *L. sawkinsi* (Mansfield, 1925) from the Miocene of Venezuela. However other species included in the genus have no hollow shoulder spine, but rather a rounded shoulder as observed in *L. ludbrookae* Keen & Campbell, 1964.

The same characteristics are observed in the Recent fauna, for example *L. bullisi* Gertman, 1969 described from eastern Panama but which also occurs in the Pleistocene of Costa Rica, has hollow shoulder spines compared to *L. tubuliger* (Thiele, 1925) and *L. tillierae* who match the other shell characters of *Laevityphis* except they are lacking the hollow shoulder spine, but have rather rounded varices with rounded shoulder. *Siphonochelus transcurrens* was assigned to *Laevityphis* by several authors but was transferred to *Siphonochelus* by Houart (2017b)

Hopefully further genetic studies including the different morphs of *Laevityphis* and some Indo-West Pacific species will be able to clarify this doubtful classification, but in the meantime it is maintained here.

Species in New Caledonia. *Laevityphis tillierae* (Houart, 1986) and *Laevityphis* sp.

Laevityphis tillierae (Houart, 1986)

Fig. 11A–G

Siphonochelus (Laevityphis) tillierae Houart, 1986: 442, pl. 2, fig. 6.

Siphonochelus (Laevityphis) tillierae – Houart, 1991a: 234, figs 26, 27, 50, 64; Houart, 1991b: 51, figs 28–30, 54.

Laevityphis tillierae – Houart *et al.*, 2010: 248.

Type locality New Caledonia, VAUBAN 1978–79, stn DR40, 22°30'S, 166°24'E, 250–350m (dd).

Type material Holotype MNHN-IM-2000-237.

Distribution North, East and South New Caledonia, living at 647–830m; off Cairns, Queensland, Australia and Transkei, South Africa.

Remarks Many additional specimens have been collected around New Caledonia since its description. Most of them were collected empty but the very few specimens collected alive usually live between 647 and 830m.

A specimen examined by the first author was obtained off Cairns, Queensland, Australia, collected empty at 1161m (AMS) while other specimens, similar to the New Caledonian shells were recorded from Transkei and Zululand, Indian Ocean, South Africa by Houart (1991b), living at 300–370m, (Fig. 11G) but no genetic analysis has ever been made for these specimens. These analyses would be recommended before any other action is taken.

Laevityphis sp.

Fig. 11H–J

Material examined New Caledonia, east coast, BATHUS 1, stn DW673, 20°48' S, 165°19' E, 170m, 1 dd.

Remarks The single examined specimen is a juvenile of 4mm with less than 3 teleoconch whorls. However, compared to a young specimen of *L. tillierae* from New Caledonia with the same number of teleoconch whorls, it differs in having a narrower, less lanceolate shell, although with a comparatively broader last teleoconch whorl, a quite smaller protoconch and obviously narrower anal tubes. Both are undoubtedly separate.

This unidentified *Laevityphis* species is close to *L. tubuliger* (Thiele, 1925) (Fig. 11K–L) described from juvenile specimens collected north of Zanzibar. The New Caledonian specimen only differs in having an obviously broader siphonal canal.

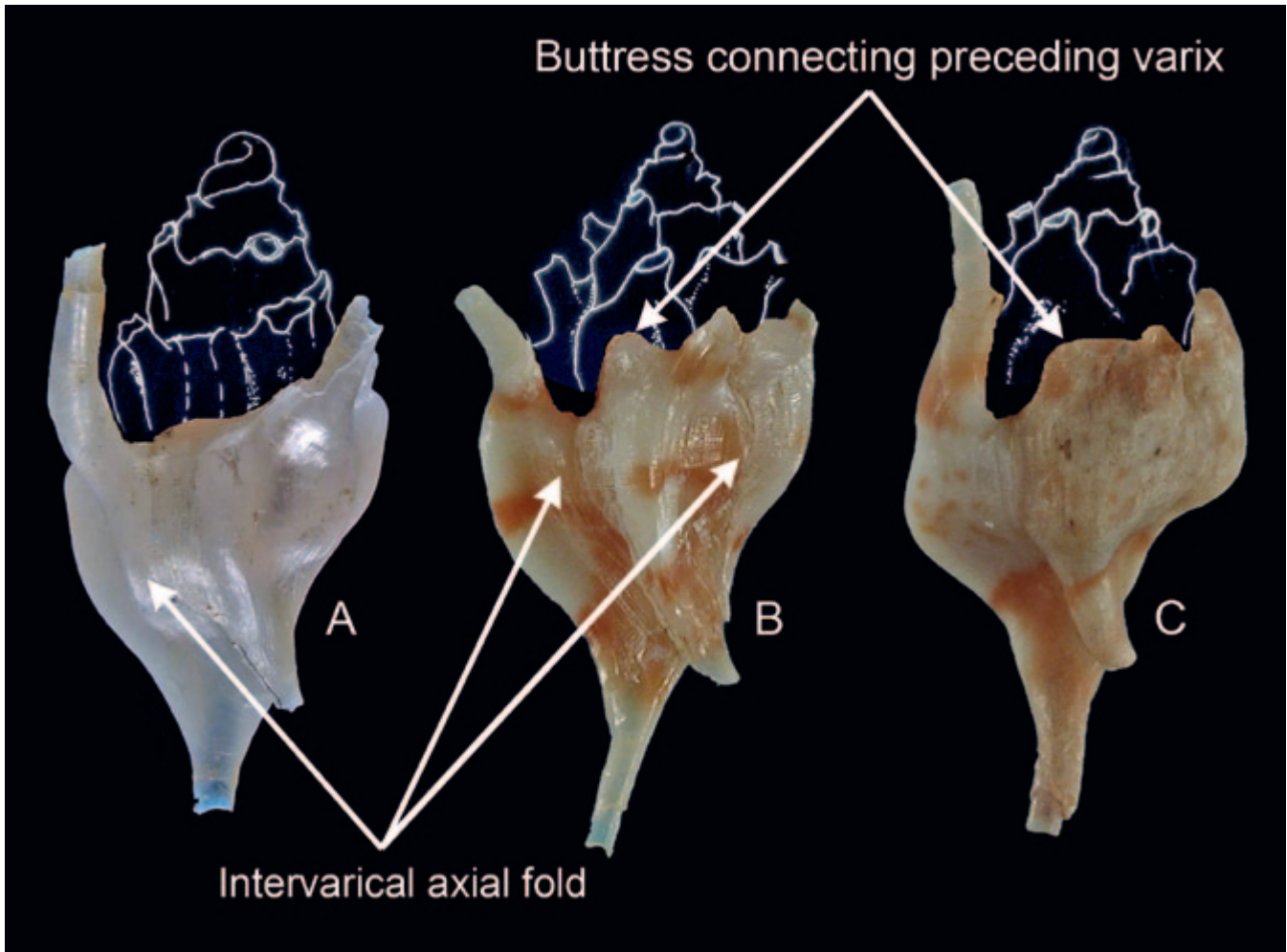


Figure 6 Interverricular sculpture and sutural morphology

A. *Siphonochelus boucheti* Houart, 1991; **B.** *Trubatsa wolffi* (Houart, 2013); **C.** *Choreotyphis pavlova* (Iredale, 1936).

Genus *Monstrotyphis* Habe, 1961

Type species by original designation: *Typhis tosaensis* Azuma, 1960, Japan.

Remarks *Monstrotyphis* Habe, 1961 was a monotypic genus until Houart (2002) moved some species from *Typhina*, in which they were originally or later classified, to *Monstrotyphis*. Nine species were then assigned to the genus. Since then *M. teramachii* was reinstated by Houart & Chino (2016) and seven new species were described, including *M. adelos* n. sp. and *M. maestratii* n. sp. below, raising the total number of *Monstrotyphis* species to 17 (18 with an unidentified one), of which 16 (and one unidentified) from the Indo-West Pacific and one from the western Atlantic.

Monstrotyphis is a much more intricate genus that it was thought to be some years ago. This is proved by the recent discovering of several

new Indo-West Pacific species and described by Houart & Marshall (2012), Houart & Chino (2016), Houart *et al.* (2017), Houart & Rosado (2019) and Garrigues (2021) and also by the present genetic analysis.

Species in New Caledonia. *Monstrotyphis adelos* n. sp., *M. carolinae* (Houart, 1987), *M. maestratii* n. sp., *M. singularis* Houart, 2002 and *Monstrotyphis* sp.

Monstrotyphis adelos n. sp.
Figs 7A; 12N–T; 13 A–G

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Typhis (Typhina) imperialis – Houart, 1991a: 226, figs 10, 40 (only) [not *Monstrotyphis imperialis* (Keen & Campbell, 1964)].

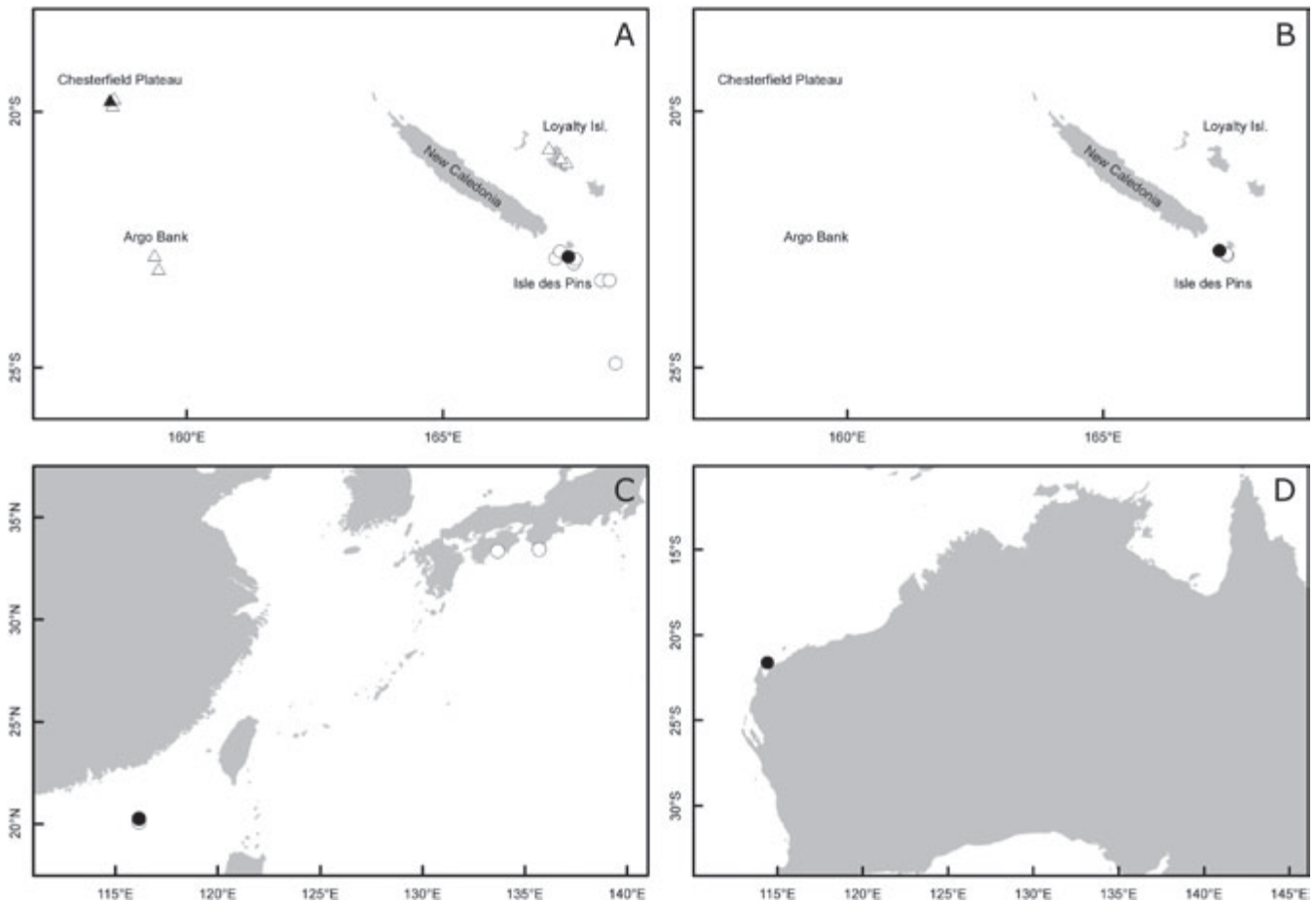


Figure 7 Distribution maps of the new species here described. Black symbols denote the type localities while other collection localities are indicated by white symbols. A *Monstrotypus adelos* n. sp. (circles) and *M. maestratii* n. sp. (triangles); B *Trubatsa alinkios* n. sp.; C *Siphonochelus hasegawai* n. sp.; D *Typhina clarksoni* n. sp.

Type material New Caledonia, KANACONO, stn DW4715, holotype MNHN-IM-2013-69415; stn DW4677, paratype MNHN-IM-2013-68865; BATHUS 2, stn DW717, 2 paratypes MNHN-IM-2014-6907.

Material examined New Caledonia, MUSORSTOM 4, stn DW222, 22°58' S, 167°33' E, 410–440m, 1 lv, MNHN-IM-2014-6912 (illustrated by Houart, 1991a, fig. 10, as *Typhis imperialis*).

SMIB 8, stns DW146–147, 24°55' S, 168° 22' E, 508–532m, 1 lv, 1 dd, juv; stns DW182–184, 23°18' S, 168°05' E, 305–330m, 1 dd, juv, MNHN-IM-2014-6906.

BATHUS 2, stn DW717, 22°44' S, 167°17' E, 350–393m, 2 lv, paratypes MNHN-IM-2014-6907; stn DW729, 22°52' S, 167°12' E, 400m, 1 lv, MNHN-IM-2014-6919.

NORFOLK 2, stn DW2124, 23°18' S, 168°15' E, 260–270m, 1 lv, MNHN-IM-2012-41626.

KANACONO, stn DW4677, 22°53' S, 167°35' E, 390–376m, 1 lv, paratype MNHN-IM-2013-68865, (BOLD MUBA910-21; Genbank MZ364554); stn DW4715, 22°50' S, 167°27' E, 424m, 1 lv, holotype MNHN-IM-2013-69415 (BOLD MUBA916-21; Genbank MZ364555).

Type locality South New Caledonia, southwest of Iles des Pins, 22°50' S, 167°27' E, 424m.

Distribution South New Caledonia, southeast and southwest of Ile des Pins, living at 270–508m (Fig. 7A).

Description Shell medium-sized for the genus, up to 13.8mm in length (paratype MNHN-IM-2014-6907). Length/width ratio 1.9–2.2, (holotype 10.4×5.5mm, length/width ratio 1.9) biconical, smooth, lightly built. Subsutural ramp moderately broad, very weakly sloping, lightly convex or almost straight.

Shell light brown, tan, covered by a thin, simple, whitish intritacalx. Aperture with whitish columellar lip and outer apertural lip, white within. Protoconch glossy white.

Spire high with 1.5 protoconch whorls and teleoconch of up to 5 whorls. Suture deeply impressed. Protoconch moderately large, smooth, rounded. First whorl broad. Maximum width 850–900µm, height 900µm; terminal lip shallow, delicate.

Axial sculpture of teleoconch whorls consisting of 4 low, narrow, webbed, serrated lamellae, abaperturally with 5 crenulations corresponding to P2–P6, adaperturally smooth. P1 spiral cord corresponding to anal tube, P2 shoulder cord ending as adapically curved, ventrally sealed, or very narrowly open spinelet, P3–P6 indistinct on shell. A long, ventrally sealed anal tube originates from P1, nearest or adpressed to preceding varix, forming an angle of 80–85° with the axis of shell. Apertural tube occasionally very long.

Aperture small, broadly ovate, forming a continuous peristome. Columellar lip broadly expanded, erect, smooth. Outer lip erect, smooth within. Siphonal canal long, broken at tip in all specimens, narrow, straight, ventrally sealed on whole length; ADP extending on canal as fairly long, adaperturally curved spine. Operculum unknown.

Animal greyish white with narrow white spots (Fig. 13F–G).

Remarks *Monstrotypis imperialis* from Japan (Fig. 13H–J) with which *M. adelos* n. sp. was confused, differs in having a larger and broader shell, a broader subsutural ramp, a larger and broader aperture, a comparatively lower and narrower spire and a broader siphonal canal.

Monstrotypis montfortii (Fig. 13K–M) has a comparatively smaller shell with a straighter, weakly concave subsutural ramp, a shorter and comparatively narrower siphonal canal with a less obvious or absent ADP spine. *M. montfortii* also have anal tubes which form an angle of approximately 45–50° with the axis of the shell as opposed to 80–85° in *M. adelos* n. sp.

Monstrotypis maestratii n. sp. described below differs in having a rounder last teleoconch whorl, more indented at its base, a lower, comparatively narrower spire, a narrower siphonal canal, especially noticeable at its base and an ADP spine located farther on the canal and usually unsplit.

In addition to the morphological differences, the two species differ by 9.1% in the COI gene.

Derivation of name *adelos* (G), unseen, obscure. Named for its resemblance with *M. maestratii* and the difficulties encountered for discerning it from that species.

Monstrotypis carolinae (Houart, 1987)
Figs 8A–B; 11M–T

Typhis (*Typhina*) *carolinae* Houart, 1987: 204, figs 2–4, 12, 13.

Typhis (*Typhina*) *carolinae* – Houart, 1991a: 227, figs 3–4, 11, 42, 61.

Monstrotypis carolinae – Houart, 2002: 148.

Type locality New Caledonia, Programme LAGON, stn DW354, 22°32' S, 167°02' E, 78m.

Type material Holotype MNHN-IM-2000-1030.

New material examined New Caledonia, Campagne d'essais drague épibenthique, stn DE33, 22°38' S, 166°38' E, 31–33m, 1 dd, MNHN-IM-2010-4919; stn DE40, 22°31' S, 166°28' E, 52–75m, 1 dd, MNHN-IM-2010-4920.

EXPEDITION MONTROUZIER, stn 1260, 20°44' S, 165°14' E, 49–59m, 1 dd, MNHN-IM-2010-21591; stn 1261, 20°46'–20°47' S, 165°15'–165°17' E, 45–56m, 1 dd, MNHN-IM-2010-21592.

MUSORSTOM 4, stn DW203, 22°36' S, 167°06' E, 105–110m, 1 dd.

TERRASSES, stn DW3078, 22° 29' S, 167° 30' E, 180–210m, 1 lv, MNHN-IM-2009-4573, (BOLD MPOM001-10; Genbank MZ364584).

KANACONO, stn DW4703, 22°46' S, 167°19' E, 350–348m, 1 lv, MNHN-IM-2013-49551 (BOLD MUBA919-21; Genbank MZ364609); 1 lv, MNHN-IM-2013-69186 (BOLD MUBA906-21; Genbank MZ364571); stn DW4727, 22°41' S, 167°02' E, 120–129m, 1 dd.

Distribution Northeast, Southeast and South New Caledonia, living at 26–348m.

Remarks Two of the specimens used here for the genetic study were collected alive between 348 and 350m while the material used in the original description was collected alive between 26 (LAGON, stn DW286) and 78m (holotype). This

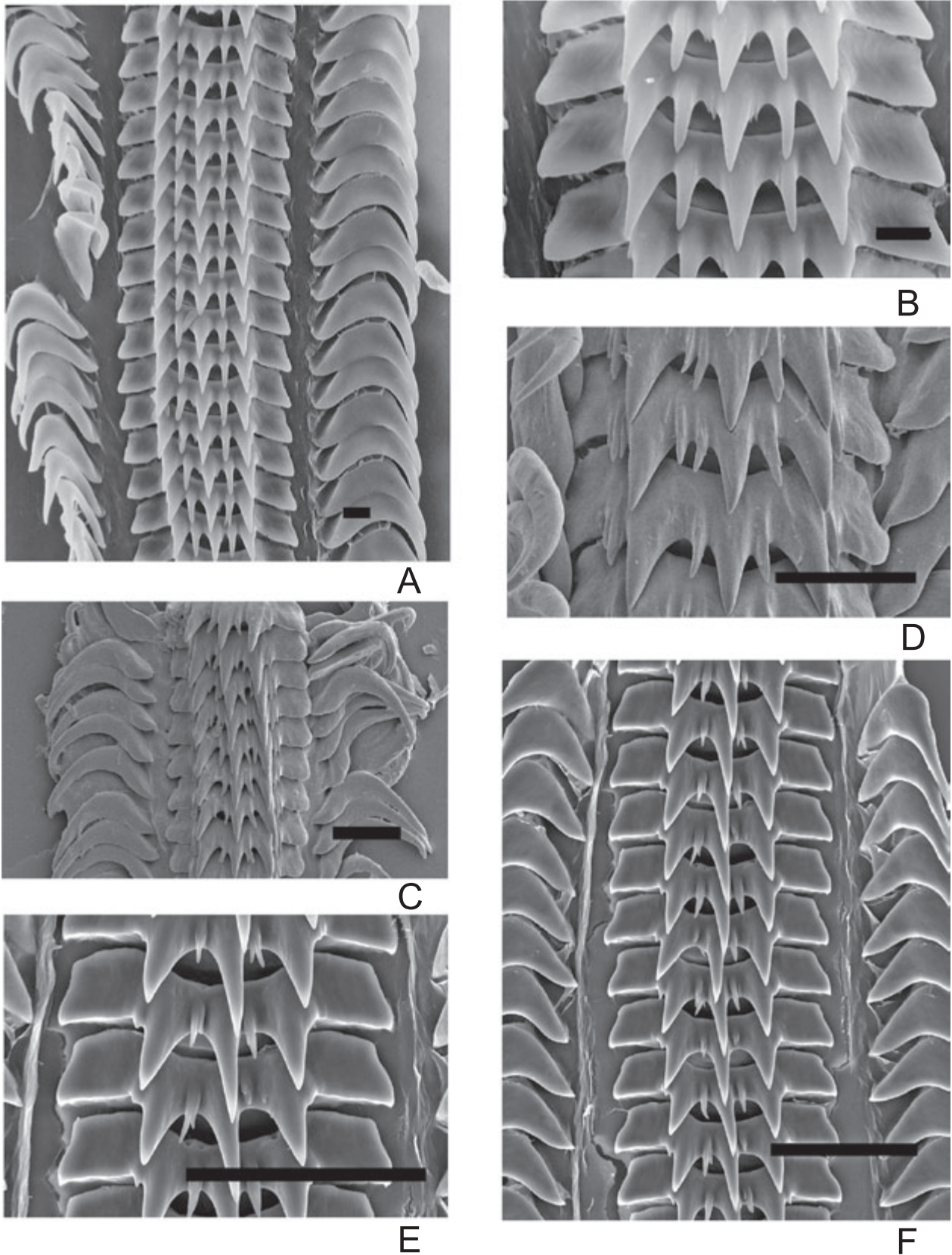


Figure 8 (radulae) A–B *Monstrotypis carolinae* (Houart, 1987). Lagon, New Caledonia, scale bars: 10 μ m (SEM P. Bouchet). C–D *Monstrotypis singularis* Houart, 2002. Montrouzier, stn 1271, New Caledonia, 20°52.7' S, 165°19.5' E, 5–25m, scale bars 10 μ m (SEM A. Warén). E–F *Monstrotypis maestratii* n. sp. MUSORSTOM 6, stn DW451, New Caledonia, 20°59' S, 167°25' E, 330m, scale bars 50 μ m (SEM Y. Kantor).

is a considerable and noteworthy extension of the bathymetric distribution. The shell morphology is absolutely similar in both cases.

Monstrotyphis maestratii n. sp.
Figs 7A; 8E–F; 12F–M

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Monstrotyphis imperialis – Houart, 2002: 153, figs 8–9; Houart et al., 2010: 249 [not *Monstrotyphis imperialis* (Keen & Campbell, 1964)].

Type material New Caledonia, EBISCO, stn CP2595, 1 paratype MNHN-IM-2009-5141; MUSORSTOM 5, stn DC368, 1 paratype RH, MUSORSTOM 6, stn DW417, 1 paratype MNHN-IM-2014-6909; KANADEEP, stn DW4977, holotype MNHN-IM-2013-65600.

Material examined New Caledonia, MUSORSTOM 5, stn DC368, 19°52' S, 158°33' E, 305m, 1 lv paratype RH, 1 dd, MNHN-IM-2014-6910; MUSORSTOM 6, stn DW417, 20°42' S, 167°04' E, 283m, 1 lv, paratype MNHN-IM-2014-6909; stn DW418, 20°42' S, 167°03' E, 283m, 1 dd, MNHN-IM-2014-6908; stn DW444, 20°54' S, 167°18' E, 300m, 1 dd, MNHN-IM-2014-6917; stn DW451, 20°59' S, 167°25' E, 330m, 1 lv, MNHN-IM-2014-6218 (radula illustrated); stn DW452, 21°00' S, 167°25' E, 300m, 1 dd, MNHN-IM-2014-6915; EBISCO, stn CP2595, 19°44' S, 158°35' E, 377m, 1 lv, paratype MNHN-IM-2009-5141 (BOLD MUBA896-21; Genbank MZ364581); stn DW2528, 22°48' S, 159° 22' E, 320–345m, 1 lv, MNHN-IM-2009-8449 (BOLD MPOM178-10; Genbank GU575389); KANADEEP, stn DW4959, 23°04' S, 159°27' E, 300–411m, 1 dd; stn DW4977, 19°46' S, 158°30' E, 280–304m, 1 lv, holotype MNHN-IM-2013-65600 (BOLD MUBA918-21; Genbank MZ364602).

Type locality Coral Sea, Chesterfield Plateau, 19°46' S, 158°30' E, 280–304m.

Distribution Chesterfield Plateau, Argo Bank, north and northwest of Lifou, living at 283–377m (Fig. 7A).

Description Shell medium-sized for the genus, up to 19.4mm in length (paratype MNHN-IM-2009-5141). Length/width ratio 2.0–2.3 (holotype 19.0×8.2mm, length/width ratio

2.3), broadly biconical, smooth, lightly built. Subsutural ramp broad, very weakly sloping, lightly convex or almost straight.

Shell light brown, tan, covered by a thin, simple, whitish intritacalx. Aperture with whitish columellar lip and outer apertural lip, light tan within. Protoconch glossy white.

Spire high with 1.5–1.75 protoconch whorls and teleoconch of up to 5 whorls. Suture deeply impressed. Protoconch moderately large, smooth, rounded. First whorl broad. Maximum width 800–900µm, height 1000µm; terminal lip shallow, delicate.

Axial sculpture of teleoconch whorls consisting of 4 low, narrow, webbed, serrated lamellae, abaperturally with 5 crenulations corresponding to P2–P6 (Fig. 12L) adaperturally smooth. P1 spiral cord corresponding to anal tube, P2 shoulder cord ending as fairly long, weakly or strongly curved, ventrally sealed, spinelet, P3–P6 indistinct on shell. A long, ventrally sealed anal tube originates from P1, nearest or adpressed to preceding varix, forming an angle of 80–85° with the axis of shell. Apertural tube occasionally very long.

Aperture small, rounded, forming a continuous peristome. Columellar lip broadly expanded, erect, smooth. Outer lip erect, smooth within. Siphonal canal long, narrow, straight, ventrally sealed on whole length; ADP in adult specimens split, resulting in two moderately long, webbed spinelets halfway down the canal. Operculum unknown.

Radula with a rachidian tooth bearing a long, narrow central cusp, narrow, small, lateral denticles of variable length, occasionally split, long, broad lateral cusps, occasionally with adpressed outer lateral denticle. Marginal areas smooth. Lateral teeth sickle shaped with broad base (Fig. 8E–F).

Remarks *Monstrotyphis imperialis* (Fig. 13H–J), with which *M. maestratii* n. sp. had previously been confused, differs in having a smaller protoconch although the shell is broader with a fairly broader and larger teleoconch whorl, a larger and broader aperture, a broader and shorter siphonal canal with a less apparent ADP spine. *M. imperialis* is still known today from only two specimens, the holotype, now in Toba Aquarium, and a paratype in California Academy of Sciences, both from Tosa Bay, Japan, living in approximately 200m.

Tsuchiya (2000: 379, pl. 188, fig. 79) illustrated a specimen of *M. teramachii* as *M. imperialis*. This was judiciously corrected by the same authors in (Ibid. 2017: pl. 246, fig. 4) where this shell was correctly identified. Higo *et al.* (1999: 205) considered *M. imperialis* a synonym of *M. tosaensis* and illustrated the holotype (Higo *et al.*, 2001: fig. 2263s).

Monstrotyphis singularis of which the protoconch was wrongly illustrated as *M. imperialis* auct. (now in part *M. maestratii* n. sp.) by Houart (1991a: fig. 60) is obviously smaller, with a maximum length of 7.6mm (Figs 11U–Za; 12A–E). The species could be confused with young specimens of *M. maestratii*, however, *M. singularis* differs constantly from *M. maestratii* of approximately the same size in having a quite smaller and more acute protoconch (Fig. 11Za), more numerous and broader teleoconch whorls and dorsally curved, broader siphonal canal.

Monstrotyphis montfortii (Fig. 13K–M) differs in having narrower teleoconch whorls, a less angulate last whorl, a clearly shorter and dorsally recurved siphonal canal with a less pronounced ADP spine, and anal tubes forming an angle of approximately 45–50° with the axis of the shell.

Monstrotyphis tosaensis, type species of the genus, differs in many aspects, the only similar point being the long siphonal canal. It is here illustrated for comparison (Fig. 13N–P).

For a comparison with *M. adelos* n. sp. described above see under that species.

The presence of *Monstrotyphis maestratii* in South Africa, as reported by Houart *et al.* (2010) (as *M. imperialis*) is not confirmed here. This is probably a misidentification (no photographs were taken) and the material studied at that time should be re-examined.

The specimens included in the molecular analysis were collected in two different locality, the Argo Bank (MNHN-IM-2009-8449) and the Chesterfield Plateau (MNHN-IM-2009-5141, MNHN-IM-2013-65600). Although not showing any appreciable morphological difference, the former differs by 6.3% (COI *p*-distance) from the latter, indicating that further investigations using a larger sample could clarify if they might represent a case of cryptic species, a strong geographic structuring or a simple case of large, intraspecific genetic variability.

Derivation of name Maestratii (L): Named for Philippe Maestrati, MNHN, in recognition for his collaboration in many ways.

Monstrotyphis singularis Houart, 2002
Figs 8C–D; 11U–Za; 12A–E

Typhis (*Typhina*) *imperialis* – Houart, 1991a: fig. 60 (only) [not *Monstrotyphis imperialis* (Keen & Campbell, 1964)].

Monstrotyphis singularis Houart, 2002: 150, figs 3, 4–6, 10–13.

Monstrotyphis singularis – Houart & Tröndlé, 2008: 86, figs 140–145.

Type locality New Caledonia, EXPEDITION MONTROUZIER, stn 1261, 20°46' S–20°47' S, 165°15' E–165°16.5' E, 45–56m.

Type material Holotype MNHN-IM-2000-293.

New material examined New Caledonia, BIOCAL, stn DW64, 24°48' S, 168°09' E, 250–250m, MNHN-IM-2014-6916, 2 dd. MUSORSTOM 5, stn DW274, 24°45' S, 159°41' E, 285m, MNHN-IM-2014-6914, 1 dd. LAGON, stn DW830, 20°49' S, 165°19' E, 105–110m, MNHN-IM-2014-6911, 5 dd. BERYX 11, stn DW18, 24°48' S, 168°10' E, 250–270m, MNHN-IM-2014-6905, 1 dd. NORFOLK 1, stn DW1675, 24°44' S, 168°09' E, 233–231m, MNHN-IM-2012-9276 and MNHN-IM-2012-9314, 2 dd. KOUMAC 2.3, stn KL36, 20°50' S, 164°16.7' E, 60m, MNHN-IM-2019-9150 (BOLD MUBA920-21; Genbank MZ364547), 1 lv. French Polynesia, RAPA 2002, stn 8, 27°36.5' S, 144°17.7' W, 52–57m, MNHN-IM-2008-2481, 7 lv & dd; stn 44, 27°36.3' S, 144°18.2' W, 30m, MNHN-IM-2008-2479 and MNHN-IM-2008-2480, 8 lv & dd.

Distribution Northeast New Caledonia, off Touho, living at 6–45m. Empty shells were collected south of New Caledonia and off the Chesterfield Islands. Also off the Island of Rapa, living at 30–52m.

Remarks Some specimens among the new material examined were previously misidentified in the collection of MNHN by the senior author and consist only of dead shells. The bathymetric distribution of living specimens of *M. singularis* is therefore not modified by this material.

As observed above, the protoconch illustrated by Houart (1991a) belongs to a specimen of *M. singularis* and not to the shell then misidentified as *M. imperialis* auct. [Not *M. imperialis* (Keen & Campbell, 1964)] which is now here described as *M. maestratii* n. sp. The protoconch of *M. maestratii* is larger, broader and rounder (see Figs 11Za and 12M for comparison).

On the other hand, 15 live and dead specimens collected off the Island of Rapa, located at some 5000km from New Caledonia were recorded by Houart & Tröndlé (2008). These specimens (Fig. 12D–E) are perfectly similar to those collected in New Caledonia and could not be separated on basis of the shell characters only.

Monstrotyphis sp.
Fig. 14A–D

Material examined New Caledonia, SMIB 8, stn DW182-184, South New Caledonia, Banc Aztèque, 23°18' – 23°19' S, 168°05' E, 305–367m, MNHN-IM-2014-6906, 1 lv.

Remarks This specimen is close to a young *Monstrotyphis maestratii* n. sp., but it is different from that species. Compare Fig. 12F and 14A.

Monstrotyphis montfortii differs in having a comparatively broader aperture, broader teleoconch whorls, a narrower and more strongly abapically tapered siphonal canal with visible ADP spine, narrower anal tubes forming an angle of approximately 45° with the axis of the shell, and a more acute spire. *Monstrotyphis teramachii* also differs in having a larger and broader shell and in many other ways.

The shell morphology of *Monstrotyphis* sp. reminds *M. singularis*, one of the other New Caledonian species. However, *M. singularis* differs in having a smaller shell with narrow anal tubes as opposed to the broad tubes in *Monstrotyphis* sp. The siphonal canal is also quite narrower, comparatively shorter, with a narrow, open spinelet corresponding to ADP. In *Monstrotyphis* sp. the canal is longer, broader and entirely smooth (compare Fig. 11X; 12A and 14A).

Looking at the shell outline, the peculiar siphonal canal, the strongly adapically, broad and sculptured apertural anal tube, it is more than likely that this is a new species but in the absence of additional intact specimen(s) it seems preferable avoiding to describe it now.

Genus *Siphonochelus* Jousseau, 1880

Type species by original designation: *Typhis arcuatus* Hinds, 1843, South Africa

Synonym: *Eotyphis* Tembrock, 1963 (fossil species only)

Type species by original designation: *Typhis sejunctus* Semper, 1861, Upper Oligocene, Germany

Species in New Caledonia *Siphonochelus angustus* Houart, 1991, *S. cf. S. arcuatus* (Hinds, 1843), *S. boucheti* Houart, 1991

Siphonochelus angustus Houart, 1991
Fig. 14E–J

Siphonochelus angustus Houart, 1991a: 230, figs. 15, 16, 43, 65.

Type locality New Caledonia, Coral Sea, MUSORSTOM 5, stn DW304, Lord Howe Ridge, Banc Nova, 22°10' S, 159°25' E, 385–420m.

Type material Holotype MNHN-IM-2000-33.

New material examined New Caledonia, KANADEEP, stn DW4956, 23°13' S, 159°35' E, 295m, Argo Bank, 1 dd; BATHUS 3, stn DW824, 23°19' S, 168°00' E, 601–608m, 1 dd.

Distribution Off Chesterfield Islands and south New Caledonia, dead collected at 295–601m.

Remarks *Siphonochelus angustus* was described from two empty specimens. Two additional ones were collected during the BATHUS 3 (1993) and KANADEEP (2017) expeditions (Fig. 14G–J), the latter close to the type locality, eastwardly distant but on the same latitude for the BATHUS 3 specimen. Both were dead collected but have the same characteristics as the holotype and paratype, namely a small shell with flattened anal tubes, a somewhat flattened protoconch, a narrow, small aperture and a narrow, strongly tapered siphonal canal. The specimen collected during the BATHUS 3 expedition is slightly larger (8.3mm), but has ½ additional teleoconch whorl.

Siphonochelus boucheti Houart, 1991
Figs 9A–B; 14K–O

Siphonochelus (*Siphonochelus*) *boucheti* Houart, 1991a: 230, Figs 5–6, 17–18, 47, 68.

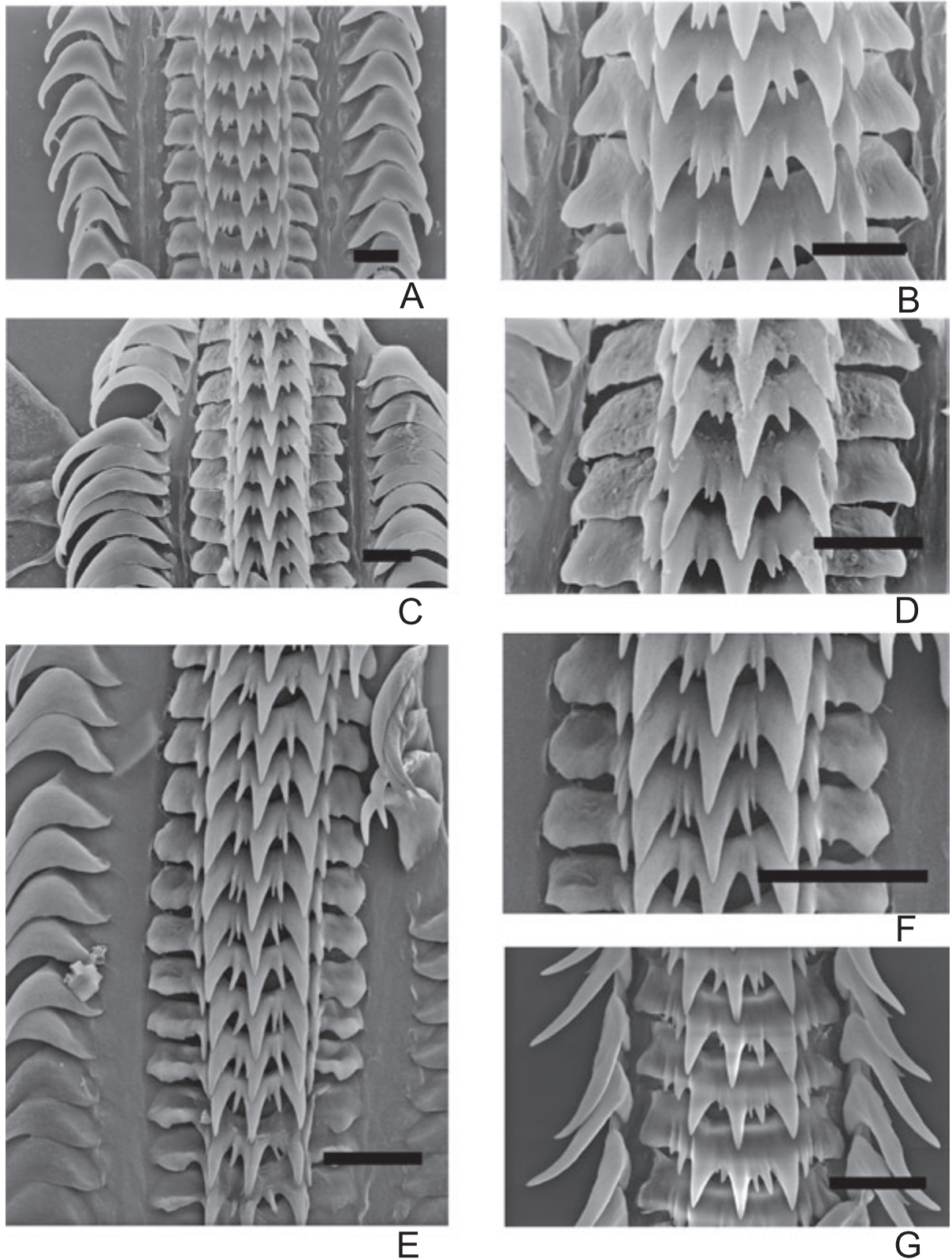
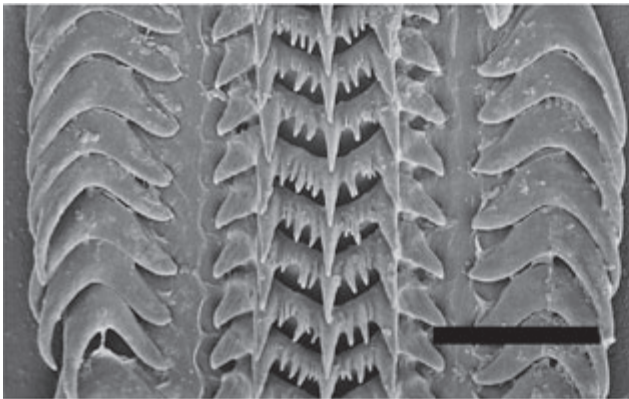
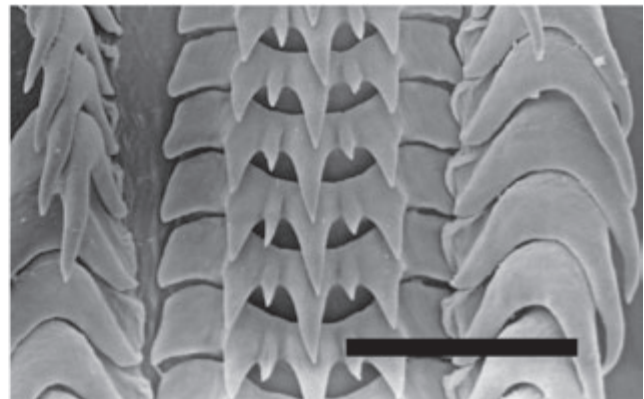


Figure 9 (radulae) A–B *Siphonochelus boucheti* Houart, 1991. New Caledonia, CHALCAL 2, stn DW72, 24°54' S, 168°22' E, 527m, scale bars 10µm (SEM P. Bouchet). C–D *Siphonochelus saltantis* Houart, 1991. New Caledonia, MUSORSTOM 5, stn DW263, 25°21' S, 159°46' E, 225–150m, scale bars 10µm (SEM P. Bouchet). E–F *Trubatsa undulata* (Houart, 1991), New Caledonia, KANACONO, stn DW4695, MNHN-IM-2013-68961, 22°47' S, 167°27' E, 200–290m, scale bars 10µm (SEM Y. Kantor). G *Trubatsa virginiae* (Houart, 1986). New Caledonia, KANACONO, stn DW4703, MNHN-IM-2013-69222, 22°46' S, 167°19' E, 350–348m, scale bar 10µm (SEM Y. Kantor).



A



B

Figure 10 (radulae) A *Typhina claydoni* (Houart, 1988), West Australia, Port Hedland, 12m (holotype WAMS_13958), scale bar 50µm (SEM A. Warén)

B *Typhis phillipensis* Watson, 1883, New South Wales, Australia, scale bar 50µm (SEM A. Warén)

Type locality New Caledonia, CHALCAL 2, stn DW72, Norfolk Ridge, 24°54' S, 168°22' E, 527m.

Type material Holotype MNHN-IM-2000-46.

Distribution New Caledonia: South of New Caledonia and South of Chesterfield Islands; Fiji (Houart & Héros, 2008), living at 285–680m.

Remarks Many specimens of *Siphonochelus boucheti* from several expeditions have been collected since its description and confirm the validity of the species as well as the very little variable shell morphology.

Initially, *S. boucheti* was compared in particular to *S. japonicus* and *S. nipponensis*, but the identification of these species proved to be incorrect, or rather reversed. Figures identified then as *S. japonicus* should be interpreted as *S. nipponensis* and *vice versa*, as demonstrated by Houart (2017a).

Siphonochelus boucheti is more strongly shouldered than *S. japonicus* (Fig. 14P–Q), has higher, rounded varices and axial folds with a deeper depression between them, the spire is obviously less acute and the protoconch is broader, approximately 1000µm broad and 900µm high, opposed to 800µm×900µm in *S. japonicus*. The last teleoconch whorl in *S. boucheti* is also comparatively less globose.

Siphonochelus boucheti differs from *S. nipponensis* (Fig. 14R) in having also a clearly less acute spire, a broader protoconch, 1000µm opposed to 800µm in *S. nipponensis*, less broad and flattened anal tubes and in having also a deeper

depression between the axial varices and folds due to the higher axial folds in *S. boucheti*.

Siphonochelus cf. *S. arcuatus* (Hinds, 1843)

Fig. 15A–D

Material examined New Caledonia, KANADEEP, stn DW4999, Lord Howe Rise, 23°53' S, 161°46' E, 1060m, 1 dd.

Remarks This *Siphonochelus* species differs from the other New Caledonian species in many respects. It differs from *S. angustus* in having a broader and larger shell with a higher and broader protoconch, more angular, strongly shouldered teleoconch whorls with a broader subsutural ramp and broader, much flatter anal tubes.

It is different from *S. boucheti* in having a more angular shell with a broad subsutural ramp, obviously flatter anal tubes and very narrow, sharp, low axial varices opposed to rounded and high varices in *S. boucheti* which also has higher and broader axial, intervarical folds near preceding varices.

It also differs significantly from *S. japonicus* and *S. nipponensis*, both species not yet recorded from New Caledonia, in having a more angular shell, narrow, sharp varices instead rounded in both other species and also in having a broader subsutural ramp and broader, flat anal tubes.

Siphonochelus cf. *S. arcuatus* is closer to the South African *S. arcuatus* because that species also has sharp varices, but the New Caledonian specimen

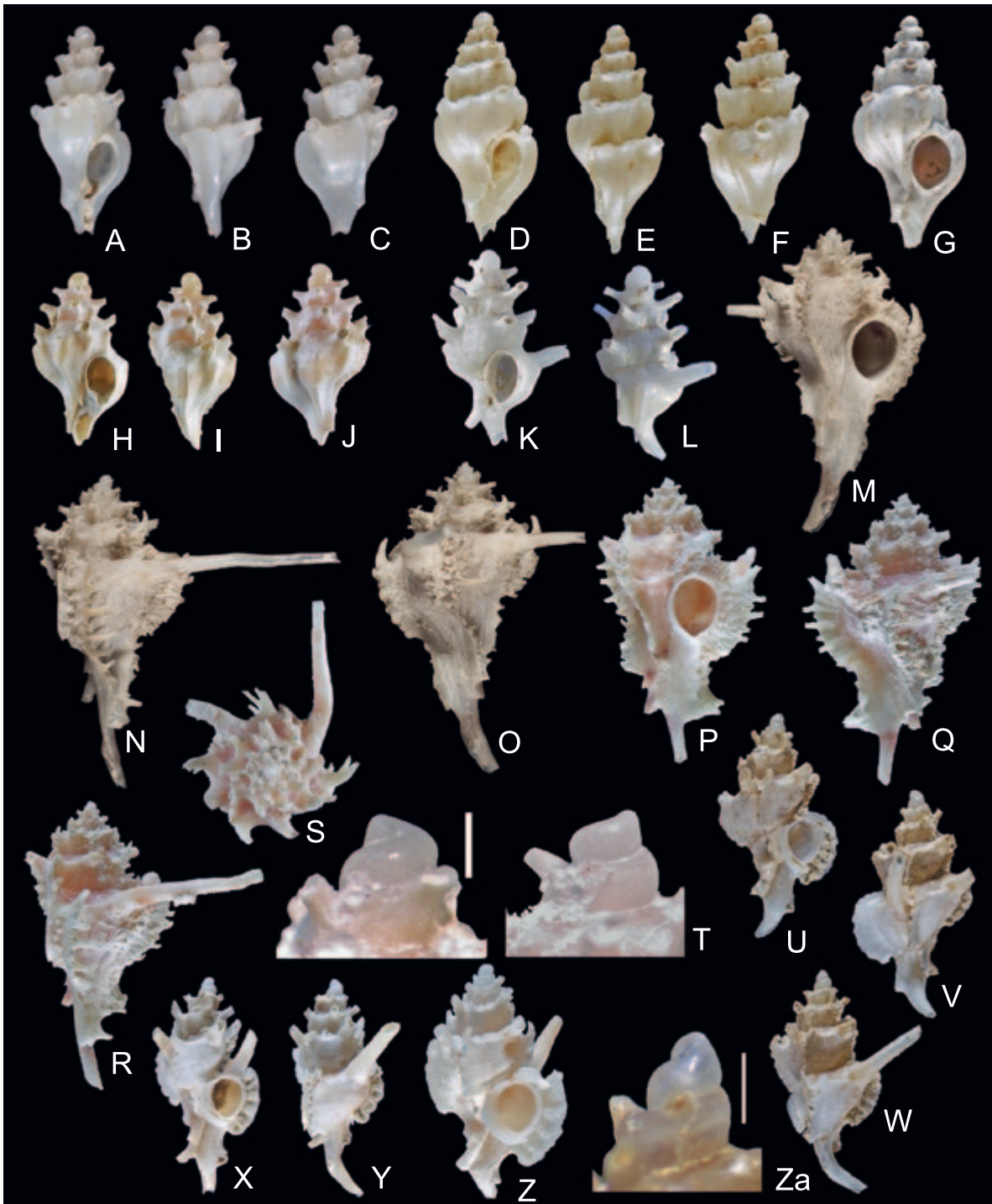


Figure 11 A–G *Laevityphis tillierae* (Houart, 1986). A–C. South of New Caledonia, 22°30'S, 166°24'E, 250–350m, holotype MNHN-IM-2000-237, 5.4mm (photo M. Caballer); D–F. New Caledonia, 22°19' S, 167°23' E, 825–860m, RH, 7.3mm; G. South Africa, off Mgazi River, 31°44' S, 29°32' E, 350m, RH, 8.9mm; H–J *Laevityphis* sp., New Caledonia, east coast, 20°48' S, 165°19' E, 170m, MNHN, 4mm; K–L *Laevityphis tubuliger* (Thiele, 1925), Sansibar-Kanal, 5°27' S, 39°18' W, 463–465m, syntype ZMB109314, 5.1mm; M–T *Monstrotyphis carolinae* (Houart, 1987). M–O. New Caledonia, 22°32' S, 167°02'E, 78m, holotype MNHN-IM-2000-1030, 20.5mm (photo M. Caballer); P–T. New Caledonia, KANACONO, stn DW4703, 22°46' S, 167°19' E, 350–348m, MNHN-IM-2013-69186, 17.5mm; U–Za *Monstrotyphis singularis* Houart, 2002. U–W. New Caledonia, 20°46' S–20°47' S, 165°15' E–165°16.5' E, 45–56m, holotype MNHN-IM-2000-293, 6.3mm (photo M. Caballer); X–Y. New Caledonia, 20°46'–47' S, 165°15'–17' E, 45–56m, paratype RH, 6mm; Z. New Caledonia, MUSORSTOM 5, stn DW274, 24°45' S, 159°41' E, 285m, MNHN-IM-2014-6914, 7.6mm; Za. Protoconch, Scale bars 500µm.

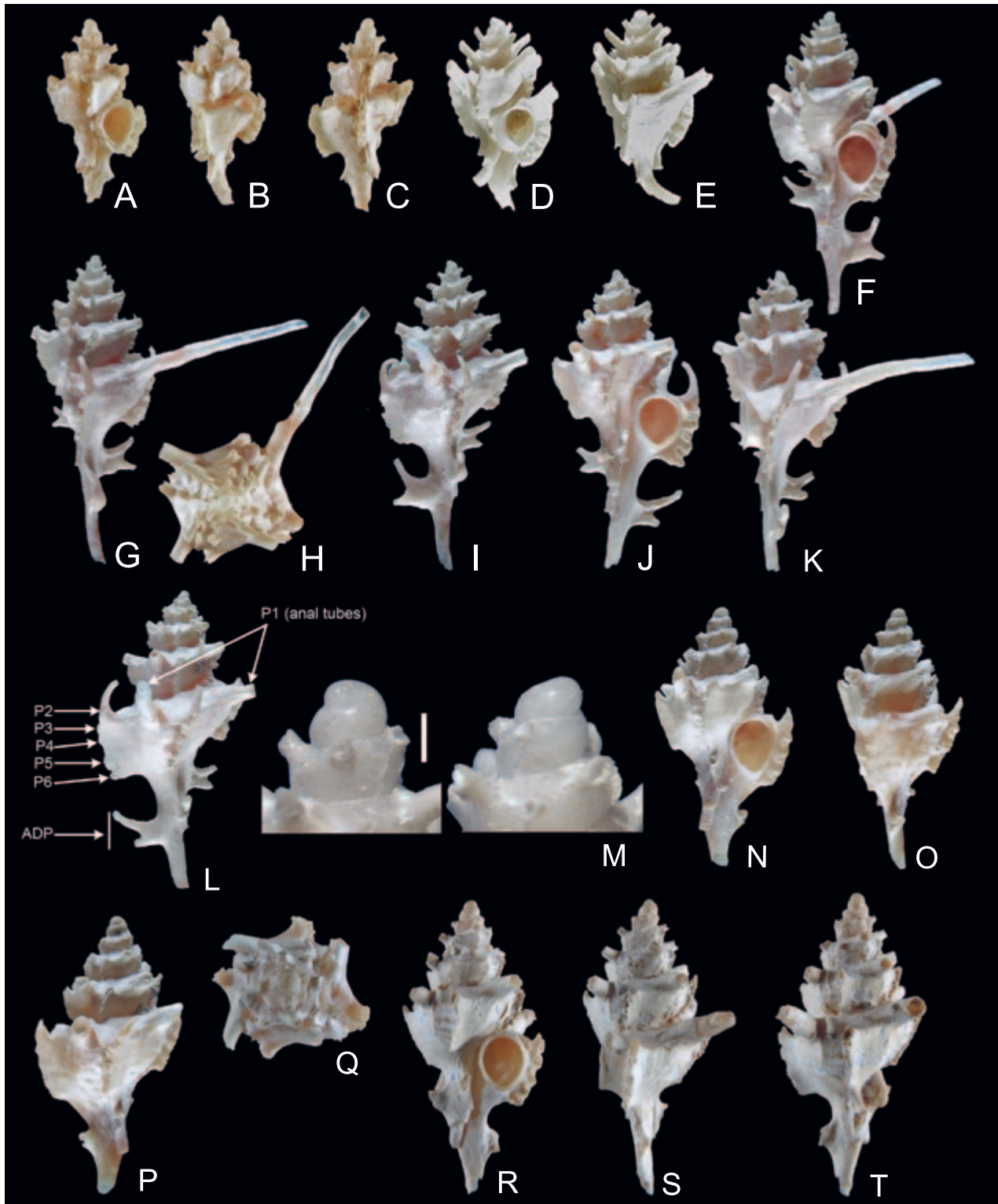


Figure 12 A–E *Monstrotyphis singularis* Houart, 2002. A–C. KOUMAC 2.3, stn KL36, 20°50'S, 164°16.7'E, 60m, MNHN-IM-2019-9150, 5.2mm; D–E. Austral Archipelago, Rapa, NW of Tauna Id, 27°36.3' S, 144°18.2' W, 30m, MNHN-IM-2008-2480, 5.7mm; F–M *Monstrotyphis maestratii* n. sp. F–I. Coral Sea, Chesterfield Plateau, 19°46' S, 158°30' E, 280–304m, holotype MNHN-IM-2013-65600, 19.0mm; J–M. New Caledonia, Loyalty Ridge, MUSORSTOM 6, stn DW417, 20°42' E, 167°04' E, 283m, MNHN-IM-2014-6909, 17.3mm; M. Protoconch (holotype); N–T *Monstrotyphis adelos* n. sp. N–Q. South New Caledonia, KANACONO, stn DW4715, 22°50' S, 167°27' E, 424m, holotype MNHN-IM-2013-69415, 10.4mm; R–T. BATHUS 2, stn DW717, 22°44' S, 167°17' E, 350–393m, paratype MNHN-IM-2014-6907, 13.8mm. Scale bar 500µm.

is still different in having a more strongly shouldered shell with a broader subsutural ramp.

In conclusion, the single examined specimen seems different from any other *Siphonochelus* species, although close to *S. arcuatus*. Nevertheless, as we only have one dead collected specimen, it seems preferable to wait for any additional sample before making a final decision on this shell.

Siphonochelus hasegawai n. sp.
Fig. 7C; 14S–Za

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Siphonochelus nipponensis – Radwin & D’Attilio, 1976: pl. 32, fig. 9; D’Attilio & Hertz, 1988: 56, fig. 64 (paratype of *S. nipponensis* figured in both publications).

Siphonochelus sp. – Houart, 2017a: 27–28, fig. 2C, D (paratype of *S. nipponensis*), 4E–G.

Type material DongSha 2014, stn CP4130, 20°16' N, 116°08' E, 02/05/2014, 795–822m, lv, holotype MNHN-IM-2013-50304 (BOLD MUBA899-21; Genbank MZ364561); 1 paratype MNHN-IM-2013-50305 (BOLD MUBA898-21; Genbank MZ364559); stn CP4131, 20°06' N, 116°08' E, 02/05/2014, 916–1012m, lv, 1 paratype MNHN-IM-2013-50327 (BOLD MUBA900-21; Genbank MZ364586); Japan, Wakayama Prefecture, off Kushimoto, 384–402m, lv, 2 paratypes RH

Other material Japan, off Tosa, in excess of 200m, 33°20' N, 133°40' E, paratype of *Siphonochelus nipponensis* (see Houart, 2017a).

Type locality South China Sea, 20°16' N, 116°08' E, 795–822m.

Distribution South China Sea and northeast Japan, living at 402–916m (Fig. 7C).

Description Shell small for the genus, up to 9.2mm in length (paratype RH). Length/width ratio 1.9–2.1 (holotype 7.4×3.8mm, length/width ratio 1.9). Lanceolate, smooth. Subsutural ramp moderately broad, weakly sloping, weakly convex.

Shell covered by a uniform off white or dirty white intritacalx. Aperture white within.

Spire high, narrow relative to the breadth of last teleoconch whorl, with 1.5–1.75 protoconch

whorls and teleoconch of up to 4 broad, convex, strongly shouldered whorls. Suture impressed. Protoconch large, broad, whorls rounded, smooth, glossy. Width and height 1000µm. Terminal lip unknown (eroded).

Axial sculpture of teleoconch whorls consisting of 4 low, strong, narrow, rounded varices from first to last teleoconch whorl, extending to tip of siphonal canal. Other axial sculpture of single, low, weakly swollen, intervarical ridge, nearest to preceding varix. Spiral sculpture of P1 with anal tube connected to axial varix and P2 (shoulder cord). Anal tubes rounded, weakly flattened at base, weakly tapered and rounded at extremity, forming an angle of approximately 40–70° with axis of shell. Only apertural tube open and functional, other tubes closed.

Aperture large, roundly ovate, forming a continuous peristome. Columellar lip narrow, smooth, rim erect. Outer lip smooth within. Siphonal canal short, 17–22% of total shell length, narrow, strongly tapered abapically, straight. Ventrally sealed.

Operculum light brown, roundly ovate with strong concentric ridges and apical nucleus. Radula unknown.

Remarks *Siphonochelus hasegawai* n. sp. was confused with *S. nipponensis* Keen & Campbell, 1964, starting with its description. Keen & Campbell (1964: 50) have indeed designated a specimen of the new species as the paratype of *S. nipponensis*.

As noted by the first author (Houart, 2017a): “The paratype of *S. nipponensis* is actually a young specimen of a probably still undescribed species with a broad last teleoconch whorl, narrower spire whorls, more rounded anal tubes and a broad, rounded protoconch, but it is not conspecific with *S. nipponensis* which has a more elongate last whorl and flattened tubes. This paratype was later illustrated by D’Attilio (1975: 53) who figured a detail of the anal tube, by Radwin & D’Attilio (1976: pl. 32, fig. 9) and by D’Attilio & Hertz (1988: 56)”. See Houart (2017a) for more details.

Three specimens of this until now nameless species have been recently collected in the South China Sea, while two specimens, already reported by Houart (2017a) are recorded from the Wakayama Prefecture, Japan.

Siphonochelus hasegawai n. sp. differs from *S. japonicus* (Fig. 14P–Q) from Japan, in having

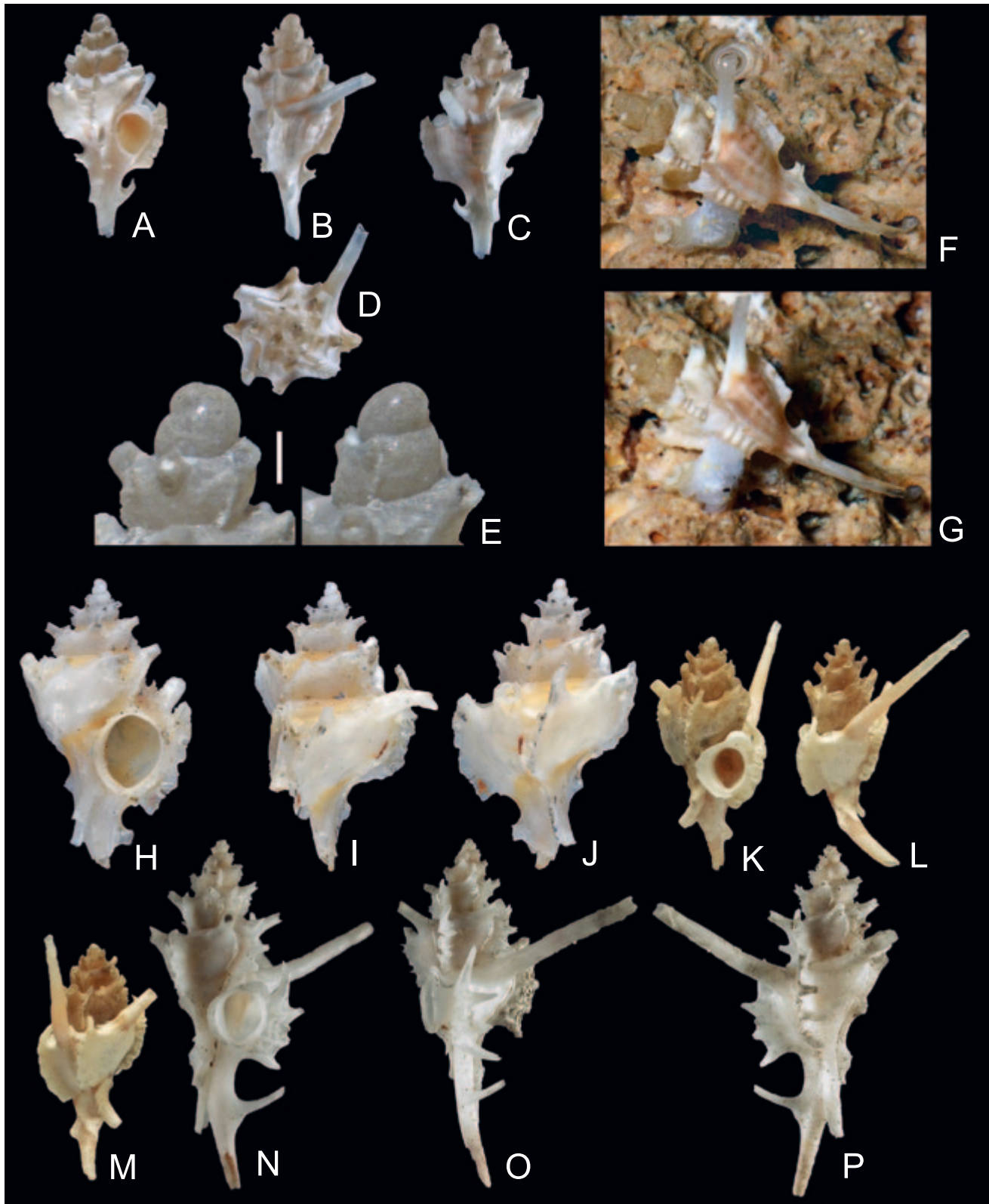


Figure 13 A–G *Monstrotyphis adelos* n. sp. KANACONO, stn DW4677, 22°53' S, 167°35' E, 390–376m, paratype MNHN-IM-2013-68865, 7.5mm (F–G: photo courtesy D. Massemin); H–J *Monstrotyphis imperialis* (Keen & Campbell, 1964), Japan, Shikoku, Kochi, Tosa Bay, 33°20' N, 133°40' E, 200m, holotype Toba Aquarium, TT n° 1013, 16.5mm, photo courtesy K. Hasegawa; K–M *Monstrotyphis montfortii* (A. Adams, 1863), Philippines, Cebu, Mactan Id, Punta Engano, tangle nets, 50–100m, RH, 10mm; N–P *Monstrotyphis tosaensis* (Azuma, 1960), South China Sea, 200m, RH, 25.4mm. Scale bar 500µm.

comparatively narrower spire whorls, a last teleoconch whorl with a broader subsutural ramp, a narrower siphonal canal and a broader protoconch. *S. hasegawai* n. sp. is also relatively larger, reaching the same length of *S. japonicus* with one less teleoconch whorl.

The confusion that existed in the identification of *S. japonicus* and *S. nipponensis* does not at present allow us to have a precise idea of the actual geographical distribution of *S. japonicus*. For example, Houart (1997: 291) reported it from Indonesia and Houart & Héros (2008: 478, Fig. 6H, K) from Tonga and Fiji, but it now appears that these specimens are in fact *S. nipponensis*.

Siphonochelus hasegawai n. sp. differs from *S. nipponensis* (Fig. 14R) in having a less high spire and a quite broader protoconch, a less elongate shell with clearly narrower axial ribs and anal tubes, a last whorl with a broader subsutural ramp and a narrower siphonal canal.

Derivation of name Named for Kazunori Hasegawa, of the National Museum of Nature and Science, Ibaraki, Japan, in recognition for his continuous help in many ways and for his contributions to Japanese malacology.

Genus *Trubatsa* Dall, 1889

Type species by original designation: *Typhis longicornis* Dall, 1888, Cuba.

Remarks *Trubatsa* differs from *Siphonochelus* in having anal tubes with a broader base, they extend almost on the entire intervarical area, being flattened at their base. The tubes and the axial varices also extend as a broad buttress on preceding whorl (Fig. 6B). In *Siphonochelus* the tubes have a narrower base and they lack the broad buttress observed in *Trubatsa* (Fig. 6A). *Trubatsa* also differs from *Siphonochelus* in having the intervarical fold (or ridge) closer to the preceding varix. *Trubatsa* is here also separated from *Siphonochelus* on basis of genetic differences.

In *Choreotyphis* Iredale, 1936 the axial varices are much broader and rounder than in *Trubatsa*, without the presence of any intervarical axial fold (Fig. 6C), while the anal tubes originates directly from the varices. The validity of *Choreotyphis* needs still to be confirmed by genetic analysis.

Species in New Caledonia *Trubatsa alinkios* n. sp., *T. lozoueti* (Houart, 1991), *T. saltantis* (Houart, 1991), *T. undulata* (Houart, 1991), *T. unicornis* (Houart, 1991), *T. virginiae* (Houart, 1986) (new combination), *T. wolffi* (Houart, 2013).

Trubatsa alinkios n. sp.
Figs 7B; 15E–L

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Type material New Caledonia, KANACONO stn DW4700, 22°43' S, 167°16' E, 245–295m, 1 lv; holotype MNHN-IM-2013-69028 (BOLD MUBA912-21; Genbank MZ364596); stn DW4713, 22°47' S, 167°24' E, 356–380m, 1 lv, paratype MNHN-IM-2013-69293 (BOLD MUBA915-21; Genbank MZ364600); stn DW 4714, 22°49' S, 167°25' E, 394–443m, 1 lv; paratype MNHN-IM-2013-68291 (BOLD MUBA908-21; Genbank MZ364568).

Type locality New Caledonia, South of Iles des Pins, 22°43' S, 167°16' E, 245–295m.

Distribution New Caledonia, Southwest of Iles des Pins, living at 295–394m (Fig. 7B).

Description Shell medium sized for the genus, up to 10.3mm in length (paratype MNHN-IM-2013-68291). Length/width ratio 2.0–2.2 (holotype 9.5×4.6mm, length/width ratio 2.1). Slender, lanceolate, narrow, ovate, lightly built, smooth. Subsutural ramp very weakly sloping, strongly concave. Shell glossy greyish-white, broad base of anal tubes tinged with orange-brown on buttress extending on previous whorl and orange-brown narrow band at base of siphonal canal. Aperture glossy white within.

Spire high with 1.5 protoconch whorls and teleoconch of up to 5 weakly convex, strongly shouldered whorls. Suture impressed. Protoconch moderately large, weakly elongate. Whorls smooth with a narrow first whorl. Maximum height 1100µm, width 700µm. Terminal lip shallow, delicate, thin, opisthocline.

Axial sculpture of teleoconch whorls consisting of 4 high, broad, shouldered varices from first to last whorl. Varices more broadly expanded apically, largely extending above shoulder, forming broad buttress, fused to preceding whorl. Intersutural axial sculpture of a narrow



Figure 14 A–D *Monstrotyphis* sp. New Caledonia, SMIB 8, stn DW182-184, South New Caledonia, 23°18' – 23°19' S, 168°05' E, 305–367m, MNHN-IM-2014-6906, 7mm; E–J *Siphonochelus angustus* Houart, 1991. E–F. New Caledonia, Coral Sea, Lord Howe Ridge, Banc Nova, 22°10' S, 159°25' E, 385–420m., holotype MNHN-IM-2000-33, 6.7mm (photo M. Caballer); G–J. New Caledonia, Argo Bank, KANADEEP, stn DW4956, 23°13' S, 159°35' E, 295m, MNHN, 5.2mm; K–O *Siphonochelus boucheti* Houart, 1991. K–L. New Caledonia, Norfolk Ridge, 24°54' S, 168°22' E, 527m, holotype MNHN-IM-2000-46, 10.1mm (photo M. Caballer); M–O. South New Caledonia, Chalcal 2, stn DW72, 24°55' S, 168°22' E, 527m, paratype RH, 9.2mm; P–Q *Siphonochelus japonicus* (A. Adams, 1863). Japan, Wakayama Prefecture, Nada-cho, neotype NHMUK 20170292, 8.9mm; R *Siphonochelus nipponensis* (Keen & Campbell, 1964). Philippines, Aliguay Island, 380m, RH, 13.7mm; S–Za *Siphonochelus hasegawai* n. sp. S–W. DongSha 2014, stn CP4130, 20°16' N, 116°08' E, 795–822m, holotype MNHN-IM-2013-50304, 7.4mm, W. Operculum; X–Y. DongSha 2014, stn CP4131, 20°06' N, 116°08' E, 916–1012m, paratype MNHN-IM-2013-50327, 7.5mm; Z–Za. Japan, off Kushimoto, 384–421m, RH, 9.2mm. Scale bars 500µm.

rounded ridge, closer to preceding varix, shell very weakly excavated between ridge and succeeding varix. Spiral sculpture of very shallow P1 with anal tube and P2 (shoulder). Other spiral sculpture of numerous shallow spiral and axial striae; spiral striae more obvious on axial varices. Anal tubes ventrally sealed, rounded, broader at base, forming an angle of approximately 30°–45° with axis of shell. Aperture small, 18% of shell length in holotype, broadly ovate, rim forming a continuous peristome, smooth within. Siphonal canal long, broad, ventrally sealed, weakly abaxially and dorsally bent, broad at base, strongly tapered abapically.

Operculum and radula not examined.

Remarks *Trubatsa alinkios* n. sp. is very close to *T. unicornis* (Fig. 16L–T) and shells of both species were confused until it became obvious from the phylogenetic analysis that they were separate. Although the shell morphology is practically the same in both species which makes them very difficult to separate, a careful examination of the specimens at our disposal showed some consistent differences.

Specimens of *Trubatsa unicornis* with the same number of whorls as in the new species are larger; the spire is slightly broader and the axial varices are weakly sharper than in *T. alinkios* n. sp. Finally, the protoconch in *T. unicornis* is rounded instead of more elongate in *T. alinkios* n. sp. and obviously broader, with a width ratio of 900–1000µm as opposed to 700µm in the new species.

Derivation of name *Alinkios* (G), resembling, like. Named for its striking resemblance with *T. unicornis*.

Trubatsa lozoueti (Houart, 1991)
Fig. 15M–Q

Siphonochelus (*Siphonochelus*) *lozoueti* Houart, 1991b: 51, figs 25–27.

Siphonochelus (*Trubatsa*) *lozoueti* – Houart, 2013: 7.

Type locality New Caledonia, BIOGEOCAL, stn DW253, 21°32' S, 166°29' E, 310–315m.

Type material Holotype MNHN-IM-2000-213.

New material examined New Caledonia, off Thio, EXBODI, stn CP3799, 21°33' S, 166°20' E,

461–466m, 1 lv, MNHN-IM-2009-22828 (BOLD MUBA001-15; Genbank MZ364548).

Distribution Eastern New Caledonia, Loyalty Basin, off Thio, empty shell collected at 310–315m (holotype), living at 461m (new material).

Remarks *Trubatsa lozoueti* is known today from only two specimens. One, the holotype, was collected during the BIOGEOCAL expedition in 1987, the second specimen was collected more recently, in 2011, during the EXBODI expedition at almost exactly the same location. Nothing has been reported between 1987 and 2011, and nothing since 2011, notwithstanding the numerous expeditions in the New Caledonia area.

The genotyping of the second specimen proved that it is distinct from other congeners, confirming that *T. lozoueti* is a valid species. Although larger than the holotype, this second specimen is strikingly similar with its broad spire, very broad, strongly shouldered last teleoconch whorl, broad anal tubes and comparatively broad, tapered, short siphonal canal.

The protoconch was broken in the holotype but the last whorl is partially intact in the second specimen and measures 800µm in width.

Trubatsa saltantis differs in having a smaller shell with a narrow aperture and obviously narrower anal tubes. *T. unicornis* has a higher and broader spire, and narrower anal tubes. *T. undulatus* differs in having a spirally sculptured shell and a more elongate last teleoconch whorls.

Finally, *T. wolffi* has comparatively narrower spire whorls with a sharper apex, narrower anal tubes and a narrower and longer siphonal canal. The last teleoconch whorl in adult specimens of *T. wolffi* is narrower than in adults of *T. lozoueti* while adults of *T. wolffi* with a similar number of teleoconch whorls are bigger than *T. lozoueti*.

Trubatsa sp.

Siphonochelus pavlova – Barco *et al.* 2010: 1032 (not *Typhina pavlova* Iredale, 1936).

Locality New Caledonia, EBISCO, stn DW2632, S Lansdowne, 21° 3' S, 160° 44' E, 297–378m, 1 lv, MNHN-IM-2009-8590.

Remarks Taking into account the numerous examined specimens of *S. wolffi*, previously misidentified as *S. pavlova* (see Table 1), a species

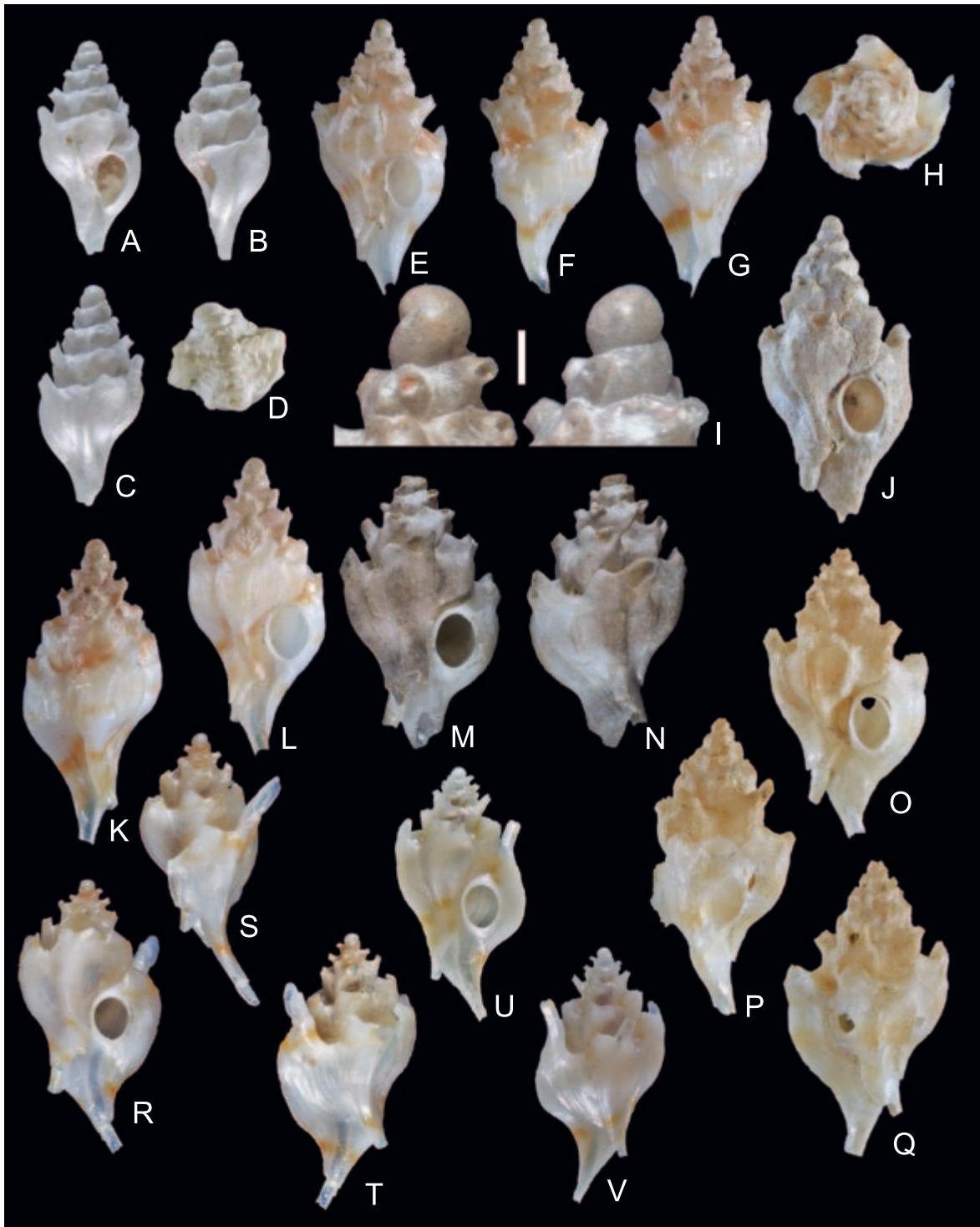


Figure 15 A–D *Siphonochelus* cf. *S. arcuatus* (Hinds, 1844), New Caledonia, KANADEEP, stn DW4999, Lord Howe Rise, 23°53' S, 161°46' E, 1060m, MNHN, 6.9mm; E–L *Trubatsa alinkios* n. sp. E–I. New Caledonia, South of Iles des Pins, 22°49' S, 167°25' E, 394–443m, holotype MNHN-IM-2013-69028, 9.5mm; J. New Caledonia, KANACONO, stn DW 4714, 22°49' S, 167°25' E, 394–443m, paratype MNHN-IM-2013-68291, 10.3mm; K–L. New Caledonia, KANACONO, stn DW4713, 22°47' S, 167°24' E, 356–380m, paratype MNHN-IM-2013-69293, 9.8mm; M–Q *Trubatsa lozoueti* (Houart, 1991). M–N. New Caledonia, BIOGEOCAL, stn DW253, 21°32' S, 166°29' E, 310–315m, holotype MNHN-IM-2000-213, 9.4mm (photo M. Caballer); O–Q. New Caledonia, EXBODI, stn CP3799, off Thio, 21°33' S, 166°20' E, 461–466m, MNHN-IM-2009-22828, 12.9mm; R–V *Trubatsa saltantis* (Houart, 1991). R–T. New Caledonia, Coral Sea, MUSORSTOM 5, stn DW303, 22°12' S, 159°23' E, 332m., holotype MNHN-IM-2000-896, 9.2mm (photo M. Caballer); U–V. Coral Sea, 25°21' S, 159°46' E, 150–225m, RH, 7.8mm. Scale bar 500µm.

occurring in Australia, from Queensland to New South Wales, the sequenced specimen from New Caledonia identified as *Siphonochelus pavlova* by Barco *et al.* (2010: 1032) may have also been misidentified. Regrettably the voucher has been mislaid and the definitive identification of this specimen will remain an enigma until the shell is found.

Trubatsa saltantis (Houart, 1991)
Figs 9C–D; 15R–V

Siphonochelus (*Siphonochelus*) *saltantis* Houart, 1991a: 232, figs 7–8, 9, 19–20, 46, 70.

Siphonochelus (*Trubatsa*) *saltantis* – Houart, 2013: 7.

Type locality New Caledonia, Coral Sea, MUSORSTOM 5, stn DW303, 22°12' S, 159°23' E, 332m.

Type material Holotype MNHN-IM-2000-896.

New material examined More than 30 specimens, empty and live collected, from numerous expeditions.

Distribution Chesterfield and Bellona Plateau, Argo and Capel Bank, Northeast and South New Caledonia, and the Loyalty Islands, living at 225–425m.

Remarks *Trubatsa saltantis* is another small deep-water species with a shell morphology only weakly variable and that rarely exceeds 9mm in length. It cannot be confused with any of the Indo-West Pacific *Trubatsa* species occurring in New Caledonia, in having the smallest shell in that group, with a broad last teleoconch whorl and a narrow spire, very narrow, rounded anal tubes, a narrow, broadly ovate aperture and a small protoconch of 650–700µm wide and 700µm high.

Trubatsa undulata (Houart, 1991)
Fig. 16A–K

Siphonochelus (*Siphonochelus*) *undulatus* Houart, 1991a: 233, figs 24–25, 49, 69.

Siphonochelus (*Trubatsa*) *undulatus* – Houart, 2013: 7.

Type locality New Caledonia, MUSORSTOM 4, stn DW203, south of Grande-Terre, 22°36' S, 167°05' E, 105–110m.

Type material Holotype MNHN-IM-2000-891.

New material examined New Caledonia, LAGON, stn DW830, 20°49' S, 165°19' E, 105–110m, 1 dd, MNHN-IM-2015-4618. BATHUS 1, stn DW666, 20°57' S, 165°34' E, 105–110m, 7 dd, juv, MNHN-IM-2015-4617; stn CP713, 21°45' S, 166°37' E, 250m, 1 lv, 1 dd. BATHUS 2, stn DW714, 22°38' S, 167°10' E, 124m, 5 dd, juv, MNHN-IM-2014-2454; stn DW715, 22°39' S, 167°11' E, 202–227m, 2 dd, juv, MNHN-IM-2015-4619. EXPEDITION MONTROUZIER, stn 1237, 20°46.9' S, 165°13.8' E, 0–1m, 1 dd, MNHN-IM-2010-21594; stn 1249, 20°49' S, 165°19' E, 80–140m, 8 lv & dd, MNHN-IM-2010-21593; stn 1260, 20°44' S, 165°14' E, 49–59m, many specimens, lv & d, MNHN-IM-2010-21599; stn 1261, 20°46–47' S, 165°15–17' E, 45–56m, 3 lv, MNHN-IM-2010-21598; stn 1270, 20°45' S, 165°17' E, 10–35m, 1 lv MNHN-IM-2010-21596; stn 1271, 20°53' S, 165°20' E, 5–25m, 1 lv, MNHN-IM-2010-21597; stn 1275, 20°49' S, 165°17' E, 50–62m, 3 lv, MNHN-IM-2010-21595. KANACONO, stn DW4695, 22°47' S, 167°27' E, 200–290m, 1 lv, MNHN-IM-2013-68961 (BOLD MUBA911-21; Genbank MZ364552); stn CP4709, 22°45' S, 167°24' E, 66–73m, 1 lv, MNHN-IM-2013-69206 (BOLD MUBA907-21; Genbank MZ364598).

Distribution Northeast and South New Caledonia, and Loyalty Islands, living at 25–80m. One live collected specimen was dredged from 200–290m during the KANACONO expedition.

Remarks *Trubatsa undulata* was described from a single specimen. Examination of additional material proved its validity.

Trubatsa undulata is close to *Choreotyphis erythrostroma* (Fig. 17P–S), however, *T. undulata* differs constantly in having a comparatively smaller and narrower shell with obviously narrower, higher and less rounded varices, a smaller aperture and a typical intervarical axial fold, absent in *Choreotyphis*. Moreover, in *T. undulata* the anal tube originates just behind the varix, although less obvious than in other *Siphonochelus* species, while in *C. erythrostroma* it originates directly from the broad, rounded varix.

Trubatsa unicornis (Houart, 1991)
Fig. 16L–T

Siphonochelus (*Siphonochelus*) *unicornis* Houart, 1991a: 233, figs 21–23, 48, 67.

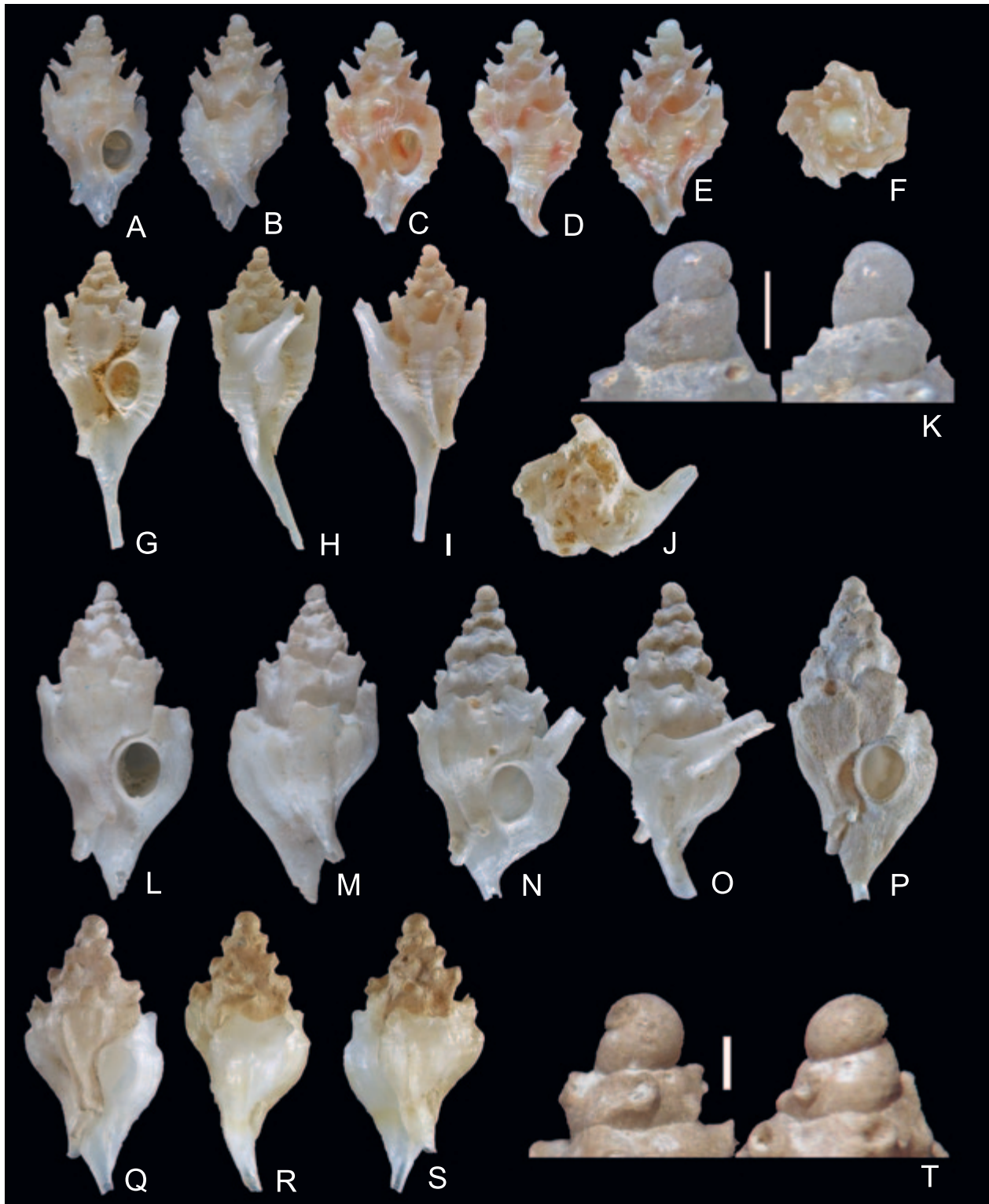


Figure 16 A–K *Trubatsa undulata* (Houart, 1991). A–B. New Caledonia, south of Grande-Terre, 22°36' S, 167°05' E, 105–110m, holotype MNHN-IM-2000-891, 5.9mm (photo M. Caballer); C–F. New Caledonia, KANACONO, stn DW4695, 22°47' S 167°27' E, 200–290m, MNHN-IM-2013-68961, 4.8mm; G–K. New Caledonia, BATHUS 1, stn CP713, 21°45' S, 166°37' E, 250m, MNHN, 10.9mm; K. Protoconch; L–T *Trubatsa unicornis* (Houart, 1991). L–M. New Caledonia, MUSORSTOM 4, stn DW226, south of Grande-Terre, 22°47' S, 167°22' E, 395m, holotype MNHN-IM-2000-890, 12.0mm (photo M. Caballer); N–O. New Caledonia, KANACONO, stn DW4711, 22°47' S, 167°24' E, 335–338m, MNHN, 11.7mm; P–T. New Caledonia, KANACONO, stn DW4666, 22°53' S, 167°17' E, 530–545m; P. MNHN-IM-2013-68579, 11.6mm; Q–T. MNHN-IM-2013-68627, 8.7mm; T. Protoconch. Scale bars 500µm.

Siphonochelus (Trubatsa) unicornis – Houart, 2013: 7.

Type locality New Caledonia, MUSORSTOM 4, stn DW226, south of Grande-Terre, 22°47' S, 167°22' E, 395m.

Type material Holotype MNHN-IM-2000-890.

New material examined KANACONO stn DW4666, 22°53' S, 167°17' E, 530–545m, 4 lv; MNHN-IM-2013-68579 (BOLD MUBA905-21; Genbank MZ364592); MNHN-IM-2013-68627 (BOLD MUBA909-21; Genbank MZ364550); MNHN-IM-2013-68630; MNHN-IM-2013-68666, 1 lv, juv; stn DW4711, 22°47' S, 167°24' E, 335–338m, 1 lv; MNHN-IM-2013-69452 (BOLD MUBA917-21; Genbank MZ364573); stn DW4698, 22°47' S, 167°18' E, 460–460m, 3 lv, MNHN-IM-2013-69086 (BOLD MUBA913-21; Genbank MZ364611); MNHN-IM-2013-69105; MNHN-IM-2013-69109, 1 lv, juv.

Distribution East and South New Caledonia, living at 345–530m.

Remarks Many specimens from several expeditions have been collected since its description, extending its geographical distribution to East New Caledonia and confirming the validity of the species as well as the weakly variable shell morphology. Moreover a few specimens have been recently collected during the KANACONO expedition and 4 of them are here included in the phylogenetic tree (Fig. 5).

Trubatsa unicornis has a high, broad spire, a relatively small, roundly ovate aperture, rounded anal tubes, forming an angle of approximately 80° with the axis of the shell, and a large protoconch of 900–1000µm wide and 900–1200µm high.

Trubatsa virginiae (Houart, 1986) (new combination)
Figs 9G; 17A–F

Typhis (Typhina) virginiae Houart, 1986: 440, pl. II, figs 7, 7A–B.

Typhis (Typhina) virginiae – Houart, 1991a: 227, figs 12, 41, 62.

Siphonochelus virginiae – Houart, 2002: 148.

Type locality New Caledonia, VAUBAN 1978–79, stn DR2, 22°17' S, 167°14' E, 425–430m.

Type material Holotype MNHN-IM-2000-877.

New material examined As for other species, many specimens from several expeditions have been collected since its description and confirm the validity of the species as well as the very little variability in the shell morphology.

Distribution East New Caledonia, 20°35'–22°44' S, 164°59'–167°14' E, East Ile des Pins, 21°00' S, 167°25' E, and East Lifou, Loyalty Islands, living at 110–440m.

Remarks This is a small species, not exceeding 8mm in length at maturity. It was originally assigned to *Typhis (Typhina)*. Thereafter Houart (2002) transferred it to *Siphonochelus*. Based on genetic analysis it is here assigned to *Trubatsa*. This is supported by the presence of narrow intervarical folds and small buttresses connecting the preceding teleoconch whorl, a feature typical to that genus.

Trubatsa wolffi (Houart, 2013)
Fig. 17G–K

Siphonochelus (Trubatsa) wolffi Houart, 2013: 7, figs 11–16, 17–18, 34, 37.

Type locality Eastern New Caledonia, BATHUS 1, stn CP668, 20°57' S, 165°35' E, 205–219m.

Type material Holotype MNHN-IM-2000-25089.

New material examined New Caledonia, EXBODI, stn CP3795, 21°32' S, 166°21' E, 240–245m, 2 lv, MNHN-IM-2009-22972 (BOLD MUBA517-15; Genbank MZ364587); MNHN-IM-2009-22973 (BOLD MUBA518-15; Genbank MZ364576); stn CP3807, 21°43' S, 166°36' E, 352–372m, 4 lv, MNHN-IM-2009-23027 (BOLD MUBA558-15; Genbank MZ364588); MNHN-IM-2009-23028 (BOLD MUBA559-15; Genbank MZ364601); MNHN-IM-2009-23029 (BOLD MUBA560-15; Genbank MZ364589); MNHN-IM-2009-23030 (BOLD MUBA561-15; Genbank MZ364558); stn CP3810, 21°44' S, 166°38' E, 384–385m, 1 lv, MNHN-IM-2009-22997 (BOLD MUBA537-15; Genbank MZ364594); stn CP3814, 21°49' S, 166°44' E, 331–344m, 4 lv, MNHN-IM-2009-22988 (BOLD MUBA530-15; Genbank MZ364567); MNHN-IM-2009-22991 (BOLD MUBA532-15; Genbank MZ364590); MNHN-IM-2009-22992 (BOLD

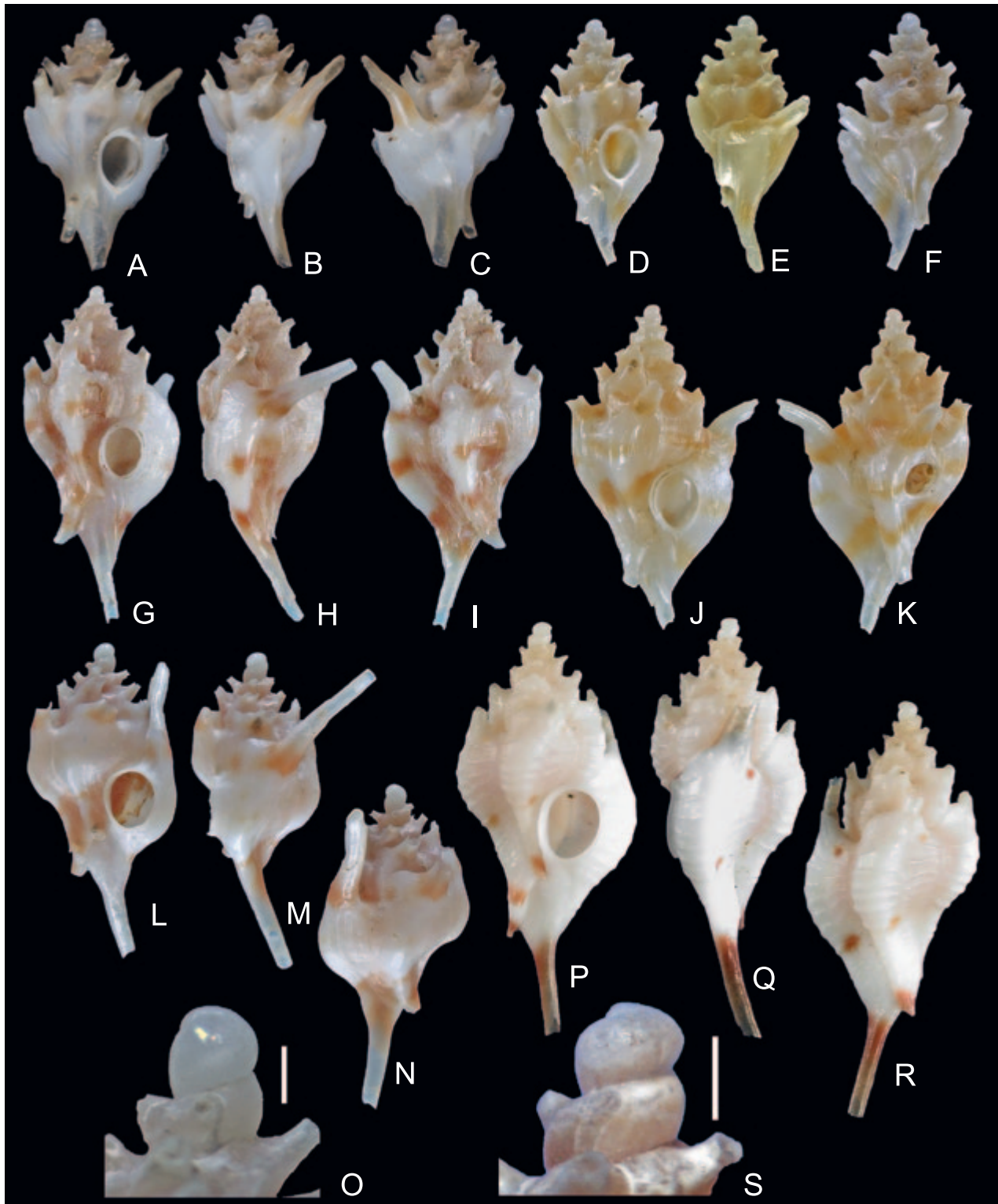


Figure 17 A–F *Trubatsa virginiae* (Houart, 1986). A–C. New Caledonia, VAUBAN 1978–79, stn DR2, 22°17' S, 167°14' E, 425–430m, holotype MNHN-IM-2000-877, 7.8mm (photo M. Caballer); D–F. New Caledonia, KANACONO, stn DW4703, 22°46' S, 167°19' E, 350–348m, MNHN-IM-2013-69222, 7.6mm; G–K *Trubatsa wolffi* (Houart, 2013). G–I. Eastern New Caledonia, BATHUS 1, stn CP668, 20°57' S, 165°35' E, 205–219m, holotype MNHN-IM-2000-25089, 14.3mm; J–K. New Caledonia, EXBODI, stn CP3821, Passe de Kouakoué-Canyon, 21°53' S, 166°50' E, 211–440m, MNHN-IM-2009-23040, 11.8mm; L–O *Choreotyphis pavlova* (Iredale, 1936), Australia, Queensland, Off Cape Moreton, 11.2mm, RH; P–S. *Choreotyphis erythrostigma* (Keen & Campbell, 1964), Australia, Queensland, east of Noosa, 65m, 17.1mm, RH. Scale bars 500µm.

MUBA533-15; Genbank MZ364612); MNHN-IM-2009-22993 (BOLD MUBA534-15; Genbank MZ364614): stn CP3821, 21°53' S, 166°50' E, 211–440m, 4 lv, MNHN-IM-2009-23039 (BOLD MUBA565-15; Genbank MZ364608); MNHN-IM-2009-23040 (BOLD MUBA566-15; Genbank MZ364551); MNHN-IM-2009-23041 (BOLD MUBA567-15; Genbank MZ364591); MNHN-IM-2009-23042 (BOLD MUBA568-15; Genbank MZ364597); stn CP3823, 21°55' S, 166°55' E, 246–255m, 1 lv, MNHN-IM-2009-22978 (BOLD MUBA523-15; Genbank MZ364593); stn CP3824, 21°57' S, 166°58' E, 280–296m, 1 lv, MNHN-IM-2009-22975 (BOLD MUBA520-15; Genbank MZ364599); stn CP3825, 21°58' S, 166°59' E, 349–405m, 1 lv, MNHN-IM-2009-22980 (BOLD MUBA524-15; Genbank MZ364570); stn CP3827, 21°58' S, 166°57' E, 220–232m, 1 lv, MNHN-IM-2009-22971 (BOLD MUBA897-21; Genbank MZ364560); stn CP3828, 22°00' S, 167°01' E, 300–302m, 1 lv, MNHN-IM-2009-22990 (BOLD MUBA531-15; Genbank MZ364572); stn CP3834, 22°06' S, 167°04' E, 257–258m, 1 lv, MNHN-IM-2009-22998 (BOLD MUBA538-15; Genbank MZ364578).

Papua New Guinea, PAPUA NIUGINI, stn CP40324°52' S, 145°50' E, 610–620m, 24 lv & dd, MNHN-IM-2012-19991; stn CP4038, 4°26' S, 145°34' E, 800–840m, 5 lv & dd, MNHN-IM-2012-19990.

Distribution Chesterfields Islands, East and South New Caledonia and northern Papua New Guinea (new record), living at 180–800m (new bathymetric record).

Remarks *Trubatsa wolffi* was wrongly identified as “*Siphonochelus*” *pavlova* by Houart (1986, 1991a, 2002) but it differs from that species by the same shell characters that differentiate *Trubatsa* from *Choreotyphis*, i.e. in having a narrow, obvious intervarical fold rather than having the intervarical fold entirely covered by the broad, rounded preceding varix in *Choreotyphis pavlova* (Fig. 17L–O). It also differs in having narrower varices, a narrower base of the anal tubes, a more elongate and higher spire and a quite smaller protoconch with a height of 800µm opposed to 1000µm in *Choreotyphis pavlova* and a width of 700µm opposed to 800µm.

Live and empty shells were also collected during the PAPUA NIUGINI expedition extending

considerably its geographical and bathymetric distribution.

The 21 specimens included in the molecular analysis were collected along a rather short transect facing the NE coast of New Caledonia. Even if the tree topology might suggest a strong structuring, comparing the haplotypes with the collection stations reveals no matching pattern.

Genus *Choreotyphis* Iredale, 1936

Type species by original designation: *Typhina pavlova* Iredale, 1936, NSW, Australia (not in New Caledonia).

Remarks No species of *Choreotyphis* are recorded from New Caledonia but *Trubatsa wolffi* was initially identified as *C. pavlova* in Houart (1986, 1991a, 2002).

The genus *Choreotyphis* was not listed in Houart (2018), however, its type species, *C. pavlova*, was illustrated (fig. 18E) but wrongly as *Siphonochelus* (*Trubatsa*). *Choreotyphis* was reinstated by Houart (2013) and is also retained here. Nevertheless, genetic studies would be welcome to confirm this status.

Radwin & D’Attilio (1976: 206) and D’Attilio & Hertz (1988: 62) considered *Choreotyphis* a junior synonym of *Trubatsa*. However, in *Choreotyphis pavlova* the axial varices are much broader and rounder than in *Trubatsa*, without the presence of any intervarical axial fold (Fig. 6C), while the anal tubes originate directly from the varices. In *Siphonochelus* and *Trubatsa* the tubes are connected to the succeeding varices but they originate just behind them, while the varices are narrower and less rounded and that an axial fold is always present near the preceding varix.

Choreotyphis Iredale, 1936 was described for a single species from eastern Australia but based on these differences, *C. erythrostigma*, another species from eastern Australia is here also assigned to *Choreotyphis* (Fig. 17P–S).

Genus *Typhina* Jousseaume, 1880

Type species by original designation: *Typhina belcheri* Broderip, 1833, West Africa and East Atlantic.

Remarks The genetic analysis groups three genera of Typhinae previously considered

Table 2 Typhinae from New Caledonia and their chresonymy, in chronological order of publications.

Houart, 1986	Houart, 1987	Houart, 1991a
<i>Typhis</i> (<i>Typhina</i>) <i>virginiae</i> n. sp.		<i>Typhis</i> (<i>Typhina</i>) <i>virginiae</i>
<i>Siphonochelus</i> (<i>Laevityphis</i>) <i>tillierae</i> n. sp.		<i>Siphonochelus</i> (<i>Laevityphis</i>) <i>tillierae</i>
<i>Siphonochelus</i> (<i>Trubatsa</i>) <i>pavlova</i> – Houart (*)		<i>Siphonochelus</i> (<i>Siphonochelus</i>) <i>pavlova</i> (*)
	<i>Typhis</i> (<i>Typhina</i>) <i>carolinae</i> n. sp.	<i>Typhis</i> (<i>Typhina</i>) <i>carolinae</i>
	<i>Typhis</i> (<i>Talityphis</i>) <i>neocaledonicus</i> n. sp.	<i>Typhis</i> (<i>Talityphis</i>) <i>neocaledonicus</i>
		<i>Typhis</i> (<i>Typhina</i>) <i>imperialis</i> – Houart (*)
		<i>Siphonochelus</i> (<i>Siphonochelus</i>) <i>angustus</i> n. sp.
		<i>Siphonochelus</i> (<i>Siphonochelus</i>) <i>boucheti</i> n. sp.
		<i>Siphonochelus</i> (<i>Siphonochelus</i>) <i>saltantis</i> n. sp.
		<i>Siphonochelus</i> (<i>Siphonochelus</i>) <i>unicornis</i> n. sp.
		<i>Siphonochelus</i> (? <i>Siphonochelus</i>) <i>undulatus</i> n. sp.
Houart, 1991b	Houart, 2002	Houart, 2013
	<i>Siphonochelus</i> <i>virginiae</i> n. comb.	
	<i>Siphonochelus</i> <i>tillierae</i>	
	<i>Siphonochelus</i> <i>pavlova</i> (*)	<i>Siphonochelus</i> (<i>Trubatsa</i>) <i>wolffi</i> n. sp. =ex <i>S. pavlova</i> in Houart (1986, 1991a, 2002).
	<i>Monstrotiphis</i> <i>carolinae</i> n. comb.	The actual <i>S. pavlova</i> is assigned to the subgenus <i>Choreotyphis</i> and does not live in New Caledonia
	<i>Typhina</i> <i>neocaledonica</i> n. comb.	
	<i>Monstrotiphis</i> <i>imperialis</i> n. comb. (*)	
	<i>Siphonochelus</i> <i>angustus</i>	
	<i>Siphonochelus</i> <i>boucheti</i>	
	<i>Siphonochelus</i> <i>saltantis</i>	<i>Siphonochelus</i> (<i>Trubatsa</i>) <i>saltantis</i> n. comb.
	<i>Siphonochelus</i> <i>unicornis</i>	<i>Siphonochelus</i> (<i>Trubatsa</i>) <i>unicornis</i> n. comb.
	? <i>Siphonochelus</i> <i>undulatus</i>	<i>Siphonochelus</i> (<i>Trubatsa</i>) <i>undulatus</i> n. comb.
<i>Typhis</i> (<i>Typhinellus</i>) <i>insolitus</i> n. sp.	<i>Typhinellus</i> <i>insolitus</i>	
<i>Siphonochelus</i> (<i>Siphonochelus</i>) <i>lozoueti</i> n. sp.	<i>Siphonochelus</i> <i>lozoueti</i>	<i>Siphonochelus</i> (<i>Trubatsa</i>) <i>lozoueti</i> n. comb.
	<i>Monstrotiphis</i> <i>singularis</i> n. sp.	

This paper*Trubatsa* *virginiae* (Houart, 1986) **n. comb.***Laevityphis* *tillierae* (Houart, 1986)*Trubatsa* *wolffi* (Houart, 2013) : ex *Siphonochelus* *pavlova* in Houart (1986, 1991a, 2002) **n. comb.***Monstrotiphis* *carolinae* (Houart, 1987)*Typhina* *neocaledonica* (Houart, 1987)*Monstrotiphis* *adelos* **n. sp.**=*M. imperialis* in Houart (1991a)*Monstrotiphis* *maestratii* **n. sp.**=*M. imperialis* in Houart (2002) and Houart et al. (2010)*Siphonochelus* *angustus* Houart, 1991*Siphonochelus* *boucheti* Houart, 1991*Trubatsa* *saltantis* (Houart, 1991) **n. comb.***Trubatsa* *unicornis* (Houart, 1991) **n. comb.***Trubatsa* *undulatus* (Houart, 1991) **n. comb.***Typhinellus* *insolitus* (Houart, 1991)*Trubatsa* *lozoueti* (Houart, 1991) **n. comb.***Monstrotiphis* *singularis* Houart, 2002*Trubatsa* *alinkios* **n. sp.***Trubatsa* sp.*Typhinellus* *occlusus* (Garrard, 1963) **new record***Laevityphis* sp.*Monstrotiphis* sp.*Siphonochelus* sp. cf. *S. arcuatus* (Hinds, 1843)

(*) Misidentified

separate taxa into the same clade (Fig. 5), indicating that they must be synonymized. These are *Talityphis* Jousseaume, 1882 (= *Typhina* Jousseaume, 1880), type species by original designation: *Typhis expansus* Sowerby, 1874, East Atlantic; *Typhisopsis* Jousseaume, 1880 (new synonym), type species by original designation: *Typhis coronatus* Broderip, 1833 and *Typhisala* Jousseaume, 1881 (new synonym), type species by original designation: *Typhis grandis* A. Adams, 1855.

As First Revisers we here give precedence to *Typhina* over *Typhisopsis* Jousseaume, 1880 (ICZN 1999, art. 24.2.1).

Species in New Caledonia *Typhina neocaledonica* (Houart, 1987)

Typhina neocaledonica (Houart, 1987)
Figs 1, 18A–C

Typhis (*Talityphis*) *neocaledonicus* Houart, 1987: 208, figs. 8, 9, 16.

Typhina neocaledonica – Houart, 2002: 148.

Type locality New Caledonia, Programme LAGON, stn DW354, Grand Récif Sud, 22°38' S, 167°14' E, 40–50m.

Type material Holotype MNHN-IM-2000-191.

Distribution Only known from the holotype, living at 40–50m.

Remarks No additional material was collected since the description of this shallow-water species.

Typhina clarksoni n. sp.
Figs 7D; 18D–I

urn:lsid:zoobank.org:act:B2044946-768E-42B7-BCD2-6906E080D651

Material examined Western Australia, North of Exmouth, Northeast side of Peak Island, 27–29m, reef covered sparsely with small sponges and hard corals, 2 dd, holotype WAMS_29958; 1 paratype RH.

Type locality Western Australia, North of Exmouth, Northeast side Peak Island, 27–29m.

Distribution Only known from the type locality, dead collected (Fig. 7D).

Description Shell up to 20.8mm in length (holotype), broad, heavy. Spire moderately high. Protoconch unknown, partially broken, last whorl rounded. Teleoconch with 5 broad, strongly shouldered whorls. Suture impressed. Length/width ratio 1.48 (holotype). Subsutural ramp broad, very weakly sloping, lightly concave.

Shell off white, light brown or grey coloured on subsutural ramp.

Axial sculpture of first 3 teleoconch whorls with sharp varices; remaining teleoconch whorls with 4 strong, broad, rounded varices; each varix with a narrow, flat, short, strongly inwards pointed triangular, flat spine at adapical extremity. Anal tube adjacent to leading edge of varix and adpressed to previous laminar extension. Varices broader and swollen at shoulder periphery. Apertural varix with a broad, very weakly sinuous flange, attached to previous whorl by a broad laminar extension.

Dorsal part of varices, including siphonal canal, with strong spiral cords. Last whorl with 9 rounded cords, increasing in strength abapically. P1 with sealed, rounded anal tube near preceding varix. P2 with flat, triangular spine at intersection with varices, followed by s2, P3, s3, P4–P6, ADP, MP, ABP. Intervarical sculpture faint. Sealed rounded anal tube adpressed to laminar extension on preceding varix, forming an angle of approximately 80–90° with axis of shell. Spiral cords ending as very short, weakly backward curved spines at the edge of the apertural flange in the holotype (flange partly broken in paratype).

Aperture broadly ovate, forming a continuous peristome, erect at outer lip and abapical portion of columellar lip and adpressed adapically. Siphonal canal long, broad, ventrally sealed. Sutural line strongly shifted to the right, left side of canal broadly overlapping right side. Holotype ending with the siphonal canal dorsally curved at the extremity.

Remarks *Typhina claydoni* (Houart, 1988) (Fig. 18J–N) from Port Hedland and Broome, Western Australia, differs from *T. clarksoni* n. sp. in having a smaller, more globose shell with broader, rounder, axial varices with strongly dorsally curved axial lamellae, a shorter spire and a strongly dorsally bent siphonal canal.

Derivation of name This species is dedicated to the memory of Peter Clarkson, South Australian

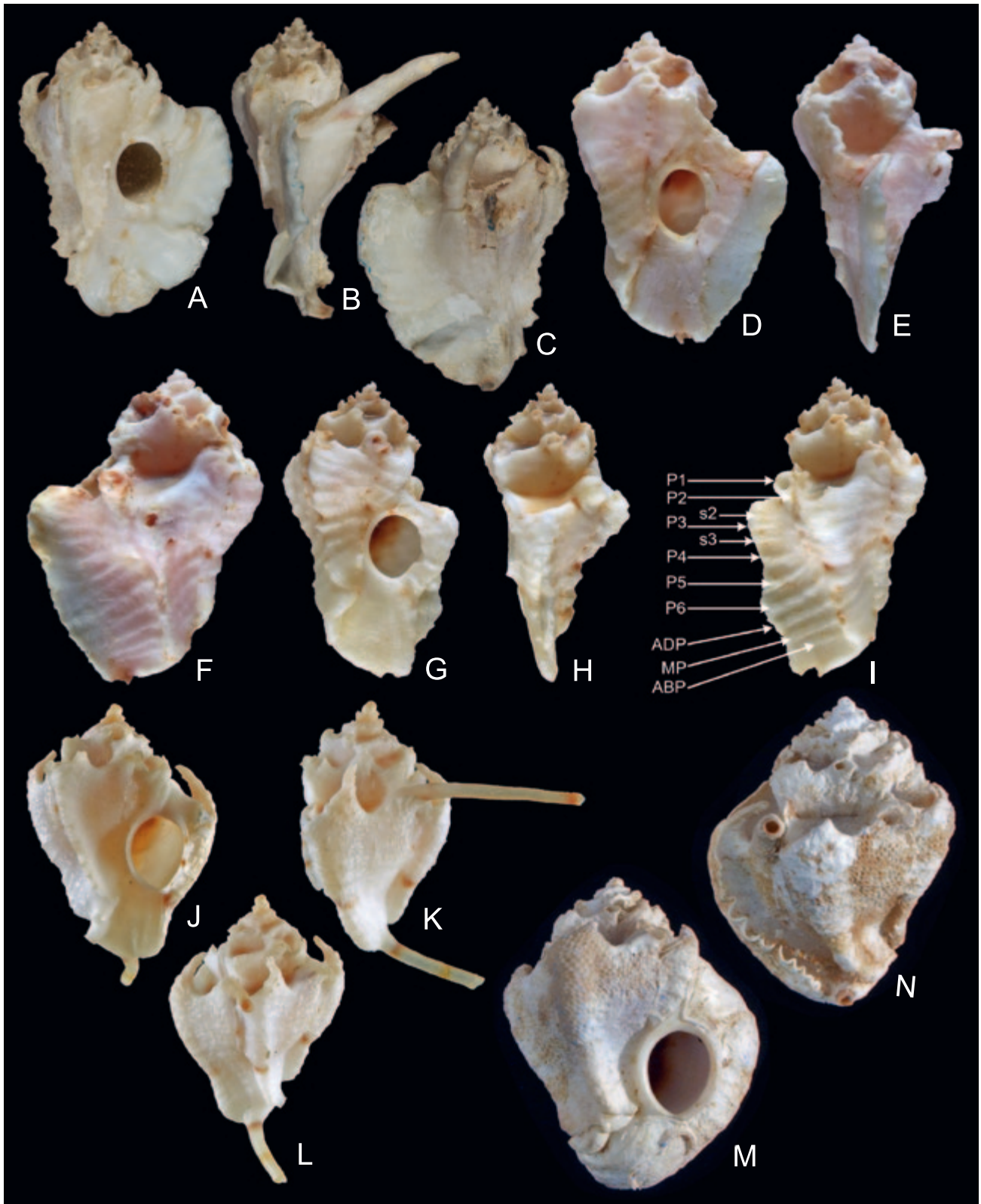


Figure 18 A–C *Typhina neocaledonica* (Houart, 1987), New Caledonia, Programme LAGON, stn DW354, Grand Récif Sud, 22°38' S, 167°14' E, 40–50m, holotype MNHN-IM-2000-191, 18.00mm (photo M. Caballer); D–I *Typhina clarksoni* n. sp., West Australia, North of Exmouth, Northeast side Peak Island, 27–29m. D–F. Holotype WAMS_29958, 20.8mm; G–I. Paratype, RH, 18.1mm; J–N *Typhina claydoni* (Houart, 1988). J–L. West Australia, off Broome, 16m, RH, 15.8mm; M–N. West Australia, Port Hedland, 12m, holotype WAMS_13958, 18.5mm (photo courtesy WAM).

commercial abalone diver, amateur shell diver and collector who sent me these two specimens in the nineties. Peter lost his life to a shark attack on 17/2/2011 off Coffin Bay, near Port Lincoln, South Australia.

Genus *Typhinellus* Jousseaume, 1880

Type species by original designation: *Typhis sowerbyi* Broderip, 1833=*Murex labiatus* Cristofori & Jan, 1832, Mediterranean, East Atlantic.

Species in New Caledonia *Typhinellus insolitus* (Houart, 1991), *T. oclusus* (Garrard, 1963) (new record in New Caledonia)

Typhinellus insolitus (Houart, 1991)
Fig. 19G–H

Typhis (*Typhinellus*) *insolitus* Houart, 1991b: 49, figs 22–24.

Type locality New Caledonia, Loyalty Ridge, MUSORSTOM 6, stn DW406, 20°41' S, 167°07' E, 373m.

Type material Holotype MNHN-IM-2000-991.

Distribution Only known from the holotype, collected dead at 373m in the vicinity of the Loyalty Islands.

Remarks No additional material was collected since the description of this very peculiar shell.

Typhinellus oclusus (Garrard, 1963)
Fig. 19A–F

Typhisopsis oclusus Garrard, 1963: 46, pl. 7, figs 9, 10.

Type locality Australia, Queensland, off Hayman Is, Withsunday Group, 20°3' S, 148°53' E, 31m.

Type material Holotype AMS C.64072.

New material examined Northern New Caledonia, PALEO-SURPRISE, stn CP1379, Atoll de Surprise, 18°25' S, 163°05' E, 46m, 1 dd; stn DW1397, 18°22' S, 163°04' E, 43m, juv., 1 lv.

Distribution Australia, Queensland, Withsunday Group, lv, 31m; north of New Caledonia, lv, 43m (new record); southern Philippine Islands, lv, 150–200m.

Remarks The holotype of *Typhinellus oclusus* (Fig. 19D–F) was described from Queensland, Australia and similar specimens have been live collected in southern Philippine Islands in 150–200m through the use of tangle nets.

One empty collected specimen was dredged from 46m from the Surprise Atoll, north of New Caledonia and a juvenile of 9.2mm was collected alive in 43m at the same locality. The subadult specimen collected dead has not completed its growth (Fig. 19A–C) and the wing of the last (apertural) varix is incomplete and partly broken. However, the preceding varix bears a broadly winged varix as observed in *T. oclusus* while the anal tube is long, adpressed to preceding varix and laminar extension and forms an angle of approximately 50° with the axis of the shell. Philippines specimens usually have anal tubes forming an angle of 45–90°.

CHECKLIST OF THE TYPHINAE IN NEW CALEDONIA

The Typhinae of New Caledonia were studied by Houart (1991a), who listed 11 species, most of them occurring in deep water, living between 250 and 600m. Since then new species and new information (Houart, 1991b, 2002, 2013, this paper) and new records (this paper) have increased the number of valid species to 17 from New Caledonia and four still unidentified species, as follows (see also Table 2 and appendix):

Laevityphis tillierae (Houart, 1986); *Laevityphis* sp.; *Monstrotyphis adelos* n. sp.; *M. caroliniae* (Houart, 1987); *M. singularis* Houart, 2002; *M. maestratii* n. sp.; *Monstrotyphis* sp.; *Siphonochelus angustus* Houart, 1991; *S. boucheti* Houart, 1991; *Siphonochelus* sp. cf. *S. arcuatus* (Hinds, 1843); *Trubatsa alinkios* n. sp.; *Trubatsa* sp.; *T. lozoueti* Houart, 1991; *T. saltantis* Houart, 1991; *T. undulatus* Houart, 1991; *T. unicornis* Houart, 1991; *T. virginiae* Houart, 1986 (new combination); *T. wolffi* (Houart, 2013); *Typhina neocaledonica* (Houart, 1987); *Typhinellus insolitus* (Houart, 1991); *T. oclusus* (Garrard, 1963) (new record).

A total of 13 species out of the 17 identified species, i.e. 76%, are endemic to New Caledonia.

APPENDIX – CATALOGUE OF RECENT TYPHINAE

● Species studied or mentioned in this paper; ◆ Living in New Caledonia; ■ Species included in the phylogenetic analysis.

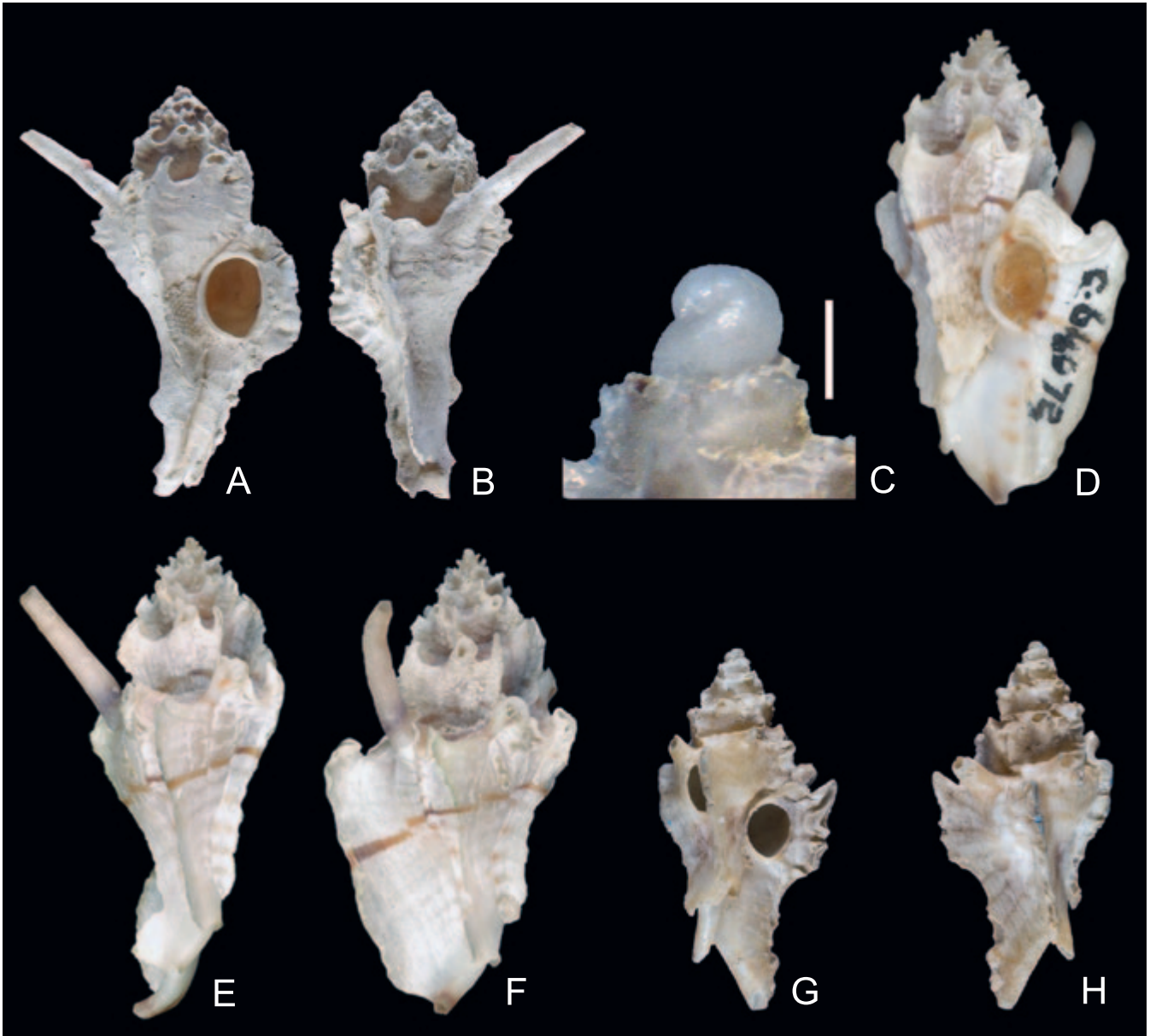


Figure 19 A–F *Typhinellus oclusus* (Garrard, 1963). A–C. Northern New Caledonia, PALEO SURPRISE, stn CP1379, 18°25,2'S 163°05'E, 46m, MNHN, 20.9mm; D–F. Australia, Queensland, off Hayman Is, Withsunday Group, GBE, 20°3' S, 148°53' E, 31m, holotype AMS C.64072, 27.7mm (photo courtesy AMS); G–H *Typhinellus insolitus* (Houart, 1991), New Caledonia, Loyalty Ridge, MUSORSTOM 6, stn DW406, 20°41' S, 167°07' E, 373m, holotype MNHN-IM-2000-991, 16.9mm (photo M. Caballer). Scale bar 500µm.

Brasityphis Absalão & Santos, 2003

Length of the holotype: 4mm.

Type species by original designation: *Brasityphis barrosi* Absalão & Santos, 2003, Brazil (Fig. 20A–B).

Included species

Brasityphis barrosi Absalão & Santos, 2003

Short description: No laminar extension; four axial varices; strong spiral sculpture; presence of strong denticles within the aperture; anal tube not originating from varix; close to succeeding varix.

Choreotyphis Iredale, 1936

Type species by original designation: *Typhina pavlova* Iredale, 1936, NSW, Australia (Fig. 20C–D).

Short description: No laminar extension; teleoconch whorls with four axial varices; varices rounded, smooth, without spines; anal tubes directly originating from broad, rounded varix; no intervarical fold. Tubes and axial varices extending as a broad buttress over preceding whorl.

Average length of the type species: 16mm.

Included species

Choreotyphis erythro stigma (Keen & Campbell, 1964) ● (new combination)
C. pavlova (Iredale, 1936) ●

Distichotyphis Keen & Campbell, 1964

Type species by original designation: *Distichotyphis vemae* Keen & Campbell, 1964, off Panama and Costa Rica (Fig. 20E).

Short description: No laminar extension; two axial varices; anal tube originating from varix; varices rounded, smooth.

Length of the holotype: 8mm.

Included species

Distichotyphis vemae Keen & Campbell, 1964

Haustellotyphis Jousseume, 1880

Type species by original designation: *Typhis cumingii* Broderip, 1833, West Mexico to Ecuador (Fig. 20F).

Short description: Presence of a laminar extension; four axial varices; long, straight, spineless siphonal canal, without distinct previous canals; intervarical nodes; anal tubes not originating from varix, closer to preceding varix.

Average length of the type species: 25mm.

Included species

Haustellotyphis cumingii (Broderip, 1833)
H. wendita Hertz, 1995

Hirtotyphis Jousseume, 1880

Type species by original designation: *Murex horridus* Brocchi, 1814, Pliocene, Italy (Fig. 20G).

Short description: No laminar extension; four axial varices per whorl; varices rounded with hollow, conical spines arranged in a linear series along the crest and decreasing in strength

adapically; anal tube not originating from varix, situated between each varix. Varices of last whorl each with broadly enlarged, sealed, straight or nearly straight, radial spines.

Average length of the type species: 21mm.

Included species

Hirtotyphis trispinosus Houart, 1991

Laevityphis Cossmann, 1903

Type species by original designation: *Typhis coronarius* Deshayes, 1865=*T. muticus* J. Sowerby, 1834, Eocene, France (Fig. 20H–I).

Short description: No laminar extension; teleoconch whorls with four axial varices; varices rounded, occasionally topped adapically by a vertical, hollow, conical spine; anal tubes not originating from varix, closer to preceding varix.

Average length of the type species: 7mm.

Included species

Laevityphis bullisi Gertman, 1969
L. libos Houart, 2017
L. tillierae (Houart, 1986) ● ◆
L. tubuliger (Thiele, 1925)

Monstrotyphis Habe, 1961

Type species by original designation: *Typhis (Typhinellus) tosaensis* Azuma, 1960, Japan (Fig. 20J).

Short description: No laminar extension; teleoconch whorls with four axial varices; varices narrow, frilled, spined or webbed; flange not extending farther than adapical portion of siphonal canal; straight, spinose or webbed, rarely smooth siphonal canal; anal tube not originating from varix, closer to preceding varix. Siphonal canal usually with the presence of a short or long, occasionally split and webbed spine, extension of ADP spiral cord.

Average length of the type species: 25mm.

Included species

Monstrotyphis adelos n. sp. ● ◆ ■
M. anapaulae Houart & Rosado, 2019
M. bivaricata (Verco, 1909)
M. carolinae (Houart, 1987) ● ◆ ■
M. goniodes Houart, Gori & Rosado, 2017
M. imperialis (Keen & Campbell, 1964)
M. jardinreinensis (Espinoza, 1985)

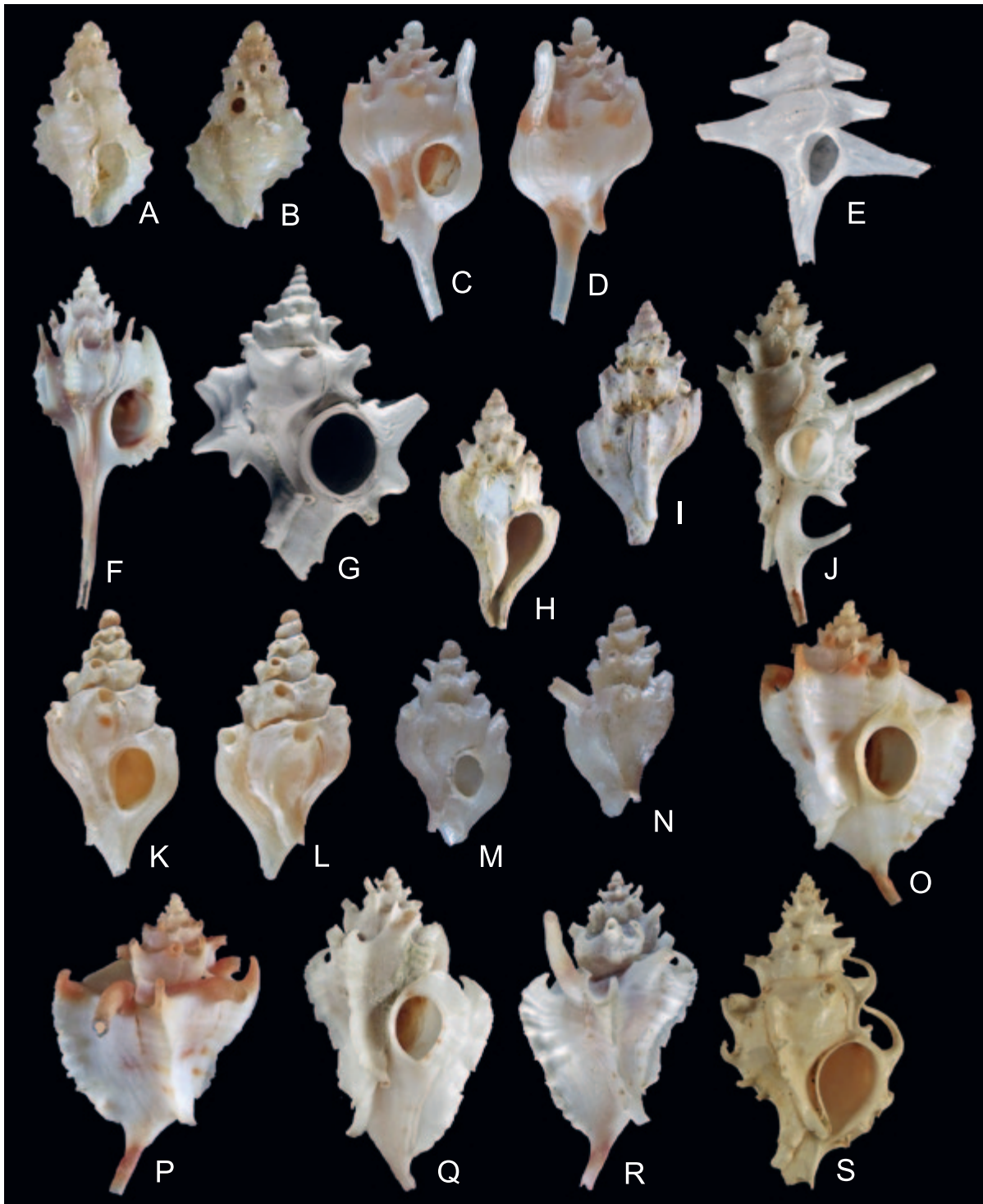


Figure 20 (type species of valid genera) **A–B** *Brasitytyphis barrosi* Absalão & Santos, 2003, Brazil, off Sergipe state, 37°05' S, 11°24' W, 99m, paratype RH, 3.3mm; **C–D** *Choreotytyphis pavlova* (Iredale, 1936), Australia, Queensland, off Cape Moreton, RH, 16.1mm; **E** *Distichotytyphis* Keen & Campbell, 1964, off the Panama-Costa Rica coast, 06°21' N, 85°17' W, 1892m, holotype AMNH 110459, 8.0mm (photo courtesy AMNH); **F** *Haustellotytyphis cumingii* (Broderip, 1833), West Mexico, Manzanillo, RH, 24.1mm; **G** *Hirtotytyphis horridus* (Brocchi, 1814), Italy, Siena, Pliocene, 19.3mm; **H–I** *Laevitytyphis muticus* (J. Sowerby, 1834), Paris Basin, France, Eocene, RH, 6.2mm; **J** *Monstrototytyphis tosaensis* (Azuma, 1960), South China Sea, RH, 25.4mm; **K–L** *Siphonochelus arcuatus* (Hinds, 1843), South Africa, Algoa Bay, RH, 12.8mm; **M–N** *Trubatsa longicornis* (Dall, 1888), Cuba, Bahia de Cochinos, 296–475m, RH, 4.5mm; **O–P** *Typhina belcheri* (Broderip, 1833), Senegal, south of Goree, RH, 16.4mm; **Q–R** *Typhinellus labiatus* (Cristofori & Jan, 1832), Tunisia, Kerkennah, RH, 20.1mm; **S** *Typhis tubifer* Bruguière, 1792, Paris Basin, France, Eocene, RH, 19mm.

M. maestratii n. sp. ● ◆ ■
M. montfortii (A. Adams, 1863)
M. pauperis (Mestayer, 1916)
M. sera Garrigues, 2021
M. singularis Houart, 2002 ● ◆
M. takashigei Houart & Chino, 2016
M. tangaroa Houart & Marshall, 2012
M. teramachii (Keen & Campbell, 1964)
M. tosaensis (Azuma, 1960)
M. yatesi (Crosse & Fischer, 1865)

Siphonochelus Jousseume, 1880

Type species by original designation: *Typhis arcuatus* Hinds, 1843, South Africa (Fig. 20K–L).

=*Eotyphis* Tembrock, 1963

Type species by original designation: *Typhis sejunctus* Semper, 1861, Upper Oligocene, Germany.

Remarks. The genus *Siphonochelus* is here restricted to the exclusion of the species previously included in the subgenus *Trubatsa* (Houart, 2013), following the preliminary findings of Barco *et al.* (2010) and our phylogenetic analysis.

Short description: No laminar extension; tel-eoconch whorls with four, rarely five axial varices; varices rounded, smooth, without spines; anal tubes weakly flattened at base, connected to succeeding varix; presence of a single intervarical fold close to preceding varix.

Average length of the type species: 16mm.

Included species

Siphonochelus aethomorpha Houart & Héros, 2015
S. angustus Houart, 1991 ● ◆
S. arcuatus (Hinds, 1843)
S. boucheti Houart, 1991 ● ◆ ■
S. generosus Iredale, 1936
S. hasegawai n. sp. ● ■
S. japonicus (A. Adams, 1863)
S. mozambicus Houart, 2017
S. nipponensis Keen & Campbell, 1964
S. pentaphasios (Barnard, 1959)
S. radwini Emerson & D'Attilio, 1979
S. riosi (Bertsch & D'Attilio, 1980)
S. rosadoi Houart, 1999 ● ■
S. solus Vella, 1961
S. stillacandidus Houart, 1985
S. syringianus (Hedley, 1903)
S. transcurrens (von Martens, 1902)

Trubatsa Dall, 1899

Type species by original designation: *Typhis longicornis* Dall, 1888, Cuba (Fig. 20M–N).

Remarks. Although previously treated as subgenus within *Siphonochelus* (Houart, 2013), our molecular analysis confirms preliminary results in Barco *et al.* (2010) that the species here included form a distinct lineage of equal rank, justifying the recognition of *Trubatsa* as valid genus.

Short description: No laminar extension; tel-eoconch whorls with four axial varices; varices rounded, smooth, without spines; tubes connected to succeeding varix; broad buttress connecting varix to preceding whorl; presence of a single axial intervarical fold; anal tubes with broad base, stretching across almost the entire intervarical area.

Average length of the type species: 9mm.

Included species

Trubatsa alinkios n. sp. ● ◆ ■
T. longicornis (Dall, 1888) (new combination)
T. lozoueti (Houart, 1991) ● ◆ ■ (new combination)
T. patera Garrigues, 2021 ■
T. saltantis (Houart, 1991) ● ◆ (new combination)
T. tityrus (Bayer, 1971) (new combination)
T. unicornis (Houart, 1991) ● ◆ ■ (new combination)
T. undulata (Houart, 1991) ● ◆ ■ (new combination)
T. virginiae (Houart, 1986) ● ◆ ■ (new combination)
T. wolffi (Houart, 2013) ● ◆ ■ (new combination)

Typhina Jousseume, 1880

Type species by original designation: *Typhis belcheri* Broderip, 1833, West Africa (Fig. 20O–P).

=*Talityphis* Jousseume, 1882

Type species by original designation: *Typhis expansus* Sowerby, 1874, East Atlantic

=*Typhisala* Jousseume, 1881 (new synonymy)

Type species by original designation: *Typhis grandis* A. Adams, 1855, Gulf of California

=*Typhisopsis* Jousseume, 1880 (new synonymy)

Type species by original designation: *Typhis coronatus* Broderip, 1833, eastern Pacific.

Remarks. The genera *Typhisala* Jousseaume, 1881 and *Typhisopsis* Jousseaume, 1880 are here synonymized with *Typhina* Jousseaume, 1880 based on the molecular phylogenetic tree that places *Typhis grandis* A. Adams, 1855 and *Typhis coronatus* Broderip, 1833, the respective type species of the two former genera, in the same clade with the other *Typhina* species included in the molecular analysis.

Short description: Presence of a laminar extension; teleoconch whorls with four flange-like or rounded, ropelike, frilled axial varices; varix with curved, sharp, shoulder spine; varical flange broadly expanded adapically, extending to midway or almost the tip of siphonal canal; occasionally with weak or moderately strong spiral sculpture; anal tube originating near preceding varix.

Average length of the type species: 21mm.

Included species

- Typhina belcheri* (Broderip, 1833)
T. campbelli (Radwin & D'Attilio, 1976)
T. carolskoglundae Houart & Hertz, 2006 (new combination, ex *Typhisopsis*)
T. clarki (Keen & Campbell, 1964) (new combination, ex *Typhisala*)
T. clarksoni n. sp. ●
T. claydoni (Houart, 1988) (new combination, ex *Typhisopsis*)
T. coronatus (Broderip, 1833) ● ■ (new combination, ex *Typhisopsis*)
T. expansa (Sowerby, 1874) ■
T. gabonensis (Garrigues, 2021)
T. grandis (A. Adams, 1855) ● ■ (new combination, ex *Typhisala*)
T. lamyi (Garrigues & Merle, 2014) ● ■ (new combination, ex *Typhinellus*)
T. latipennis (Dall, 1919)
T. neocaledonica (Houart, 1987) ● ◆
T. nitens (Hinds, 1843)
T. pallidus (Garrigues, 2021)
T. puertoricensis (Warmke, 1964)

Typhinellus Jousseaume, 1880

Type species by original designation: *Typhis sowerbyi* Broderip, 1833=*Murex labiatus* Cristofori & Jan, 1832, Mediterranean, East Atlantic (Fig. 20Q–R).

Short description: Presence of a laminar extension; teleoconch whorls with four flange-like, frilled axial varices. Varices constricted above the aperture and flaring at its abapical end; varical flange of last teleoconch whorl extending to almost the tip of siphonal canal; anal tubes situated near preceding varix, addressed to preceding laminar extension.

Average length of the type species: 17mm.

Included species

- Typhinellus amoenus* Houart, 1994
T. androyensis Bozzetti, 2007 ● ■
T. bicolor Bozzetti, 2007
T. constrictus Houart & Héros, 2015 ● ■
T. insolitus (Houart, 1991) ● ◆
T. jacolombi Houart, 2015
T. labiatus (Cristofori & Jan, 1832) ● ■
T. laminatus Houart & Héros, 2015
T. mirbatensis Houart, Gori & Rosado, 2015
T. oclusus (Garrard, 1963) ● ◆

Typhis Montfort, 1810

Type species by original designation: *Typhis tubifer* Bruguière, 1792, Eocene, France (Fig. 20S).

Short description: No laminar extension; four axial varices per whorl; varices rounded with hollow, conical spines arranged in a linear series along the crest and decreasing in strength adapically; anal tube not originating from varix, situated between each varix. Varices of last whorl each with backward curving, sealed spines of moderate size. Shoulder spine strongly adapically bent.

Average length of the type species: 22mm.

Included species

- Typhis phillipensis* Watson, 1883
T. ramosus Habe & Kosuge, 1971 ● ■
T. wellsii Houart, 1985
T. westaustralis Houart, 1991

Note: While the manuscript of this article was already with the publisher, four new species of Typhinae were described by Garrigues (2021): *Monstrotyphis sera* Garrigues, 2021 from Queensland, Australia; *Talityphis gabonensis* Garrigues, 2021 from Gabon, West Africa; *Talityphis pallidus* Garrigues, 2021 from Martinique and *Trubatsa patera* Garrigues, 2021 from Guadeloupe.

These four species have been included here in the appendix according to the classification adopted by the authors.

ACKNOWLEDGEMENTS

The first author would like to thank Philippe Bouchet (Muséum national d'Histoire naturelle, Paris) for entrusting him and allowing him to study the material collected during the deep-sea and other expeditions throughout the Indo-West Pacific, for information about the various expeditions and for constructive comments.

We are also grateful to Philippe Bouchet (MNHN), Yuri Kantor (A. N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia) and Anders Warén (Natural History Museum, Stockholm, Sweden) for preparation of radulae and for SEM work; to Manuel Caballer (MNHN) who provided most of the images of the MNHN holotypes, E-Recolnat Project: ANR-11-INBS-0004; to Kazunori Hasegawa (National Museum of Nature and Science, Tsukuba, Japan) for the digital images of the holotype of *Siphonochelus nipponensis* and *Monstrotyphis imperialis* and useful information; to the late Rudolf Kiliyas (Humboldt-Universität zu Berlin, Germany) and Matthias Glaubrecht, (then Humboldt-Universität zu Berlin, Germany, now in Centrum für Naturkunde an der Universität Hamburg, Germany), for the loan of the syntypes of *Laevityphis tubuliger* (Thiele, 1925); to Lisa Kirkendale and Corey Whisson (Western Australian Museum, Perth, Australia) for the images of the holotype of *Typhina claydoni* and for providing us with the registration number of the holotype of *T. clarksoni* n. sp.; to David Massemin (New Caledonia) for the images of the living *Monstrotyphis adelos* n. sp.; to Winston F. Ponder and the late Ian Loch (then Australian Museum Sydney) for the loan of the holotype and other material of *Typhinellus oclusus* (Garrard, 1963) and to Mandy Reid who recently provided me with digital images of the holotype; to Nicolas Puillandre, curator of the molecular collection (MNHN) who provided us with the GenBank and BOLD numbers assigned to the specimens used in the phylogenetic tree and for other information.

We are also very thankful to Virginie Héros and Philippe Maestrati (MNHN) for their help in searching for and sending specimens

in loan to the first author, and for relevant information.

This work was in part supported by 'Service de Systématique Moléculaire' (UMS 2700 2AD, MNHN, CNRS). This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 865101).

Marco Oliverio and another unknown referee are thanked for comments that improved the initial manuscript.

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