XXV REPORT ON A COLLECTION OF SUMATRAN MOLLUSCS FROM FRESH AND BRACKISH WATER

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(Plate XIV.)

INTRODUCTORY NOTE.

The collection on which this report has been based was made by Mr. J. E. A. den Doop and was submitted to me for examination. After a certain amount of preliminary work I was obliged by stress of official duties to hand it over to Dr. B. Prashad, who has worked it out in detail. The collection is very representative of the Molluscs of most types of fresh and brackish water in Sumatra. Only the true lacustrine forms and the bivalves of brackish water are poorly represented. The collection is particularly rich in Gastropoda from streams in the plains and mangrove-swamps on the coast. It has been of great assistance to us in working out similar elements in the fauna of the eastern districts of British India, and we may claim it as fortunate that it has been possible to consider the Molluscs of the two countries together.

The molluscan fauna of Sumatra is now at least as well known as that of any other similar area in the Eastern Tropics. It is very much better known, for example, than that of the Malay Peninsula or even that of many parts of Burma. The number of fresh- and brackish-water species that has been recorded from the island is two hundred and forty-six including sixty here recorded or described for the first time. Of the 246 species no less than 100 have been found in Mr. den Doop's collection. The thanks and congratulations of all malacologists are due to him, and we are particularly grateful in the Indian Museum for permission to retain a first set of the specimens. The remainder are to be sent to the Amsterdam Museum. The fact that a large proportion of the material is preserved in spirit with the soft parts intact is an interesting and important feature.

We have to thank Prof. Max Weber of Amsterdam not only for sending us in exchange specimens of a large proportion of the species described by the late Prof. E. von Martens from his own collections in the Malay Archipelago, but also for sending us on loan examples of the species of which no duplicates were available. This has not only rendered the report more authoritative but has greatly lessened the labour of its preparation. [N. ANNANDALE].

INTRODUCTION.

This report deals with a large collection of fresh- and brackish-water mollusca[1] made by Mr. J E. A. den Doop in Sumatra[2] during the years 1916—1918. Details about it are included in the introductory note by Dr. N. Annandale at the beginning of the report

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[1] The collection also includes large numbers of marine and land-molluscs, but these we are unable to deal with at present.

[2] The collections were made only in the northern part of the "Gouvernement Oostkust van Sumatra" and on the Isle of Sabang.

and need not be repeated here. I may note that the specimens in the collection had no locality-labels in the beginning, but their provenance was indicated by serial numbers, the details regarding their localities were later supplied to me by Mr. den Doop and these have been filled in the paper according to the list sent me. All available details regarding habitat and distribution of the various species have been included. Detailed synonymies are not given except in special cases; in others references to von Martens' paper (*Süss- und Brackwasser-Mollusken des Indischen Archipelago.* in *Zool. Ergeb. Nieder. Osi-Indien* IV, and to papers published since that date only are necessary.

Owing to the little information available it is not possible for me to discuss in detail the geographical distribution and relationships of the species represented in the collection but a close connection between most of the freshwater species of Sumatra and continental Indian forms is quite apparent. This is particularly well marked in the families Planorbidae, Melaniidae and Viviparidae. Indeed some of the forms from Sumatra are quite indistinguishable from the true Indian species.

In the case of the estuarine forms also we find the same relationships, but this probably has much less value in this case than for the freshwater forms, because a large proportion of the species have an extremely wide range.

The most useful summary of all that was known about the distribution of the fresh and brackish-water species of Sumatra was given by the late Prof. E. von Martens in the Zoological Results of Prof. Max Weber's collections in the Indo-Australian Archipelago. For comparison I give below von Martens' list together with a list of species described since his paper was published; and also a list of the species found in Mr. den Doop's collection. In addition to the references given in von Martens' paper the following more recent publications on Sumatran molluscs may be consulted.

1898. Aldrich, T H. "Notes on some land and freshwater shells from Sumatra with descriptions of new species." *Nautilus*, XII, pp. 1–4, pl. i.

1899. Dautzenberg, P. "Contribution à La Faune Malacologique De Sumatra." *Ann. Soc. Roy. Malacol. Belgique*, XXXIV, pp. 1–26.

1900. Martens, E. von. "Ueber Land und Susswasser Schnecken aus Sumatra." *Nachr. Deutsch. Malakozool. Ges.* XXXII, pp. 3–14.

1903. Martens, E. von. "Die beschalten Gastropoden der deutschen Tiefsee expedition." *Valdivia Reports*, VII, pp. 1–146.

1906. Bullen, R. "On some land and fresh-water molluscs from Sumatra." *Proc. Malacol. Soc.* VII, pp. 12–16 and 126–130.

1908. Rolle, H. "Zur Fauna von West Sumatra." *Nachr. Deutsch. Malakozool. Ges.* XL, pp. 63–69.

I have not included references to the monographs in Martini and Chemnitz "Systematisches Conchylien Cabinet" published during the recent years.

I have also here to express my great indebtedness to Dr. N. Annandale for the great help he gave me while I was working out this collection and for his valuable advice given ungrudgingly at all times.

	von Martens' list (1897).	Species described or recorded since von Martens' paper in 1897.	Mr. den Doop's collection.
GASTROPODA.			
PULMONATA.			
AURICULIDAE.			
Pythia ...	*pantherina, undata*	*scarabeus, imperforata.*	*trigona, plicata, undata.*
Cassidula ...	*auris-felis, multiplicata, mustelina.*	... ...	*auris-felis.*
Auricula ...	*midae, judae, scheepmakeri.*	... ...	*midae, judae, limnaeiformis* (sp nov.).
Melampus ...	... ...	*fasciatus* ...	*percha* (sp. nov.).
LIMNAEIDAE.			
Limnaea ...	*javanica, brevispira*[1]	*javanica* var. *angustior, excavata, bongsonensis.*	*javanica* and vars. *intumuscens, subteres, angustior, porrecta, costulata* and *turgidula.*
PLANORBIDAE.			
Planorbis (in part) = *Indoplanorbis.*	*indicus* = *exustus*...	... ...	*exustus.*
Planorbis (in part) = *Gyraulus.*	*sumatranus, proclivis.*	*sagoensis* (probably a *Gyraulus*).	*convexisculus, sumatranus, proclivis.*
Segmentina ...	... ...	*kennardi* ...	*calathus.*
Isidora = *Physastra*	*sumatrensis, stagnalis.*	... ...	*doopi* (sp. nov.).
PROSOBRANCHIA.			
AMPULLARIIDAE.			
Ampullaria (in part) = *Pachylabra.*	*ampullacea, involuta, scutata=conica.*	*ampullacea* var. *sumatrensis.*	*conica, ampullacea* vars. *typica* (= *celebensis*), *sumatrensis* and *magnifica.*
VIVIPARIDAE.			
Vivipara ...	*grassicosta, sumatrensis, hamiltoni, ingalsiana.*	*javanica, javanica* var. *sumatrana, sumatrensis, deliensis.*	*sumatrensis, hendrici,* (sp. nov.), *javanica* with vars. *laevior, saleyerica, moussoni, scalaris, borneensis.*

[1] Dr. Annandale and I have recently established (*Proc. As. Soc. Bengal*, XIV, pp. 460—462, pl. xii, figs. 4, 4*a* and text-fig. 2) the genus *Omia* for a Japanese species and we believe that the Sumatran *L. brevispira* also probably should be assigned to it.

	von. Martens' list (1897).	Species described or recorded since von Martens' paper in 1897.	Mr. den Doop's collection.
Hydrobiidae.			
Bithynia ...	... ..	... ...	*truncata.*
Pachydrobia ...	*lacustris.*		
Stenothyra ...	... ...	*weyersi.*	
Assimineidae.			
Assiminea ...	... ...		
Subg. *Cyclotropis.*	*carinata, banka, lirata.*		
Littorinidae.			
Littorina.			
Subg. *Littorinopsis.*	*scabra, intermedia, carinifera, undulata.*	... ...	*scabra, intermedia, rinifera, conica.*
Subg. *Nodilittorina*	*vilis.*		
Subg. *Melarraphe.*	*ventricosa* var. *subgranosa, biangulata.*		
Melaniidae.			
Protia = *Acrostoma*...	*sumatrensis, episcopalis, curvicosta, subplicata, verbecki, papillosa, stricticosta, zollingeri.*[1]	*indragirica, curvicosta* var. *prestoniana.*	*variabile,* vars. *sumatrensis, infracostata, binodulifera, pseudospinosa* and *menkeana.*
Melania (*Stenomelania, Melanoides, Plotia, Tarebia* and *? Sermyla,* all=*Melanoides*).	*bisinuata, laevigata?, crepidinata, tuberculata, pulchella, scabra, granum, datura, spectabilis, granifera, lineata, flavida, dissimulans, riqueti, pinguiuncula.*	*mucronata, arctecava, javanica, rustica, perplicata, sobria, rudis, pagoda* var. *costulata, savinieri, javanica, acanthica. distinguenda, livata* (= *semigranosa*), *palembangensis, datura, unifasciata, sykesi, kobelti.*	*aspirans, plicaria, acutissima, turris, monile, crenulata, uniformis, litigosa, tuberculata,* vars. *seminuda, virgulata, angularis* and *truncatula*; *scabra,* vars. *nodosocostata, angulifera* and *mutica*; *semigranosa, sluiteri* (sp. nov).
Melania, s.s. ...	*cybele* (*amara*), *setosa?, bocki, snellmani.*	*setosa, mitra* (probably same as *cybele*), *rudis, winteri, berkoltzi.*	
Faunus ...	... ...	*ater.*	
Paludomus ? ...	*olivacea.*		
Cerithiidae.			
Potamides ...	... ...		
Subg. *Terebralia* ...	*palustris, sulcatus.*		
Subg. *Telescopium.*	... ...	... ...	*telescopium.*
Subg. *Tympanotonos.*	*cingulatus* (*fluviatilis*).	... ...	*cingulatus, microplerum.*
Subg. *Cerithidae* ...	*ornatus, charbonnieri*	*cornea, weyersi* ...	*obtusum, quadratum.*
Nassidae.			
Canidia ...	... ...	*theminckiana* ...	*helena, theminckiana.*
Clea	*bocki*	... ...	*bocki.*

[1] I have given these names as they stand in von Martens' list, without attempting to give their correct names for want of sufficient material.

	von. Marten's list (1897).	Species described or recorded since von Marten's paper in 1897.	Mr. den Doop's collection.
NERITIDAE.			
Neritina.			
Subg. *Auriculatae* = *Neripteron.*	*auriculata* ...	... ...	*simoni* (sp. nov.).
Subg. *Mitrulae* = *Dostia.*	*crepidularia* ...	... ...	*crepidularia* with vars. *melanostoma* and *exaltata; weberi* (sp. nov.).
Subg. *Hemispheri-cae*=*Clypeolum.*	*iris, pennata* ...	*pulligera.*	
Subg. *Sulculosae* ...	*guerini,*		
Subg. *Aculeatae* ...	*aculeata.*		
Subg. *Serratae* = *Neritae.*	*gagates*?, *variegata, zizac, communis* ?, *turrita.*	*turrita* var. *semiconica.*	*zizac, variegata.*
Subg. *Neritodryas*	*cornea*	... ...	*cornea.*
Subg. *Clithon* ...	*brevispira, subpunctata, solium, ualensis.*	*cliadema* ...	*brevispina, squarrosa.*
		... ...	*lineata, planospira.*
Nerita	*lineata, planospira*	*tessellata* with vars.	*tessellata* with vars.
Septaria ...	*sculpta, suborbicularis, tessellata.*	*clypeolum, insignis, compressa, lineata.*	*clypeolum, compressa* and *lineata.*
PELECYPODA.			
OSTREIDAE.			
Ostrea s.s. ...	... ...	... ...	*gryphoides.*
Subg. *Alectryonia*	*cucullata* ...	... ...	*folium, cuculata.*
ARCIDAE.			
Arca	*granosa.*		
UNIONIDAE.			
Unio (genus doubtful).	*macropterus* ...	*stolatus.*	
Schizocleitherium. ...	... ...	*hajakomboensis.*	
Pilsbryoconcha ...	... ...	*exilis, expressa.*	
Contradens ...	*hageni, dimotus* (= *Unio sumatrensis*, Lea), *verbecki.*	*laticeps* ...	*dimotus* var. *lugens.*
Rectidens ...	*sumatrensis* (=*Unio sumatrensis*, Dnkr.) *palembangensis.*	*gracilis, pressirostris.*	
Physunio ...	*superbus.*		
Monodontina ...	... ...	*vondembuschianus*...	*vondembuschiana*, var. *chaperi.*
Pseudodon ...	... ...	*bicristatus.*	
Trapezoideus ...	*peninsularis* (=*Unio sumatrensis*, Sow.)		
Diplodon ...	*novo-Hollandiae*(= *Unio cucumoides*, Lea).		
LUCINIDAE.			
Lucina (*Anodontia*)...	*phillipinarum.*		
CYRENIIDAE.			
Cyrnae ...	*sumatrensis* ...	... ...	*sumatrensis.*
Batissa ...	*jayensis* ...	*sphaericula, violacea* var. *discoidea.*	

	von. Marten's list (1897).	Species described or recorded since von Marten's paper in 1897.	Mr. den Doop's collection.
Corbicula ...	*moltkeana, tumida, ducalis, trapezoidea, angulifera, pullata, lacustris. gibba.*	*gustairana, tobae, sulcata, moussoni, subrostrata.*	*moltkeana, trapezoidea, angulifera, pullata.*
Sphaerium ...	... ...	... ...	*ceciliae* (sp. nov.).
Pisidiam ...	*sumatranum.*		
GLAUCOMYIIDAE.			
Glaucomya ...	*sumatrensis.*		
PSAMOBIIDAE.			
Elizia ...	*orbicularis.*		
Psmamotellina ...	*palleus.*		
Asaphis ...	*rugosa.*		
SOLENIDAE.			
Siliqua ...	*radiata, winteriana.*		
Cultellus, s.s. ...	*attenuatus.*		
Subg. *Pharella* ...	*javanicus* ...	... ...	*javanicus.*
PHOLADIDAE.			
Teredo ...	... ...		
Subg. *Cuphus* ...	*arenaria* ...	... ...	*arenaria.*

Family AURICULIDAE.

Genus **Pythia**, Link.

Specimens of three species of this genus are represented in the collection. Of these *P. undata* was the only form hitherto collected from Sumatra. The other two species *P. trigona* and *P. plicata*, though known from the adjacent islands, had never been taken in Sumatra. *P. pantherina* has also been recorded from Sumatra by von Martens, but is not represented in the present collection.

Pythia trigona (Troschel).

1897. *Pythia trigona*, von Martens, *op. cit.*, pp. 130, 131, pl. viii, fig. 1.

This widely distributed species had, as noted above, been never recorded from Sumatra before. It is represented in Mr. den Doop's collection by a few specimens collected in the mangrove-swamps at Belawan (Deli) and at a pematang [1] in the estate of Batang Kwis (Serdang) also near the mouth of the Soengei Batang Kwis (Serdang). All the specimens are quite typical.

[1] A pematang is an old sandy strand ridge along the coast formed by elevation of the land as yet situated in the mangrove-swamps or (older) fresh-water swamps near the coast. [den Doop].

Pythia plicata (Fer.).

1897. *Pythia plicata*, v. Martens, *op. cit.*, pp. 131–133.

The only specimen of this species was collected in the mangrove-swamps at Belawan (Deli). I have no doubt as to its correct identification.

Pythia undata (Less.).

1897. *Pythia undata*, v. Martens, *op. cit.*, pp. 139–140.

A single specimen of this species, collected in the mangrove-swamps at Belawan (Deli), is represented in the Sumatran collection.

Genus Cassidula, Fer.

Cassidula auris-felis (Brug.).

1897. *Cassidula auris-felis*, v. Martens, *op. cit.*, pp. 141, 142, pl. viii, figs. 12-14.

A large number of specimens of this variable species were collected in the mangrove-swamps at Belawan (Deli), from the mouth of the Soengei Batang Kwis (Serdang) and at Perbaoengan (Serdang). Most of these resemble fig. 13 of von Martens, but a few are like fig. 14 as regards the shape of the mouth.

Genus Auricula, Lam.

This genus is represented by four species, two of which are new. The descriptions of these new forms were drawn up by Dr. Annandale and are here included to make the account of Mr. den Doop's collection complete.

Auricula midae (Linn.).

1897. *Auricula Midae*, v. Martens, *op. cit.*, pp. 150–152.

I have adopted with von Martens the name *A. midae* in preference to the name *A. auris-Midae* used in Küster's Monograph in Martini and Chemnitz *Conch. Cab.*

A fairly full account of the anatomy of the species is included in Quoy and Gaimard's work [1] and the radular teeth are also figured.

In the Sumatran collection it is represented by a few specimens collected in the mangrove-swamps at Perbaoengan (Serdang) and at Belawan (Deli). A few were also collected on the sea-shore at Perbaoengan (Serdang).

Auricula judae (Linn.).

1897. *Auricula Judae*, v. Martens, *op. cit.*, pp. 154–158, pl. vii, figs. 6—11.

Von Martens has treated the question of the various forms of this variable species in great detail, and published good figures.

In the Sumatran collection there are three specimens collected by Mr. den Doop along with those of *A. midae* in the mangrove-

[1] *Voy. Astrolabe Zool.* II, p. 156, pl. xiv, figs. 1—14 (1832).

swamps at Belawan (Deli) and on the sea-shore at Perbaoengen (Serdang). Two of the specimens resemble fig. 7 of v. Martens, and one is like his fig. 11.

Auricula limnaeiformis, Annandale (sp. nov.).

(Plate xiv, figs. 1, 2).

Shell of moderate size, imperforate, very thin, spindle-shaped, acuminate, with the anterior extremity bluntly pointed if examined microscopically; the greatest diameter about $\frac{3}{5}$ the height. Suture somewhat impressed, hardly oblique. Spire rather narrowly conical, $\frac{1}{2}$ the length of the body-whorl, with seven complete whorls; its whorls not at all swollen, increasing gradually and evenly. Body-whorl triangular, very little swollen, almost bilaterally symmetrical. Mouth long and narrow, sharply pointed posteriorly and bluntly pointed anteriorly; its main axis forming an acute angle with that of the shell; outer lip thin; columellar and parietal teeth rather feebly developed. Periostracum thin, bright olive-green, rather dull. Longitudinal sculpture obscure, irregular, spiral sculpture on the spire consisting of numerous guttate lines confined to the upper half of each whorl, similar lines covering the whole of the body-whorl but much stronger over the posterior region than over the greater part of its area. On this posterior region irregular longitudinal branching ridges can also be detected with the aid of a hand lens.

Measurements of shells (in millimetres).

	A (Type).	B.
Height	28·5	19·5
Maximum diameter	16	11·1
Height of mouth	19	13·2
Maximum diameter of mouth ...	7	5

The two shells of this interesting species were obtained by Mr. den Doop at Perbaoengan (Serdang).

The shell of this species is remarkable for its thinness and for the absence of any thickening of the lip. It is somewhat *Limnaea*-like in appearance. Nothing is known about its anatomy.

Auricula percha, Annandale (sp. nov.).

(Plate xiv, figs. 3, 4).

Shell of fair size, spindle-shaped, imperforate, moderately thin, slightly corroded at the posterior extremity but apparently blunt, with the anterior extremity bluntly pointed, the greatest diameter about $\frac{1}{2}$ the height. Five and a half whorls in all. Suture not impressed and slightly oblique. Spire broadly connoidal, contained about $3\frac{3}{4}$ times in the body-whorl; last whorl as high as the first two taken together. Body-whorl long, narrow and ovoid, not at all swollen, bluntly pointed anteriorly, bilaterally asymmetrical. Mouth long and narrow, sharply pointed pos-

teriorly and narrowly rounded anteriorly, its main axis forming an acute angle with that of the shell, the outer lip with a well defined internal ridge but sharp at the edge; columellar tooth obsolete, parietal of moderate size. Periostracum thin, bright chestnut, streaked on the body-whorl with irregular deep brown longitudinal stripes; longitudinal sculpture consisting of irregularly sinuate lines; the whole surface covered with minute tubercular spiral lines, which become gradually less well developed from behind forwards but never disappear altogether.

The single specimen of this shell, collected by Mr. den Doop in a mangrove-swamp at Batang Kwis (Serdang), measures 36·7 mm. by 18·2 mm., the mouth measures 26·7 mm. by 8·5 mm.

The shell resembles *A. morchi*, Menke, in outline and colour, but it is evidently thinner and has the suture less impressed and the parietal tooth much better developed. The mouth also is more elongate and the lip much thinner. The species is interesting as providing a link between the large thick-shelled forms of the genus and the small thin-shelled species.

Family LIMNAEIDAE.

Genus **Limnaea**, Lamarck.

Two species of this genus, *L. javanica* (Mouss.) and the highly peculiar *L. brevispira*, v. Martens, have been recorded from Sumatra,[1] but only the former is represented in the present collection.

Limnaea javanica (Mouss.).

1849. *Limnaeus succineus* var. *javanica*, Mousson, *Moll. Java*, pp. 42, 43, pl. v, fig. 1.
1897. *Limnaea javanica*, v. Martens, *op. cit.*, p. 3.
1899. *Limnaea javanica*, Dautzenberg, *Mem. Soc. Roy. Malacol. Belgique*, XXIV, p. 8.
1912–1913. *Limnaea javanica*, var., Schepmann, *Proc. Malacol. Soc. London*, X, pp. 235, 236.

Mousson described this species as a variety of *Limnaea succinea*, Desh., but as v. Martens and others have shown, the species, though allied to it, is quite distinct. It may also be noted here that *L. succinea*, Desh. is only a synonym or at the most a form of *L. luteola*, Lam.

In the Sumatran collection this variable species is represented by a large series of specimens from various localities. None of the specimens belong to the typical form, but specimens of the following six forms described by v. Martens are present:—*intumuscens*, *subteres*, *angustior*, *porrecta*, *costulata* and *turgidula*. Besides the above there are a few individuals which it is not possible to assign to varietal rank.

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[1] Prof. Max Weber collected especially in the western south half of Sumatra. These regions are geologically more related to Java, whereas the north half of Sumatra generally has more relations to the continent of Asia. [den Doop].

var. **intumuscens**, v. Martens.

1881. *Limnaea Javanica* var. *intumuscens*, v. Martens, *Conch. Mitth.* I, p. 88, pl. xvi, figs. 2-4.
1897. *Limnaea javanica* var. *intumuscens*, v. Martens, *op. cit.*, p. 3, pl. i, fig. 5.
1898. *Limnaea javanica* var. *intumuscens*, Sarasin, P. and F., *Süssw. Moll. Celebes*, p. 89.
1900. *Limnaea javanica* var. *intumuscens*, v. Martens, *Nachr. Malakozool. Ges.* XXXII, p. 10.
1912–13. *Limnaea javanica* var. *intumuscens*, Schepmann, *op. cit.*, pp. 235, 236.

This variety is one of the lake-forms of this species and shows the characters of the lake-forms.

Specimens closely agreeing with a specimen identified by the later Dr. E. von Martens and with his published figures are represented in the collection from freshwater areas at Mariendal (Deli), Poengei (Langkat), the Soengei Bohorok and Anak Laut (a freshwater lake in the isle of Sabang). Some young specimens from pools in the Lau Kling Valley and the Lau Goemba Valley (Karo-Batak High Plain) near Brastagei also seem to belong to this form. There are a few examples with the locality label "Mangrove, Belawan (Deli)." Probably they had been carried into this area with the fresh-water flowing into it, if the labels have not got mixed.[1]

This form is already recorded from Java, Sumatra and Celebes.

var **subteres**, v. Martens.

1881. *Limnaea Javanica* var. *subteres*, v. Martens, *op. cit.*, p. 88, pl. xvi, figs. 6, 7.
1897. *Limnaea javanica* var. *subteres*, v. Martens, *op. cit.*, p. 4.

This form appears from the shell-characters to be a stream-phase of *L. javanica*. It is represented in the collection by many specimens from the Valley of the Lau Kling (Karo Batak High Plain) and Soengei Landak (Upper Langkat). All the specimens, though rather small, are fully typical.

This form is also known from the Celebes.

var. **angustior**, v. Martens.

1881. *Limnaea Javanica* var. *angustior*, v. Martens, *op. cit.*, pp. 88, 89, pl. xvi, fig. 9.
1897. *Limnaea javanica* var. *angustior*, v. Martens, *op. cit.*, pp. 4, 5, pl. I, fig. 7.
1898. *Limnaea javanica* var. *angustior*, Sarasin, F. and P., *op. cit.*, p. 89.
1900. *Limnaea javanica* var. *angustior*, v. Martens, *op. cit.*, p. 10.

L. javanica var. *angustior* appears to be a true stream-phase of the species in spite of the fact that v. Martens has recorded

[1] At many places the mangrove-swamps (mangrove-bosschen) pass gradually into fresh-water swamps (moreas-bosschen). At some places these two areas are only separated by a pematang. A sharp limit in plant growth does not exist. The shells mentioned are from such regions. [den Doop].

some specimens from ponds at Makassar. The elongate, slender form of the shells clearly points to their having had this habitat.

In the collection the specimens of this phase are from a streamlet next Timbang Langkat.

var. **porrecta**, v. Martens.

1881. *Limnaea Javanica* var. *porrecta*, v. Martens, *op. cit.*, p. 89, pl. xvi, figs. 9, 10.
1897. *Limnaea javanica* var. *porrecta*, v. Martens, *op. cit.*, p. 5.
1898. *Limnaea javanica* var. *porrecta*, Sarasin, P. and F., *op. cit.*, p. 89.

This form, which is still more elongate than the var. *angustior* and has a much longer and more regular spire, has been recorded from Sumatra by von Martens. It is also known from Java and the Kupang Islands, Timor.

The only specimens I assign to it were collected in a fresh-water area near Tandjong Djatti (Langkat). All the specimens are rather young, but I have no doubt as to their identification.

var. **costulata**, v. Martens.

1897. *Limnaea javanica* var. *costulata*, v. Martens, *op. cit.*, p. 2, figs. 3–7, pl. xii, figs. 2, 4.

This variety was described by von Martens from specimens collected by Prof. Max Weber in Tjipanas, Java, and I have, through the courtesy of Prof. Max Weber, had a chance of examining one of the co-types.

Mr. den Doop's specimens are from a streamlet near Timbang Langkat, and a few young specimens from near Medan. The costae on the shells are not so well developed as in the co-type, but there is no doubt that the shells belong to the variety.

var. **turgidula**, v. Martens.

1897. *Limnaea javanica* var. *turgidula*, v. Martens, *op. cit.*, p. 4, pl. i, fig. 6.

This elegant form is known only from Sumatra. My specimens closely agree with one of von Martens' co-types and his figure of the shell. They were collected in the Valley of the Lau Goemba [1] (Karo-Batak High-Plain) near Brastagei and from the stream Soengei Landak (Upper Langkat).

Family PLANORBIDAE.

Genus **Indoplanorbis**, Annandale and Prashad.

Recently Dr. Annandale [2] and I have found it necessary to separate the common Indian species hitherto known as *Planorbis*

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[1] I remember that I collected here many specimens of a *Limnaea* among which there were some two per cent of left-handed shells. They were from a little rice-field in the valley beneath. [den Doop].

[2] *Ind. Journ. Med. Research*, VIII, p. 113 (1920).

exustus, Deshayes, as the type of a distinct genus on purely anatomical grounds. A full account of the animal and our reasons for adopting this course are given in a paper shortly to be published in the *Records of the Indian Museum*, but a few notes are included here to facilitate reference.

Indoplanorbis exustus (Deshayes).

1834. *Planorbis exustus*, Deshayes, *Voyage Belanger Indes-Orient. Zool.*, p. 417, pl. i, figs. 11–13.
1836. *Planorbis indicus*, Benson, *Journ. As. Soc. Bengal* V, p. 743.
1856. *Planorbis Coromandelicus* and *P. zebrinus*, Dunker, in *Mart. Chemn. Conch.-Cab*, pp. 43, 57, pl. vi, figs. 14–16, 20, 22, and pl. vi, figs. 11–13.
1876. *Planorbis exustus*, ? *P. zebrinus* and *P. Merguiensis*, Hanley and Theobald, *Conch. Ind.*, pp. XVIII and 18, 60, pl. xl, fig. 1, pl. cli, figs. 5, 6.
1878. *Planorbis exustus P. Coromandelicus*, *P. eburneus*, *P. brunneus*, *P. Merguiensis* and *P. orientalis*, Sowerby in *Reeve's Conch. Icon.*, pl. iv, figs. 31, 34; pl. v, figs. 38 *a—c*, 40*a*, *b*; pl. xi, fig. 85 and fig. 89.
1897. *Planorbis exustus* (*Coromandelicus*, Beck, *Indicus*, Benson), v. Martens, *op. cit.*, p. 12.
1915. *Planorbis exustus* with vars. *eburneus*, *brunneus* and *zonatus*. *P. zebrinus*, *P. orientalis* and *P. Merguiensis*, Preston, *Faun. Brit. Ind. Freshw.-Moll.* pp. 115–118.

Dr. L. Germain of the Paris Museum, after a detailed examination of numerous shells of this species in the large collection of Planorbidae [1] in the Indian Museum has concluded that the various so-called species (with the exception of *P. orientalis*, Lamarck), included in the synonymy given above are all synonymous and should be known as *P. exustus*, Deshayes. I include *P. orientalis*, Lamarck, also in this synonymy as the differences noted by Lamarck [2] are of the same nature as the variations exhibited so commonly by this very variable species. The reasons that prompted Dr. Annandale and myself to create the new genus *Indoplanorbis* may be briefly stated as follows:—The branchial process is not a simple structure as in other members of the genus *Planorbis*, Geoff., but is distinctly lobed, the radula is rather large and broad and the penis is a long cylindrical tube without any stylet or retractor muscles.

Von Martens (*loc. cit.*) recorded the occurrence of this species from near Deli, Sumatra and in the present collection there are large numbers of specimens from various localities. Dr. L. Germain in his "Catalogue," referred to already, has discussed at length the variations exhibited by this species in the form of the spire, the mouth-aperture, the size of the shell, its colour and structure, and the sculpture on the various whorls. All these

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[1] The results of Dr. Germain's work on the Indian Museum collection are being published as a special volume in the *Records of the Indian Museum*, and I have had the advantage of consulting the original manuscript and drawings of this valuable work.

[2] *His. Nat. Anim. Vertebres*, 2nd edition, p. 385 (1838).

points are beautifully illustrated by the large Sumatran collection before me and I include below a few notes regarding the shells of different types from the various localities.

Most of the shells are from fresh-water areas on the outskirts of Deli. They consist of many lots collected at different times by Mr. den Doop and Mr. J B. Corporaal at Medan, Medan Estate, Padang Boelan and Mariëndal Soengei. These lots include shells of different types, varying in colour from pale yellow to dark brown and even black. The last are of this colour owing to a black deposit on their surface. The sculpture also is variable, some of the shells are quite smooth, others have delicate oblique striae more marked on the body-whorl than elsewhere, while in some cases the striae are so prominent as to look like low ridges. The shape of the aperture is also different, in some shells it is nearly subcircular, not much higher than broad, in others it has a distinct campanulate appearance, while others still show a distinct angulation, making the curvature much less regular but more prominent and the upper side rather straight. Young *Physa*-like shells in the earlier stages of development as recorded by Annandale [1] and Germain among Indian specimens are also present. A few shells resemble the *coromandelicus* form, others are identical with *zebrinus*, and a few others resemble the figures of *brunneus* and *eburneus* in Sowerby's monograph.

Other Sumatran localities from which the species was collected are rice-fields at Perbaoengan (Serdang), Serdang Estate; Batang Kwis; in a fresh-water lake near Perbaoengan; Anak Laut (in the isle of Sabang); and a streamlet near Timbang Lankat. These shells are also of the same types as the ones from Deli, except those collected from the Timbang Langkat streamlet, which are rather smaller, have a smaller mouth and have the striae on the surface much coarser.

The following are the measurements (in millimetres) of some shells from various localities :—

Locality.	Maximum diameter.	Minimum diameter.	Total Height.	Diameter of aperture.	Height of aperture.
1. Medan Estate ...	12	10	5	5·8	6
2. Near Medan ...	15·7	13	6·8	6·9	7·8
3. Rice-fields (Serdang) ...	14·6	12·2	6·3	6·4	7·7
4. Padang Boelan ...	15·5	13·2	6	6·8	8·6
5. Near Perbaoengan.	11·5	9·5	5·5	6	6·8
6. Streamlet at Timbang Langkat ...	10·1	8·4	5·6	4·6	6·5

Genus **Gyraulus**, Agassiz.

Gyraulus convexiusculus (Hutton).

1897. *Planorbis compressus*, v. Martens, *op. cit.*, pp. 13, 14, pl. i, figs. 17–21 ; pl. xii, figs. 7, 10.

[1] *Rec. Ind. Mus.* XIV, pp. 111, 112, figs. 1, 1*a* (1918).

1919. *Gyraulus convexiusculus*, Annandale and Prashad, *Rec. Ind. Mus.* XVIII, pp. 52–54, figs. 6*c*, 7*b*, 8*b*.
1920. *Gyraulus convexiusculus*, Annandale, *Rec. Ind. Mus.* XVIII, p. 148.

As has been recently shown by Dr. Annandale and myself the correct name for the species identified as *Planorbis compressus* by von Martens is *G. convexiusculus*. In the same paper we have published figures of the shell, the radula and the genitalia. I have now compared a shell from Makassar, Celebes, identified by the late Dr. E. von Martens as *P. compressus* with Indian and Mesopotamian specimens and have no doubt that they are identical.

The specimens before me are from freshwater areas at Padang Boelan and from Anak Laut (a fresh-water lake) at Sabang.

Gyraulus sumatranus (v. Martens).

1897. *Planorbis sumatranus*, v. Martens, *op. cit.*, p. 12, pl. i, figs. 8–10; pl. xii, figs. 6–9.

An examination of one of von Martens' co types from Danau di bawah, Sumatra, has confirmed my impression that this species also belongs to the genus *Gyraulus* and not to *Planorbis*, as von Martens believed.

In the present collection the species is represented by a number of small specimens from Anak Laut (Sabang), collected along with those of *P. convexiusculus* and *G. proclivis*.

Gyraulus proclivis (v. Martens).

1897. *Planorbis proclivis*, v. Martens, *op. cit.*, pp. 12, 13, pl. i, figs. 11-16.

This species also belongs to the genus *Gyraulus*. The few specimens of it were collected along with those of the other two species of the genus in the freshwater lake Anak Laut (Sabang).

Genus Segmentina, Fleming.

Segmentina calathus (Benson).

1897. *Planorbis* (*Segmentina*) *calathus*, v. Martens, *op. cit.*, p. 15.
1917. *Segmentina calathus*, Annandale and Prashad, *Rec. Ind. Mus.* XVIII, pp. 56, 57, figs. 5D (not F) and 8C.

A few dry shells of this widely distributed species are represented in the collection from near Medân. The specimens are all rather small in size, and are of a shining amber colour.

Genus Physastra, Tapparone-Canefri.

In a recent paper Annandale [1] has discussed the question of the synonymy of the genus *Bullinus*. Shortly before this Hedley [2]

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[1] *Rec. Ind. Mus.* XV, pp. 167, 168 (1918).
[2] *Rec. Aust. Mus.* XII, p. 18, pls. i, ii (1917).

had published critical notes of the Victorian species of *Bullinus* but his conclusions do not seem to be quite correct. He separated, with Tate,[1] a group of species in which the columella has no fold (*Isidora* with *Isidorella* as a synonym) from others with a distinct columellar fold (*Bullinus*). The name Isidora, however, as Cook[2] and Annandale have shown is strictly synonymous with *Bullinus*, and Hedley's conclusions, therefore, are inaccurate so far as it is concerned. The position, so far as can be judged from the available literature and the material at my disposal, is as follows :— The name *Bullinus*[3] under the circumstances should be reserved for the more globose type of shells without any or with a poorly developed columellar fold ; this will include the genus *Isidorella*, Tate, or what Hedley designated as *Isidora ;* while the more elongate shells with *Limnaea*-like facies and with a distinctly produced spire and with the characteristic columellar fold may be separated as *Physastra*, Tapparone-Canefri.[4] It is possible that this name may be synonymous with the much earlier name *Pyrgophysa*, Crosse,[5] but there is much uncertainty as to the structure of the type-species *P. mariei*. So far as the form of the shell is concerned *Pyhsastra* seems to bear the same relation to *Bullinus* as *Aplecta* does to *Physa*, but there is clearly less anatomical difference.

I regard *Physastra* as a genus rather than a subgenus of *Bullinus* as the difference between the two genera are, in my opinion, of sufficient importance to separate them as such. They are, however, very closely related. As understood by me the genus *Physastra* would include *P. vestita*, Tapparone-Canefri, from New Guinea, the species *sumatrana*, *ovalina*, *minahassae*, *timorensis*, *celebensis* and *stagnalis* from the Dutch East Indies referred to the genus *Isidora* by v. Martens (*loc. cit.*, pp. 6–11), Bollinger's *badae* and doubtfully *sarsinorum*[6] and probably most of the long-spired forms known from Australia and the adjoining islands and catalogued by Tate and Brazier,[7] Smith,[8] Cooke, Hedley and Suter.[9] It is not, however, possible for me with the limited material at my disposal to go into the question in greater detail.

The only specimens of this genus collected by Mr. den Doop belong to a new species which I have described as *P. doopi*.

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[1] *Rep. Horn-Exped. Zool.* II, p. 212 (1896).

[2] *Proc. Zool. Soc. London*, pp. 136–143 (1889).

[3] I agree with Dr. Annandale in adopting the generic name *Bullinus* instead of *Isidora* in spite of what Kennard and Woodward have said [*Proc. Malacol. Soc. London* XIV, pp, 86–88 (1920)] because of the wide usage of this name in medical nomenclature. See also *Nature* Vol. 106, p. 251 (October 1920).

[4] *Ann. Mus. Civ. Stor. Nat. Genova*, XIX, p. 245 (1883).

[5] *Journ. Conchyliol.* 3rd ser. XIX, pp. 208, 209 (1879) and XX, pp. 141, 142, pl. iv, fig. 5 (1880).

[6] *Rev. Suiss. Zool.* XXII, pp. 570–572, pl. xviii, figs. 7 (*a*, *b*) and 8 (*a*, *b*) 1914).

[7] *Proc. Linn. Soc. N. S. Wales,* VI, pp. 552–569 (1881).

[8] *Journ. Linn. Soc. London* (*Zool.*), XVI, p. 275 (1882).

[9] *Man. New Zealand Moll.* pp. 610–615 (1913).

Physastra doopi, Prashad (sp. nov.).

(Plate xiv, figs. 5, 6).

The shell is elongate-ovate, subrimate, nearly smooth or with very fine striae; in the last part of the body-whorl these longitudinal and somewhat curved striae are more prominent. There are $5\frac{1}{2}$—$6\frac{1}{2}$ somewhat swollen whorls. The suture is very oblique and moderately impressed. The body-whorl is narrowly heart-shaped, with the outer outline markedly sinuate and somewhat emarginate towards the anterior extremity, its antero-external angle is rounded; the inner outline is evenly but not strongly curved. The mouth is elongate elliptical, extending backwards for more than $\frac{4}{5}$ of the body-whorl and is two and a half times as long as broad. It is narrowly pointed posteriorly, but, owing to the slight recurving of the outer lip in this region, the angulation is quite distinctly visible. The outer lip is sharp and not at all thickened; it is, as noted already, slightly recurved in the upper region. The peristome is continuous; the callus is rather narrow and only slightly thickened; the columella shows a distinct but rather faint fold near its posterior end. The shell is of a dull brownish colour and the apex is black.

In some of the specimens the mouth is rather broader and the spire a little shorter.

Measurement of shells (in millimetres).

	1 (Type)	2	3	4
Length ...	... 16	14·6	14·5	14·3
Maximum breadth	... 8·3	8	7·6	8·4
Length of spire	... 6	5·4	5·5	4·9
Height of aperture	... 10	8·8	9	9·4
Breadth of aperture	... 4·4	4·3	4·4	4·2

Locality.—The eight specimens of this species in the collection were obtained by Mr. den Doop in the valley of the Lau Kling stream (Karo-Batak High Plain near Brastagei).

Remarks.—The species is allied to *P. sumatrana* (v. Martens), but has the shell comparatively shorter and broader, the spire less elongate, the mouth much less broad and the outer lip thin and only slightly retroverted. The fold of the columella is less deep.

I have great pleasure in naming this species after Mr. den Doop, to whose careful collecting and keenness is due the great advance in our knowledge of the aquatic fauna of Sumatra.

Family AMPULLARIIDAE.

Genus **Pachylabra,** Swainson.

1911. *Pachylabra,* Kobelt. *Martini and Chemnitz Conch.-Cab., Ampullariidae,* pp. 44–46.

I have adopted with Kobelt the generic name *Pachylabra,* Swainson, for the Oriental and African species of the family Ampullariidae. The genus is distinguished from the American *Am-*

pullaria, Lam., by the structure of the operculum and the inhalent siphon. In *Pachylabra* the operculum is a massive calcareous structure with a coarse external horny covering, while the siphon, when expanded, is a funnel-shaped structure considerably broader than long, when contracted it is a prominent fold on the left side of the head forming an incomplete tube not much longer than its transverse diameter.

Pachylabra conica (Gray).

1828. *Ampullaria conica*, Gray, *Supp. Wood's Index Test.*, pl. vii, fig. 22.
1848. *Ampullaria orientalis*, Philippi, *Zeitschr. Malakozool.*, p. 192.
1849. *Ampullaria scutata*, Mousson, *Moll. Java*, p. 60, pl. vii, fig. 2.
1851. *Ampullaria scutata*, Philippi, *Mart. Chem. Conch. Cab.*, p. 9, pl. i, figs. 4, 5.
1854. *Ampullaria conica*, Hanley, *Conch. Miscell.*, pl. iii, fig. 13.
1854. *Ampullaria conica*, and *A. Javanica*, Reeve, *Conch. Icon.*, pl. ii, fig. 10; pl. xx, fig. 26.
1857. *Ampullaria scutata*, v. Martens, *Malakozool. Blatt.*, p. 186.
1877. *Ampullaria conica* near *type form*, var. *orientalis and ? borneensis*, Nevill, *Cat. Moll. Ind. Mus.* Fas. E., pp. 7–10.
1885. *Ampullaria conica typical form*, vars. *orientalis* and *? borneensis*, Nevill, *Hand-List Moll. Ind. Mus.* II, p. 5.
1890. *Ampullaria conica* var. *Javanica*, Boettger, *Ber. Senckenb. Naturg. Ges.*, p. 156.
1897. *Ampullaria scutata* v. Martens, *op. cit.*, pp. 18, 19.
1898. *Ampullaria scutata*, Sarasin, P. and F., *Moll. Celebes*, I, p. 69.
1910. *Ampullaria conica*, and vars. *borneensis, Javanica, orientalis* and *scutata*, Sowerby, *Proc. Malacol. Soc. London*, IX, pp. 57, 58.
1911. *Pachylabra conica*, and *P. javanica*, Kobelt, *op. cit.*, pp. 93, 94, 83, 84, pl. XI., figs. 1–5, 8, 9, and pl. xxxv, figs. 5, 6.
1913. *Ampullaria scutata*, Schepmann, *Proc. Malacol. Soc. London*, X, p. 236.
1915. *Pila conica* and var. *orientalis*, Preston, *Faun. Brit. Ind. Freshw.-Moll.*, pp. 100, 101.
1920. *Pachylabra conica*, Annandale, *Journ. Nat. Hist. Soc. Siam*, IV pp. 9, 10, pl. i, fig. 3 and pl. ii, fig. 2.

The above fairly complete synonymy is given in view of the great differences of opinion that have existed regarding the form named *Ampullaria conica* by Gray. Von Martens considered the name *conica*, as used in Wood's Index, as being too doubtful to apply to the Javanese species. There remains no doubt, however, if we take Hanley's figure, which is a delineation of Gray's type, as representing *conica*. I have, therefore, with Sowerby adopted Gray's name in preference to Mousson's *scutata*, though I do not agree with Sowerby in considering *lubrica*, *stoliczkana*[1] and *turbinoides* as varieties of this species. The forms *orientalis*, *borneensis* and *javanica* certainly belong to it. Philippi and Kobelt regard the latter two as distinct species, but an examination of the collections in the Indian Museum does not uphold their conclusions. The specimens of these forms show a clear gradation towards *conica*, and must be assigned to it. Owing to the paucity of material

[1] Most authors seem to have missed Nevill's paper (*Journ. As. Soc. Bengal*, L. pt. ii, p. 155, pl, vi, figs. 11, 11A) in which he gives good figures of this interesting species.

at my disposal I am, however, unable to definitely decide as to whether they should be considered as distinct varieties.

Schepmann has referred to the peculiar vermiculations round the pad on the inner surface of the operculum of *P. conica.* This character which was also pointed out by Mousson in his description of *scutata* and is well shown in his figure, is a constant character of the species.

The Sumatran specimens are from fresh-water areas near Poengei and Talang Koeda, and from the Soengei Minahol.

Pachylabra ampullacea (Linn.).

1885. *Ampullaria ampullacea* and var. *javaensis*, Nevill, *op. cit.*, pp. 5, 6.
1890. *Ampullaria ampullacea*, Boettger, *op. cit.*, p. 155.
1896. *Ampullaria ampullacea*, Schepmann, *Notes Leyden Mus.* XVII, p. 159.
1897. *Ampullaria ampullacea*, v. Martens, *op. cit.*, p. 18.
1898. *Ampullaria ampullacea*, Sarasin, P. and F., *op. cit.*, p. 68.
1899 *Ampullaria ampullacea*, Dautzenberg, *Ann. Soc. Malakol. Belgique*, XXXIV p. 17.
1900. *Ampullaria ampullacea* var. *sumatrensis*, v. Martens, *Nachr.-Bl. Deut. Malakozool. Ges.* XXXII, p. 10.
1910. *Ampullaria ampullacea*, Sowerby, *op. cit.*, p. 66.
1911. *Pachylabra ampullacea*, Kobelt, *op. cit.*, pp. 76–78.
1913. *Ampullaria ampullacea*, Kruimel, *Bijdr. Dierkunde Amsterdam*, p. 226.
1915. *Ampullaria ampullacea*, Bollinger, *Rev. Suisse. Zool.* XXII, pp. 507, 568.

Authors have experienced great difficulty in ascertaining the exact species, which was named *Helix ampullacea* by Linnaeus. His description in the " Museum Ulricae " is unfortunately incomplete, and, as has been pointed out by Hanley,[1] contradictory. In the Linnaean collection, however, Hanley found a marked shell, which probably Linnaeus meant to be the type of the species described in his ' Systema,' but Philippi to whom Hanley sent a sketch of this specimen considered it to belong to a distinct species, which he named *A. linnaei.* Philippi, in his monograph [2] doubtfully considered *A. ampullacea* as synonymous with *A. celebensis* and considered the various species, which later Reeve rightly considered as synonymous, as distinct. Reeve [3] appears to have been the first author who correctly understood the species named *Helix ampullacea* by Linnaeus. He included in this species *A. magnifica*, Dunker, *A. sumatrensis*, Philippi and *A. celebensis*, Quoy and Gaimard, but considered *A. linnaei*, Philippi, as distinct. Nevill followed von Martens and possibly Reeve as regards the synonymy of the species, but considered *A. celebensis*, Mousson [4] (not Quoy and Gaimard [5]) as a distinct variety, which he

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1 Hanley, *Ipsa Linnaei Conchylia*, pp. 368, 369 (London, 1855).
2 *Ampullaria* in *Martini and Chemnitz Conch.-Cab.*, p. 58 (1851).
3 *Conchologia Iconica*, pl. x, fig. 48 (1854).
4 *Moll. Java*, p. 60, pl. ix, fig. 2 (1849).
5 *Voy. Astrolabe Zool.* III, pp. 167–169 (1834).

named *javensis*. The latter, as Boettger has shown, is the same as *magnifica*, Dunker. The other authors, cited in the references above, have followed v. Martens who agreed with Reeve's conclusions in his first paper but in 1910 considered *sumatrensis* as worthy of varietal rank. Kobelt in his recent work included *A. linnaei* with others in the synonym of *P. ampullacea*, but was doubtfully inclined to consider the forms *sumatrensis*, *celebensis* and *magnifica* as worthy of varietal ranks, a conclusion with which I agree. Of these var. *celebensis* represents the *forma typica*. These three forms may be distinguished as follows:—

1. Shell globose-ovate, scarcely rimate, spire more than $\frac{1}{3}$ of the total length with the whorls increasing evenly in size, aperture narrower than in the var. *sumatrensis* ... ... *forma typica* (= *celebensis*).
2. Shell globose, narrowly umbilicate, spire about $\frac{1}{3}$ of the total length but with the whorls rapidly increasing in size, aperture rather broad ... var. *sumatrensis*.
3. Shell subglobose, comparatively larger than in the other two forms, very narrowly umbilicate, spire short, less than $\frac{1}{3}$ of the total length, whorls rapidly increasing in size but less pronounced than in the other two forms, aperture oblong, about twice as long as broad ... var. *magnifica*.

Specimens of the *forma typica* (=*celebensis*) are represented from fresh-water areas near Perbaoengan and from rice-fields near the same place, also from the Kroeeng Seunara (Sabang). A few dry shells from Perbaoengan are labelled as coming from the mangrove-swamp region near Perbaoengan, where they were probably carried with the current.

Specimens of the *sumatrensis* form were all collected in fresh-water areas near Medan.

There are three specimens from Talang Koeda which I assign doubtfully to the var. *magnifica*. It is impossible to identify these specimens definitely as all of them are young, and have not developed the characters of the fully-grown adults.

Family VIVIPARIDAE.

Genus **Vivipara**, Lam.

This genus is represented in the collection by three species, *V sumatrensis*, *V javanica* and the new species described here as *V hendrici*.

Vivipara sumatrensis (Dunker).

1852. *Paludina sumatrensis*, Dunker, *Zeitschr. Malakozool.* p. 128.
1864. *Paludina sumatrensis*, Reeve, *Conch. Icon.* XIV, pl. x, sp. 65*a*, *b*.
1875. *Paludina sumatrensis* (in part), Morelet, *Ser. Conchyliol.* IV pp. 304–306.
1885. *Paludina bengalensis* subsp. *polygramma* (in part), Nevill, *Hand-List Moll. Ind. Mus.* II, p. 22.
1896. *Paludina sumairensis*, Schepmann, *Notes Leyden Mus.* XVII, p. 159.
1897. *Vivipara sumatrensis*, v. Martens, *op. cit.*, p. 24, pl. x.

1900. *Vivipara sumatrensis*, v. Martens, *Nachr. Malakozool. Ges.* XXXII, p. 10.
1909. *Vivipara sumatrensis*, Kobelt, *Martini and Chemnitz Conch.-Cab. (ed. Kuster)*, pp. 276, 277, pl. lvi, figs. 9–12.

There has been some difference of opinion as to whether *V sumatrensis* should be considered a species distinct from *V. lineolata* (Mousson) v. Martens, *V polygramma* (v. Martens) and *V bengalensis* (Lam.). Morelet summed up the situation as follows: "En résumé, les *Pal. Sumatrensis* et *polygramma* ne sont, à mon avis, qu'eune même espèce; le nom de *lineolata* est un double emploi; toutes ces formes, enfin, se rattachent étroitement à la *P. Bengalensis* et n'en sont probablement que des variétés." Nevill, following Morelet, considered the forms *polygramma*, *lineolata* and *sumatrensis* as synonymous, and for this form, which he considered to be a subspecies of *P. bengalensis*, he wrongly selected the name *polygramma*. Von Martens, however, after carefully considering the whole situation, concluded that *V sumatrensis* is quite distinct from *V polygramma*, and that Mousson's *V lineolata* should be considered as synonymous with it. Reeve's *P. lineolata*, however, he considered to be a distinct species and so also, though with some doubt, Frauenfeld's description of the same species. Kobelt, agreeing with von Martens, has described *V lineolata* and *V polygramma* as distinct from both *V. sumatrensis* and *V bengalensis*.

The largest specimen in the collection measures 21 mm. in length. The keel on the body-whorl is well marked in young individuals but becomes less distinct in older specimens. The specimens are mostly yellowish or even of an olive colour, but a few have a reddish-brown tinge owing to a deposit on the surface. In all cases the black bands on the yellow or brown back-ground are quite distinct.

Most of the specimens are from areas of fresh water near Medan and near Bohorok, but a few dead shells were also collected on dry land. A few specimens are from the east coast of Sumatra (exact locality not stated).

Vivipara javanica (v. d. Busch).

1897. *Vivipara javanica*, v. Martens, *op. cit.*, pp. 21, 22.
1909. *Vivipara javanica*, Kobelt, *op. cit.*, pp. 251, 252, pl. lii, figs. 1–7.

A number of forms of this species were described as distinct varieties by von Martens, and Kobelt has since included some more. The identification of these varieties, in spite of the careful descriptions and excellent figures published by the two authors, is not an easy task owing to the very great individual variation exhibited in large series of shells, and I would have been obliged to identify some of the specimens before me as varieties of Busch's form without assigning them to their exact varietal rank, but for the valuable named material that I have received from Prof. Max Weber for examination and in exchange.

None of the specimens in the collection belong to the typical

form, but in the large series the following five varieties can be distinguished:—*saleyerica*, *scalaris*, *laevior*, *borneensis* and *moussoni*.

var. **laevior** (v. Martens).

1897. *Vivipara costata* var. *laevior*, v. Martens, *op. cit.*, p. 21, pl. ii, figs. 5, 6.
1909. *Vivipara javanica laevior*, Kobelt, *op. cit.*, p. 253, pl. xlviii, figs. 3–6.

The form as the Sarasins [1] and Kobelt have shown is a variety of *V javanica* and not of *V costata* as von Martens considered it to be. I have one of von Marten's co-types before me and agree with the opinion of these authors.

Most of the Sumatran specimens agree closely with von Martens' co-type and his figures, except that they are a little broader and less elongate. The operculum agrees with Kobelt's fig. 3 (*loc. cit.*). The specimens are mostly olive brown in colour, but some of them are much darker owing to a deposit on the surface. The largest specimen is smaller than the largest of von Martens'; it measures 28·2 mm. in length by 20 mm. in breadth, and the aperture is 14·8 mm. by 11·6 mm.

The specimens before me are from fresh-water areas at Medan and Mariëndal (Deli); also from the Soengei Krah (Medan); and the Soengei Minahol.

This variety was hitherto known from Java and South Celebes only.

var. **saleyerica**, v. Martens.

1897. *Vivipara javanica* var. *Saleyerica*, v. Martens, *op. cit.*, p. 24. pl. ii, fig. 3.
1909. *Vivipara javanica saleyerica*, Kobelt, *op. cit.*, p. 235, pl. xlviii, fig. 16.

The only adult specimen of this variety in the collection is from the Soengei Minahol. It agrees closely with one of v. Martens' co-types before me. The specimen is of a yellowish brown colour with dark transverse bands on the first three whorls, and measures 17·4 mm. by 12·5 mm., the aperture is 10·5 mm. by 8·3 mm.

I also assign to this form, with some doubt, two young shells from a fresh-water area at Padang Boelan (Deli). These specimens are not larger than 12 mm. in length, have a fairly prominent keel on the body-whorl and are narrowly umbilicate. They are of an amber-brown colour.

This record greatly extends the range of this form, which was only known from Saleyer.

var. **moussoni**, v. Martens.

1849. *Paludina angularis* (*nec* Müll.), Mousson, *Moll. Java*, p. 62, p viii, fig. 5.

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[1] *Moll. Celebes*, p. 64 (Wiesbaden, 1898).

1897. *Vivipara javanica* var. *moussoni*, von Martens, *op. cit.*, p. 22.
1909. *Vivipara javanica moussoni*, Kobelt, *op. cit.*, p. 256, pl. lii, figs. 10, 11.

This interesting variety is represented by two lots of specimens. Of the first lot collected by Mr. den Doop at Medah (Deli), the specimens are mostly brownish in colour. A few however, have a darkish colour owing to a clayey deposit on the surface. The apex of the shells is, in most cases, eroded, and many show rather low varices in the regions of growth. A very low but distinct keel is present near the lower edge of the body-whorl; it is better marked in some specimens than in others. The operculum resembles Kobelt's figure. The largest specimen of this lot measures 29·1 mm. by 22·5 mm., the aperture being 14·6 mm. by 12 mm.

The second lot of specimens was collected near Medan by Mr. J B. Corporaal. The shells are rather smaller and much lighter in colour than those in the other lot.

var. **scalaris**, Mousson.

1909. *Vivipara javanica scalaris*, Kobelt, *op. cit.*, p. 257, pl. liii, figs. 1, 2, pl. lv, figs. 8, 9.

This beautiful variety has a highly evolved type of shell. It is represented in the collection by a few young shells and some adults collected from the fresh-water lake, Anak Laut (Sabang).

The shells are of an olive brown colour with a few vertical stripes of a darker shade more marked on the body-whorl than on the rest of the shell. The adult shell consists of 6–6½ somewhat inflated whorls, with a deeply impressed and oblique suture, and with a large body-whorl; the keel on the body-whorl is more distinct in young than in fully-grown adults, in which it becomes even quite obsolete. The shells are broadly rimate and perforate. The largest specimen measures 33·4 mm. by 22·6 mm., and the aperture is 18 mm. by 15·5 mm. in size.

The variety was hitherto known from Java only.

var. **borneensis**, Kobelt.

1909. *Vivipara javanica borneensis*, Kobelt, *op. cit.*, p. 257, pl. liii, figs. 3, 4, 19, 20.

Kobelt in the paper cited above has given a very complete description of this form and pointed out its distinguishing characters very well. The shell is rather small, nearly smooth, ovato-conical in form with an acute apex; the whorls are very little swollen and the suture is oblique and faintly impressed.

The two shells that I identify with *borneensis* are from near Medan. They agree closely with figs. 3, 4 of the Bornean shells in Kobelt's Monograph.

Vivipara hendrici, Prashad (sp. nov.).

(Plate xiv, figs. 7-10).

This new species, though closely allied to *V javanica*, appears to be quite distinct, and is here described under the name *V hendrici* after the name of Mr. den Doop's father.

The shell is of a large size and rather thick in texture. It is narrowly rimate, with the spire elongate and the body-whorl somewhat swollen. The whorls of the spire are a little oblique and only moderately swollen, they increase gradually in size. The suture is oblique, rather narrow, but fairly impressed. The body-whorl, as seen in dorsal view, is band-shaped, increasing gradually but not very greatly towards the end; near the periphery there is no angulation in the adult shells, but traces of it are to be seen in shells of moderate size; it is not very much swollen. The mouth is fairly large, subcircular, bluntly pointed above and broadly rounded below. The outer lip is thin and irregularly arched. The columella is narrow and slightly curved but without any fold. The peristome is complete. The colour of the shell is uniform dark olive-green in fresh shells, but rather brownish in those covered with a deposit. The first three whorls, in some specimens, also show 2–3 transverse bands of a darker colour. The margin of the mouth is blackish, while the interior of the shell is light blue. The sculpture consists of fairly coarse longitudinal curved striae crossed by a few transverse ones; the latter are all more conspicuous on the body-whorl than on the rest of the shell.

The operculum is dark brownish or even black; it is large ovoidal, thick but somewhat brittle. Externally only a few concentric striae can be made out, but the nucleus is excentrically situated. There is on the inner surface a well marked muscular scar with raised subcircular boss lying near the left margin, the scar shows thick vermicular ridges on its surface.

Measurements of shells (in millimetres).

	1 (Type)	2	3	4	5
Length of shell ...	31	26·7	25·8	24	24·2
Maximum breadth ...	20·8	20·1	18·4	16·5	17·3
Height of spire (dorsal view)	14	12·3	11·2	11·3	10·7
Height of mouth ...	16	14·9	14·7	13·4	13
Breadth of mouth ...	13·2	13	11·6	11·1	11·3

Locality.—A few adults of this species were collected in the Bah Endah (streamlet) by Mr. den Doop.

Family HYDROBIIDAE.

Genus **Bithynia**, Leach.

Only a single representative of the family Hydrobiidae is represented in the collection. This might to some extent be due to the minute size of the shells of the members of this family.

Bithynia truncata, Eyd. and Soul.

1897. *Bithynia truncata*, v. Martens, *op. cit.*, pp. 25, 26, pl. ix, figs. 11, 11*b*.

B. truncata had not hitherto been recorded from Sumatra but was known only from Java and Celebes. In Mr. den Doop's collection there are a fair number of specimens from fresh-water areas at Medan and near Padang Boelan. The specimens are typical and agree fairly well with the detailed description in von Martens' paper.

Family LITTORINIDAE.

Genus **Littorina**, Fer.

Subgenus **Littorinopsis**, Morch.

The four species of this subgenus from Sumatra all belong to the subgenus *Littorinopsis*, Morch. All these species are rather thin-shelled forms not exceeding 25 mm. in length.

Littorina scabra (Linn.).

1897. *Littorina scabra*, v. Martens, *op. cit.*, pp. 194–196.

There are eight specimens of this species collected from a mangrove-swamp at Belawan (Deli). All the specimens are fairly typical, showing only slight variation in colour.

Some features of the gross anatomy of this species are shown in Quoy and Gaimard's figures[1] and the radula has been figured by Troschel.[2]

Littorina intermedia, Phil.

1897. *Littorina intermedia*, v. Martens, *op. cit.*, p. 197.

In the paper cited above von Martens has given the complete synonymy, and discussed the distribution of this widely distributed species.

In the Sumatran collection it is represented by a large number of specimens from the sea-shore at Perbaoengan (Sardang), and a few from the Soengei Belawan (Deli), not far from the sea. All these specimens closely agree with the large series of this species in the Indian Museum collection from various localities.

Littorina carinifera (Menke).

1897. *Littorina carinifera*, v. Martens, *op. cit.*, p. 198.

This widely distributed species is represented in the collection by a few individuals from the mouth of the Soengei Batang Kwis (Serdang) and from a mangrove-swamp at Belawan (Deli).

The specimens closely agree with Menke's and von Martens' descriptions, but show a slight variation in colour.

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[1] *Op. cit.*, p. 770, pl. xxxiii, figs. 1–3. The species is referred to as *Littorina angulifera* (Lam.).

[2] *Das Gebiss der Schnecken*, I, sp. 133, pl. x, fig. 18.

Littorina conica, Phil.

1897. *Littorina conica*, v. Martens, *op. cit.*, p. 198.

All the specimens of this species are from a mangrove-swamp at Belawan (Deli). Some of the specimens are much darker than others, while two are nearly creamy in colour. In shape and sculpture, however, they are all alike.

Family MELANIIDAE.

Genus Acrostoma, Brot.

1920. *Acrostoma*, Annandale, *Rec. Ind. Mus.* XIX, pp. 109, 110.

In the paper cited above Annandale has fully discussed the reasons for adopting the name *Acrostoma*, Brot, for the species which had hitherto been classed as belonging to *Melanoides*, H. and A. Adams (*nec* Olivier), *Brotia*, v. Martens and "Paleomelanien," P and F. Sarasin. The only species of this genus in the Sumatran collection comprises a number of forms of the common *Acrostoma variabile* (Benson). In the Sumatran forms I can find no differences of sufficient importance to consider them as belonging to a distinct species. They show an identically similar variation as regards shape and shell-sculpture as the Indian forms, and many of them seem to be quite identical. I have, therefore, after a careful comparison of the large series of Sumatran shells with the very large collections of Indian specimens in the Indian Museum, Calcutta, decided to consider them as varieties of *A. variabile*, even though none of them are identical with the typical form.

Acrostoma variabile (Benson).

1836. *Melania variabilis*, Benson, *Journ. As. Soc. Bengal*, V, pp. 746, 747.
1874. *Melania variabilis*, Brot, *Melanidae in Mart. and Chemn. Conch.-Cab.*, pp. 85–87, pl. x, figs. 1*a-d*.
1915. *Tiara* (*Melanoides*) *variabilis*, Preston, *Faun. Brit. Ind. Freshw.-Moll.*, p. 23.

This species was originally described from the Goomty River, Jaunpur in the United Provinces of India, and was later found by Benson in Tolly's Nullah near Calcutta. It has since been found to be widely distributed, and is, as its name indicates, a very variable species both as regards the shape and sculpture of the shell. The Indo-Burmese forms of this species are in need of a thorough revision.

None of the Sumatran specimens belong to the typical form but the five varieties considered further on are represented. There are besides a few specimens from some localities, which it is not possible to assign to their exact varietal rank, owing to their imperfect condition and to the fact that the sculpture is quite eroded.

var. **sumatrensis** (Brot).

1874. *Melania sumatrensis*, Brot, *op. cit.*, pp. 87, 88.
1885. *Melania* (*Melanoides*) *variabilis*, Nevill, *Hand-List Moll. Ind. Mus.* II, pp. 251, 252.
1897. *Melania* (*Brotia*) *sumatrensis*, v. Martens, *op. cit.*, pp. 34–36.
1900. ? *Melania* (*Brotia*) *episcopalis*, v. Martens, *Nachr. Deut. Malakozool. Ges.*, XXXII, p. 10.

In spite of what von Martens has said regarding the validity of this species, I do not think that it is possible to separate it from *A. variabile*. Nevill interpreted its relationships correctly, but was mistaken in considering Brot's species as a mere synonym of Benson's. Probably he was led to this conclusion by the very different forms figured by Brot as representing his species. It might have been a better course to have dropped Brot's name *sumatrensis* and adopted the earlier *varicosa*, Troschel, for the Sumatran form, but as Troschel's original specimens came from the River Ganges, India, this form was probably the *forma typica* or one of the various Indian varieties of the true *variabile*. The Sumatran shell recorded by v. Martens as *M. episcopalis*, in the paper cited above, appears from the short note appended to have probably been this form. I have no doubt, however, regarding the one he described as *M sumatrensis* in his first paper, for I have seen one of the specimens named by him.

The form I consider as Brot's *sumatrensis* is widely distributed in Sumatra. It is well represented by Brot's figure 1*a* (pl. xiii). The shell of this form is fairly massive, pyramidal, with 6–9 persistent whorls increasing more or less evenly in size, the suture is oblique and moderately impressed and the whorls have well developed oblique varices or rather ribs. The ribs, though feeble on the upper whorls, are quite distinct on all of them; the body-whorl has at least ten distinct ribs. The aperture is ovate, somewhat pointed posteriorly and produced but rounded anteriorly. The shells are uniformly coloured, being chestnut-brown or even black. The aperture has a black margin though the mouth further inwards is bluish or even whitish.

The following are the measurements (in millimetres) of six specimens from different localities :—

Localities.	Height.	Maximum breadth.	Height of aperture.	Breadth of aperture.	Number of persistent whorls.
Soengei Kalau ...	48·5	20	18·2	12·3	5—7
Timbang Langkat	52·6	18·4	17·8	11·2	$8\frac{1}{2}$
Bah Endah ...	45·2	20·8	17·6	11·5	$6\frac{1}{2}$
Soengei Bohorok...	46·8	18·2	18	11	6—7
Soengei Minahol ...	56·5	23·8	21·1	13·1	$7\frac{1}{2}$
Soengei Lepan ...	22·4	9·3	9	4·8	$5\frac{1}{2}$

This is a true stream form, and in Mr. den Doop's collection is represented by a large series of specimens of all ages from the following streams:—Soengei Kalau (near Bohorok), streamlet at Timbang Langkat, Bah Endah, Soengei Lepan (Langkat), Soengei Minahol and Soengei Bohorok (Langkat).

var. **infracostata** (Mousson).

1849. *Melania infracostata*, Mousson, *Moll. Java*, pp. 65, 66, pl. x, fig. 3.
1874. *Melania infracostata*, Brot, *op. cit.*, pp. 98, 99, pl. xii, fig. 3.
1885. *Melania* (*Melanoides*) *variabilis* var. *infracostata*, Nevill, *op. cit.*, p. 253.

I agree with Nevill in considering this as only a variety of *A. variabile*. The shell is similar to that of the var. *sumatrensis*, but is distinguished by the ribs being obsolete on the last whorl. A few spiral striae are, however, to be distinguished below the suture in some specimens, and these often decussate as in Mousson's figure. The ribs are more distinct in the young than in fully-grown adults.

I do not think that fig. 3*a* (pl. xii) of Brot's represents this form. His figure 3 is not very good, but resembles some of the specimens in the Sumatran collection.

The following are the measurements (in millimetres) of some specimens from two localities :—

Locality.		Height.	Maximum breadth.	Height of aperture.	Breadth of aperture.	Number of persistent whorls.
Soengei Deli Medan	1.	60·2	22·9	21·3	14·4	$6\frac{1}{2}$
	2.	51	18·2	17·6	10	8
	3.	49	17·9	17·1	9·8	$7\frac{1}{2}$
Soengei Kalau	1.	36	14·1	14	8·4	$6\frac{1}{2}$
	2..	32·3	12·8	12·2	6·7	$6\frac{1}{2}$

This form, like the var. *sumatrensis*, is a true stream form. Large number of specimens of it were collected from the streams Soengei Deli (Medan) and Soengei Kalau (near Bohorok).

var. **binodulifera** (Nevill).

1885. *Melania* (*Melanoides*) *variabilis* subsp. *episcopalis* var. *binodulifera*, Nevill, *op. cit.*, p. 259.

Nevill has discussed the mistakes committed by both Brot and Hanley and Theobald (*Conch. Indica*) in the identification of the form *episcopalis*, Lea. He was, I think, justified in giving a new name to the variety with a double row of nodules in the region corresponding to the ribs on the whorls in *A. variabile* and var. *sumatrensis*. His specimens of the variety were collected in various places in Assam in the north-east of India.

The Sumatran specimens I assign to this form all resemble the Indian specimens. They are dull yellowish-brown in colour with a few darker vertical bands. They are rather smaller than those of the var. *sumatrensis* and have two distinct rows of small nodules on the last $2\frac{1}{2}$–3 whorls. On the upper whorls the nodules are more or less obsolete. In younger shells, however, the nodules are present on the upper whorls also.

In the Sumatran collection the variety is represented by specimens of all ages from the Soengei Deli (Medan), from Deli (without precise habitat) and from the Soengei Kalau (a streamlet near Bohorok).

var. **pseudospinosa** (Nevill).

1885. *Melania* (*Melanoides*) *variabilis* subsp. *episcopalis* var. *pseudospinosa*, Nevill, *op. cit.*, pp. 258, 259.

As Nevill has pointed out this variety appears to be intermediate between Brot's *M. sumatrensis* and *M. spinosa*. The type-specimens were from Assam, but Nevill found it hard to distinguish some Perak and Malacca specimens from them. I can find no difference between the Sumatran shells I assign to this form and those from Assam, Perak and Malacca.

This variety leads on to the form *menkeana* (Lea), but differs from the latter in the suture being less impressed, the spines much smaller and less protruding, and the shell being much smaller.

The Sumatran specimens were collected along with those of the vars. *infracostata* and *binodulifera*.

var **menkeana** (Lea) Nevill.

1885. *Melania* (*Melanoides*) *variabilis* subsp. *menkeana*, Nevill, *op. cit.* pp. 260, 261.

Nevill fully discussed the confusion introduced by Brot and by Hanley and Theobald (*Conch. Indica*) regarding this form. He gave a full synonymy and emended the description of the species. The form, as stated already, is closely allied to the var. *pseudospinosa*, but differs in colouration, in the whorls being more convex, the suture sharply and more deeply impressed, and in the spines being better developed.

I can detect no differences between the Assamese and the Sumatran specimens.

All the Sumatran specimens are from the Soengei Lepan in Langkat. The measurements (in millimetres) of a few specimens are as follows :—

Height.	Maximum breadth.	Height of aperture.	Breadth of aperture.	Number of persistent whorls.	
33	14·1	13·3	7·8	$5\frac{1}{2}$	
30	13·3	12·4	7·2	$4\frac{1}{2}$	Apex greatly eroded.
27	13·8	12·2	6·8	5	„

Genus **Melanoides**, Olivier (*nec* H. and A. Adams).

1920. *Melanoides*, Annandale, *Rec. Ind. Mus.* XIX, pp. 108, 109.

In the paper cited above Annandale has given reasons for accepting the generic name *Melanoides* for the species of the type of *M. tuberculata* (Müller), and not in the sense it was used by H. and A. Adams. He has also given a complete synonymy of the genus. My examination of the large Sumatran collection completely upholds his views, except that I adopt, for the sake of convenience, some of the subgeneric names used by von Martens for the various groups of species.

Subgenus **Stenomelania,** Fischer.

Melanoides aspirans (Hinds).

1874. *Melania aspirans*, Brot, *op. cit.*, pp. 140, 142, pl. xvii, figs. 4*a–d*.
1885. *Melania fuscata* var. *aspirans*, Nevill, *op. cit.*, p. 222.

Nevill considered this species to be only a variety of the Nicobarese *M fuscata*, but I think it to be distinct. In the Sumatran collection there is a single specimen from a streamlet along the road to Anak Laut (Sabang), which resembles Fijian specimens of this species in the Indian Museum collection.

The specimen is fairly large, measuring 36·5 mm. by 11 mm., and the aperture is 12·5 mm. by 6·7 mm. It has five persistent whorls; the apex is greatly eroded and at least 3 more whorls must have been present in the complete specimen. The whorls increase regularly in size and are only moderately swollen. The sculpture consists of very faint vertical ridges irregularly disposed on the various whorls, on the uppermost whorl transverse ridges are also to be seen a few such ridges are also present on the base of the body-whorl. The suture is very oblique and moderately impressed. The aperture is ovoidal, drawn out to an acute angle posteriorly. The shell is dark brownish.

Melanoides plicaria (Born).

1897. *Melania plicaria*, v. Martens, *op. cit.*, pp. 41, 42.

This species has a wide range in the Malay Archipelago, but had not hitherto been recorded from Sumatra. In Mr. den Doop's collection there are three adult specimens, collected from a streamlet along the road to Anak Laut (Sabang). Another specimen collected at Sabang by Mr. J B. Corporaal also probably belongs to the species.

Melanoides acutissima (Busch).

1874. *Melania acutissima*, Brot, *op cit.*, p. 129, pl. xvi, figs. 2, 2*a*.
1885. *Melania acutissima*, Nevill, *op. cit.*, pp. 226, 227.
1897. *Melania acutissima*, v. Martens, *op. cit.*, pp. 42, 43.

The specimens I assign to this species are from a streamlet along the road to Anak Laut (Sabang). They are of all ages and show the specific characters distinctly.

M. acutissima was hitherto known from Java, Bali and Luzon.

Melanoides turris (Brot).

1874. *Melania turris*, Brot, *op. cit.*, pp. 146, 147, pl. xviii, figs. 5, 5*a*.

I assign to this species 3 adult and 3 medium-sized specimens from a streamlet along the road to Anak Laut (Sabang). The specimens were collected along with those of *M. plicaria*, *M acutissima* and *M monile*. They agree closely with Brot's description and figures of the species.

Brot gives the locality of his specimens as doubtfully from Borneo, and von Martens states that the species is found in the Malaccas, Bali and Flores.

Melanoides monile (Mouss.).

1874. *Melania monile*, Brot, *op. cit.*, p. 173, pl. xx, fig. 7.
1897. *Melania monile*, v. Martens, *op. cit.*, pp. 44, 45.

In a tubeful of specimens of *M. acutissima* I found three specimens of this species. They had been collected in a streamlet along the road to Anak Laut (Sabang).

The exact localities of the original specimens are rather doubtful, they are stated to have come from Java and the Moluccas. Von Martens' specimens were collected by Prof. Wichmann at Kupang in Timor.

Melanoides crenulata (Chemn.).

1874. *Melania crenulata*, Brot, *op. cit.*, pp. 114-117, pl. xiv, a fig. 9*a*.
1897. *Melania crenulata*, v. Martens, *op. cit.*, pp. 45, 46.

I have compared the specimens I assign to this species with a specimen named by the late Prof. E. von Martens, and can find no differences in the form of the shell or the shape of the mouth. These specimens, however, have vertical striae on the first 3–4 whorls, while von Martens' is nearly smooth. The difference is probably due to age, von Martens' specimen being an adult in which the striae have probably become obsolete. The difference, however, is not of much importance in this variable species.

The Sumatran specimens are from near the Prise d'eau of Sabang.

Melanoides uniformis (Quoy and Gaim.)

1874. *Melania uniformis*, Brot, *op. cit.*, pp. 124, 125, pl. xv, figs. 3, 3*a*, pl. xvi, fig. 1.
1897. *Melania uniformis* with vars. *crispulata*, *aequisulcata* and *plicatula*, v. Martens, *op. cit.*, pp. 46-48; pl. iii, figs. 3-6.

The typical form of this interesting species is not represented in the Sumatran collection but specimens of the vars. *crispulata*, *aequisulcata* and *plicatula* of v. Martens are present. The specimens of the first variety are from the Soengei Minahol, while those of the other two were collected in a streamlet along the road to Anak Laut (Sabang).

The present record of the occurrence of the various varieties of this species in Sumatra is interesting as the species was hitherto known from the North Celebes, Molucca, Bali, Flores and Timor only.

Melanoides sluiteri, Prashad (sp. nov.).

(Plate xiv, figs. 11, 12).

At Mr. den Doop's request I have associated this new species with the name of Prof. Ph. Sluiter of Amsterdam.

The shell is elongate, acuminate, somewhat conical, about three times as long as broad. The whorls, of which there are at least 7 in complete shells, increase very gradually and regularly,

and are very little swollen. The suture is oblique and moderately impressed. The body-whorl is broadly ovoidal, narrow above, gradually widening to the region of the mouth, where, owing to the greater part of the mouth lying outside the median axis, it is broadest. In dorsal view the outer profile of the body-whorl is slightly arched in the upper half and then suddenly curves downwards and inwards, and has a somewhat sinuate course. The inner profile is regularly curved. The mouth is of fair size, being a little more than half the size of the body-whorl; it is ovoid in outline with the basal margin regularly curved and drawn to an acute angle at the apex. The outer lip is only slightly thickened; seen from the side it shows a distinctly sinuate outline. The columella is narrow and slightly bent. The surface of the shell in young shells on the first 4–5 whorls shows regular transverse ridges, these become obsolete in adult shells, and are quite absent on the penultimate and the body-whorl; on these two whorls fine longitudinal striae are always present. The shells are blackish in colour, but the whole or a part of the body-whorl along the outer lip in the region of growth is dull olivaceous or yellowish; in this region a few vertical brownish stripes are also present.

The type-specimen measures 22·2 mm. in length by 8·1 mm. in maximum breadth, the aperture measures 8 mm. by 4·7 mm.

Locality.—A large number of specimens of this species were collected by Mr. den Doop in the Kroeëng Seunara (Sabang); streamlet from the Prise d'eau of Sabang, and in fresh-water areas near Boelan and Padang Boelan.

Remarks.—The species is nearly allied to *M. uniformis* but is distinguished by its shape, position and form of the mouth and by its sculpture.

Melanodies litigosa (Brot).

1874. *Melania litigosa*, Brot, *op. cit.*, pp. 170, 171, pl. xx, fig. 5, 5*a*, *b*.
1897. *Melania litigosa*, v. Martens, *op. cit.*, pp. 48, 49.

A single specimen from a streamlet along the road to Anak Laut (Sabang) agrees well with Brot's description and figures.

Subgenus **Plotia**, A. Adams = **Melanoides**, *s.s.*

Melanoides tuberculata (Müll.).

1897. *Melania tuberculata*, v. Martens, *op. cit.*, p. 56.
1919. *Melanoides tuberculata*, Annandale and Prashad, *Rec. Ind. Mus.* XVIII, pp. 31, 32, pl. iv, fig. 1.

Although *A. tuberculata*, as Dr. Annandale and I stated in the above-cited paper, has a wide range from the Mediterranean to Australia and China, there is no evidence of its occurrence in Baluchistan or Southern Persia. There are no specimens of the typical form in the Sumatran collection, but specimens of four varieties are present.

var. **seminuda**, v. Martens.

1897. *Melania tuberculata* var. *seminuda*, v. Martens, *op. cit.*, p. 58, pl. iv, fig. 1.

Von Martens recorded this variety from a number of localities in Sumatra and in the present collection it is represented from the following sources :—Fresh-water areas at Medan and Toentoengan, streamlets at Sabang and Timbang Langkat, the Soengei Landak and Soengei Bohorok (both near Bohorok).

Some of the specimens, owing to a deposit on the surface, appear much darker than others.

var. **virgulata** (Quoy and Gaim.).

1897. *Melania tuberculata* var. *virgulata*, v. Martens, *op. cit.*, pp. 57, 58.

This variety is widely distributed in the Malay Archipelago, and has been recorded from various localities in Sumatra. In the present collection there are specimens from a fresh-water area at Medan and Padang Boelan and from the Soengei Bohorok.

var. **angularis**, v. Martens.

1867. *Melania tuberculata* var. *angularis*, v. Martens, *op. cit.*, p. 59, pl. iv, figs. 2, 3.

This form is only known from Sumatra. I have compared my specimens with one of von Martens' co-types and have no doubt as to their identity.

The specimens are from near Medan, from a streamlet on the Medan Estate, from the Soengei Bohorok and Anak Laut (Sabang).

var. **truncatula** (Lam.).

1897. *Melania tuberculata* var. *truncatula*, v. Martens, *op. cit.*, p. 59 pl. iv, fig. 4.

Large series of specimens of this interesting form are represented in the Sumatran collection from Padang Boelan, Poengei, Medan and Timbang Langkat, and from the Soengei Bohorok and Soengei Minahol.

The ribs in fully adult specimens become greatly reduced and are not so clear as they are on young shells.

Melanoides scabra (Müll.).

1897. *Melania scabra*, v. Martens, *op. cit.*, p. 62.

The groups or subgenera *Plotia* and *Striatella* as defined by Brot in his monograph, as has been pointed out by Dr. Annandale and myself,[1] fade imperceptibly into one another and we have, therefore, adopted the older name *Plotia* for the subgenus.

The complete synonymy of *M. scabra* and its allies has still to be worked out,[2] but there is no doubt regarding the Sumatran

[1] *Rec. Ind. Mus.* XVIII, p. 28 (1919), see also Vol. XIV p. 147 (1919).
[2] *Rec. Ind. Mus.* XVIII, p. 37 (1919).

forms dealt with here. None of the specimens belong to the typical form.

var. **nodosocostata** (Mousson).

The specimens of this variety are from a pool in the valley of the Lau Kling (a stream) near Brastagei and from the Soengei Bohorok. The costae on young individuals are rather faint and the body-whorl is nearly smooth.

var. **angulifera**, v. Martens.

The only specimens of this form were collected in the streamlet Soengei Kalau (near Bohorok). They agree in all respects with one of von Martens' co-types from Rotti, river Oilelao, near Bilba, in the Indian Museum collection.

var. **mutica**, v. Martens.

This form is represented in the Sumatran collection by a fair number of specimens from a streamlet near Anak Laut (Sabang).

Subgenus **Tarebia**, H. and A. Adams

Melanoides semigranosa (Busch).

1842. *Melania semigranosa*, V D. Busch, *Philippi Abbild.* I, p. 2, pl. i, fig. 13.
1874. *Melania lirata* var. 2, Brot, *op. cit.*, p. 329, pl. xxxiii, figs. 6, 6*a*.
1885. *Melania lineata* var. *semigranosa*, Nevill, *op. cit.*, p. 277.
1897. *Melania lineata* var. *semigranosa*, v. Martens, *op. cit.*, p. 72.
1899. *Melania (Tarebia) semigranosa*, Dautzenberg, *Ann Soc. Roy. Malacol. Belgique.* XXXIV, p. 14, pl. ii, figs. 9, 9*a–c*.

I agree with Dautzenberg in considering this form as a distinct species rather than as a variety of *M. lineata*. The specific characters as defined by Mousson are, as was also found by Dautzenberg, quite constant in a large series of specimens.

The specimens in the Sumatran collection are from the Soengei Lepan, the Soengei Kalau and from Medan.

Family CERITHIIDAE.

Genus **Potamides**, Defr.

This genus is represented in the collection by specimens of the three subgenera, *Telescopium*, Montf., *Tympanotonos* (Morch) Adams, and *Cerithidea*, Swains. There are no specimens of the subgenus *Pyrazus*, Montf., which is also known from Sumatra.

Subgenus **Telescopium**, Montf.

Potamides telescopium (Linn.).

1855. *Cerithium telsecopium*, Sowerby, *Theasaurus Conchyliorum*, II, p. 890, pl. clxxxv, fig. 269.
1866. *Telescopium fuscum*, Reeve, *Conch. Icon.* XV, pl. i, sp. I, *a b*.

1897. *Potamides (Telescopium) telescopium*, v. Martens, *Suss. und Brackw.-Moll.* in Weber's *Zool. Ergebn. Niederl. Ost.*-Indien IV, pp. 180–182.
1898. *Cerithium (Telescopium) telescopium*, Kobelt, *Cerithium* in *Martini and Chemnitz Conch.-Cab. (ed. Kuster)*, pp. 57, 58, pl. xii, fig. 1.
1916. *Potamides (Telescopium) fuscum*, Annandale and Kemp, *Mem. Ind. Mus.* V, pp. 344, 345.

Von Martens has given a fairly complete synonymy and the exact distribution of the species, and a few of the important references only are given above.

A fairly complete account of the anatomy of this species was published by Berkley[1] in 1835, while Quoy and Gaimard had given good figures of the animal in the previous year.[2] The radula has the formula 3.1.3.

The specimens in the collection are from mangrove-swamps at Belawan (Deli); and at Perbaoengan (Serdang). They were collected at different times and are of various sizes ranging from 30 mm to 110 mm. in length.

Subgenus **Tympanotonos** (Morch) Adams.

Potamides cingulatus (Gmelin).

1788. *Murex cingulatus*, Gmelin, *Linn. Syst. Nat. ed.* XIII, p. 3561.
1838. *Cerithium fluviatile*, Potiez and Michaud, *Gal. de Moll.* I, p. 363, pl. xxxi, figs. 19, 20.
1866. *Tympanotonos fluviatilis*, Reeve, *Conch. Iconica*, XV, pl. ii, sp. 9, figs. *a*, *b*.
1897. *Potamides (Tympanotonos) cingulatus*, v. Martens, *op. cit.*, pp. 183, 184.
1916. *Potamides (Tympanotonos) fluviatilis*, Annandale and Kemp, *op. cit.*, p. 344.

Kobelt in his monograph of the genus *Cerithium* (*loc. cit.*) does not mention this species, but the references given above and those given in the above references should be quite enough to identify the species. It may also be noted that the species is not the same as *Murex fluviatilis*, Gmelin, which is a synonym of *P. radula* (Linn.).

There are a few specimens in the collection from the mangrove-swamps at Belawan (Deli) and Perbaoengan (Serdang), two specimens from the mouth of the Soengei Batang Kwis (Serdang), and two from a rice-field at Perbaoengan (Serdang). The species is essentially a brackish-water form and the two specimens from a rice-field at Serdang were probably carried there during floods.[3] Only two of the specimens are perfect, in all others the greater part of the outer lip is broken. The radula of the species is described and figured by Troschel.[4]

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[1] *Zoological Journal*, V, pp. 431–439, pls. xx, xxxi (1835).
[2] *'Astrolabe' Zoology*, III, p. 125, pl. lv, figs. 4–6 (1834).
[3] I think this is not possible. Perhaps there is a label-error. I remember that once I collected in these rice-fields and also near the sea on the same day and that I did not possess good boxes for keeping separate the collected material. [den Doop].
[4] *Das Gebiss der Schnecken*, I, pp. 145–146, pl. xii, fig. 2.

The species was originally described from the Malabar Coast of Peninsular India, but has since been found to be widely distributed in the Indian Ocean and the western parts of the Pacific.

Potamides micropterum (Kiener).

1866. *Tympanotonos microptera*, Reeve, *Conch. Iconica*, XV pl. ii, sp. 7, figs. *a*, *b*.
1897. *Potamides* (*Tympanotonos*) *micropterus*, v. Martens, *op. cit.*, p. 185.
1898. *Cerithium* (*Tympanotonos*) *microptera*, Kobelt, *op. cit.*, p. 74, pl. xiv, figs. 5, 6.

I assign, with some doubt, a single specimen from the East Coast of Sumatra to this species. The entire outer lip is broken and the shape of the mouth cannot, therefore, be made out. In form, sculpture and colouration the specimen quite resembles some of the authentic specimens of the species in the Indian Museum collection, though the suture is a little less excavated.

The species was hitherto known from the Phillipines and Borneo.

Subgenus Cerithidea, Swains.

Potamides obtusum (Lam.).

1897. *Potamides* (*Cerithidea*) *obtusus*, v. Martens, *op. cit.*, pp. 186, 187, pl. ix, fig. 22.
1898. *Cerithium* (*Cerithidea*) *obtusum*, Kobelt, *op. cit.*, pp. 42, 43, pl. ix, figs. 3-5.

This species should be assigned to Lamarck and not Wood, as Kobelt has done. The form figured and described by Quoy and Gaimard (*loc. cit.*, pp. 126, 127, figs. 18–21) under this name is not this species but *P. quadratum* (Sow.[1]) ; the shells of the two are quite different and the animal also in the two species, as was pointed out by Eydoux and Souleyet,[2] has a different colouration. The figure of these authors is a very good representation of the colouration of the animal of the true *P. obtusum*.

There are a large number of specimens of this species in the collection from the mangrove-swamps at Belawan (Deli) collected at different times, and from the mouth of the Soengei Batang Kwis (Serdang). Some of the Deli specimens are apparently subfossil, being very much worn and rather chalky in consistency.

This is a widely distributed species and von Martens has given a fairly detailed list of the localities from which it has been recorded.

Potamides quadratum (Sow.).

1897. *Potamides* (*Cerithidea*) *quadratus*, v. Martens, *op. cit.*, pp. 187, 188, pl. ix, fig. 23.
1898. *Cerithium* (*Cerithidea*) *quadratum*, Kobelt, *op. cit.*, pp. 45, 46, pl. ix, fig. 8.

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[1] Kobelt in his monograph (*loc. cit.*, p. 42) does not seem to have detected this mistake, but von Martens had come to the same conclusions as myself; his figure references, however, are incorrectly cited as 19–24 instead of 18–21, pl. lv.

[2] *'Voyage Bonite,' Zoology*, III, p. 600, pl. xxxix, figs. 1, 2 (1852).

Good figures of this species are given by Reeve, von Martens and Kobelt and all these closely resemble Quoy and Gaimard's fig. 18 (*loc. cit.*) of "*P. obtusum.*" The species is easily distinguished from *P. obtusum* by the shape of the shell, the mouth and the much more delicate sculpture.

There are only four specimens of this species in the collection. These were collected along with those of *P. obtusum* from the mangrove-swamps at Belawan (Deli).

Family NASSIDAE.

Genus **Canidia**, Adams.

1861. *Canidia*, Adams, *Proc. Zool. Soc. London*, p. 383.
1876. *Canidia*, Brot, *Journ. Conchyliol.* XXIV, p. 343.
1897. *Canidia*, v. Martens, *op. cit.*, p. 75.

No specimens of this genus were obtained by Prof. Weber in Sumatra and the genus was described by von Martens as being unrepresented there. In 1900, however, he recorded the occurrence of *C. themenckiana* from Lake Toba, Sumatra. In Mr. den Doop's collection there are two specimens, one of which is referrable to *C. themenckiana*, while the other is a specimen of *C. helena*, which has hitherto been recorded from Java and Timor. These two records greatly extent the known range of the species.

Canidia helena (Phil.).

1897. *Canidia Helena*, v. Martens, *op. cit.*, pp. 75, 76.
1912–13. *Canidia Helena*, Schepmann, *op. cit.*, p. 236.

The species was originally described as a *Melania*, and later referred to the genus *Melanopsis* by Mousson, but Brot [1] from an examination of the radula and operculum referred it to its true position amongst the Nassidae.

There is a single specimen of the species in the Sumatran collection from a fresh-water area near Medan (Deli).

Canidia theminckiana (Petit).

1853. *Melania Theminckiana*, Petit, *Journ. Conchyliol.* IV, pp. 255, 256, pl. vii, fig. 11.
1876. *Canidia Theminckiana*, Brot, *Journ. Conchyliol.* XXIV, p. 347.
1900. *Canidia Temminckiana*, von Martens, *Nachr. Deutsch. Malakozool. Ges.* XXXII, p. 12.

A single specimen collected along with that of *C. helena* is referred to this species. It is quite like the figure of the species and agrees well with Petit's description.

Genus **Clea**, Adams.

1855. *Clea*, Adams, *Proc. Zool. Soc. London*, p. 119.
1876. *Clea*, Brot, *op. cit.*, pp. 348–353.

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[1] *Journ. Conchyliol.* XXIV, pp. 343–351, pl. xii (1876).

There is a single specimen in the Sumatran collection which is referrable to this genus. Brot described it from Sumatra and it has not been found anywhere else.

Clea bocki, Brot.

1881. *Clea Bockii*, Brot, *Journ. Conchyliol.* XXIX, pp. 159, 160, pl. vi, fig. 5.
1895. *Clea Bockii*, Smith, *Proc. Malacol. Soc. London*, L, p. 253.

I assign to this species a single specimen obtained in the mangrove-swamps at Belawan, Deli. The mouth is slightly broader and the body-whorl a little larger than in Brot's figure, but these differences are probably of the nature of individual variations. The entire spire except for the penultimate whorl has disappeared and the specimen is in poor condition, but the characteristic sculpture on the shell is well preserved.

The occurrence of a member of the genus *Clea* in estuarine areas is worthy of note, as the genus is essentially a fresh-water one.

Family NERITIDAE.

Genus Neritina, Lam.

Subgenus Neripteron, Recluz (= Auriculatae, v. Martens).

The only species in the Sumatran collection I assign to this subgenus is the new form described below as *N. simoni*. It is a very interesting species, in that it shows definite relationships between the subgenera *Neripteron* and *Dostia*, but clearly belongs to the first sub-genus.

Neritina simoni, Prashad (sp. nov.).

(Plate xiv, figs. 13, 14).

The shell of this species is suborbiculate-ovate, with the posterior margin regularly curved. Its lateral profile is somewhat semicircular, much more arched on the anterior than near the posterior margin. The spire is short and distinctly lateral, but obliquely turned inwards; only a small part of it is visible in ventral view. The columellar area is provided with a short auricle on the upper side; on the lower side the auricle is not well developed. The columellar plate is very broad, extending to a little more than half way across the ventral surface; it is greatly depressed inwards towards the true mouth. The free margin of the columellar plate is slightly but regularly curved, and is finely crenulate. The periostracum is dull black, and has fine concentric striations on its surface; the columellar plate is dull olivaceous with a tinge of orange in some places; the mouth is rather dusky and the operculum is dark brownish with a light orange border.

Measurements of shells (in millimetres).

	A (Type).	B.
Maximum diameter	14·3	13·7
Height	6	5·9
Height of aperture	10	9·8
Columellar plate	7·4	6·5

Locality.—The two specimens of this species were collected by Mr. den Doop from near the mouth of the Soengei Batang Kwis (Serdang), in the mangrove-swamp region.

Remarks.—The species is closely allied to *N auriculata*, Lam., but differs from it in the shell being more elongate, the auricles much less developed and in the comparatively greater width of the columellar plate. The species is interesting in that it affords a connecting link between the subgenera *Neripteron* and *Dostia.*

I have associated the name of this species with that of Mssrs. Simon (Managers of the Estates Batang Kwis and Loeboe Pakam) who greatly assisted Mr. den Doop in making collections on their estates.

Subgenus **Dostia**, Gray.

1879. *Dostia*, v. Martens, *Neritina* in *Mart. and Chemn. Conch.-Cab.*, pp. 16, 37.
1883. *Dostia*, Tapparone-Canefri, *Ann. Mus. Civ. Stor. Nat. Genova*, XIX, p. 63.
1919. *Dostia*, Annandale and Prashad, *Rec. Ind. Mus.* XVI, pp. 241, 242.

In the paper cited above Dr. Annandale and I considered *Dostia* to be sufficiently well characterized to deserve generic rank. Having since examined the large collections in the Indian Museum, some Mesopotamian shells, and the large Sumatran collection I find that there are various intermediate forms between it and the subgenus *Neripteron. Dostia*, therefore, cannot stand as a separate genus but must be considered as a subgenus of *Neritina.* Von Martens' name "Neritae Mitrulae" must, however, give way to Gray's older name *Dostia.*

Neritina crepidularia, Lam.

1879. *Neritina crepidularia*, v. Martens, *op. cit.*, pp. 37–45, pl. vii, figs. 1–4.
1897. *Neritina crepidularia* with var. *melanostoma*, v. Martens, *op. cit.*, p. 218.

This widely distributed species is represented in the Sumatran collection by two varieties, which are separately considered below.

var. **melanostoma** (Troschel).

1837. *Neritina melanostoma*, Troschel, *Arch. Naturgesch.*, p. 179.

This variety was described from specimens collected in the River Ganges, probably from the deltaic region. It is represented from Sumatra by a large number of specimens of all ages collected in the mangrove-swamps at Belawan (Deli). The Sumatran specimens are exactly like the Indian shells.

var. **exaltata** (Recluz).

1850. *Neritina exaltata*, Recluz, *Journ. Conchyliol.* I, p. 65, pl. iii, fig. 3.

Recluz's type-specimens of this form were collected in the Negros Island, Philippines. There are a few named specimens in the Indian Museum with which I have compared the Sumatran specimens I assign to this variety. All these specimens agree fairly with the description and figure of Recluz.

The Sumatran specimens were collected in the mangrove-swamps at Belawan (Deli) along with those of the var. *melanostoma*.

Neritina weberi, Prashad (sp. nov.).

(Plate xiv, figs. 15, 16).

The shell is very thin, subcircular in outline in the ventral view, regularly curved anteriorly and broadly truncated posteriorly. In the lateral view it forms an arch much less than a semicircle, greatly depressed anteriorly, and only slightly raised a little behind the middle. The spire is very minute, lateral, recurved inwards and just visible from below. The columellar plate is broad, greatly inclined forwards and downwards, and with a distinct depression near the margin; the margin is entire or very slightly crenulate, and is distinctly curved. The dorsal surface is strongly marked with concentric transverse striae. The periostracum is dark olivaceous in the region of the spire, but over the rest of the shell has a marked tessellated pattern formed by the crossing of dark olive bars over a dark yellowish background; the columellar plate is bluish, the shell on the inner surface is greyish but the tessellated pattern of the outer surface is visible through the transluscent shell; the operculum is black.

Measurements of shells (in millimetres).

	A (Type).	B.
Maximum diameter	8·2	8·5
Height	3·3	3·4
Height of aperture	7·2	7·9
Columellar plate	3·6	3·8

Locality.—The two specimens of this interesting species were obtained from the mouth of the Soengei Batang Kwis (Serdang) in the mangrove-swamp region along with those of *N. simoni*.

Remarks.—The species is distinguished by its very depressed type of shell, its outline and the distinctly tessellated colouration.

I have great pleasure in associating the name of this species with that of Prof. Max Weber, who has been kind enough to send me a large proportion of the collection of fresh-water and brackish-water species made by him in the Dutch East Indies, and identified by the late Prof. E. von Martens.

Subgenus **Neritaea**, Roth (=**Serratae**, Recluz).

Neritina ziczac, Lam.

1897. *Neritina ziczac*, v. Martens, *op. cit.*, p. 79.
1899. *Neritina ziczac*, Dautzenberg, *Ann. Soc. Malacol. Belgique*, XXXIV, p. 19, pl. i, figs. 7, 7*a*.

I refer to this species two specimens of a characteristic colour. The colouration of these specimens resembles fig. 29, pl. vii in Reeve's *Conch. Iconica*. The spire of one of the specimens is very much eroded.

The two specimens were collected from the mouth of the Soengei Batang Kwis (Serdang), in the mangrove-swamp region.

Neritina variegata, Lesson.

1897. *Neritina variegata*, v. Martens, *op. cit.*, pp. 78, 79, pl. x, fig. 14.

Nine specimens collected from a streamlet along the road to Anak Laut (Sabang) closely agree with Lesson's description and with a specimen named by the late Prof. E. von Martens. The colour-pattern is, however, slightly variable.

Subgenus **Neritodryas**, v. Martens.

Neritina cornea (Linn.).

1879. *Neritina cornea*, v. Martens, *op. cit.*, pp. 140-142, pl. xii, figs. 14–18.
1899. *Neritina* (*Neritodryas*) *cornea*, Dautzenberg, *op. cit.*, pp. 21, 22, pl. i, figs. 11, 11*a* and *b*.

This species is widely distributed in the Dutch East Indies, and is represented in the Sumatran collection by a large number of variously coloured specimens collected along with those of *N variegata* from a streamlet along the road to Anak Laut (Sabang) at various times.

Subgenus **Clithon**, Recluz.

Neritina brevispina, Lam.

1879. *Neritina brevispina*, v. Martens, *op, cit.*, p. 28.

A very large series of this species was collected by Mr. den Doop at different times in the streamlet along the road to Anak Laut (Sabang). The specimens are variously coloured, and either have well-developed spines or are nearly smooth, there being only rugosities in the regions of the spines.

Neritina squarrosa (Recluz).

1897. *Neritina squarrosa*, v. Martens, *op. cit.*, p. 80.

The specimens of this species are also from the streamlet along the road to Anak Laut (Sabang). The banding on the shell is very like that figured on pl. xii in Reeve's *Conch. Iconica*.

Genus **Nerita**, Linn.

This genus is represented by two widely distributed species *N lineata* and *N planospira*.

Nerita lineata, Chemn.

1897. *Nerita lineata*, v. Martens, *op. cit.*, p 219.

A large series of specimens of all ages collected from the mangrove-swamps at Belawan (Deli), and a few from the Soengei Belawan (Deli) not far from the sea, are represented in the collection. Some of the empty shells contain hermit-crabs.

Nerita lineata, Anton.

1897. *Nerita planospira*, v. Martens, *op. cit.*, p. 219.

The specimens of this species were collected along with those of the preceding species in the same mangrove-swamps. They are of all ages and some have hermit-crabs in the empty shells.

Genus **Septaria**, Fer.

Septaria tessellata (Lam.).

1899. *Septaria tessellata* with vars. *clypeolum*, *compressa* and *lineata*, Dautzenberg, *op. cit.*, pp. 23–26, pl. i, figs. 14, 14*a*, 15, 16.

Many specimens of the *forma typica*, showing all grades of tessellated colouration and closely corresponding with Lamarck's original figures and also with those of Dautzenberg cited above, are represented from the streamlet along the road to Anak Laut, Sabang. Besides these specimens of the *forma typica*, shells of the three varieties *clypeolum* (Recluz), *compressa* (v. Martens) and *lineata* (Lam.), collected in the mangrove-swamps at Belawan (Deli) are also present in the Sumatran collection.

Family OSTREIDAE.

Genus **Ostrea** Linn.

Specimens of three species of this genus are represented in the collection from the regions of mangrove-swamps in Sumatra. One of these, which I consider to be identical with the widely distributed miocene and recent *Ostrea gryphoides* (Schlotheim), belongs to the subgenus *Ostrea, s.s.*, and was probably brought into the estuarine region by the tides as there are remains of corals on the shells,[1] but it is likely that the species in Sumatra, like an allied form found living in the Chilka Lake,[2] is a true inhabitant of brackish waters. The other two species belong to the subgenus *Alectryonia*, and are true estuarine forms.

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[1] Might it not be possible that the shells are subfossil, and at the present day are found in the mangrove-swamps in consequence of the retiring of the sea by land elevation, which is here very prominent. [den Doop].

[2] See Annandale and Kemp, *Mem. Ind. Mus.* V pp. 348, 349 (1916).

Ostrea gryphoides (Schlotheim).

1912. *Ostrea gryphoides*, Newton and Smith, *Rec. Geol. Surv. Ind.* XII, p. 7, pls. i–vi.

Newton and Smith have identified the recent species, which occurs very commonly from the Mekran Coast to the Malay Peninsula, with the miocene *O. gryphoides*; Annandale and Kemp (*loc. cit.*), on Mr. Vredenberg's authority, consider it doubtful whether the living form should not be known as *O. virginiana* rather than *O. gryphoides*. As the identity of the Indian and the American species has not yet been definitely established, I prefer to designate the Indian and Sumatran forms *O. gryphoides*. The differences in the shell of the American *O. virginiana* and the Indian species were fully noted by Newton and Smith, and are summarised in the paper by Annandale and Kemp.

The Sumatran shells are closely similar to the Indian forms from the Malay Peninsula and other localities in the Indian Museum collection. They resemble the photographs on pls. iv and v of Newton and Smith's paper. The specimens were collected by Mr. den Doop in the mangrove-swamp region at Belawan (Deli). The shells are not much worn, but are parasitised by some species of boring sponge of the genus *Cliona*. The external surface of the shell and the inner layer are whitish, the muscle scar is somewhat yellowish, while the ligament has a blackish colour.

Subgenus Alectryonia, Fischer Waldh.

Ostrea folium, Linn.

1897. *Ostrea folium*, v. Martens, *op. cit.*, p. 222.

Typical specimens of this species are present from the mouth of the Soengei Batang Kwis (Serdang). The specimens were collected in the estuarine area and are stated to be subfossil in a sandy incision of an old *pematang*. This incision was made for a new drain-canal on the estate.

Ostrea cuculata, Born.

1897. *Ostrea cuculata*, v. Martens, *op. cit.*, p. 223.
1916. *Ostrea cuculata*, Annandale and Kemp. *Mem. Ind. Mus.* V, p 349, pl. xiv, figs. 2.

This widely distributed species is represented by two partially bleached shells from the same locality as the preceding species. The specimens are rather broken and imperfect.

Family UNIONIDAE.

Many species of this family have been recorded from Sumatra by Bruno Strubbel, von Martens and others, but in the present collection this family is poorly represented.[1] In a recent paper I

[1] I think in the region where I collected this family is very poorly represented. Of this the freshwater Neritinas afford another instance. These are entirely

have dealt with one of the species and here only include a few notes on it. There are, however, in the collection a few specimens of a species of the genus *Contradens*, Haas, a short account of which is given below.

Genus **Monodontina**, Conrad.

Monodontina vondembuschiana var. **chaperi** (de Morgan).

1919. *Monodontina vondembuschiana* var. *chaperi*, Prashad, *Rec. Ind. Mus.* XVI, pp. 407, 408.

In my recent paper I unfortunately missed a reference to one of von Marten's papers[1] in which he had recorded a Sumatran form under the name *Pseudodon vondembuschianus*. Probably his specimens also belonged to the variety *chaperi*.

In the Sumatran collection the variety is represented by a large series of specimens from the Soengei Kalau (a streamlet near Bohorok), Soengei Deli at Medan and a few empty shells from Bohorok. Mr. den Doop informs me that the empty shells had been left there after the soft parts had been eaten.

Genus **Contradens**, Haas.

1913. *Contradens*, Haas, *Nachr. Deutsch. Malakozool. Ges.* XLV p. 35.
1914. *Contradens*, Haas, *Mart. Chemn. Conch.-Cab. Unio*, p. 173.
1914. *Nodularia* (in part), Simpson, *Des. Cat. Naiades*, p. 108.

Haas proposed this genus on both shell-characters and soft-parts for the species included by Simpson[2] in his group of *Nodularia contradens*. Simpson in his later work, cited above, has not accepted Haas' new genus and continued his original scheme. I have had a chance of examining the shells of some of the species and the soft-parts of *C. dimotus* var. *lugens* recorded below, and think that the genus is well characterised and should be separated from *Nodularia* as accepted by Simpson.

Contradens dimotus var. **lugens** (Drouet and Chaper).

1892. *Unio lugens*, Drouet and Chaper, *Mem. Soc. Zool. France*, V, p. 147, pl. v, figs. 1–3.
1914. *Contradens dimotus lugens*, Haas, *op. cit.*, pp. 182, 183, pl. xix, fig. 7.
1914. *Nodularia lugens*, Simpson, *op. cit.*, p. 1012.

A large series of rather young shells from the Soengei Krah at Medan, and a young specimen from a fresh-water area near Medan, quite resemble Drouet and Chaper's description and figures and also Haas' figure of one of the co-types. The only differences are in the beaks being a little more high and having a

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absent (even in the chalky mountains) from the northern part of the government "Oostkust van Sumatra" whereas they are abundantly represented in Sabang. [den Doop].

[1] *Nachr. Deutsch. Malakozool. Ges.* XXII, p. 13 (1900).

[2] *Proc. U. S. Nat. Mus.* XXII, p. 817.

distinct sculpture of rather thick wavy lines; they show distinct V-shaped curvatures in the upper regions of the umbones, and some of the lines extend on to the posterior wing as well. The posterior ridge is not single but distinctly double, and in some specimens another faint ridge is also indicated above these ridges. In outline, as stated above, the specimens quite resemble Drouet and Chaper's figures. The specimens are all quite fresh, and are of a brownish yellow colour with a few greenish stripes in the region of the posterior wing. The largest specimen does not exceed 40 mm. in length.

This form had hitherto been known from Borneo only but the *forma typica* and other nearly allied forms have been recorded from Sumatra.

The animal resembles that of the species *C. hageni* and *C. verbecki* described by Haas (*loc. cit.*, pp. 175, 199 and 200, text-figures 2, 3).

Family CYRENIDAE.

Genus **Cyrena** (Lam.) Gray.

Cyrena sumatrensis, Sowerby.

1897. *Cyrena sumatrensis*, v. Martens, *op. cit.*, p. 92.

One complete specimen and a few rather worn shells of this species were collected from the mangrove-swamps at Belawan (Deli). These specimens agree fairly well with the large series of this species in the Indian Museum collection.

Genus **Corbicula**, Meg.

In Mr. den Doop's Sumatran collection the genus is represented by dry shells of the four species dealt with below, and a few young shells which it is not possible to identify specifically. It may also be noted here that the shells of practically all the specimens are greatly eroded.

Corbicula moltkeana, Prime.

1897. *Corbicula moltkeana*, v. Martens. *op. cit.*, pp. 111, 112.

This species is represented by a few rather imperfect specimens from a streamlet at Timbang Langkat. The specimens closely agree with a specimen named by the late Prof. E. von Martens.

Corbicula trapezoidea, v. Martens.

1897. *Corbicula trapezoidea*, v. Martens, *op. cit.*, pp. 115, 116, pl. vii, figs. 14–19.

A single specimen from a streamlet at Timbang Langkat agrees in shape and hinge-teeth with one of v. Martens' co-types, but the ribs on the surface are more closely situated and not so prominent as in that specimen.

Corbicula angulifera, v. Martens.

1897. *Corbicula angulifera*, v. Martens. *op. cit.*, p. 116, pl. vii. figs. 28–31.

A few specimens from fresh-water areas near Medan and Tandjong Djatti, from the Soengei Lepan (Langkat) and a young shell from a streamlet at Timbang Langkat agree closely in shape with one of von Martens' co-types, but the sculpture of all the shells, owing to erosion, is very indistinct, and it is, therefore, impossible to be quite certain about their identification.

Corbicula pullata, Phil.

1897. *Corbicula pullata*. v. Martens, *op. cit.*, pp. 117, 118.

I assign a single specimen from a streamlet at Timbang Langkat to this species. This specimen agrees with the description of the species and also with Issel's description and figures of *C. dayakorum*,[1] which von Martens considers to be only a synonym of Philippi's species.

Genus Sphaerium, Scopoli.

So far as I can find no species of this genus of world-wide distribution has so far been recorded from Sumatra. This may be due to the various collectors having overlooked the rather minute shells. The only species known from the adjacent island is *P. borneense* (Sowerby), but the single shell in the Sumatran collection found in a tubeful of *Limnaea javanica* var. *subteres*, v. Martens, is quite different from it. As it does not correspond to any previously described form, I have described it here under the name *Sphaerium ceciliae* at the request of Mr den Doop.

Sphaerium cecilae, Prashad (sp. nov.).

(Plate xiv, fig. 17).

The shell is ovate, somewhat swollen, subequilateral, rather thick, with the anterior margin small and rounded; the posterior margin is a little longer than the anterior and is broadly rounded; the upper and lower margins are regularly curved, the upper curve being deeper than the lower. The umbones are prominent, swollen, recurved inwards and separated from one another in the middle line by a narrow chink. The epidermis is nearly smooth in the umbonal region but has closely situated faint concentric striae below on both the valves. The shell is of a pale horny colour in the umbonal region, but is much darker in the lower region and shows greenish stripes in some places; the inner surface of the valves is dusky bluish. The right valve has two lamellar laterals on each side, of these the upper is very feeble; there are

[1] *Ann. Mus. Civ. Stor. Nat. Genova*, VI, p. 410, pl. vii, figs. 25–27 (1874).

two cardinals, the anterior one being narrow, elongate, somewhat triangular, and the posterior thick and tooth-like. The left valve has a single lateral on each side; of the two cardinals of this valve the anterior is thick and blade-like, while the posterior is small and reduced to a knob.

The single type-shell measures 9·3 mm. in length by 7·4 mm in maximum breadth, and is 4 mm. thick. It was collected in the valley of the Lau Kling (stream near Brastagei in the Karo-Batak High Plain).

FAMILY SOLENIDAE.

Genus **Cultellus**, Schumacher.

1887. *Cultellus*, v. Martens, *op. cit.*, p. 263.
1820. *Cultellus*, Ghosh, *Rec. Ind. Mus.* XIX, pp. 61, 62.

Three subgenera *Cultellus s.s.*, *Pharella* and *Enisculus* are known from the Dutch East Indies, while specimens of the first two have been recorded from Sumatra. In Mr. den Doop's collection only specimens of *C.* (*P.*) *javanicus*, a species previously recorded from Sumatra, are represented.

Subgenus **Pharella**, Gray.

1887. *Pharella*, v. Martens, *op. cit.*, p. 266.
1820. *Pharella*, Ghosh, *op. cit.*, p. 63.

Von Martens redescribes this subgenus in the paper cited above and Ghosh has given a fairly complete description of the gross anatomy based on Bloomer's work.[1] He considers it with Bloomer to be worthy of separate generic rank, but the small differences in the gills of *Pharella* and *Cultellus s.s.* are not, in my opinion, sufficient to separate the two into distinct genera. The shells of the two are closely similar and it appears best, therefore, to consider the two as subgenera rather than as distinct genera.

Cultellus javanicus (Lam).

1897. *Cultellus* (*Pharella*) *Javanicus*, v. Martens, *op. cit.*, pp. 267-269.

Three specimens of this species collected in the mangrove-swamps at Belawan (Deli) agree closely with von Martens' description and with the large series of this species from Penang and other localities in the Malay Peninsula, preserved in the Indian Museum collection.

Family PHOLADIDAE.

Genus **Teredo**, Linn.

Subgenus **Furcella**, Lam.

Teredo arenaria (Linn.).

1897. *Teredo* (*Furcella*) *arenaria*, v. Martens, *op. cit.*, pp. 284–286.

A rather small and somewhat broken specimen is assigned with some doubt, to this species. The shape and texture is quite

[1] *Journ. Malacol.* X pp. 114–121 (1903).

like the specimens in the Indian Museum collection, but the imperfect condition of the shell renders exact identification difficult.

The specimen was obtained by Mr. den Doop in the mangrove-swamps at Belawan (Deli).