

REVISION OF THE AFRICAN
AMPULLARIIDAE SPECIES

OF THE

GENUS *PILA* RODING 1798

(MESOGASTROPODA, ARCHITÆNIOGLOSSA, MOLLUSCA)

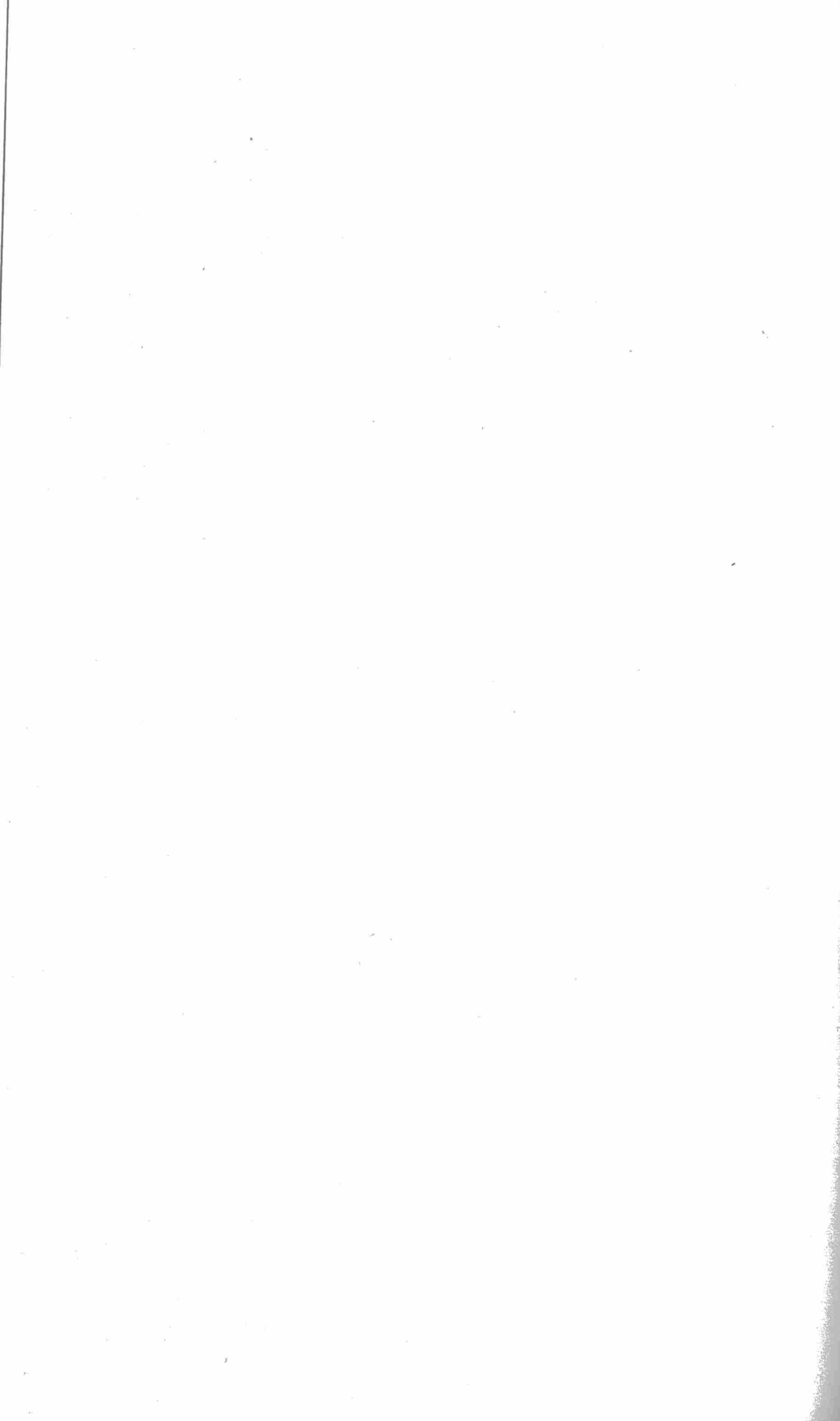
by T. PAIN

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SUMMARY

The paper reviews all the species and subspecies of African *Pila* known to the Author. It is pointed out that past writers on the subject found with surprise that only twenty one species had been described, a number which seemed out of proportion to the vast area covered. However, a detailed review of the literature and of many specimens has convinced the Author that even this number contains many synonyms and he seeks to maintain only the following species:

Ovata (with subspecies *ovata*, *stuhlmanni*, *gordoni*, *nyanzae*, *congoensis*, *eleanorae* and new subspecies *dartevellei*, herein described), *wernei*, *speciosa*, *gradata*, *adusta*, *occidentalis* and *africana* (with subspecies *africana* and *ko-leensis*).

The paper describes each species and subspecies, pointing out the reasons for its retention and for the relegation of the remaining names: and a complete synonymy is provided, together with an account of the distribution and range of each.



Although the various accounts of the African members of the genus *Pila* have from time to time appeared in a wide variety of publications, the most recent, that of PILSBRY and BEQUAERT (1927) deals only in detail with species from the Belgian Congo. ALDERSON (1925) gives useful details of those which he had represented in his collection, but in spite of this, many of the described species — often founded upon one example and not subsequently recorded — remain little known, and their place in the genus is a matter of doubt.

In the introduction to the African section of his work, ALDERSON (1925, 83) suggests that the small number of species described is out of all proportion to the immense size of the areas concerned, many of them eminently suited to the development and growth of these aquatic snails, and suggests that the twenty-one species enumerated by SOWERBY (1910) represents only a fraction of those which might eventually be discovered and described from the tropical parts of the continent.

However, it is nearly thirty years since the publication of ALDERSON'S work, during which time much scientific exploration has been carried out in tropical Africa, and since only one new species (*Pila dewulfi* BEQUAERT & CLENCH 1933) and two new subspecies (*Pila ovata eleanorae* MANDAHL BARTH 1954 and *P. africana koleensis* VENMANS 1956) have been described and published, it seems reasonable to doubt his assumption. Careful study of the known African species and their distribution has convinced me that in fact the reserve is the case. Many of the described species will be found, when adequate material from as many localities as possible is used for comparison, merely to be local variations of the two or three very variable and widely distributed forms. Of these two, *P. ovata* (OLIVER) and *P. wernei* (PHIL.) occur over almost all the tropical areas where conditions are suitable and have in consequence been described on numerous occasions as new species.

The doubtful forms, mostly the work of BOURGUIGNAT, BILLOTTE and GERMAIN, have as far as possible been relegated herein to the synonymy of such species or subspecies as the author considers after many years close acquaintance and study of the genus to be valid ones. Every effort has been made to account for all species of *Pila* so far described from continental Africa.

It has not been thought necessary to give figures of the African *Pila* dealt with in this paper, with the exception of one subspecies described as new, since excellent illustrations of all of them can be found in the standard

works on the subject (REEVE 1856, KOBELT 1911-1915, ALDERSON 1925, PILSBRY and BEQUAERT 1927 and MANDAHL-BARTH 1956), references to which are given in the synonymy.

The author is deeply indebted to the late Dr. E. DARTEVELLE and Prof. P. L. G. BENOIT (Musée Royal du Congo Belge) and Dr. W. ADAM (Brussels Museum) for affording him every facility to examine the collections of *Ampullariidae* in their respective institutions. To Dr. J. C. BEQUAERT and Dr. W. CLENCH (Museum of Comparative Zoology, Harvard College) and Dr. L. S. B. LEAKEY (Coryndon Museum, Nairobi) for the loan of specimens for study. To Dr. J. MANDAHL-BARTH and Dr. B. VERDCOURT for the gift of specimens, to Mr. T. E. CROWLEY for much helpful criticism and advice and to Prof. P. L. G. BENOIT also for the photographs of *P. ovata dartevellei* n. sub. sp., here reproduced. Without the help of these and other colleagues this revision would have been impossible.

Family **AMPULLARIIDAE**

Genus **PILA** RODING 1798 (= **AMPULLARIA** LAMARCK 1799)

(Mus. Boltenianum, p. 145)

Type **Helix ampullacea** LINN.

Shell large to medium, dextral, globular or ovate, usually umbilicate, brown or green, often with darker bands, more visible inside than outside the shell. Weak vertical and often scarcely visible microscopical sculpture; operculum rigid with strong calcareous laver inside.

Pila ovata (OLIVER)

This variable species, of which a number or recognisable subspecies exist, has already been dealt with in some detail by the writer (PAIN 1952), as a result of the study of much additional material, mostly from the collection of the Musée Royal du Congo Belge, some further revision became desirable, particularly in respect of the distribution of the various subspecies, which in some cases is far more extensive than was at first realised. The synonymy, given in full in my previous paper, is not in consequence, repeated here.

Pila ovata ovata (OLIVER)

1804 *Ampullaria ovata* OLIVER, Voyage dans l'Empire Ottoman, II, p. 39, pl. 31, fig. 1.

1849 *Ampullaria kordofana* PHILIPPI, Mon. Amp. in MART. und CHEM., Syst. Conch. Cab., taf. 13, fig. 1.

1885 *Ampullaria bridouxii* BOURGUIGNAT, Iconogr. Malacol. Tanganyika, pl. 5, fig. 32.

- 1901 *Pila martensi* BLANCKENHORN, Neus zur Geologie und Palaeontologie Aegyptiense, 4. - Z. Dtsch. Geol. Ges., 53, p. 307.
- 1915 *Pachylabra ovata* KOBELT, Mon. Amp. in MART. and CHEM., Syst. Conc. Cab., n. F., p. 46, pl. 31, figs. 1, 3 & 4.
- 1952 *Pila ovata ovata* PAIN, Rev. Zool. Bot. Afr., XLVI, p. 286 (Synonymy).
- 1953 *Pila ovata* LELOUP, Institut Royal des Sciences Naturelles de Belgique 3, Exploration Hydrobiologique du Lac Tanganyika; Gastéropodes, p. 60, pl. 3, figs. 1a to j.
- 1954 *Pila ovata ovata* MANDAHL BARTH, Ann. Mus. Royal du Congo Belge, 32, p. 40 (figs. in text).

Distribution. Egypt: Lake Marcotis (Type OLIVER); Canal Marmoudich, Lake Ballah (PALLARY); Siwa Oasis (CONNOLLY); Kafr. esh Sheikh, Sakha mound (Ptolemaic Period) (HOLDEN).

Sudan: Tiwila, Kosti, Hillet Abbâs, Masrau Is., Gebel En, Renk, South of Melût, Bahr el-Zarâfa (Southern end), Hillet el-Nûwêr (LONGSTAFF 1912); Dabba el-Gardega, Bahr el Ghazal, Djebel Zaraf (LE ROI 1913).

Uganda: near Murchison falls, Jarvis Dam, near Nyanja Station, Sejibura River, near Kichwamba, road from Mbarara to Masaka (MANDAHL BARTH 1954); Buddu, West of Masaka (SOWERBY 1910); Ntotoro, Bwamba (MITTON 1956); Lotome near Moroto Karamoja (PLNHEY); Tororo (FISHER); Lake Duma (PITMAN); Greeki River at Sebei (LOVERIDGE 1933); Kampala (PINKERTON).

Tanganyika Territory: Lake Ruzkwa (PITMAN).

Lake Tanganyika: Kigoma (ALDERSON 1925); Usumbura (DARTEVELLE); Sumbu (CONNOLLY).

Congo: Inkisi (VAN DEN BROECK); Lake Mohasi, Ruanda (LESTRADE); Mougupa, Tumbi (DARTEVELLE); Séminaire Stanleyville (MILLER); Lake Edward, delta de la Rutshuru (SCHWETZ 1949); Albertville (J. BEQUAERT); Moba (SCHWETZ); Rumonge (LESTRADE).

Northern Rhodesia: Sumbu (CONNOLLY).

Typical *ovata* is thus reliably reported from Egypt and the Sudan, throughout the course of the Nile, and from Uganda, Tanganyika Territory and the Belgian Congo. Its occurrence in Lake Tanganyika is also beyond doubt, examples having been taken at localities as far apart as Kigoma in Tanganyika Territory, Usumbura in the Congo and at Sumbu in Northern Rhodesia. As pointed out by VON MARTENS (1897) more than one form of *P. ovata* exists in this lake. He mentions a globose variety with dark olive-green colouring and a wide aperture such as that figured by ALDERSON (1925, pl. 19, fig. 1). Shells I have seen from Sumbu, on the other hand, are far thicker, with a noticeably high and pointed spire; all would however fall within the range of *ovata* s. s., and a distinct sub-species such as is found in Lake Victoria and Lake Albert is not present in Lake Tanganika. *P. o. bridouxii* (BOURGUIGNAT 1885), previously retained as a distinct sub-species (PAIN 1952, 291), would appear to be more correctly regarded as a giant example of typical *ovata*. It has been recorded from the mouth of the Mala-

garazi River and near the outlet of the Lukuga below the Chakabala Islands. The type locality was not designated.

It is unfortunate that by an accident of priority in publication, a rather insignificant form has obtained the specific name of *ovata*, that figured later by PHILIPPI (1849) as *kordofana* being far more typical of the subspecies as a whole. When, however a large series is examined, examples linking typical *ovata* to typical *kordofana* can usually be found, as for instance amongst the fine series collected in the Sudan by LONGSTAFF (1914).

E. LELOUP (1953, 60), whilst recognising the occurrence in Lake Tanganyika of the nominate race of *P. ovata*, wrongly in my opinion makes *P. gradata* SMITH and *P. o. congoensis* PILSBR. and BEQ. synonyms of it. I have carefully examined the type and paratype of *P. gradata* and consider it distinct from any race of *P. ovata* (see p. 21). The large series of *P. o congoensis*, the common race of the Congo River drainage, in the Musée Royal de l'Afrique Centrale, which I have also examined, leads me to maintain the form as a distinct subspecies of *P. ovata*.

The shell figured by LELOUP (pl. III, fig. E) as *P. gradata* would appear to me to represent *P. o. gordonii* SMITH. I do not furthermore consider the two shells figured on pl. 3, fig. G as *P. wernei* (PHIL.) from Tanganyika Territory (Kigoma) as correctly identified, since typical *wernei* is unknown from the vicinity of Lake Tanganyika and in any case is unlikely to be mistaken for any form of *P. ovata*, to which species all the shells figured by LELOUP should be referred.

MEASUREMENTS OF ADULT SHELLS

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
82	70	56	37		Bahr el Zarefa
80	65	66	36		Kafr esh Sheikh
70	51	45	29		Sumbu
60	45	38	24		Lake Mareotis
53	45	37	21		Sebei
52	47	42	27		Lake Ru Kiva
50	42	41.5	28		Seminaire Stanleyville
50	42	38	25		Inkisi
48	40	33	21		Lake Duma

Fossil Records. *P. ovata ovata* was recorded by R. B. NEWTON from Miocene (Burdigalian) deposits on Lake Victoria at Kavirondo, Kenya (R. B. NEWTON, 1914, Quart. Journ. Geol. Soc. Lond., 70, p. 189) from material collected by Dr. FELIX OSWALD. Much additional material has since been obtained at this locality by Dr. L. S. B. LEAKEY and which I have been privileged to examine. These fossils are in the form of internal casts in a coarse limestone and I am of the opinion that NEWTON was perfectly correct in referring them to the nominate race of *P. ovata*. This subspecies occurs also in recent and

post-Pliocene alluvial deposits in Egypt. There are no authentic records of the occurrence of any African *Pila* in deposits older than the Miocene.

BLANCKENHORN (1901) describes a new species, *Pila martensi* from the alluvium of Fayoum, Egypt. I have not seen this species, but from the description would consider it as not separable from the very variable *P. ovata* still living in the lower Nile valley. All the records of *Pila* from the Post-Pliocene and recent deposits in Egypt should in my opinion be referred to *P. o. ovata*.

***Pila ovata stuhlmanni* (VON MARTENS).**

- 1887 *Ampullaria erythrostroma* var. *stuhlmanni* v. MARTENS, Deutsch. Ost. Afr., 4, Beschalte Weichth., p. 155 (fig. in text).
 1915 *Pachylabra erythrostroma* var. *stuhlmanni* KOBELT, Mon. Amp., in MART. and CHEM. Syst. Conc. Cab., n. F., p. 54, pl. 32, fig. 1.
 1952 *Pila ovata stuhlmanni* PAIN, Rev. Zool. Bot. Afr., XLVI, 3-4, p. 288.
 1954 *Pila ovata stuhlmanni* MANDAHL BARTH, Ann. Mus. R. Congo Belge, 32, p. 45, figs. 16 a-d, 17 a-b.

Distribution: Uganda: Lakes Albert and Kyoga (typical form). Butiaba (MANDAHL BARTH 1954). Subfossil near Kibero (FISHER). Lake Kyoga at Bugondo (MANDAHL BARTH). Namasagali (VERDCOURT). Pond at Serere and at Masindi, Victoria Nile at Namasagali (thin-shelled « *pejus* » form, MANDAHL BARTH 1954).

Congo: Lake Albert near Kasenyi (type, STUHLMANN). Lake Albert, Kasenyi, Port Mahagi (DYKE in coll. SPENCE).

Typical *P. ovata stuhlmanni* is restricted to the Lakes Albert and Kyoga. It differs from the nominate race by reason of its generally larger size, considerably higher spire, more acute apex with the whorls rounded and not flattened at the sutures. The apical whorls, in contrast to most other subspecies are frequently preserved. MANDAHL BARTH (1954, 48) regards a small thin shelled form, found in ponds at Serere and at Masindi, as well as in the Victoria Nile at Namasagali, as probably a « *pejus* » form of *P. o. stuhlmanni*. Type specimen in Berlin Museum.

MEASUREMENTS OF ADULT SHELLS

Length	GREATEST Width	APERTURE		Locality
		Length	Width	
105	90	75	48	Bugondo
95	73	66	44	Butiaba
85	72	65	40	Bugondo
84	77	63	41	L. Albert (Type STUHLMANN)
60	45	48.5	34	Namasagali
60	47	47	30	Serere

Subfossil examples of this race have been obtained in alluvial deposits bordering Lake Albert and indicate a considerable drop in the level of its waters. *P. o. stuhlmanni* has been recorded living in Lake Edward by GERMAIN (1916), but his statement is based upon VON MARTENS (1897), who doubtfully refers some young *Pila* found at Katarenga to this form. However as pointed out by MANDAHL BARTH (1954, 47) it is quite impossible to distinguish young specimens of the different races of *P. ovata* from each other, and one should be satisfied, as VON MARTENS says himself, that this find proves the genus to be at least represented in lake Edward. For my own part, I have been unable to see any *Pila* from this lake.

W. ADAM (1957, 44) however, refers a number of fossil specimens from recent deposits at Ishango to *P. o. stuhlmanni* and gives (pl. I, figs. 11 and 12) excellent illustrations of two. From these figures and his extensive table of dimensions, I am of the opinion that these fossils are correctly referred to this race, although the specimens are considerably smaller (see table, p. 13.) than recent examples from Lakes Albert and Kioga. It would seem highly probable that a small form of *P. o. stuhlmanni* has been and may still be living in Lake Edward, similar in size and appearance to that recorded by MANDAHL BARTH (1954) from the Victoria Nile at Namasagali.

E. DARTEVELLE (1948) records subfossil shells from Lake Edward, estuary of the River Semliki, which he doubtfully refers to ? *Pila* sp.

***Pila ovata gordonii* (SMITH).**

1892 *Ampullaria gordonii* SMITH, Annals & Magazine Nat. Hist., 10, p. 382.

1897 *Ampullaria ovata* var. *emini* v. MARTENS, Deutsch Ost Afr., 4, Beschalte Weichth., p. 156 (fig. in text).

1915 *Pachylabra gordonii* KOBELT, Mon. Amp. in MART. and CHEM., Conc. Cab., n. F., p. 64, pl. 30 a, figs. 2-5.

1952 *Pila ovata gordonii* PAIN, Rev. Zool. Bot. Afr., XLVI, p. 289.

1954 *Pila ovata gordonii* MANDAHL BARTH, Ann. Mus. R. Congo Belge, 32, p. 42, 42, figs. 14 a-g.

Distribution: Uganda: Lake Victoria at the Southern end (Type, GORDON); Jinja, Entebbe, Napoleon Gulf, Buvuma Channel, Dugusi Is., Muranya (MANDAHL BARTH 1954); Kibuko Is., (ALLEN TURNER); Kirami (HARGER); Victoria Nile 22 miles above the Murchison Falls (PITMAN); Kampala (PINKERTON); Victoria Nile below Owen Falls dam (CRIDLAND).

VON MARTENS variety *volkensis*, which was obtained in the Yipe Lake S. E. of Mount Kilimanjaro, Kenya Colony, by Volkens, is from a locality far removed from the known range of *P. ovata* and is almost certainly *P. wernei* (PHIL.). Although *P. o. gordonii* is said to be restricted to Lake Victoria, MANDAHL BARTH (1954, 44) records it from the upper part of the Victoria Nile, and shells obtained there by PITMAN and now in my possession are typical of this subspecies.

P. ovata emini (v. MARTENS 1897, 156) which was doubtfully retained as a distinct subspecies in my previous paper (PAIN, 1952, 289), was obtained

at Nyemirembe on Lake Victoria by STUHLMANN; it resembles a high-spired thin form of *P. o. gordonii* I have seen from several localities on this lake and would appear to be an extreme form of it. *P. o. emini* is also recorded by v. MARTENS from Lake Edward at Rumande (STUHLMANN), but the only *Pila* so far known from this lake belongs to a small form of *P. o. stuhlmanni* (v. Mts.), of which STUHLMANN's specimen (60 × 49 mm.) is possibly a large example. The type of *gordonii* is in the British Museum.

MEASUREMENTS OF ADULT SHELLS

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
94	72.5	58	42		Nyemirembe
82	75	67	—		(Type of <i>emini</i> Mts.) Napoleon Gulf
70	58	49	29		Entebbe
67	51	49	32		Kampala
54	50	42	29		Jinja
43	35	33.5	23		Victoria Nile

Pila ovata nyanzae (SMITH)

- 1892 *Ampullaria nyanzae* SMITH, Ann. Mag. Nat. Hist., (6) 10, p. 382.
 1915 *Pachylabra nyanzae* KOBELT, Mon. Amp. in MART. and CHEM., Syst. Conc. Cab., n. F., p. 66, pl. 30 a, fig. 1.
 1951 *Pila nyanzae* PAIN, Proc. Malac. Soc. Lond., 28, p. 230, pl. 28, figs. 1-4.
 1952 *Pila ovata nyanzae* PAIN, Rev. Zool. Bot. Afr., XLVI, 3-4, p. 290.
 1954 *Pila ovata nyanzae* MANDAHL BARTH, Ann. Mus. R. Congo Belge, 32, p. 44, figs. 15 b-c.

Distribution: Restricted to Lake Victoria. *Uganda*: Jinja Bay (MANDAHL BARTH 1954). *Tanganyika Territory*: Jordan's Nullah (Type, GORDON).

This subspecies, which was formerly known only from the southern end of Lake Victoria, has now been taken also in the north (MANDAHL BARTH 1954, 44). It would appear therefore to be generally distributed throughout the lake. *P. o. nyanzae* is one of the largest of all the races of *P. ovata*, often attaining gigantic proportions. In fully adult shells the spire is almost always decollate, the umbilicus very wide and deep. Fresh specimens often have the columellae and base of the aperture colored orange or pale red.

MEASUREMENTS OF ADULT SHELLS

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
115	108	80	52		Jordans Nullah (Lectotype)
95	85	68	43		Id. (Syntype)
83	69	66	37		Jinja Bay

The type of *P. o. nyanzae* could not be located at the British Museum, lectotype in the author's collection.

Pila ovata congoensis PILSBRY & BEQUAERT.

1927 *Pila congoensis* PILSBRY and BEQUAERT, Bull. Amer. Mus. Nat. Hist., 53, The Aquatic Mollusca of the Belgian Congo, p. 177, pl. 15, figs. 3, 4 (With subsp. *amplior*, p. 179, pl. 15, figs. 1, 2).

1952 *Pila ovata congoensis* PAÏN, Rev. Zool. Bot. Afr., XLVI, 3-4, p. 291.

Distribution : Congo : Stanleyville (Type loc.); Niangera, Nouvelle Anvers, near Bumba, Medje (LANG and CHAPIN); Nyangwe (PUTZEYS); Pania Mutombo, Luka River at Manda, Arakubi (J. BEQUAERT); Lului River at Kalonda (M. BEQUAERT).

MEASUREMENTS OF ADULT SHELLS

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
105	117	88	56	Kalonda	
95	85	72	48.5	Nyangwe	
91	83	67	45	Nouvelle Anvers (Type of <i>amplior</i>)	
90	84	67	42	Bumba	
63	58	45	31	Stanleyville (Type of <i>congoensis</i>)	

The considerable series of specimens in the Musée Royal de l'Afrique Centrale indicates that *P. o. congoensis* is widely distributed in the regions of the Upper and Middle Congo River. There is considerable variation in size even amongst adult shells from the same locality and examples are occasionally found which rival *P. o. nyanzae* and *P. wernei* in this respect. The shell is moderately inflated, with a large and open umbilicus. The spire is always much eroded in adult examples. In subspecies *amplior* PILS. & BEQ. the shell is larger, and in big specimens very inflated, but since examples typical of both forms can be found in many localities. I can see no justification for maintaining *amplior* as a separate race.

P. o. congoensis can be distinguished from *P. wernei* (PHIL.), which, under the name *leopoldvillensis* (PUTZ.) is also common in the Congo River, by its proportionally thinner shell, very wide umbilicus and short adnate portion of the inner lip. The spire when preserved, is also much more produced. Type is in the American Museum of Natural History, New York.

Pila ovata eleanorae MAND AHL BARTH.

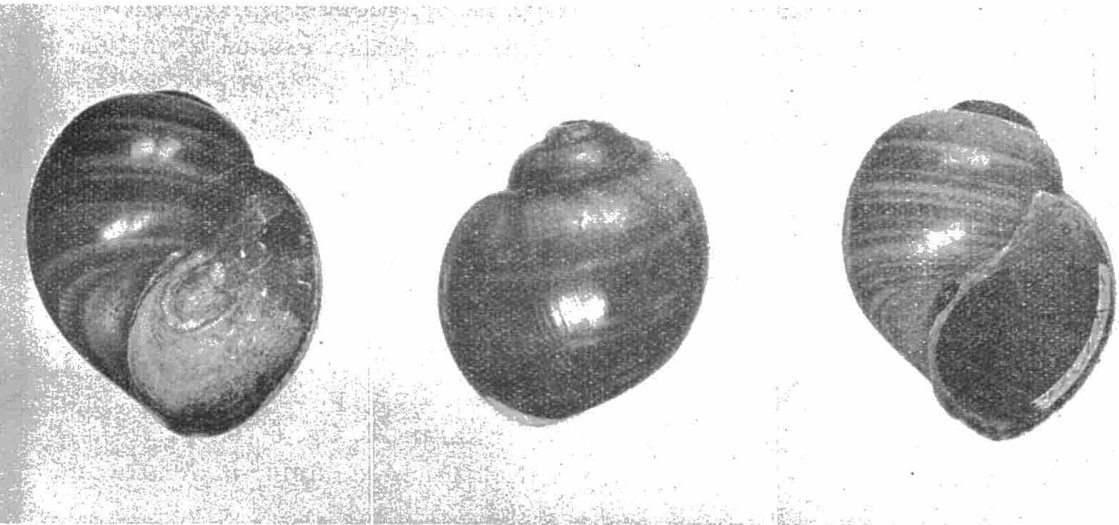
1954 *Pila ovata eleanorae* MAND AHL BARTH, Ann. Mus. Roy. Congo Belge, 32, p. 41, figs. 13 a-c.

Distribution: Victoria Nile at Bajagali (MAND AHL BARTH 1954). A very distinct subspecies with a thick and heavy shell, resembling some of the South American *Limnopomus* in this respect and perhaps like them representing an adaptation to life amongst rocks in swiftly flowing water. Known only from the type locality; type in the Musée Royal du Congo Belge.

Pila ovata dartevellei n. subsp.

Shell thin, barrel-shaped, spire short, apex eroded, moderately umbilicate, whorls convex, the last somewhat flattened at the suture. Aperture oblong-ovate, peristome not reflected, columellar lip thin and curved at the base, parietal lip thin, transparent. Surface glossy, showing under a strong lens very dark microscopically granular spiral striae in some places, marked with moderately strong growth striae.

Colour olive-green, with numerous irregular and often broken reddish-brown bands of varying width on the body-whorl, not extending above the periphery but present again at the suture in some examples. Interior of the aperture bluish-white, with numerous irregular reddish-brown bands extending to the edge of the lip. Peristome and parietal calus bluish-white.



Pila ovata dartevellei n. subsp. (holotype).

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST Width	APERTURE		Locality
		Length	Width	
38	35	31	20	Holotype
38	31	29.5	20	Paratype
32	30	27.5	19.5	Paratype
30	26	25.5	17	Paratype
29	25	24.5	17	Paratype

Type locality: Elisabethville, Katanga (ERCOLIERS).

(Ex. PUTZEYS coll., Musée Royal de l'Afrique Centrale, no. 36662-66).

The only other form of *P. ovata* to which this novelty bears any resemblance is that from Kigoma, Lake Tanganika figured by ALDERSON (1925, pl. 19, fig. 1).

It is however always much thinner, more strongly banded, with a considerably wider umbilicus and lacking the brilliant orange-yellow lip and columella of the Tanganyika shells. It is so far known only from the type locality. The operculum is typical of the *P. ovata* complex, the animal is unknown.

Named in honour of the late Dr. EDMOND DARTEVELLE, who contributed so much to our knowledge of the Mollusca of the Belgian Congo.

***Pila wernei* (PHILIPPI)**

- 1851 *Ampullaria wernei* PHILIPPI, Mon. Amp. in MART. and CHEM., Syst. Conc. Cab., 1, 20, p. 19, pl. 5, fig. 4 & pl. 17, fig. 2.
- 1868 *Ampullaria ovata* MORELET (not of OLIVER 1804), Voy WELWITSCH, Moll. Terr. et Fluv., p. 94, pl. 9, fig. 10.
- 1879 *Ampullaria welwitschi* BOURGUIGNAT, Descrip. Moll. Egypt., p. 31.
- 1885 *Ampullaria charmesiana* BILLOTTE, Bull. Soc. Malac. France, 2, p. 106.
- 1885 *Ampullaria dumesmiliana* BILLOTTE, Ibid., p. 105, pl. 6, fig. 5.
- 1897 *Ampullaria gordonii* var. *volkensis* v. MARTENS, Deutsch Ost Afr., 4, Beschalte Weichth., p. 157.
- 1898 *Ampullaria leopoldvillensis* PUTZEYS, Ann. Soc. Malac. Belgique, 33, Bull. Séances, p. XCVIII, fig. 23.
- 1904 *Ampullaria chevaleri* GERMAIN, Bull. Mus. Hist. Nat. Paris, 10, No. 7, p. 468.
- 1905 *Ampullaria chariensis* GERMAIN, Ibid., 11, No. 6, p. 486.
- 1905 *Ampullaria speciosa* var. *globosa* GERMAIN, Ibid., p. 324.
- 1912 *Ampullaria ovata lamellosa* GERMAIN, Ibid., p. 23, fig. 6 (on p. 324).
- 1915 *Pachylabra charmesiana* var. *minor* KOBELT, Mon. Amp. in MART. and CHEM., Syst. Conc. Cab., n. F., p. 62.
- 1925 *Ampullaria wernei* ALDERSON, Studies in Amp., p. 89, pl. 18, figs. 2, 5, 6.
- 1925 *Pila leopoldvillensis* PILSBRY and BEQUAERT, The Aquatic Moll. of the Belg. Congo: Bull. Amer. Mus. Nat. Hist., 53, Art. 2, p. 180, pl. 14, fig. 1 & 9.
- 1933 *Pila dewulfi* BEQUAERT and CLENCH, Rev. Zool. Bot. Afr., 23, p. 71, pl. 5, fig. 1-13.
- 1953 *Pila wernei dewulfi* DARTEVELLE, J. of Conch., 23, No. 9, pl. 8. (sinistral shell).

Distribution: Sudan: White Nile (type, PARREYS); Abbâ Island to Rejâf, many localities (LONGSTAFF); Bahr el Ghazal (CONOLLY); Darfur, Bueira, Wadi howe (ARKELL).

Somalia: Beles Cogani, 00° 16' N., 41° 47' E. (HEMMING).

Kenya Colony: Northern Province, Habaswein, 1° N., 39° 30' E., Garissa, Lake Rudolph, Ferguson's Gulf, (Sub-fossil) (HEMMING); Lorian Swamp (BALLY); Malagaresi Swamp (VERDCOURT); North bank of Tana River (ALEXANDER); Voi River (MCARTHUR); Ngalana, Witu (SMITH); Nyam-nyam (SCHWEINFURTH); (SPEKE, 1861).

South West Africa: Ovamboland, Okovango River (WOHLFAHRT); Upper reaches of the Omurambe-Omataak River (SHORTTRIDGE).

Angola: Inner Angola (BEQUAERT).

Congo: Stanley Pool near Leopoldville (Type of *leopoldvillensis* PUTZ.); Brazzaville (ROUBAUD); Kasai River (WISSMANN); Coquilhatville (T. BURCH); Léopoldville, Ukaturake, Congo River at Eala (BEQUAERT); Inkisi River near Kisanta (type loc. of *dewulfi* BEQ. and CL.); Konde li Satchi, Mayumbe (DARTEVELLE); Ruisi River at Buta (DYKE).

French Equatorial Africa: Lake Chad, Western watershed between Bosso and Nguigi, Mare di Dungass, Valley of the Komadougou-Yoobe (GERMAIN); Berao (M. C. Z.); Ubangi River (FOUREAU); Lie (LANG & CHAPIN).

Nigeria: River Niger, 160 miles from its mouth (ALDERSON); Gadau; Bornu Province. W. Nigeria (PATERSON).

French West Africa: River Niger, Koulikoro, Mamoun, Terr. du Chari (GERMAIN 1905).

There are unconfirmed reports of *Pila wernei* from Uganda, Mozambique and the Gold Coast, but these await confirmation at present. I have seen neither specimens nor authentic records.

Pila wernei, next to the Brazilian *Pomacea maculata* PERRY (= *gigas* SPIX), is the largest freshwater gastropod known (see Table of dimensions below). It does not vary very much except in size and colour, dwarf forms being known from a number of localities; the variation in colour is considerable as may be expected in a species having such a wide distribution as this. Various shades of olive brown are most usual.

External banding, whilst usually present, is often only poorly developed or obsolete. The columella and outer lip are sometimes a brilliant orange as in PHILLIP'S (1851) figure referred to as var. *minor* by KOBELT (1915, 62), but usually of a pale yellow or ivory white. The surface is very often conspicuously malleated, the spire nearly always much eroded.

In *P. wernei* the aperture and umbilicus are narrower than in *P. speciosa* (PHIL.), the lip produced downwards to a considerable extent. The spire is short and the body whorl very globose.

I am quite unable to separate the Congo race *P. leopoldvillensis* (PUTZ.) from typical *wernei* of the upper Nile. It would in fact be impossible to tell them apart if the localities of the specimens were not known. *P. dewulfi* BEQUAERT and CLENCH, a small race now known from numerous localities in the Congo grades naturally into typical *wernei*, as examination of the fine series of shells in the Musée Royal de l'Afrique Centrale plainly shows.

Ampullaria dumesmiliana BILLOTTE 1885 was wrongly included in the synonymy of *P. ovata* (OLIVIER) in my previous article on African *Pila* (PAIN, 1952, 287), on the authority of SOWERBY (1910, 60). *P. ovata* is unknown in Somaliland. BILLOTTE'S type is an immature shell according to SOWERBY.

Pila ovata gordonii var. *volkensi* MARTENS is also unlikely to belong to *P. ovata*, as the type locality, Jipe Lake, is far from the known range of that species. *P. ovata gordonii* SMITH is in any case confined to Lake Vic-

toria. *Volkensi* Mts. is almost certainly a synonym of *P. wernei* (PHIL.). The type of *P. wernei* may be in Santiago Museum, that of *leopoldvillensis* is in the Musée Royal de l'Afrique Centrale.

A number of fossil records of *P. wernei* exist, some of which however, are very doubtful. E. W. GARDNER (1932) referred shells of Palaeolithic age from the Fayoum, Egypt, to this species, but I should consider them to be a large form of *P. o. ovata* (OLIVER), which is the only *Pila* known from the lower Nile Valley.

In the Sudan, where *P. wernei* is common, it has been recorded from a Mesolithic site at Khartoum (A. J. ARKELL 1949) and a neolithic site at Esh Sheheind (A. J. ARKELL 1953).

In Kenya, *P. wernei* occurs in surface deposits round Lake Rudolph, sixteen miles S. W. of Furguson's Gulf, subfossil in clay pan (PAIN 1956), from Sanderson's Gulf, (J. ROGERS 1944). No *Pila* are now found living in this lake.

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
127	125	92	64		Bahr el Ghazal
115	110	83.5	48		Léopoldville
111	100	84.5	50		Coquilhatville
103	97	77	45		Hillet Abbas
80	72	62	36		Fashoda
75	70	58	35		R. Niger
60	50	41	26		Dafur
60	56	40.5	29		Inkisi R.
56	45	36	24		Id. (type of <i>Dewulfi</i>)
57	53	48	27		Ovambo
32	28	24	16.5		Voi R.

Pila speciosa (PHILIPPI)

1849 *Ampullaria speciosa* PHILIPPI, Centuria Tertia, Testaceorum Novorum, Zs Malacozool. 6, p. 18.

1851 *Ampullaria speciosa* PHILIPPI, Mon. Amp. in MART. and CHEM., Conc. Cab., 1, 20, p. 40, pl. 11, fig. 2.

1856 *Ampullaria speciosa* REEVE, Conc. Icon. 10, Mon. Amp., fig. 33.

1856 *Ampullaria canaliculata* REEVE, Ibid., fig. 79 (Not of LAMARCK 1822).

1885 *Ampullaria revoili* BILLOTTE, Bull. Soc. Malac. France, 2, p. 103.

1885 *Ampullaria ruchetiana* BILLOTTE, Ibid., p. 105, pl. 6, fig. 1.

1925 *Ampullaria speciosa* ALDERSON, Studies in Amp., p. 97-99, pl. 19, figs. 5-6.

1949 *Pila speciosa* PAIN, J. of Conch. 23, p. 69.

Distribution: Somaliland: Cape Guardafui (type, PETERS); Gunana (BOTTFGER); Jubaland, Deshek Wama (HUNTER); Webi River above Guelidi; between Merca and Mogadishu (BILLOTTE); 22 m. N.E. of Mudum; 4 m. N. of Villagio (HEMMING).

Kenya-Somaliland border: between Garissa (Kenya) and Kismayu (0° 8' N., 41° 30' E.) (HEMMING).

The distribution of this, perhaps the most beautiful of all the African *Pila* has already been discussed at some length by the writer (PAIN, 1949). It is restricted to the former Italian colony of Somaliland, the most southerly known locality being Garissa (0° 8' N., 41° 30' E.).

The shell varies little except in size and colour, the spire unlike other African *Pila* being always beautifully preserved, the suture is deeply channelled, the umbilicus wide and deep. The columella and outer lip are usually bright orange-red which is sometimes reduced to salmon colour, orange, yellow or even yellowish-white, particularly in the largest examples. The periostracum is always some shade of clear yellow brown with bands of darker shade which show more prominently on the interior but which cease abruptly just before the outer lip. The surface of the body whorl is usually more or less malleated. The type of *A. speciosa* may be in Santiago Museum.

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST Width	APERTURE		Locality
		Length	Width	
105	100	75	49	Deshek Wama
93	85	67	42	Italian Somaliland
79	68	61	36	ALDERSON's figured shell
82	67	52	34	Italian Somaliland
55	48	45	27	Webi River
65	58	48	29	Garissa

Pila gradata (SMITH).

1881 *Ampullaria gradata* SMITH, Proc. Zool. Soc., p. 289, pl. 33, fig. 22.

1915 *Pachylabra gradata* KOBELT, Mon. Amp. in MART. and CHEM., Syst. Conc. Cab., n. F., p. 48, pl. 31, fig. 2.

1925 *Ampullaria gradata* ALDERSON, Studies in Amp., p. 88, pl. 18, figs. 3-4 (Synonymy).

1939 *Pila gradata* MOZLEY, The Freshwater Mollusca of Tanganyika Territory and Zanzibar Protectorate: Trans. Roy. Soc. Edinb., 59, p. 700 (excluding description pl. 1 b, fig. 10 and references to Zanzibar).

Distribution: Tanganyika Territory: Between Lake Nyassa and the coast (Type, THOMPSON); Usagara (BOURGUIGNAT); Tabora (VON MARTENS, MOZLEY); near Dar es Salaam, Bogomogo, Mkomazi, Hangila (MOZLEY).

ALDERSON (1925) has discussed the various points of resemblance between this and *P. wernei* (PHIL.) and, correctly in my opinion retained them both as separate species. *P. gradata* would seem to be intermediate in shape between *P. ovata* and *P. wernei*; the shell is comparatively thin, often brilliantly banded within, the umbilicus narrow and the columella strongly

curved below. The whorls are somewhat flattened at the suture giving the spire a noticeably gradated appearance which suggests the specific name.

P. gradata appears to have a considerable distribution in central and southern Tanganyika and would seem to be the only species of *Pila* reliably reported from this area. SMITH's original locality for the type, on the authority of THOMPSON, Lake Nyassa, is almost certainly erroneous, since no *Pila* s. s. are known from this lake. Until further authentic material is available, it will not be possible to determine the exact relationship between *gradata* and *P. ovata* OLIVER which was suggested by SMITH 1881, but the type and paratype do not indicate any. Type in the British Museum.

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST		APERTURE		Locality
	Width	Length	Width		
73	67	58	36		Holotype
82	72	60	38		Paratype
95	75	65	40		ALDERSON'S figured Shell

***Pila adusta* (REEVE).**

- 1856 *Ampullaria adusta* REEVE, Conch., Icon., 10, Mon. Amp., fig. 11.
 1856 *Ampullaria pilula* REEVE, Ibid., figs. 12, 11 b and 12 i.
 1856 *Ampullaria ovata* var. *deckeni* VON MARTENS, Deutsch Ost Afr., Beschalte Weichthieri, p. 159.
 1915 *Pachylabra adusta* KOBELT, Mon. Amp. in MART. and CHEM., Syst. Conc. Cab., n. F., p. 55, pl. 33, figs. 1-3.
 1925 *Ampullaria adusta* and *pilula* ALDERSON, Studies in *Ampullaria*, p. 86-87, pl. 17, figs. 9, 10.
 1939 *Ampullaria gradata* MOZLEY, The Freshwater Mollusca of Tanganyika Territory and Zanzibar Protectorate; Trans. Roy. Soc. Edinb., 59, p. 700, pl. 1 b, fig. 10. (Not of SMITH 1881).

Distribution: Zanzibar Island: Mwera River, Mbiji (MOZLEY, WILLIAMS and others).

It would seem unlikely that *P. adusta* occurs outside the Island of Zanzibar. MOZLEY (1939) gives a description and excellent figure of it, wrongly referring it to *P. gradata* (SMITH), although his Tanganyika localities certainly apply to the latter.

P. adusta together with the synonymous *pilula* (REEVE), were in part confused by ALDERSON (1925) with the West African *P. africana* (VON MARTENS) of which he gives a characteristic figure, (pl. 17, fig. 8), under the name *pilula* but with the locality « West Coast of Africa ».

The shell of *P. adusta* is of moderate size, fairly thick, the whorls conspicuously flattened at the sutures, the spire short and broadly pointed. The umbilicus is wide and funnel shaped. Colour light to dark brown, often orange or yellow, the interior of the aperture often brilliantly banded. This

species may prove on examination of the anatomy to be more closely related to *P. wernei* (PHIL.) than appears from study of the shell, which is always fairly constant in form and differs from *wernei* by reason of its noticeably flattened suture. The types of *adusta* and *pilula* are in the British, *deckeni* in the Berlin Museum.

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
72	61	51	35		Mbiji
63	55	45	30		Mbiji
61	50	41	30		Mbiji
57	48	40	27		Mwera
52	43	37	24		Mwera

Pila occidentalis (MOUSSON)

1887 *Ampullaria occidentalis* MOUSSON, J. de Conc., 35, p. 299, pl. 12, fig. 9.

1915 *Pachylabra occidentalis* KOBELT, Mon. Amp. in MART. and CHEM., Syst. Conch. Cab., n. F., p. 51, pl. 31, fig. 5.

1925 *Ampullaria occidentalis* ALDERSON, Studies in Amp., p. 85, pl. 17, figs. 5, 6 & 7.

1938 *Pila occidentalis* CONOLLY, A monographic Survey of the South African Non-Marine Mollusca. Ann. S. Afr. Mus., 33, p. 553 (Synonymy).

Distribution: Ovamboland: Kunene River (Type, GEALE; SCHINTZ); below Erikson Drift (LEBELTER); Ondongua (BARNARD); Gautscha Pan 20° S., 20° 21' E. (MARSHALL).

Damaraland: Nuragas (LIGHTFOOT); Okosongoho (HERMANN).

Britisch Bechuanaland: Okavango Marshes; Lake Ngami; Botletle District (PASSARGE).

Angola: Cunene River, Dongwenna Monamedes (SOWERBY).

The shell of this species is thin, dull and often semitransparent pale green, with or without a number of narrow chestnut bands. Body whorl very globose, spire short, rounded; umbilicus wide and deep.

This thin shelled species is at present known only from Southwest Africa; it is unlikely to be confused with any other. Type in Zurich Museum.

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
55	53	42	27		Dogwenne
42	40	34	22		Dogwenne
41	40	32	22		Dogwenne
49	42	33	24		Gantscha Pan
36	33	28	20		Gantscha Pan
50	47	38	23		Erikson Drift

Pila africana (VON MARTENS)

- 1886 *Ampullaria africana* VON MARTENS, Sitz. Ber. Ges. Naturf. Fr., Berlin, 1886, p. 114.
- 1925 *Ampullaris pilula* ALDERSON, Studies in Amp., p. 87, pl. 17, fig. 8 (not of REEVE 1856).
- 1927 *Ampullaria microglypta* PILSBRY & BEQUAERT, The Aquatic Mollusca of the Belgian Congo: Bull. Amer. Mus. Nat. Hist., 53, p. 176, pl. 15, figs. 5, 6.
- 1957 *Pila africana* BINDER, Mollusques aquatiques de la Côte d'Ivoire, I. - Gastéropodes. — Bulletin de l'IFAN, 19, sér. A., no. 1, p. 106, fig. 5.

Distribution: Gold Coast: Abtifi and Accra (Type, VON MARTENS); Adeiso near Nsawan, N. of Accra (M. C. Z.) *Ivory Coast:* Agboville, Agneby, Dabou, etc. (BINDER 1959).

Congo. Stanleyville (LANG) (DYKE).

Liberia: Ganta (BEQUAERT).

P. africana was not recognised by ALDERSON (1925), although he gave a very good figure of an example from the Gold Coast under the name *pilula* REEVE. I am quite unable to separate *P. microlypta* PILSBRY and BEQUAERT (1927) from VON MARTENS' species as I have seen both banded and umbilicate examples amongst typical *africana*, these points being considered by the authors of *microglypta* to indicate the chief differences between their species and *africana*.

The shell of *P. africana* is moderately umbilicated, almost imperforate in some specimens. The spire is moderately raised and much eroded, suture deep, flattened but not channelled. Colour buff olive to dark brown with or without bands of brownish olive; aperture oblong, rather wide. The type of *africana* is in the Berlin Museum, that of *microglypta* in the American Museum of Natural History, New York.

MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST		APERTURE		Locality
	Width	Length	Width		
50	42	35	24	Accra	
46	40	33.5	22.5	Adeiso	
35	30	25	15.5	Ganta	
34	31	24.5	17	Ganta	
37	32	26	?	Stanleyville (Type of <i>microglypta</i>)	
36	32	25	17.5	Stanleyville	

Pila africana koleensis VENMANS

1956 *Pila africana koleensis* VENMANS, J. of Conch., 24, no. 4, p. 140, pl. 5.

Distribution : Known only from the Congo. Kole, in the Aruwimi Basin, 80 km. North of Banalia (CH. VAN DEN HOF, 1950).

This subspecies represents a very local giant race of *P. africana*, at present known only from the type locality, an area from which typical *P. africana* has not so far been recorded. Type in the collection of the late Dr. VENMANS.

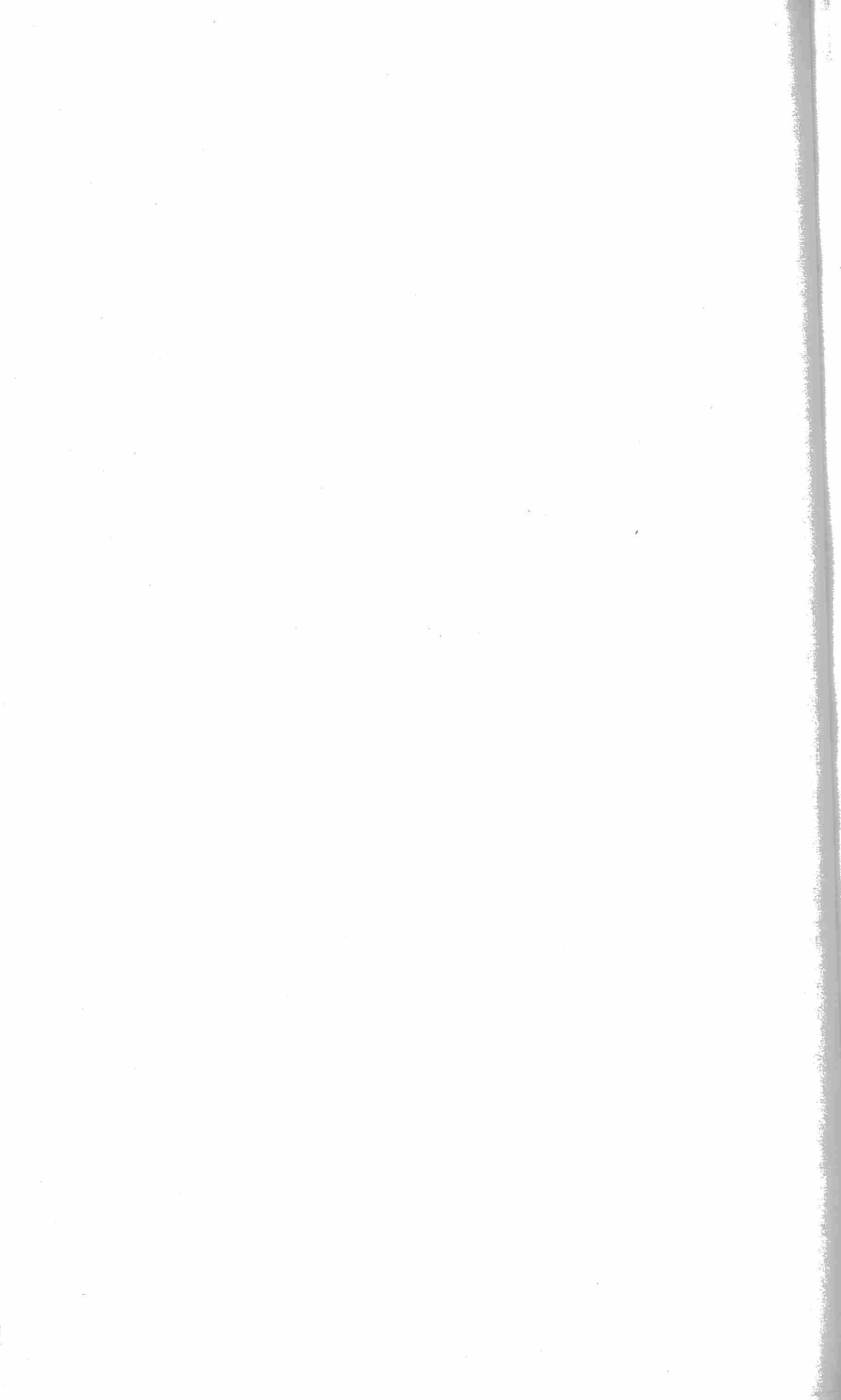
MEASUREMENTS OF ADULT SHELLS (in mm.)

Length	GREATEST		APERTURE		Locality
	Width	Length	Width	Length	
56.7	46.1	38.2	24.6	Holotype	
52.0	46.6	39.1	24.7	Paratype	
52.6	47.5	36.2	25.2	Paratype	
52.0	45.1	37.8	25.5	Paratype	



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