BEAUFORTIA

SEREIS OF MISCELLANEOUS PUBLICATIONS

ZOOLOGICAL MUSEUM - AMSTERDAM

No. 78 Volume 6 April 10, 1958

A Note on *Protancylus* P. & F. Sarasin

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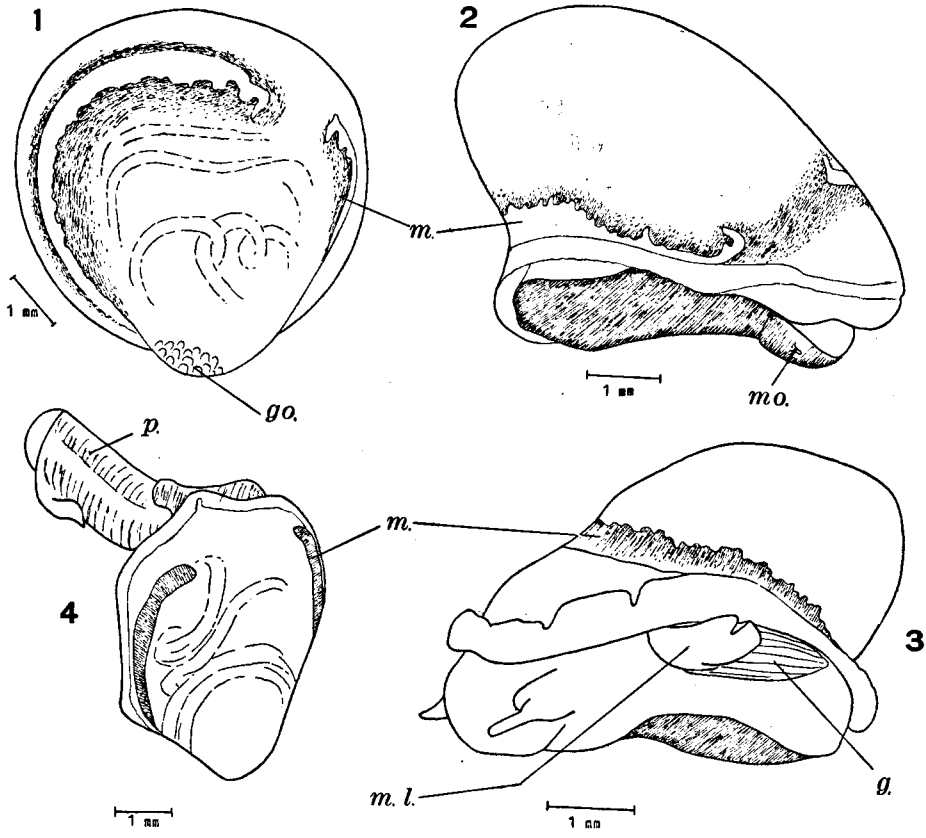
In their account of the fresh water molluscs of Celebes P. & F. SARASIN (1898) described the genus *Protancylus*. They pointed out certain resemblances between *Protancylus* and *Ancylus* as well as between *Protancylus* and *"Miratesta, Isidora* und *Planorbis"*. However, they did not present any conclusion regarding the systematic position of the group. In his famous handbook THIELE (1931) placed *Protancylus* in the family *Ancylidae*. Furthermore, he regarded *Protancylus* as congeneric with some of the main genera of the family, e.g. *Burnupia, Ferrissia,* and *Gundlachia*. In connection with extensive studies of the family *Ancylidae* I had to examine the morphology and systematic position of *Protancylus*. As a result the genus *Protancylus* proper proved to be distinct from the other Ancylids and has to be removed from this family. Before I present the results of my own studies, however, it may be appropriate to briefly summarize the SARASIN's findings.

They found a well delimited hollow in each tentacle. Inside the bottom of the hollow they found a ganglion. They stated the presence of a comparatively large mantle cavity. Its inner end should be directed anteriorly, the opening more or less posteriorly though located at about the middle of the left side of the animal. Behind the mantle opening they noticed the strongly folded gill, which consists of one lamella only. They stated that the heart is anterior of the gill, what, however, is of only moderate importance as the gill is no ctenidium. The large gizzard was noticed and the radula was studied. They pointed out that the latter was more similar to the radula of certain *Planorbidae* than to that of *Ancylus fluviatilis* MÜLLER. However, their information regarding the latter species was most unsatisfactory.

Thanks to the courtesy of the Zoological Museum in Amsterdam the author of the paper had the opportunity to examine topotypical material of the two species of *Protancylus* originally described by P. & F. SARASIN. The material comprised one specimen of *P. adhaerens* from Lake Matano, Central Celebes (leg. E. C. ABENDANON, 1910) and three specimens of *P. pileolus* from Celebes. In addition, at an earlier occasion two spe-

Received May 23, 1957

cimens of *P. adhaerens* from Lake Towuti, Celebes (Naturhistorisches Museum Basel 1288-a) were studied. Complete series of sections with a thickness of eight microns were prepared of one specimen of each species from the Amsterdam material. The material was not particularly well preserved and therefore only parts of the topographical anatomy could be worked out. However, the results have such a significant bearing on our knowledge of the systematical position of the genus that they ought to be published. The following description is based mainly on *P. adhaerens,* but in all essential features the two species seem to be similar.



FIGURES 1—4. 1. *Protancylus pileolus,* dorsal view; 2. *Protancylus pileolus,* from the right; 3. *Protancylus adhaerens,* from the left; 4. *Protancylus adhaerens* with everted penis, dorsal view.
g. = gill; *go.* = gonad; *m.* = surface corresponding to the so-called muscle impression; *m.l.* = functional mantle lobe; *mo.* = mouth.

The shell and the external features of the animal have already been described by P. & F. SARASIN. It may be added that the so-called muscle impression is horse-shoe-shaped with an anterior opening. Its runs continously from the middle anterior part of the interior of the shell, around its posterior portion and to its right anterior part. Corresponding areas,

probably with adhesive epithelium, can be seen on the surface of the animal (fig. 1—4). Further, the base of the gill continues anteriorly forming a lateral process through which the rectum passes. The anal pore is located near the lateral edge of the fold. The anterior portion of the process is situated just below the opening of the mantle cavity and thus corresponds in position to the mantle lobe of many *Basommatophora*.

The surfaces of the shell adductors, underlying the mantle epithelium,

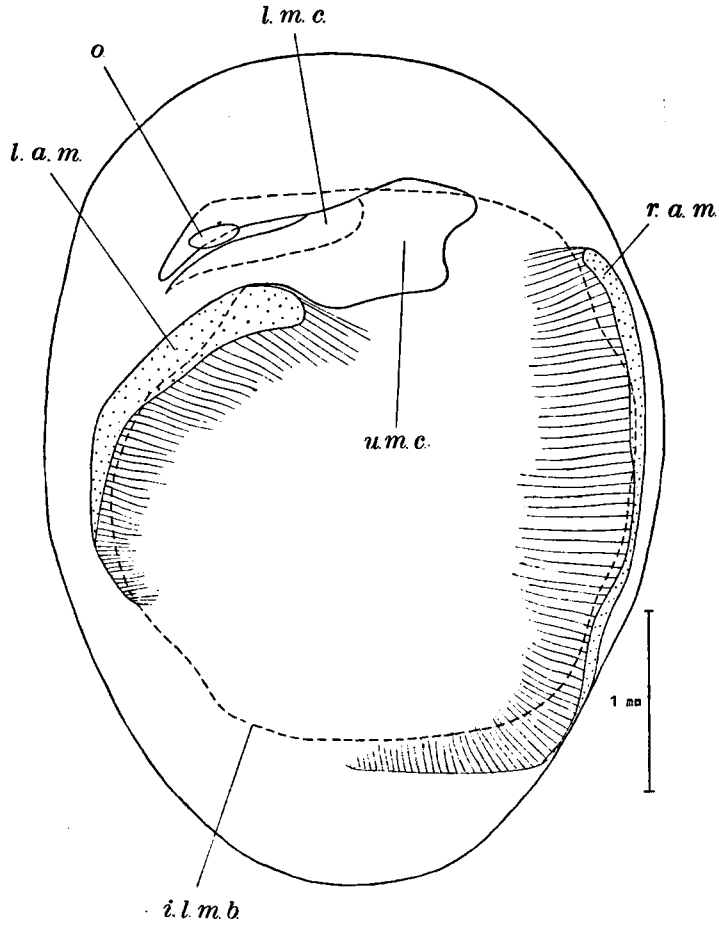


FIGURE 5. *Protancylus adhaerens*. The adductor muscle and the mantle cavity. *i.l.m.b.* = inner limit of mantle border ; *l.a.m.* = left adductor muscle ; *l.m.c.* = lower portion of mantle cavity ; *o.* = osphradium ; *r.a.m.* = right adductor muscle ; *u.m.c.* = upper portion of mantle cavity.

do not have the same extension as the mantle areas corresponding to the so-called muscle impressions in the shell. There are two well-developed adductor muscles (fig. 5), one almost straight antero-posterior muscle along the right side, and one oblique muscle on the left side. The latter is located between the left part of the mantle cavity, which is anterior to it, and the bulk of the visceral mass, which is posterior to it.

The mantle opening is on the left side and anterior to the left adductor muscle (fig. 5). The mantle cavity is well-developed and deep. It reaches beyond the midline of the animal and continues into its right half. The

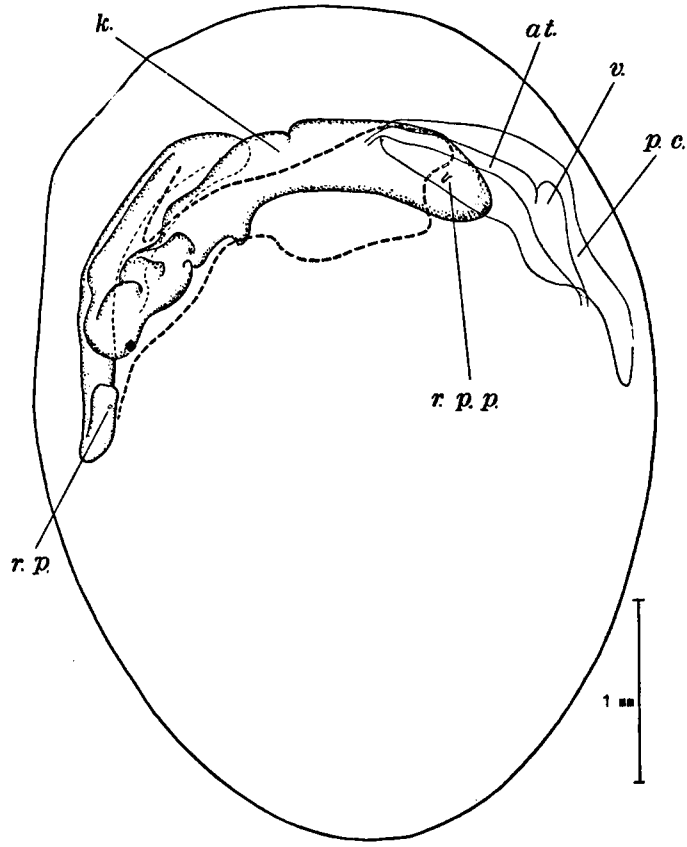


FIGURE 6. *Protancylus adhaerens*. Mantle organs. *at.* = atrium ; *k.* = kidney ; *p.c.* = pericardium ; *r.p.* = renal pore ; *r.p.p.* = renopericardial duct ; *v.* = ventricle. The thick broken line indicates the circumference of the mantle cavity.

posterior wall of the mantle cavity is bulging into the cavity to give space for the last loop of the intestine, which runs just behind the mantle cavity. Therefore the mantle cavity is semilunar in cross section. Anterior to the mantle opening there is an osphradium of the ordinary basommatophoran type. It is not bifurcated. No such ciliated ridges, as occur in *Planorbidae,* have been seen in the mantle cavity of *Protancylus.*

The pericardium (fig. 6) is located to the right of the mantle cavity and along part of the right side of the body. In the heart the atrium is situated anterior of the ventricle. A short, narrow reno-pericardial duct connects the pericardium with the innermost part of the kidney. The latter is a dorsally located sack, rich in internal folds. To the left the kidney merges into the urethra which is S-shaped, with an additional turning just before the very narrow efferent pore. The urethra runs

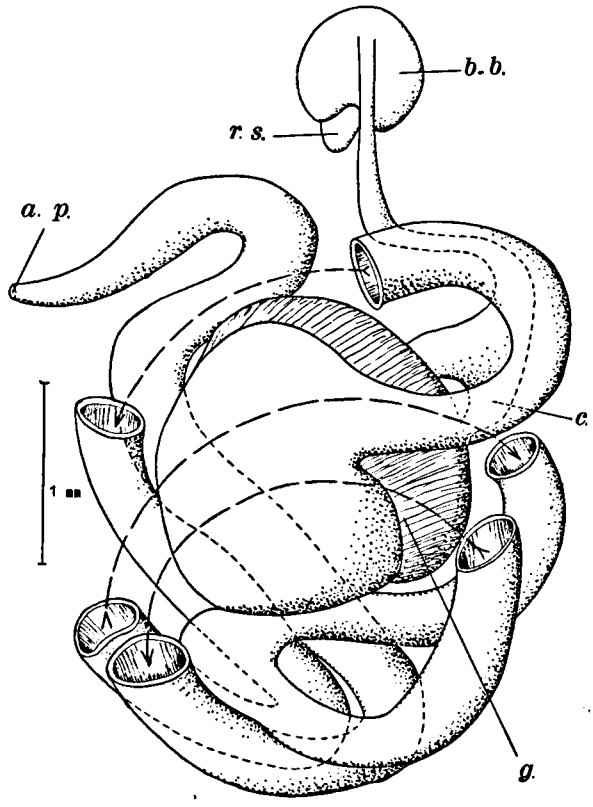


FIGURE 7. *Protancylus adhaerens*. The alimentary tract. *a.p.* = anal pore; *b.b.* = buccal bulb; *c.* = coecum; *g.* = gizzard; *r.s.* = radula sack.

in the left mantle border and the pore is situated on the inside of the same, behind the mantle opening.

In the alimentary tract (fig. 7), the oesophagus has a small, posteriorly directed coecum before it enters the huge gizzard. The intestine is peculiar by being longer and more coiled than in any other basommatophorous snail. It forms five loops.

In the reproductive system the rather large gonad is located dorsally and posteriorly in the visceral mass (fig. 8). It has several diverticulae. A hermaphrodite duct with several small vesiculae runs anteriad, tapers and continues to the left where it bifurcates into a male and female duct. The last part of the hermaphrodite duct and the upper parts of the male and female ducts with their glands form a dense ball of intimately entangled tissues. Because of the poor condition of the material it has not been possible to unravel all the details of the complex with definite certainty. The way of the male duct through the complex is not quite clear. The large gland marked (a) in fig. 8 is displaced in the figure. It is in fact situated dorsally of the rest of the complex. It looks like an albumen gland but a connection with the female duct could not be stated. There seems to be a connection between this gland and

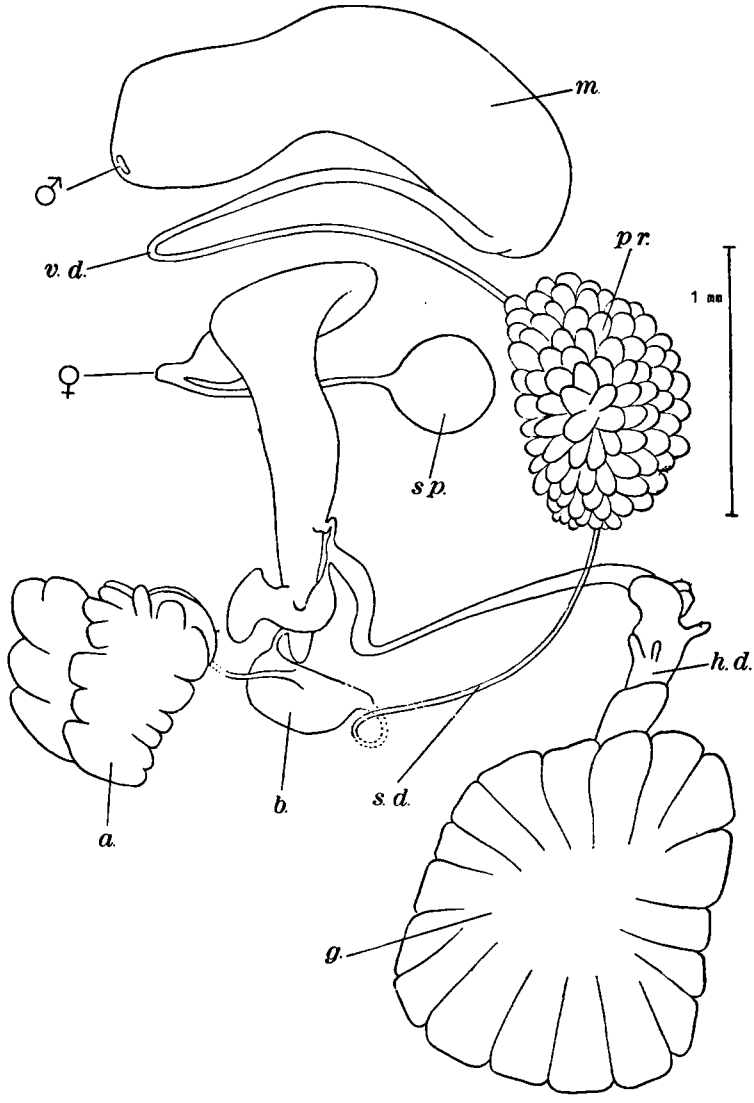


FIGURE 8. *Protancylus adhaerens*. Reproductive system. *a.* and *b.* = glands; *g.* = gonad; *h.d.* = hermaphrodite duct; *m.* = male copulatory organ; *pr.* = prostate; *s.d.* = spermatic duct; *sp.* = spermatheca; *v.d.* = vas deferens; ♀ = female genital pore; ♂ = male genital pore.

a large flat gland (*b*) in the upper part of the male duct. However, it has not been possible to verify the existence of the entire connecting duct.

The female system has a round spermatheca with a rather long and slender duct. The male system has a well-developed prostate with numerous diverticulae in many directions from its central portion at the ventral side of the organ.

The male copulatory organ (fig. 9) has a praeputium with two mus-

cular pillars. There are two vela separating the lumen of the praeputium from that of the penis sheath. The latter is comparatively short. The penis is pendent with a lateral pore. Below the pore is a longitudinal furrow and further down a bifurcation. The one branch is considerably larger than the other.

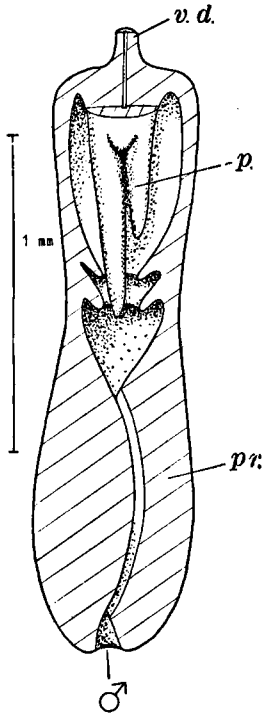


FIGURE 9. *Protancylus adhaerens.* Male copulatory organ. The whole organ except the penis longitudinally sectioned. The cut surfaces are hatched, *p.* = penis; *pr.* = praeputium; *v.d.* = vas deferens; ♂ = male genital pore.

The central nervous system is very concentrated. Behind the pleural ganglia there are three visceral ganglia. The right one of these is fused with the right pleural ganglion and the fusion is marked by a furrow or contraction. All the ganglia of the central nervous system are placed so tightly together that any connectives can hardly be distinguished.

Though similar to an Ancylid in general habitus *Protancylus* differs definitely from all *Ancylidae* by having a well-developed mantle cavity. In all recent *Ancylidae* the mantle cavity is almost completely reduced. In spite of this reduction *Ancylidae* must have its origin in forms with a normal mantle cavity, as presented by *Protancylus*. However, *Protancylus* can hardly represent the morphology of the Ancylid ancestor. In *Ancylinae* (the conditions in the sinistral *Acroloxinae* are not considered here) the rest of the mantle cavity is always situated behind the accessory left anterior shell adductor. In *Protancylus*, on the other hand, the mantle cavity is situated in front of the correspondingly located adductor

muscle. In both forms the mantle cavity is of course homologous, but not so the accessory adductor muscle. Hence the *Ancylidae* cannot represent a further phase in the evolution away from the morphological type of *Protancylus*.

The radula of *Protancylus*, described by P. & F. SARASIN, is a typical planorbid radula and more precisely the type of radula characteristic of *Bulininae* and primitive genera in *Planorbinae* (HUBENDICK, 1955). The genus *Protancylus* may have evolved from the common root of the two planorbid subfamilies *Bulininae* and *Planorbinae*. No features contradict that supposition though several peculiar features described above show that *Protancylus* has undergone a considerable independent evolution. A basic feature in the evolution of *Protancylus* is the reduction of the spire. Some other features, e.g. the further development of the shell adductors, the prolongation of the urethra and its serpentine form, and the fargoing concentration of the central nervous system, are most probably secondary consequences of the reduction of the spire. A comparative study of the various patelliform *Basommatophora* gives some evidence for this.

The planorbid genus *Patelloplanorbis* HUBENDICK (1957) is less specialized in comparison with *Protancylus*. Though both are more or less patelliform and both have their origin within the family *Planorbidae*, the two genera have evolved independently.

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