

Watson H. A note on Bathonian gastropods assigned to freshwater genera.// The geological magazine, 1950.- Vol. 88, №1.- p. 17-25, pl. 3. <1950>

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A Note on Bathonian Gastropods Assigned to Freshwater Genera

By HUGH WATSON

(PLATE III)

ABSTRACT

It is claimed that the Bathonian gastropods recently assigned to *Bathonella* Yen do appear to not differ from *Viviparus* in any marked features of generic importance, and that there is really no satisfactory evidence to show that they and certain associated organisms lived in the sea rather than in fresh or brackish water.

IN view of the correspondence in this magazine on "*Bathonella* and *Viviparus*" Dr. Arkell has asked me to make known my views on the question whether *Bathonella* Yen (1948) differs from *Viviparus* Montfort (1810) in conchological characters of generic importance and in having probably lived in the sea instead of in freshwater. It will be best to consider these two points separately.

Almost the only features which Dr. Yen (1948, p. 168) states characterize his proposed new genus, and which are not also to be found in typical species of *Viviparus*, are the naticoid form of the shell, implying that the spire is shorter than it usually is in *Viviparus*, and the descending body-whorl. But the height of the spire is a variable feature; it is only short enough to make the shell naticoid in one of the four species and subspecies which Yen includes in his genus, namely *V. scoticus* (Tate); and even in this form it is no shorter than in the living American species, *V. intertextus* (Say). Similarly, the deflection of the last whorl is not a constant feature of the shells included by Yen in *Bathonella*, as may be seen from his own Plate XI, and it is also found in some living species of *Viviparus*, being conspicuous in the keeled form *V. museruensis* var. *pagodiformis* Smith (illustrated by Pilsbry and Bequaert, 1927, pl. xix, fig. 7).

Dr. Cox (1948, pp. 314, 315), however, mentions four other differences which he considers give to *Bathonella* an aspect unlike that of *Viviparus*.

In the first place, he says that *Bathonella* differs from *Viviparus* in having an acute projecting apex and an expanded, highly convex, last whorl, which make the shell elevated-turbinate rather than conical, a line tangential to the successive whorls presenting an outward-facing concavity in contrast to the corresponding convexity of *Viviparus*. But the well-known living species, usually called *V. fasciatus* (Müll.) in England and *V. viviparus* (Lin.) in Germany, has an acute projecting apex and very convex lower whorls, and a line tangential to the first three whorls is concave, although it becomes convex when tangential to the last three whorls. Thus, in the young of this recent species the turbinate form found in Yen's proposed new genus is well developed,

and it is not unusual for some of the early members of a genus to retain to maturity characters that are only found in the young of the more recently evolved species.

Secondly, he states that *Bathonella* differs from *Viviparus* in that the last whorl becomes almost detached from the parietal wall to which the continuous peristome adheres but loosely. Yen's photographic figures, however, show that this feature is not always very apparent in his new genus; while in the recent species of *Viviparus* I have mentioned the lower whorls are separated by a very deep suture, and the practically continuous peristome is attached to the parietal wall for an unusually short distance, only about one-seventh of its circumference.

Thirdly, he states that while the aperture of *Viviparus* is "inverted-pyriform", that of *Bathonella* is nearly semicircular, with the columellar lip (much straighter than in *Viviparus*) forming the diameter.¹ But in fully-grown specimens of this recent species of *Viviparus* the aperture is not inverted pyriform, but approximately ovate, as Yen describes and figures it in his proposed genus; and the curvature of the columella also agrees closely with most of Yen's figures, being intermediate between that of the two type specimens of *Viviparus langtonensis* (Hudleston) belonging to the Sedgwick Museum, a form which Yen thinks may be only subspecifically distinct from *V. scoticus* (Tate), the type species of his new genus.

Lastly, Cox says that the test of *Bathonella* is thicker than that of *Viviparus*. But Yen writes of the "thin shell substance" of his new genus; and the many species of *Viviparus* itself vary considerably in the thickness of their shells, the thickest forms having naturally had the best chance of being preserved as fossils.

Sometimes when the form of a shell shows little that is distinctive the microscopical sculpture is of greater systematic value, especially that of the apical whorls. This is seldom preserved in these fossils, but through the kindness of the Palaeontologist of the Geological Survey I have been able to examine forty-five specimens of *Viviparus langtonensis* (Hudleston), three of which show it. These have the same type of fine, threadlike, spiral striae on the upper whorls which also characterize the later species of *Viviparus*, both recent and fossil, and which gradually die out on the lower whorls, as in the typical members of the genus. The axial striae crossing them are usually stronger on the upper whorls than they are in the living British species, but their strength varies considerably in the different specimens (see the accompanying drawings) and is, on an average, scarcely greater than in one of the recent Indian species that I have examined.

¹ Anderson and Cox (1949, p. 177), however, now describe the aperture of *Bathonella* as circular.

Thus, *V. langtonensis* agrees with living members of the genus in the type of its microscopical sculpture.

In at least three of the forms that Yen places in *Bathonella*—*Viviparus langtonensis* (Hudleston) *V. scoticus* (Tate) and *V. aurelianus* Cossmann—the outer lip and the lines of growth on the last whorl curve backwards between the suture and the periphery and again on the base more markedly than they do in the typical species of *Viviparus*. But a similar curvature is found in the Purbeckian species *V. subangulatis* (Roemer) (see Arkell, 1941, p. 86, figs. 7a and b), and, in any case, the difference is not very great, and had it been at all constant it would doubtless have been mentioned by Dr. Cox. Indeed, that so able and experienced a palaeontologist should have discovered no more substantial and less inconstant differences between the shells of *Bathonella* and *Viviparus* than the four that he does mention strongly supports the view that none exist of generic importance. Hudleston (1896, p. 488), who uses the name *Paludina* for the genus we now call *Viviparus*, states that we cannot doubt that *P. scotica* Tate, which Yen makes the genotype of *Bathonella*, is correctly referred to the genus *Paludina*; and he adds, on the next page, that *P. Langtonensis* differs but little from the existing species, *P. vivipara*. Similarly, Cossmann (1899, p. 142), when describing *V. aurelianus*, states that, apart from its more expanded last whorl, it is indisputable that this species presents all the characters of the genus *Viviparus*. Thus, any differences that separate the four species and subspecies which Yen places in *Bathonella* from the typical species of *Viviparus* appear to be much less striking than those that separate some of the groups of *Viviparus* that have merely been given subgeneric rank (see, for example, the figure of *V. (Eyriesia) eyriesi* (Morelet) given by Thiele in his well-known Handbuch, 1929, p. 114, fig. 86). Accordingly, the characters of the shell seem to afford little justification for placing in a separate genus from *Viviparus* the species that Yen assigns to *Bathonella*, and none for placing them in a separate family. And as not only *Viviparus* itself but practically all the known genera of the Viviparidae live in freshwater, it follows that these species probably did so too, unless there should be any other good evidence that they lived in the sea. If there had been any such evidence, then these species might have belonged to a marine family some members of which had developed almost exactly the same simple form of shell as we find in *Viviparus*; or it might be that in Jurassic times, when the sea was slightly less salt than it now is, a few members of the Viviparidae were able to live therein. But it is difficult to find any good grounds for Yen's statement (1948, p. 169) that the evidence suggests that the species he places in *Bathonella* had a marine habitat.

The four species and subspecies that Yen assigns to his proposed new genus are all of Bathonian age. Two of them—*Viviparus scoticus*

that these diverse organisms found in this Bathonian deposit should not be what they appear to be, but should really be marine forms which had suddenly and simultaneously developed for a short time a deceptively close resemblance to freshwater forms differing widely from one another that also lived in the Jurassic period. It is true that a few marine gastropods have also been found in this Oxfordshire deposit ; but this is not surprising when we remember that the bed is stated to be usually not more than about 3 inches thick, and, where the marine fossils have been found, to rest directly on the highly fossiliferous marine strata of the Lower Sharp's Hill Beds, with a gentle unconformity between them. Thus, the marine forms in the *Viviparus* Marl may easily have been derived from the underlying marine strata, a view supported by the pebbles and phosphatic nodules that the Marl also contains.

Alternatively, it is possible that the *Viviparus* Marl of North Oxfordshire may have been formed by a large river, when abnormally flooded, having washed into the sea numerous freshwater shells which were deposited among marine forms beyond the river's mouth. This hypothesis, or one very similar to it, has the support of the eminent French geologist, Haug (1921), as well as of Dr. Arkell (1948), who has so carefully studied the Jurassic rocks of Oxfordshire and elsewhere, and to whom my thanks are due for much kind help. We know that non-marine shells are sometimes carried down into the sea, because they are occasionally found cast up with marine forms on the sea shore. We know, too, that great quantities of estuarine or freshwater Pectinibranchs may live in swamps near the mouths of rivers such as the Congo (see Pilsbry and Bequaert, 1927, pl. lxxvii) ; and after floods one often finds considerable accumulations of empty freshwater shells stranded on low ground by the sides of rivers. Moreover, members of the relatively primitive families Viviparidae and Valvatidae seem to have been specially common in the freshwaters of the Jurassic Period. Clearly, therefore, a quantity of such shells might be swept down into the sea by an exceptional flood, such as might occur if a natural dam holding back a lake in the river valley were to burst after torrential rain and lead to a great volume of water sweeping down the river and carrying with it to the sea all loose objects that lay in its course. Specimens that had dried and become filled with air, through having been stranded on the river banks after former minor floods, might float far out to sea, like the pieces of wood, etc., discharged by the Amazon in times of flood ; but they would become scattered before sinking and are very unlikely to form an appreciable element in any deposit laid down at a great distance from the coast. Moreover, the influence of the tides would tend to cause the majority of these shells to be drifted sideways over any low-lying ground when they approached

the river's mouth, whereas the slightly less buoyant specimens would be more likely to be swept straight forward into the sea during such an exceptional flood. They would probably come to rest, however, as soon as the current slackened within a few miles of the mouth of the river, and might there form, with other debris from the flood, a thin patchy deposit of limited extent, distinguishable from the adjacent beds by containing freshwater as well as marine shells. The *Viviparus* Marl of North Oxfordshire seems to be a thin deposit not unlike this ; so far as I know it does not extend far ; and the evidence of the remains of land animals and plants mixed with marine fossils in the neighbouring and practically contemporaneous Stonesfield Slates suggests that land was not far away, from which a large river may have issued. The unconformity at the base of the *Viviparus* Marl might easily have been caused by submarine erosion due to the currents produced by the first onrush of the flooded river into the sea.

On the other hand, this unconformity could also be easily explained if we accept the view that this Oxfordshire deposit was probably formed in the same way as Cossmann believed the somewhat thicker one in Central France had been formed, that is to say, by the slight elevation of a tract of land that had been covered by the sea, and the formation thereon of freshwater marshes or lakes, in which the *Viviparus* and the associated non-marine species flourished until the sea again flowed over the area. In this case some erosion would almost certainly occur during or immediately after the raising of the land above sea-level before the marshes or lakes were established, thus producing the unconformity. And in favour of this hypothesis it may be added that, while a river flood great enough to sweep into the sea a sufficient number of freshwater shells to form even a thin deposit must have been a very rare event, the extent, thickness, and character of the various deposits of Bathonian age in Southern England show so much diversity that it is very unlikely that the exact limits of the area occupied by the shallow Bathonian sea did not fluctuate.

But which of these two views about the formation of the *Viviparus* Marl of North Oxfordshire is the more probable is a stratigraphical problem to be solved by the student of palaeogeography rather than of palaeozoology. Suffice it to say that either of these two hypotheses seems to be far more likely than the one favoured by Prashad (1928), Yen (1948), and Cox (1948), which appears to imply that the various Bathonian species found in Skye, Oxfordshire, and Central France that have been assigned to the genera *Viviparus*, *Valvata*, *Corbicula*, *Metacypris*, and *Chara* (or some allied genus of plants) do not really belong to these freshwater genera—which are known to have been common in Jurassic times—but are marine forms which, by an extraordinary coincidence, had simultaneously come to resemble these

different freshwater forms very closely indeed. Surely, to accept this view is to stretch the long arm of coincidence too far!

And it would be no less improbable if it were supposed that the gastropods just mentioned were marine forms, while the rest, such as *Metacypris*, lived in freshwater, but had been brought down into the sea either by a flooded river or by the slight subsidence of the area in which they had become established when the sea had temporarily receded from it. Seeing that in the fresh or only slightly brackish waters of later Jurassic times *Metacypris* was associated with abundant specimens of both *Viviparus* and *Valvata*, it would be strange indeed if not only did neither of these genera of freshwater gastropods accompany this ostracod in the Bathonian deposits, but that their places were there taken by members of different marine families which had happened to have come to simulate these particular freshwater genera so closely that able palaeontologists, both in England and in France, have independently concluded that they undoubtedly belonged to them.¹ By convergent evolution gastropods belonging to different groups have sometimes come to resemble each other very closely in their external appearance when they are adapted to living in the same type of environment; but when one is adapted to marine conditions and another to a freshwater habitat the resemblance is seldom close enough to mislead an experienced conchologist unless the specimens are in very poor condition. Let us hope, therefore, that palaeontologists will refrain from assuming that good authorities like Huddleston, Cossmann, and others have all been deceived, and from removing to marine families the Bathonian species we have been considering, until we have far more satisfactory evidence that they do not belong to the freshwater genera they so much resemble, but that they actually did inhabit the sea.²

¹ Anderson and Cox (1949, p. 116) claim that because Phillips in 1871 (p. 181, pl. x, fig. 34), when he figured the form that Huddleston named *Paludina langtonensis* twenty-five years afterwards, called this species *Phasianella elegans*, he "regarded it as probably marine"; but Dr. Arkell thinks that this is more likely to have been a misidentification with the *Phasianella elegans* of Morris and Lycett, to whom Phillips attributes this name on p. 243.

² It has been suggested that, as the affinities of the Bathonian gastropods that have been assigned to *Viviparus* and *Valvata* are not certain, but are subject to differences of opinion, these species should be placed separately under the heading "*incertae sedes*". To adopt this course, however, would be misleading, as it would imply that the relationships of these forms are even more doubtful than those of numerous other fossil gastropods which are not usually placed in this category, although their affinities are at least as debatable and often far more so. It would seem better to follow those writers who retain species in the genera and families in which they have usually been placed—merely adding a question mark to the names of any of which the affinities are exceptionally problematical—until good evidence, which will bear critical examination, has been brought forward to show that they more probably belong to other groups.

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EXPLANATION OF PLATE

- FIG. 1.—Shell of the common recent species of *Viviparus*, *V. fasciatus* (Müll.), for comparison with that of the Bathonian form, *V. langtonensis* (Hudl.). Drawn from a specimen collected by the author in Coe Fen, Cambridge. $\times 1.2$.
- FIG. 2.—Shell of *Viviparus langtonensis* (Hudl.) from the Viviparus Marl of the Bathonian beds of North Oxfordshire. Drawn from specimens belonging to the Geological Survey, from Sharp's Hill, near Hook Norton, and Castle Barn Quarry, near Chipping Norton. $\times 1.5$. The shell of the genotype of *Bathonella*, *V. scoticus* (Tate)—of which *V. langtonensis* may be only a subspecies—is similar, but relatively shorter, with a broader last whorl and aperture, having thus the more turbanate form characteristic of young specimens of *V. fasciatus*.
- FIG. 3.—Upper whorls of *Viviparus langtonensis* (Hudl.) from the Viviparus Marl of the Bathonian beds of North Oxfordshire, showing the microscopical sculpture. Drawn from a specimen belonging to the Geological Survey, from Sharp's Hill, near Hook Norton. $\times 15$.
- FIGS. 4 AND 5.—Upper whorls of *Viviparus langtonensis* (Hudl.) from the Viviparus Marl of the Bathonian beds in another locality in North Oxfordshire, showing that in this species the microscopical sculpture varies, even in specimens found together, in the same way as it does among different recent species of *Viviparus*. Drawn from specimens belonging to the Geological Survey, from Castle Barn Quarry, near Chipping Norton. $\times 15$.
- Note.—The drawings of the fossil shells are semi-diagrammatic, defects in the original specimens not being shown.

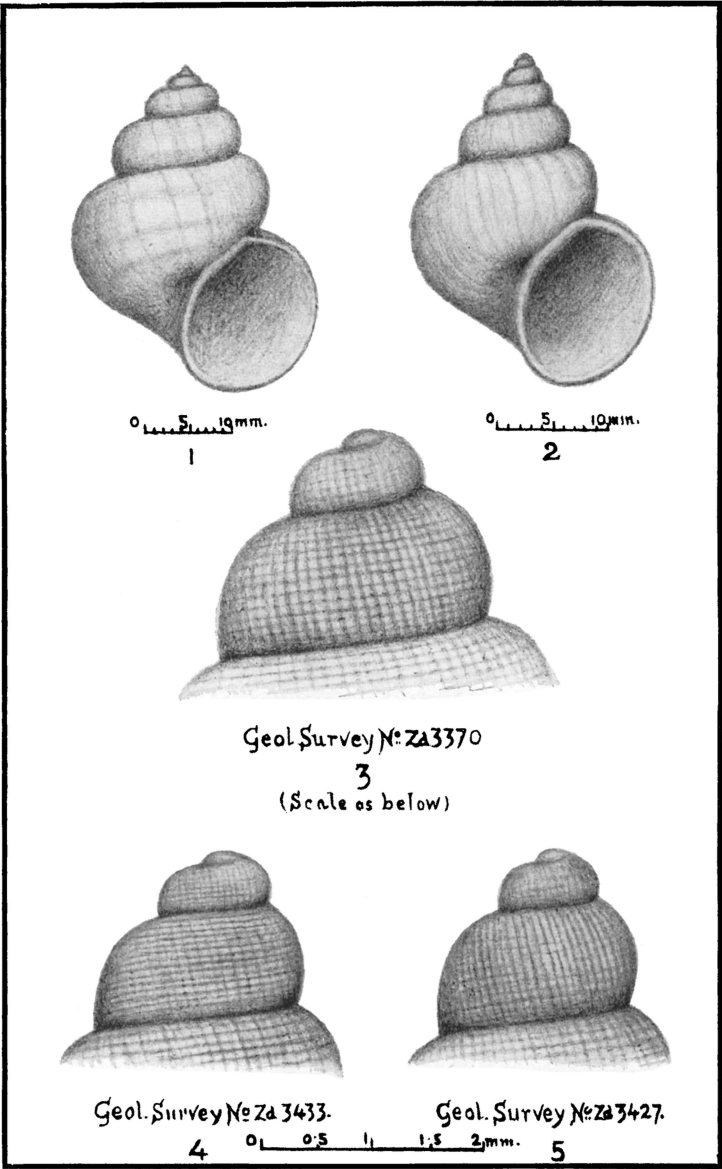


Fig. 1, a recent, and Figs. 2-5, a Bathonian, *Viviparus*.