

XVI. *Remarks on the difficulty of distinguishing certain Genera of Testaceous Mollusca by their Shells alone, and on the Anomalies in regard to Habitation observed in certain Species.* By JOHN EDWARD GRAY, Esq. F.R.S. &c.

Received June 11,—Read June 18, 1835.

IT has been a very common error, both among conchologists and geologists, to regard all shells in which no remarkable difference of form and character can be distinguished as inhabited by one and the same genus of animals; and not less usual to assume that all the species of the same genus inhabit similar localities. Many geologists have still further enlarged the boundaries of error, by taking for granted that all the fossil species of shells which are referrible by the characters of the shell to recent genera, must have been formed by animals which, in their recent state, possessed the same habits as the most commonly observed species of the genus to which they appear to belong. These theories were, indeed, quite consistent with our former ignorance of the habits of the animals of this class; but since the works of POLI, MÜLLER, MONTAGU, LAMARCK, and CUVIER have induced zoologists again to turn their attention, as was the practice among the older writers, to the animals of shells, and their habits, and no longer to confine themselves, as was too often the case with the followers of the Linnean system of conchology, to the study of the shells as mere pieces of ornament, classed without reference to their inhabitants, the acknowledged importance of the subject is daily bringing to our knowledge some animal unknown before, and adding to our stock of information facts which prove the fallacy of the opinions so hastily taken up. Thus, although even at the present day the animals of less than one twentieth part of the well-known species of shells have been observed,—and of those which are known the greater part have been very imperfectly described,—numerous exceptions to the theories in question have been brought to light, which deserve to be collected into one point of view, and made the subject of serious consideration.

The exceptions which it is the object of the present paper to notice may be arranged under the two following heads:

1. Shells having every appearance of belonging to the same natural genus, but inhabited by animals of a very different character.
2. Species of testaceous *Mollusca* living in very different situations from the majority of the known species of the genus to which they belong, or having the faculty of maintaining their existence in several different situations.

These two classes of exceptions I shall proceed to notice in detail.

1. *Of Shells apparently similar, but belonging, on a comparison of their Animals, to very different Genera.*

In a note on my former paper on the structure of shells*, I pointed out the perplexity in which the extreme similarity of the shells belonging to the genera *Patella* and *Lottia* must involve the geologist and the conchologist, intending at some future time to pursue the subject further, and to show that similar difficulties existed in regard to several other genera. The two genera above referred to are probably, however, the most remarkable example of this complete resemblance, on account of the extreme dissimilarity of their animals, which are referrible to two very different orders of *Mollusca*, while the shells are so perfectly alike, that after a long-continued study of numerous species of each genus, I cannot find any character by which they can be distinguished with any degree of certainty. Both genera present a striking discrepancy from all other univalve shells, in having the apex of the shell turned towards the head of the animal, the genera to which they are immediately related in both the orders to which they belong offering no variation in this respect from the usual structure of the class. The agreement in the internal structure of their shells is equally complete; yet the animal of *Patella* has the branchiæ in the form of a series of small plates disposed in a circle round the inner edge of the mantle, while that of *Lottia* has a triangular pectinated gill seated in a proper cavity formed over the back of the neck within the mantle, agreeing in this respect with the inhabitants of the *Trochi*, *Monodontæ*, and *Turbines*, from which it differs so remarkably in the simple conical form of its shell. This difference in the respiratory organs of animals inhabiting shells so strikingly similar is the more anomalous, inasmuch as those organs commonly exercise great influence on the general form of shells; a circumstance readily accounted for when we reflect that a principal object of the shell is to afford protection to those delicate and highly important parts.

To the practical conchologist it will be sufficient to mention *Pupa* and *Vertigo*, *Vitrina* and *Nanina*, *Rissoa* and *Truncatella*, as affording numerous and perplexing instances of the difficulty of distinguishing between genera of shells, inhabited by very different animals.

A similar difficulty exists with regard to *Siphonaria* and *Ancylus*, genera belonging to two different families, one inhabiting the sea-shores, while the other lives in rivers and brooks. The only distinction between the shells of these two genera consists in the *Ancyli* being generally of a thinner substance than the *Siphonariæ*; but this is by no means an adequate character, some species of *Siphonaria* (*S. Tristensis*, for example,) being quite as thin in texture as any *Ancylus*. Both have the muscular impression interrupted by the canal through which the air passes to the respiratory organs; yet the animal of *Ancylus* has long tentacles, and eyes placed as in the *Lymnææ*, to which it is closely allied, while *Siphonaria* has no distinct tentacles, and

* Philosophical Transactions, 1834, p. 800.

in these respects agrees with the equally marine genus *Amphibola*, confounded by LAMARCK with the *Ampullariæ*.

About fifteen years since, I first observed, in the marshes near the banks of the Thames between Greenwich and Woolwich, in company with species of *Valvata*, *Bithynia*, and *Pisidium*, a small univalve shell, agreeing with the smaller species of the littoral genus *Littorina* in every character both of shell and operculum; yet this very peculiar and apparently local species has an animal which at once distinguishes it from the animal of that genus, and from all other Ctenobranchous *Mollusca*. Its tentacles are very short and thick, and have the eyes placed at their tips; while the *Littorinæ*, and all the other animals of the order to which they belong, have their eyes placed on small tubercles on the outer side of the base of the tentacles, which are generally more or less elongated. The shell in question and its animal were described and figured by Dr. LEACH, in his hitherto unpublished work on British *Mollusca*, under the name of *Assiminia Grayana*; and as this name has been referred to by Mr. JEFFRIES and other conchologists, it may be regarded as established, and that of *Syncera hepatica*, proposed by myself in the Medical Repository, vol. x. p. 239, will take the rank of a synonym. A second species of this genus has lately been made known by Mr. BENSON, by whom it was found in ponds in India. Its shell is banded like that of *Littorina 4-fasciata* and several others of the smaller *Littorinæ*, and had been figured in the Supplement to Wood's Catalogue, t. 6. f. 28, under the name of *Turbo Francesiæ*.

Taking this in conjunction with the preceding, we have here two instances of univalve shells apparently belonging to the same genus, the one found in fresh and the other in salt water, but proving, when their animals are examined, to belong to genera essentially distinct. My next illustration will show that a similar fact has been observed among the bivalves.

The *Mytilus polymorphus* of CHEMNITZ is truly a freshwater species, having been first observed in the Wolga by the illustrious PALLAS. It has recently been introduced, doubtless with the Russian timber, (for this species, in common with the *Ampullariæ*, *Paludinæ*, and *Neritinæ* of fresh water, and the *Littorinæ*, *Monodontæ*, and *Cerithia* of salt, has the faculty of living for a very long time out of water,) into the Lake of Haarlem and the Commercial Docks at Rotherhithe; in both of which it appears to increase with great rapidity. I am aware that Mr. LYELL has given another explanation of the mode of introduction of this remarkable species; but from experiments which I have myself made on the animal's power of living out of water, I cannot hesitate in giving the preference to the suggestion advanced above, rather than supposing it to have made its passage from one river to the other, across the sea, attached to the bottom of a vessel. The shell in question differs from the shells of other *Mytili* in no character of more than specific importance; but the animal is essentially distinct. In the genus *Mytilus* the lobes of the mantle are free throughout nearly their whole circumference, as in *Unio*, *Cardita*, *Pecten*, *Ostrea*, &c.; while in

the animal of *Mytilus polymorphus* they are united through nearly their whole extent, leaving only three small apertures, one for the passage of the foot and beard, and the other two for the reception and rejection of the water, from the contents of which the animal derives its sustenance. This shell must consequently form a new genus, to which the name of *Dreissena* has been appropriated by VAN BENEDEN*. As a proof of the importance attached to this character, it may be observed that CUVIER considered the adherence or non-adherence of the lobes of the mantle so essential a distinction as to found on it his division of the bivalves into families. In his system, therefore, the genus *Dreissena* would be placed with the family of *Chamacées*, while the genus *Mytilus* forms the type of the preceding family of *Mytilacées*. The genus *Iridina*, however, and one or two others, show that this character cannot be implicitly relied on for the natural classification of animals of this class, although it forms a very good generic mark of distinction.

The genus *Iridina* † above referred to affords a second instance of this anomaly; for though the animals of the *Iridinæ* and *Anodontæ* differ in the adhesion and non-adhesion of the lobes of the mantles, yet the shells are so alike that they cannot be distinguished by any external character; so much so, that one of the species now referred to the genus by M. DESHAYES, who first pointed out this peculiarity in the animal, was considered as an *Anodon* by LAMARCK.

The animals of *Cytherea*, *Venus*, and *Venerupis* have, like those of most of the allied genera, a lanceolate foot projecting at the anterior part of the shell; while the genus *Artemis* of POLI, which has generally been confounded with *Cytherea*, from which it is not easily to be distinguished except by its usually more rounded form, is provided with a crescent-shaped foot, exerted at the middle of the lower edges of the valves.

Again, there is but little difference in external characters and habit between *Cyclas* and *Pisidium*; but the animals of the latter have elongated siphons which are not found in the former.

In reference to Univalves it may also be observed, that it is frequently impossible to distinguish some of the genera of that class without an examination of their opercula. This is the case, for instance, as regards the smaller and more solid *Paludinæ*, inhabitants of fresh water, and some species of *Littorina* living on the coast; several of the shells described as *Paludinæ* by DRAPARNAULD and others appearing rather to belong to the latter genus. A similar difficulty exists with respect to other *Littorinæ* as distinguished from *Phasianella*, and with the *Neritinæ* as distinguished from the *Neritæ*. In the latter case the characters derived from the operculum are so essential

* Institut, 1835, p. 130; and Annales des Sciences Naturelles, N. S., tom. iii. p. 193.

† LAMARCK formed this genus on a specimen which had its hinge margin accidentally tubercular and slightly crenated; but this character is not found in most of the specimens of the species which he describes. The English conchologists, misled by this character, have referred to the genus a very different African shell, with a long series of transverse teeth on the hinge margin, which has lately been separated by Mr. CONRAD under the name of *Pleiodon*.

to the discrimination of the two genera, that M. RANG, looking only to the characters of the shell, has proposed to reunite them into one. In proof of the little attention that has hitherto been paid to this very important part, I may mention that three species referred by LAMARCK to the genus *Solarium* are each furnished with a different kind of operculum; and it is deserving of notice that the *Monodonta canaliculata*, according to the observations of M. QUOY, has an operculum very different from the rest of the shells of that genus.

In some shells, again, the differences in character are so slight as almost to throw an air of ridicule on the attempt to separate them generically from the structure of the shells alone; and yet when the animal is examined the necessity of their separation becomes so obvious as to be immediately acknowledged. This is especially the case with my genus *Bullia* compared with *Terebra*: the shells of these two genera are so similar, that LAMARCK and all other conchologists have retained them in one group, no other distinction being observable except that in the former there is a more or less distinct callous band winding round the volutions just above the suture, and produced by a slight extension of the inner lip beyond the part of the shell occupied by the whorl. This extension of the lip is probably deposited by the foot of the animal, which in the genus *Bullia* is very large and expanded, while that of *Terebra* is small and compressed. This, however, is not the only difference between the two animals, that of the former genus having rather large and eyeless tentacles, while the *Terebræ* have very small and short tentacles, bearing the eyes near their tips.

A second example of a similar kind is derived from the genus *Rostellaria*, in which LAMARCK includes the *Strombus Pes Pelecani* of LINNÆUS. The animal of this shell has been figured by MÜLLER, and very much resembles that of *Buccinum*, having long slender tentacles with the eyes sessile on the outer side of their base; while, as Dr. RÜPPELL informs me, the *Rostellaria curvirostris* has an animal allied to *Strombus*, with the eyes on very large peduncles, which give off from the middle of one of their sides the small tentacles. Notwithstanding this difference in the form of their animals, I am not, however, aware of any essential character by which the shell of *Aporrhais* (as the *Strombus Pes Pelecani* has been generically named) can be distinguished from the other *Rostellariæ*.

With all this uncertainty with regard to the generic characters of the recent species of shells, of which the animals can be subjected to examination, how much must the difficulty of deciding their genera with certainty be enhanced with reference to the fossil species, and especially to those which have no strictly analogous form existing in the recent state. Considerations like these tend greatly to disturb the confidence formerly reposed in the opinion that every difference in the form and structure of the animal was accompanied by marks permanently traced upon the shell, by which it might be at once distinguished, and which it was therefore the great object of the conchologist to point out. But another source of error, particularly interesting to the geologist, is included under my second head, to the elucidation of which I shall now proceed.

2. *Of Species belonging to the same natural Genus, inhabiting essentially different situations.*

The general belief that all the species of the same genus inhabit the same kind of situation, undoubtedly holds good with reference to most of the genera of shells; but many exceptions have already been observed, and we may anticipate that many more will be discovered as the natural habits of the different species become better known. In bringing together a number of these exceptions, I have been under the necessity of placing considerable reliance on the observations of others, who have noted in foreign countries facts similar to those which I have myself witnessed at home; but these observations have been chiefly collected from the works of Professor NILSSON of Sweden, of Mr. SAY of the United States of North America, and of MM. LESSON, QUOY, and RANG of Paris, writers who, from their extensive knowledge of conchology, are fully capable of accurately recording their observations, and whose statements may therefore be received as deserving of the most implicit confidence. It is moreover to be observed, that all their observations on this subject were made simply with the view of extending the knowledge of the history of the species to which they refer, and without reference to the establishment of any preconceived theory.

These observations may be classed under the four following subdivisions: 1st, where species of the same genus are found in more than one kind of situation, as on land, in fresh and in salt water; 2nd, where one or more species of a genus, most of whose species inhabit fresh water, are found in salt or brackish water; 3rd, where, on the contrary, one or more species of a genus, whose species generally inhabit the sea, are found in fresh water; and 4th, where the same species is found both in salt and fresh water.

Of the first of these classes the genus *Auricula*, as defined by LAMARCK, may be quoted as a striking example. Of its species, *A. Scarabus* and *A. minima* are found in damp places on the surface of the earth; *A. Judæ* lives in sandy places overflowed by the sea; *A. Myosotis*, *A. coniformis*, *A. nitens*, &c. (separated by DE MONTFORT under the name of *Conovulus*;) are found only in the sea in company with Chitons, *Littorinæ*, and other truly marine shells; and the South American species which I distinguished some time since under the name of *Chilina*, including *A. Dombeyi* of LAMARCK, and *A. fluviatilis* of LESSON, inhabit freshwater streams, having most of the habits of the *Lymnææ*. This disparity of habitation has been in some degree overcome by dividing the genus into several, as noticed above; but the characters employed for their distinction are very slight, and species apparently intermediate between them are constantly occurring.

The genus *Lymnæa* has usually been considered as confined to fresh water; but M. NILSSON describes a species under the name of *L. Balthica*, which is found "in aquâ parùm salsâ Maris Balthici ad littora Gothlandiæ et Scaniæ, &c. In maris juxta Esperöd fucis et lapidibus adhærens frequenter obvenit simul cum *Paludinâ Balthicâ* et *Neritinâ fluviatili*;" and a second under the name of *Lymnæa succinea*, which is

found on the shores of the sea near Trelleborg. All the species of *Paludina* and *Bithynia* which have fallen under my own observation are essentially fluviatile; but M. NILSSON refers in the paragraph above quoted to a species of the former genus inhabiting the sea. This may, however, like some of the smaller *Paludineæ* of DRAPARNAULD, be truly a *Littorina*, having a horny and spiral, and not an annular, operculum.

According to the observations of my sister, Mrs. INCE, of Mr. BENSON, of MM. QUOY and GAIMARD, and of M. LESSON, the Indian species of *Neritina*, like the European, are found only in fresh water; yet M. RANG, in his Manuel des Mollusques, p. 193, states that the *Neritina viridis* is a marine species found on rocks covered by the sea at Martinique, and that a larger variety of this species is found in similar situations at Madagascar; General HARDWICKE marks on his drawing of the *Neritina crepidularis*, that it was found in "saltwater lakes, April 1816;" and SAY has described the *Neritina Meleagris* of LAMARCK (*Theodoxus reclinatus*, SAY,) as living both in fresh and salt water. This is most probably the species to which Mr. GUILDING refers*, when he observes that he has kept *Neritina* for some time alive in a close vessel of salt water, which they appear to purify. The animals of some of the tropical species often quit the stream and crawl up the trunks of neighbouring trees, on which, like the species of *Littorina*, *Planaxis*, and *Bulla*, which creep up the rocks on the sea-coast, they attach themselves, and remain exposed to the influence of the sun. It may be added, that M. RANG has found *Neritina Auricula* in brackish marshes near the sea in the Island of Bourbon, in company with *Aviculæ* and *Aplysiæ*; and I have little doubt that *Neritina Pupa* inhabits the sea, it being uniformly brought to this country in company with marine shells.

Many species of *Melania*, as, for example, *M. amarula*, *M. fasciolata*, and *M. lineata*, are found in the freshwater streams of India and its islands. Mr. SAY mentions species found in similar situations in North America; he also describes one (*M. simplex*) as found in a stream running through the saltwater valley near the salt-works, but does not state whether the water of the stream is salt or fresh. On the other hand, M. QUOY asserts that they are sometimes taken in brackish water; M. CAILLIAUD states that *Melania Oweni* is found in brackish water; and M. RANG has found other species in the Island of Bourbon under the same circumstances with the *Neritina* just adverted to. The genus *Melanopsis* has the same habits; its species are often found in large inland lakes. I have myself received *M. buccinoidea* from the sea of Galilee; and Dr. CLARK, in his Travels, vol. ii. p. 243, figures *M. Dufourii* under the name of *Buccinum Galileum*. The water of this lake, however, unlike that of the neighbouring Dead Sea, is, according to the statement of FULLER, perfectly fresh and sweet. M. LESSON, on the other hand, states that he found the *Pyrena terebrans*, regarded by M. DE FÉRUSAC as a *Melanopsis*, in great abundance in brackish marshes in New Guinea, and at the Island of Bourou.

I am informed by Mr. SOWERBY that some species of the fluviatile genus *Cyrena* are found in the sea on the coast of South America; but he thinks it probable that

* See Zoological Journal, vol. v. p. 33.

the part of the sea in which they are met with may be fresh, like certain parts of the ocean described by Dr. ABEL in his voyage to China. It would be highly interesting to procure a verification of this observation. Similar phenomena may not be uncommon, for I have myself observed in Torbay a small space in the neighbourhood of Brixham, the water of which was of a different colour and much fresher than that of other parts of the bay. With reference to another species of the same genus, *Cyrena Vanikorensis*, M. QUOY observes: "Ne l'ayant pas trouvée dans les lieux marécageux, mais sur les bords de la mer, il est probable qu'elle vit à l'embouchure des rivières qui sont saumâtres à marée haute*."

The third class of cases, in which species of *Mollusca* that are generally found in the sea are taken in fresh water, is much more rare than the preceding. It is obvious that in such instances the animal must be possessed of the capability of adapting itself to the different characters of the two fluids. This capability exists in much more highly organized animals, such as fishes, many species of which constantly migrate from the sea and ascend the rivers to deposit their spawn; but in these cases it is the result of a regular and determinate habit, while in the *Mollusca* it appears to be entirely dependent on accidental circumstances.

In some marshes in the Island of Bourbon, in which the water is almost fresh, M. RANG has observed specimens of *Aplysia dolabrifera* in company with *Neritimæ* and *Melanice*.

The greater number of species of the genus *Cerithium* are truly marine, chiefly living in sandy bays, like our own *Cerithium reticulatum*. M. LESSON, however, found *C. sulcatum*, and ADANSON the African species figured by him, in the pools of brackish water, sometimes overflowed by the sea, which are situated between the weeds and the belts of mangrove trees on the shore; and Mr. SAY observes that the small species, called by him *Pyrena scalariformis*, but which is a true *Cerithium*, is found in great abundance in the fresh water of Florida Keys. He adds: "it is most certainly a freshwater shell, yet it is destitute of an epidermis."

The genus *Bulla* is also truly marine; but the Rev. Mr. HENNAH some time since presented to the British Museum specimens of one of its species, resembling the *Bulla Hydatis*, found by him in brackish pools on the coast of Chili; and Mr. SAY has described a *Bulla fluviatilis* found by Mr. AARON STONE deeply imbedded in the mud of the river Delaware †.

The *Littorinæ*, again, are all found either on the sea-shore or in the very brackish water of the mouths of rivers, except two, which although described as *Paludinæ* by PFEIFFER and DE FÉRUSSAC, and formed into a distinct genus by ZIEGLER under the name of *Lithoglyphus*, agree with *Littorina* in every character of shell and operculum, and, as far as I can ascertain from the descriptions, of the animal also. These are the *Paludina fusca* of PFEIFFER, and the *P. naticoides* of DE FÉRUSSAC: they are truly fluviatile.

* Voyage de l'Astrolabe, tom. iii. p. 516.

† See for this latter instance the Journal of the Academy of Natural Sciences of Philadelphia, vol. ii. p. 179.

These anomalies are not restricted to the univalves : bivalves have also their share. Thus, the genus *Solen* is generally and properly considered as marine ; but Mr. BENSON has lately discovered a species inhabiting the mud on the banks of the Ganges ; and conceiving, from the nature of its habitation, that it ought to be separated from the common species, he has formed a genus for its reception under the name of *Novaculina*. On comparing, however, some specimens of the shell presented to the British Museum by Mr. ROYLE, I can scarcely distinguish it as a species from the *Solen Dombeyi* of LAMARCK, which is found on the coast of Peru ; and I have two other species, very nearly related, one from the rivers of China, and the other from pools of brackish water on the coast of America. In like manner M. NILSSON has found his *Tellina Balthica*, which appears to be little more than a variety of the *Tellina solidula* of our coast, in the brackish water of the shores of the Baltic. *Avicula margaritifera*, the mother-of-pearl shell, commonly found in the ocean, has been taken by M. RANG in marshes in the Isle of Bourbon in the neighbourhood of the sea in which the water is nearly fresh. Specimens of *Mya arenaria* also are often found so high up the rivers that the water in which they live is brackish only during high tides. They are found, moreover, with freshwater shells on the coasts of the Baltic, while all the other species of the genus are found only where the water is quite salt.

By far the greater part of the species of *Corbulæ* are truly marine ; but there is a large species of the genus, called by Dr. MATON* *Mya labiata*, brought with freshwater shells from the mouth of the Rio de la Plata ; and this agrees in many respects with the fossil *Corbula Gallica*, which occurs in what are called the upper freshwater strata of the Isle of Wight.

The transitions to which the oysters intended for the London market are exposed may be mentioned as an additional illustration. Many of these are collected in the sea on the coasts of Guernsey and of France, and are brought to situations in the mouth of the river where the water is merely brackish during the ebb of the tide, and where they are consequently subjected to the alternate action of salt and brackish water twice in each day. It is even affirmed that oysters can exist in water absolutely fresh ; for in the Museum of the Bristol Institution there is a large group said to have been dredged up in a river on the coast of Africa where the stream was so sweet as to have been used to water the ship. To these shells are attached specimens of *Cerithium armatum* ; and the person by whom they were presented to the collection stated that *Cardium ringens* was found abundantly in the same situation.

The genus *Cucullæa*, again, is universally considered as truly marine ; but Mr. BENSON has found in the Ganges a small shell belonging to it, regarded by him as an *Arca*, but on account of its freshwater origin formed into a new genus under the name of *Scaphula*.

On this subject I may observe, that I was some time ago informed that *Arca senilis* was found in the rivers of Africa in company with *Galatea radiata* : M. CAILLIAUD,

* Linnean Transactions, vol. x. p. 326, t. 24, f. 3.

however, assures me that this is by no means the case, the shells in question being found near the mouths of the rivers, but never in the rivers themselves.

One of the most decisive facts regarding the finding of the same species of shell in both salt and fresh water is noticed by SAY*. Speaking of *Theodoxus reclinatus*, he observes, "I found this species in great plenty, inhabiting St. John's river in East Florida, from its mouth to Fort Picolata, a distance of one hundred miles, where the water is potable. It seemed to exist equally well where the water was as salt as that of the ocean, and where the intermixture of that condiment could not be detected by the taste." The shell in question is determined, by specimens which I received from my late friend himself, (to whom science is so deeply indebted, and especially for his researches into the zoology of North America,) to be the *Neritina Meleagris*, obtained in such abundance from the West Indian Islands. NILSSON too, as before mentioned, has noticed the *Neritina fluviatilis*, which in this country is not observed to inhabit ditches in the neighbourhood even of brackish water, living on the coasts of the Baltic, in brackish situations, in company with *Lymnæa Balthica* and *L. succinea*; and M. RANG found *Neritina auriculata* in similar situations.

According to the observations of OLIVIER, the *Ampullaria ovata* inhabits Lake Ma-reotis, where it is taken in company with marine shells found also in the Mediterranean; and I have lately received (dead) specimens from the locality indicated. The same species was found by M. CAILLIAUD in freshwater lakes in the Oasis of Siwah, where it is called Bozue and eaten as food. It thus appears to be found both in fresh and brackish water. Two of the species referred to this genus by LAMARCK, his *Ampullaria Avellana* and *A. fragilis*, are truly marine; but they differ from the others in animal and operculum, as well as in the sinuated form of the outer lip of their shell.

The common cockle of the shops, *Cardium edule*, is constantly to be seen in the ditches of brackish water in the neighbourhood of Tilbury Fort, which gradually become more or less fresh in proportion to the quantity of rain that falls between the periods of opening the sluices. It is to be observed that the specimens found in this situation are rather thinner and more produced posteriorly than those usually found in the sea. The species in question is also, according to NILSSON, found in the brackish water on the shores of the Baltic, but I am not aware whether or not it is there subject to a similar variation in form. NILSSON observes, however, that the marine species found in those localities are generally smaller than those found in other situations.

From this list of exceptions to the general rules which have commonly been regarded as decisive of the localities inhabited by recent shells, and of the nature of the deposits in which the fossil species are found, it is manifest that those rules cannot safely be made use of for practical purposes without considerable reservation.

* Journal of the Academy of Natural Sciences of Philadelphia, vol. ii. p. 258.