

TABLE (continued).

Species.	Tremadoc Slates.	Skiddaw Slates (Lowest Llandeilo).	Lower Llandeilo.	Upper Llandeilo.	Caradoc.	Lower Llandovery.	Upper Llandovery.	Wenlock.	Lower Ludlow.	Upper Ludlow.
<i>Pleurograpsus linearis</i> , Carr. ....	..	..	..	*						
<i>vagens</i> , Nich. ....	..	*								
<i>Graptolites Bohemicus</i> , Barr. ....	..	..	..	..	*					
<i>colonus</i> , Barr. ....	..	..	..	..	*	..	..	*	*	*
<i>discretus</i> , Nich. ....	..	..	..	..	*					
<i>fimbriatus</i> , Nich. ....	..	..	..	*	*					
<i>Flemingii</i> , Salt. ....	..	..	..	..	..	..	..	*		
<i>lobiferus</i> , M'Coy ....	..	..	..	*	*					
<i>Nilssonii</i> , Barr. ....	..	..	..	*	*					
<i>priodon</i> , Bronn ....	..	..	..	*	*	*	*	*	*	*
<i>sagittarius</i> , Linn. ....	..	..	..	*	*					
<i>Sedgwickii</i> , Portl. ....	..	..	..	*	*					
<i>tenuis</i> , Portl. ....	..	..	..	*	*					
<i>turriculatus</i> , Barr. ....	..	..	..	..	*					
<i>Rastrites capillaris</i> , Carr. ....	..	..	..	*						
<i>Linnæi</i> , Barr. ....	..	..	..	*	*					
<i>peregrinus</i> , Barr. ....	..	..	..	*	*					
<i>Helicograpsus gracilis</i> , Hall ....	..	..	..	*	*					
<i>Cyrtograpsus Murchisoni</i> , Carr. ....	..	..	..	*						
<i>Retiolites Geinitzianus</i> , Barr. ....	..	..	..	..	*	..	..	*	..	*
<i>perlatus</i> , Nich. ....	..	..	..	..	*					
<i>venosus</i> , Hall ....	..	..	..	*						
<i>Dicranograpsus ramosus</i> , Hall ....	..	..	*	*	*					
<i>Callograpsus elegans</i> , Hall ....	..	..	..	..	*					
<i>Ptilograpsus anglicus</i> , Nich. ....	..	..	..	..	..	..	..	..	*	

XLII.—*Remarks upon Mr. J. Gwyn Jeffreys's last Dredging Report.* By R. M'ANDREW, F.R.S.

MY friend Mr. Jeffreys, in the Dredging Report read by him at the Norwich Meeting of the British Association, and published in the Number of the 'Annals of Natural History' for last month, gives a summary of observations previously recorded by him; and as some of these are not in accordance with the result of my dredging experience, I feel called upon to state the grounds upon which I am compelled to differ from one who is generally so trustworthy an authority, and to make a few remarks bearing upon the questions at issue. Mr. Jeffreys states:—

"1. The bathymetrical zones have been too much divided



by Risso and subsequent authors. There are two principal zones, the littoral and the submarine; the nature of habitat and supply of food influence the residence and migration of animals, not the depth of water. *Psammobia costulata* and *Buccinum undatum* are instances in support of this proposition."

Now a natural inference from this would be that, excepting those which are littoral, the species inhabit all depths indifferently, which I know it could never have been Mr. Jeffreys's intention to imply. Admitting that "the nature of the habitat and supply of food influence the residence of animals," it is evident that these must vary to meet the requirements of different species, also that *depth* is not only itself an important element in the nature of a habitat, but must have considerable influence on the food of Mollusca. For instance, the *Laminaria* does not grow below 15 or 20 fathoms at the most; several species of Mollusca are entirely dependent upon *Laminaria* for food, and consequently are strictly confined to its zone. In most cases the conditions cannot be so easily defined; but it is nevertheless a fact that most, if not all, the species of Mollusca have their maximum of development at a particular depth—and that while some enjoy a considerable bathymetrical range, others are confined within comparatively narrow limits—and that, in consequence of the great interest attached to vertical distribution, it has been found convenient to institute zones of depth as well as geographical provinces.

According to Forbes, there exist in the eastern Mediterranean eight well-marked regions of depth, each characterized by its peculiar fauna. As this conclusion was arrived at after some eighteen months of research by no ordinary observer, I consider that it is entitled to respect until the data upon which it is founded, set forth in the Report on the *Ægean Invertebrata*, shall have been proved to be erroneous. It does not follow that observations made in the *Ægean Sea* are of universal application, or that different conditions in the ocean or other seas may not require a modification in the number or extent of the zones. Where the action of the tide is considerable, there are, in fact, an upper and a lower littoral zone—some species of Mollusca as well as of marine plants being found even beyond the reach of ordinary tides, while others are not to be met with much above the lowest water-mark. It is to be noted that the same species often frequent different depths in different seas; and in these cases it is generally where the climate and other conditions are most favourable to their existence and multiplication that they inhabit the shallowest water. Several of the rare Shetland species, which might



there be searched for in vain in less than about 80 fathoms, are to be met with in much shallower water and greater frequency on the coasts of northern Norway.

Mr. Jeffreys's second proposition, that individuals and varieties are generally of smaller size when found in deep water, is confirmed by my own observation; and I proceed to

3. "The size of North-European specimens is usually greater than that of South-European specimens of the same species,"—from which I must record my dissent, more especially if it is meant to be implied that size diminishes in proportion to southern latitude.

The examples he names in support of his hypothesis do not bear it out, but might generally be quoted to prove (though there are many exceptions) what I conceive to be the true theory, viz. that species attain their largest dimensions under those latitudes and conditions, though not in the particular localities, most favourable to their numerical development; and it is quite consistent with this proposition that certain species which find in high northern latitudes the circumstances most favourable to their existence and increase (*Saxicava arctica*, *Arca raridentata*, and *Chiton Hanleyi* may be taken as instances) should attain smaller growth in more southern regions.

*Pecten septemradiatus* I have dredged on the Scandinavian coast as far north as Finmark, without obtaining in its more northern habitat a specimen so large as those of Loch Fyne, or even larger than those of the Sicilian species (*P. clavatus* of Poli) which Mr. Jeffreys assumes to be identical with it. *Pecten opercularis*, *Astarte sulcata*, *Artemis exoleta*, *A. lineta*, and *Natica Alderi* all appear to attain their greatest dimensions in the British seas; but they are all distributed from the Mediterranean or coasts of Spain to those of Nordland or Finmark, and I have found them all as large in their more southern as in their more northern habitat. My specimens of *Astarte sulcata* from Gibraltar and from Finmark, the extremes of its range, are of equal size, and, in fact, not distinguishable one from the other. *Lima hians* I have found largest at Oban; specimens from Nordland are similar to those from Loch Fyne. *Mytilus adriaticus* is, as far as my observation goes, smaller in more southern localities than in Britain; and I am not aware of its having been met with further north; but in my Dredging Report of 1856 I have given Britain as the locality of its principal development. The same observations will apply to *Defrancia teres* and *Bulla utriculus* as to *Mytilus adriaticus*, unless the former should prove to be identical with *Pleurotoma boreale* of Lovén.



Of the distribution of *Isocordia cor* our information is imperfect. The Dublin-Bay specimens are, I believe, the largest. I have dredged it in at least two localities in the Hebrides, though only dead in an adult state, my largest examples much below the ordinary dimensions of the species.

*Tellina balaustina* is of extreme rarity in the Atlantic, where next to nothing is known of its distribution. Except on our northern coasts, the only Atlantic specimen of which information has reached me is a single valve obtained by myself, in company with the late Dr. S. P. Woodward, off Cape Finisterre of Spain. In the Mediterranean the size I have found to vary, not from north to south, but from east to west, being smallest in the Ægean and largest at Gibraltar; so that this species does not throw any light upon the question.

*Tectura virginea* is about as large in the Bay of Vigo as in the British seas, much larger than I have procured it from more northern latitudes on the Scandinavian coast.

Of *Defrancia purpurea* my finest and largest specimens were obtained at Vigo.

The foregoing examples (not selected by me, but by Mr. Jeffreys) render it, I conceive, needless for me to bring forward any instances in support of my views. I may, however, name a few of the commonest and best-known Mollusca of our shores, as *Purpura lapillus*, which I have found largest in the south of England, *Mytilus edulis* at Algiers, *Buccinum undatum* in Shetland (frequent in the neighbourhood of the North Cape, where it is much smaller), *Fusus antiquus* in Liverpool Bay, &c.

I should not omit mention of two striking exceptions to what I conceive to be the general rule—viz. *Haliotis tuberculata* and *Chiton cajetanus*, both of which attain their largest dimensions in their most northern habitat, the Channel Islands and south coast of Brittany respectively. This I do not pretend to account for. They do not progressively augment in proportion to their northern latitude, as I have obtained both species on the north coast of Spain, where they are no larger than in the Mediterranean. Other southern species which find their northern limit on our coasts (e. g. *Venus verrucosa*, *Cytherea chione*, *Cardium maculeatum*, and *C. tuberculatum*) are larger in the Mediterranean. I could cite a few exceptional instances of specimens being larger in their southern distribution; but, to show that there are other conditions besides latitude which affect growth, I will mention that the individuals of *Chiton fascicularis* are uniformly larger at Mogador than I have found them elsewhere, while at no great distance, at Lancerote, they are much smaller than in any locality that I



am acquainted with. In the former case they were littoral, in the latter on a red *Fucus* obtained from a depth of from 10 to 20 fathoms.

4. "The colour of specimens from the greatest depths is not less vivid than from shallow water," &c. This statement would imply either that no rays of light are intercepted or deflected in their passage through water (in which case we ought to be able to see objects as well through this medium as through air)—or that light has no effect upon colour, which I may venture to say is not the case. I have no reason to suppose that colour is affected by depth, except in relation to the supply of light, or that the effect of light is appreciable except where the colour is superficial. The colour of our blood may be independent of the action of light, though not so that of our complexions. It should be observed that in some of the examples mentioned by Mr. Jeffreys the colouring-matter permeates the substance of the shell; and with respect to *Venus ovata* I must add that my experience is at variance with his statement, which I therefore presume must be founded upon some exceptional case. There are in the national collection specimens, not selected, of *Venus ovata* and *V. striatula*, procured by me from a depth of 80 fathoms and upwards, which will be found to be of a chalky consistency and almost destitute of colour.

The effect of light in heightening the superficial colour, particularly the brighter hues of shells, is evident on comparing together specimens of the same species from different latitudes. *Venus ovata*, *V. verrucosa*, *V. casina*, all the British species of *Tapes*, *Circe minima*, and many others have much more colour in the latitude of the Mediterranean than in our seas, which is naturally attributable to exposure to a more intense light.

It is a remark of Forbes, which my own observation has confirmed, that the species of Mollusca peculiar to great depths are generally void of colour.

Of the remaining propositions I will only remark upon

7. "Exotic and oceanic shells are carried northward by westerly winds, and not directly by the Gulf-stream, which does not reach our coasts," that I do not see how the distribution of Mollusca inhabiting the bottom of the sea can be affected by winds, from the direct influence of which they are so effectually removed. With respect to animals frequenting the surface of the ocean, such as *Ianthina* and *Veilella*, which occasionally appear on our coasts in considerable numbers after a prevalence of westerly or south-westerly winds, they are temporary visitors, and have not succeeded in establishing themselves permanently in our seas.



The currents by which most parts of the Atlantic are more or less affected, and of which the Gulf-stream is the most important, generally prevail from the west. Along the coast of Norway the action is decidedly from south to north, and has the effect of keeping the entrance of the most northern ports, such as Hammerfest, free from ice at all seasons. To the south of the Bay of Biscay, more particularly south of Gibraltar, the current sets southward, past the Canary Islands; but I cannot say that I have been able to detect any effect from these currents upon the distribution of Mollusca—a subject to which I have paid some attention.

It is a remarkable fact that the shells of the Açores are of European and West-African species, and not American, as would have been the case had they been carried there by the prevailing currents; and, what is still more remarkable, the *Littorina* most abundant in these islands (*L. striata*) is not a European species, but common to the Madeira, Canary, and Cape Verde Islands, and to the west coast of Africa—a circumstance deserving the attention of geologists, as pointing to a former distribution of land.

Isleworth House, Oct. 16, 1868.

### XLIII.—On *Ophiocrinus*, a new Genus of Comatulidæ.

By Dr. C. SEMPER, of Würzburg\*.

AMONG the numerous Comatulidæ found by me at Bohol, there is one species possessing only five, wholly undivided arms. At first I held it to be a young specimen of some real *Comatula*; but, not corresponding exactly to any of the Philippine species, I consider myself justified in describing it as a separate species. In this case the fact of the arms being undivided gives it a claim to a separate genus.

#### OPHIOCRINUS, n. gen.

Five wholly undivided arms; they spring direct from the central knob, which below bears the cirrhi: other ossicula of the calyx are entirely wanting throughout. Disk ——?

#### *Ophiocrinus indivisus*, n. sp.

Sixteen cirrhi range in a single row around the small flat knob. Joints of the cirrhi 18–20, very knotty, especially at the basis; the knots correspond to the articulations: the first two joints are short, as high as they are broad; the third to sixth are

\* Translated by Frau Anna Semper.