

XIX.—*Observations on the Microscopic Examination of Foraminifera obtained in Deep-sea Bottoms at the Feejee Islands.* By JOHN DENIS MACDONALD, Assistant Surgeon H.M.S. Herald.

[With two Plates.]

THE accompanying figures (Plates V. and VI.) represent some forms of *Foraminifera* obtained by two soundings taken in the *Feejee* group, from the respective depths of 1020 fathoms and 440 fathoms; the former between *Kandaru* and *Mbengga*, and the latter between *Ngau* and *Viti Laru*, about four miles from the barrier reef.

Illustrations of all the divisions of D'Orbigny's classification were found in a few atoms placed under the microscope; and from the great number of species occurring in so small a quantity of the bottom, it may be readily conceived how vast must be the accumulation of these microscopic beings at the depths of the ocean, but more especially in the neighbourhood of islands and continents, on whose coasts they are originally developed.

The figures may be arranged as follows:

- |                                             |                                        |
|---------------------------------------------|----------------------------------------|
| I. <i>Monostega</i> , figs. 1-5.            | IV. <i>Entomostega</i> , fig. 25.      |
| II. <i>Stichostega</i> , figs. 6-10.        | V. <i>Euallostega</i> , figs. 26 & 27. |
| III. <i>Helicostega</i> , figs. 11-23, 24?. | VI. <i>Agathistega</i> , figs. 28-30.  |

The *Stichostega* and *Agathistega* occurred in the bottom taken at 440 fathoms, and nearly all the others were found in that brought up from a depth of 1020 fathoms; but this I am inclined to refer to casualty rather than to any essential difference in the materials existing in both.

Figs. 31-33, representing living *Helicostega*, obtained in shallow water, will presently be noticed.

During our late cruises we frequently observed considerable numbers of recent *Foraminifera* adhering to the fronds of the smaller marine *Algæ* (*Confervaceæ*, &c.), either floating on the surface of the ocean, or growing on the shores of the *Pacific Islands*; so that the abundant appearance of the dead shells of these animals in the sand of every beach, and in every sea-bottom fathomed by the armed lead, was satisfactorily accounted for.

On examining some living *Bryozoa* taken with the dredge at *Port Curtis*, and including the British genera *Serialaria*, *Vesicularia* and *Crisia*, I first observed that the *Foraminifera* brought up with them were pedunculated, and so fixed to the polypidoms as to preclude locomotion completely\*. I could not help re-

\* These results furnish a striking confirmation of the statements published by Mr. W. Clark in the *Annals* for May 1849 and March 1850.—EDS.



marking also that the *Foraminifera* themselves closely resembled some of the forms entombed in the chalk formations of England, and there can be little doubt that these facts will prove of considerable importance in a geological point of view. I generally find it convenient to support the correctness of my own observation by submitting any particular object to the scrutiny of others, and in this way I can vouch for the truth of figs. 31, 32, and 33. Fig. 32 is a minute *Nummulina*, nearly sessile on the frond of a sea-weed, gathered on the barrier reef at Ovalau; but in figs. 31 and 33 (*Operculina*) the pedicle is more distinctly seen. In the latter, the little *Foraminifer* is attached to a sprig of *Serialaria*.

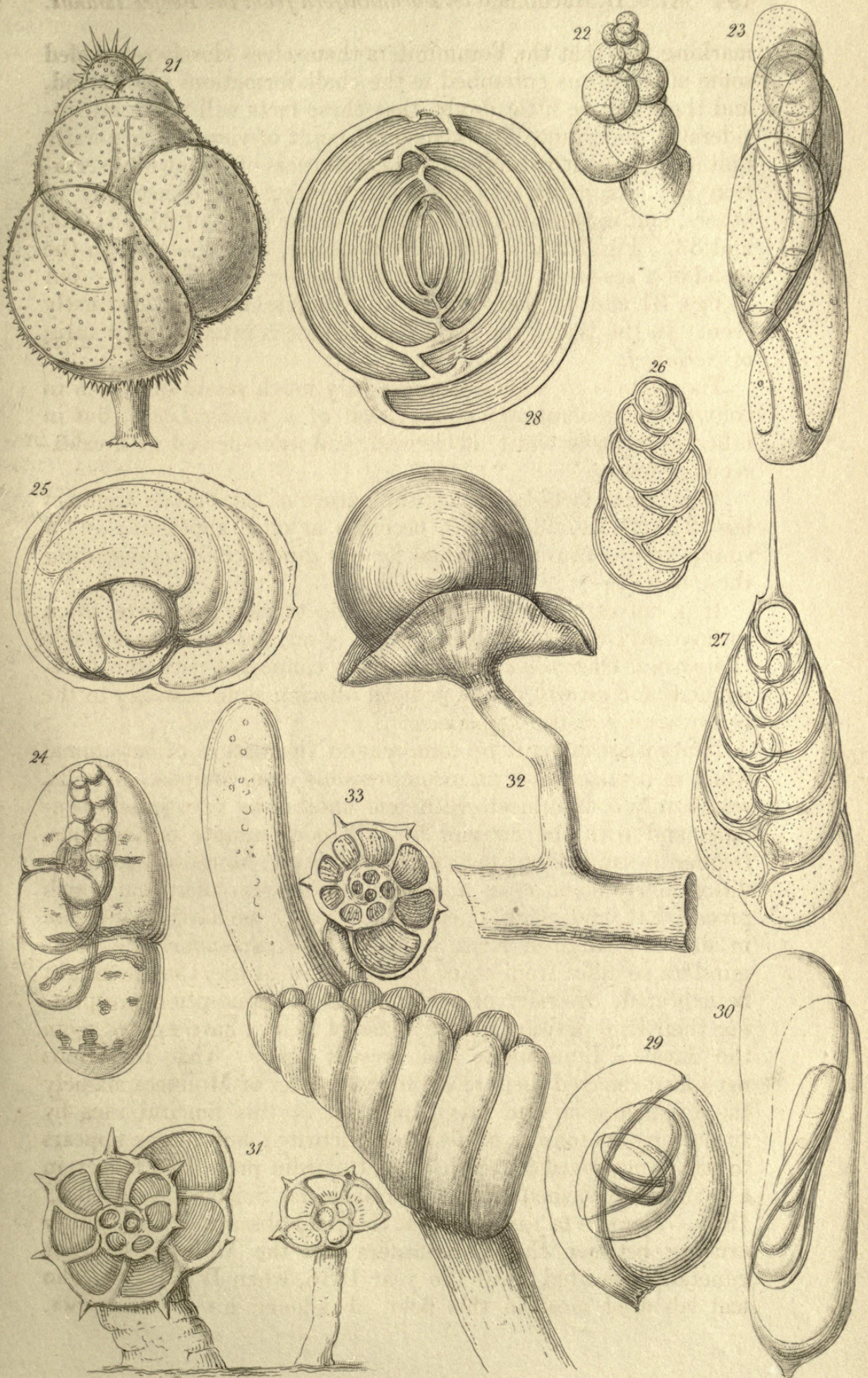
The pedicle in some instances very much resembles, both in colour and general appearance, that of a young *Lepas*, but in other cases it is short, ill-defined, and interspersed with calcareous granules.

With these facts before us, the nature of the broken stems of figs. 2, 4, 6, 21, 23 and 30, becomes at once apparent; and a simple rule is thus established for our guidance in representing these objects.

It is not at all improbable that the tubular structure, often so distinctly visible between the cells on the umbilicated side (*Faujasina*, *Operculina*), is intimately connected with the development and growth of the pedicle, offering some analogy to the cement-tubes of the *Lepadidæ*.

It is rather difficult to comprehend the nature of an animal which is invested with an incompressible case, composed of cells, which only communicate with one another by very small openings, and with the exterior by still more minute perforations, frequently amounting to a mere porosity. Moreover, each addition newly made is in a certain ratio larger than that which preceded it, and parts once formed suffer no farther increase in size or change of form. In all these particulars the *Foraminifera* so differ from other forms of animal life, that, as might be expected, diversity of opinion and misconceptions respecting their true position in the scale of being, have existed from the days of Linnæus to the present time. That illustrious naturalist referred them to the highest order of Mollusca, namely the Cephalopods, and was supported in this fanciful idea by succeeding anatomists of deserved celebrity; but no one appears to have questioned its truth until Dujardin proved its fallacy in a memoir published in the 'Annales des Sciences Naturelles,' 1835. Strange to say, however, the total absence of any affinity existing between the *Foraminifera* and the Mollusca was not generally admitted until the year 1846, when D'Orbigny, who had laboured most in this field, abandoned his former views,









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