

**Notes on the Appearance of some Foraminifera in the
Living Condition, from the 'Challenger' Collection.**

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The habits and mode of existence of Foraminifera are always interesting subjects to students of the Protozoa, and this fact alone might perhaps justify the following notes, even were they not accompanied by the valuable drawings prepared by Mr G. West, from pencil sketches and microscopic slides made by Sir John Murray from the living Foraminifera collected during the voyage of H.M.S. 'Challenger.'

The writer is greatly indebted for the privilege of examining and describing these drawings, and a collection of mounted specimens of a like character, to Sir John Murray, K.C.B., LL.D., F.R.S., who generously placed them in his hands a year or two ago.

The species of Foraminifera depicted on these plates are:—

Textularia conica, d'Orbigny.

? *Discorbina globularis* (d'Orbigny).

Truncatulina lobatula (Walker and Jacob).

Anomalina polymorpha, Costa.

Carpenteria balaniformis, Gray (young specimens).

Pulvinulina elegans (d'Orbigny) [the deep-water variety, *P.*

Partschiana (d'Orbigny)], and

Amphistegina Lessonii, d'Orbigny.

PLATE I.

The examples of living Foraminifera shown on this plate were obtained from two stations in the Pacific—No. 192A (Sept. 26, 1874); lat. 5° 49' 15" S., long. 132° 14' 15" E. Off Ki Islands, Banda Sea. Depth 129 fathoms. Sandy mud (H. B. Brady).

Also No. 232 (May 12, 1875); lat. 35° 11' N., long. 139° 28' E. S. of Japan (Hyalonema ground). Depth 345 fathoms; bottom

temperature 41.1° F., surface temperature 64.2° F. Green mud (Murray and Renard).

The central figure on Plate I. is that of a fine specimen of *Textularia conica* (fig. 1). The test is rather larger than usual, consisting of no less than twenty-five chambers; the initial series being practically hyaline or sub-arenaceous in structure. This example is seen to be creeping along a smooth spicule of *Hyalonema*, with the granular sarcode completely covering the oral surface of the test. There is no sarcode emission, apparently, from the lateral surfaces of the test, and this would point to its imperforate character. From Station 232, S. of Japan, 345 fathoms.

Figs. 2 and 3 are typical specimens of *Truncatulina lobatula*, fig. 2 showing the superior, and fig. 3 the inferior surface of the shell. The protruded sarcode in these examples seems to form somewhat ragged extensions, which partially separate from the main mass surrounding the oral opening of the shell, and are probably emitted from the tubules, forming by themselves a knotted reticulum. These specimens were found moving over the surfaces of various marine algæ. Station 232, S. of Japan, 345 fathoms.

The remaining figures, 4, 5, and 6, on this plate, are examples of the curiously variable and interesting species *Anomalina polymorpha*. In this form we have a remarkable instance of the adaptability of the foraminiferal shell to the surfaces over which the organism moves. This species presents two modifications, one with longish, rounded spines, and the other, not so frequent, without processes. The latter form resembles *Discorbina rugosa* very closely, but is as a rule never so regularly shaped; and it is, moreover, always associated with the spinous variety.* The specimens shown in figs. 4 and 5 were found attached to marine algæ, and, it will be remarked, are fairly regular in the coiling of the shell. The other specimen, shown in fig. 6, has adapted its shell to the form of the object of attachment, the spicule of *Hyalonema*; and the coiled shell, besides being laterally elongated, is hollowed along the longer axis, on its inferior surface, so as to be more securely seated on the sponge-spicule. There is little doubt that these modifications of *Anoma-*

* See H. B. Brady's remarks, *Rep. Chall.*, vol. ix., 1884, p. 676.

lina polymorpha could easily move along the rod-like spicule when living; and in that condition always appear to have carried an arming of slender sponge-spicules round the region of the oral aperture, which might serve to guide the extruded sarcode and act as axes of support.

In this remarkable adaptation of a foraminiferal shell to the surface on which it lives, *Anomalina polymorpha* shows a parallelism with *Orbitolites marginalis*, which at Funafuti was found to frequently present the most unconventional modifications of the ordinary discoid form, often appearing as a sinuous, contorted or S-shaped series of chamberlets when seen in vertical section in the cores of the Atoll-boring; and in the lagoon* it was often found to have attached itself to the fronds of *Halimeda*, and even to have wound itself round the cylindrical stems. Both in the case of *Anomalina* and *Orbitolites*, the more regular form seems to be the simpler in construction, because formed on a uniform and successional plan of growth, the wild-growing varieties being a later and hence secondary modification. In the examples quoted, it is possible that this anomalous *Anomalina* was derived from the regular *Discorbinae*, and from *Orbitolites* the genus *Nubecularia* may have been derived through the more regular or intermediate genus *Miliolina*.

Figs. 4 and 5 represent specimens from Station 232, and fig. 6 from Station 192A.

PLATE II.

The specimens shown on this plate were obtained at Station 344, (April 3, 1876), off Ascension; lat. 7° 54' 20" S., long. 14° 28' 20" W.; depth 420 fathoms.

The specimens of Foraminifera represented in fig. 1 are probably the young of *Carpenteria balaniformis*, Gray. This species is in its earliest stage remarkably like the erect forms of the Rotaline type, as *Truncatulina refulgens* and *Pulvinulina Micheliniana*.† These young forms are seen living attached to the stems of hydroids, and a noteworthy feature is the presence of a conspicuous bunch of

* Chapman, "On Foraminifera from the Funafuti Lagoon," *Journ. Linn. Soc. Lond., Zool.*, vol. xxviii., 1901, p. 181, pl. xx. figs. 1-3.

† *Rep. Chall.*, vol. ix. p. 677.

sponge-spicules grouped round the mouth of each test. This habit of collecting sponge-spicules is common to the other species of *Carpenteria*, and in some cases, notably in *C. raphidodendron*, the sponge-spicules are often enclosed in the sarcode within the test in such abundance that at first sight the animal resembles a sponge rather than a foraminifer.

The other specimens on Plate II. (fig. 2) are a small variety of the deep-water type of *Pulvinulina elegans*, and these, similarly with the *Truncatulinae* before mentioned, have an irregular mass of sarcode surrounding the test.

PLATE III.

The Foraminifera figured on this plate were obtained off St Vincent, in the Cape Verd Islands, at a depth of 10 fathoms (30th July 1873).

Amphistegina Lessonii, of which there are numerous specimens in this dredging, is here seen to be attached to an algæ, and its sarcode almost covers the weed in places. Another and much smaller species accompanies the *Amphisteginae*, bearing a strong resemblance to *Discorbina globularis*; but this is not quite clear in the absence of specimens preserved in the mountings, which the writer has examined for them, but without success.

The species upon which the above remarks have been made, illustrated by the beautiful drawings by Mr West, will, the writer ventures to think, amply show the interest attaching to any records relating to the appearance and habits of living Foraminifera; and this may be an incentive to those who have opportunities for collecting and preserving these tiny creatures when they are in the living condition to add to our knowledge in this direction, and especially to note any facts regarding the changes or development of the animal during its life's history.

PLATE I.

Fig. 1. *Textularia conica*, d'Orb. Station 232, S. of Japan, 345 fathoms.

Figs. 2, 3. *Truncatulina lobatula* (W. & J.). Station 232, S. of Japan, 345 fathoms.

Figs. 4, 5, and 6. *Anomalina polymorpha*, Costa. 4 and 5 from Station 232, S. of Japan, 345 fathoms; 6 from Station 192A, off Ki Islands, 129 fathoms.

PLATE II.

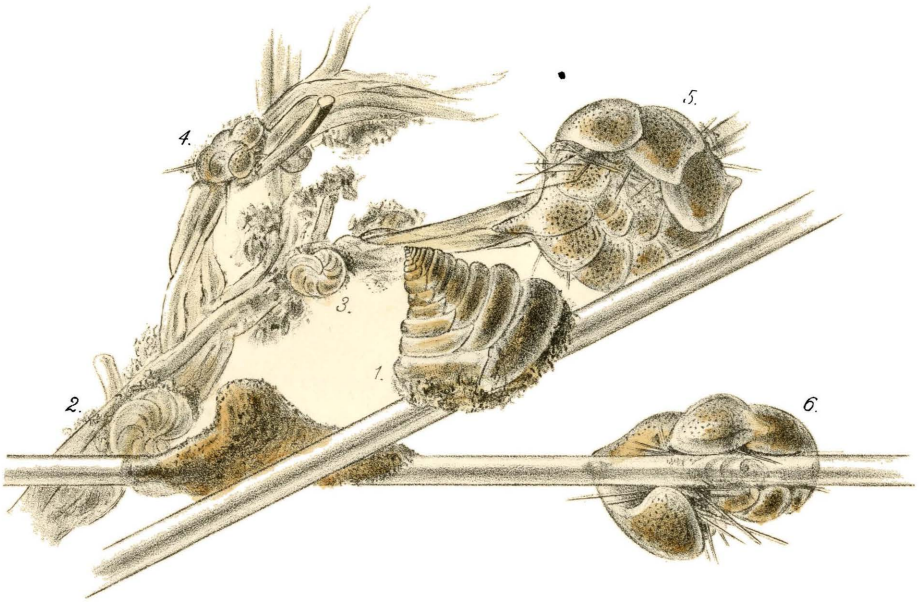
Fig. 1. *Carpenteria balaniformis*, Gray (young specimens). Station 344, off Ascension, 420 fathoms.

Fig. 2. *Pulvinulina elegans* (d'Orb.). Station 344, off Ascension, 420 fathoms.

PLATE III.

Fig. 1. *Amphistegina Lessonii*, d'Orb. Off St Vincent, 10 fathoms.

Fig. 2. ? *Discorbina globularis* (d'Orb.). Off St Vincent, 10 fathoms.



CHAPMAN: FORAMINIFERA,— Plate II.



CHAPMAN: FORAMINIFERA,— Plate III.

