

affected; and there is the Burmese family observed by successive ambassadors at the court of Ava, where father, daughter, and grandson had the body, with the exception of the feet and hands, covered with long, straight, silky hair. And from these and many similar cases it would seem a natural inference that, just as the bones and dermal covering vary with altered nutrition, so also do all other parts of the organism, which are less easily observed.

In conclusion, it has been seen that growth depends upon a kind of organic dialysis, called nutrition, which is sustained throughout the body by the mechanical actions of the parts of the organism which produce pressure and tension, while the direction in which this action is manifest is due to the common plan on which the individual is built. And the amount of the change is due to the change of structure produced in the individual by changed function inherited in the offspring, and partly by the realization in the offspring of such structures as the parent's functions tended to produce, but which its common plan rendered impossible for itself to develop. And with this condition of variation, the general inference from the phenomena of growth is, that the form of the whole skeleton, as of every bone, is due to the mechanical strains to which it is subjected, since these govern its nutrition.

[To be continued.]

XXIX.—*On the Nomenclature of the Foraminifera.* By W. K. PARKER, F.R.S., and Prof. T. RUPERT JONES, F.G.S.

[Continued from p. 230.]

*Nummulitic Limestone of Gyzeh and Mokattam**. (Abhandl. Berl. Akad. Wiss. 1838, p. 93, tables XIV. XVI. pl. 4. fig. vii.)

Pl. xxiii. fig. 1, *Miliola sphæroidea* ("compare *Cenchridium oliva*, 1843"), and fig. 2, *M. ovum*, are both *Lagena globosa*; but the second specimen is longer in proportion (oval-oblong). Fig. 3, *Textilaria globulosa* (1838), α , fig. 4, β . *obtusa*, fig. 5, γ . *amplior*, fig. 6, δ . *dilatata*, are *Text. globulosa*, Ehr. Fig. 7, *T. linearis* ("*T. striata*, 1838, is known only in fragments"), fig. 8, *Grammostomum polytheca* (?), figs. 9 & 10, *Gr. ægyptiacum*, figs. 11 & 12, *Gr. angulatum*, fig. 13, *Gr. falx*, fig. 14, *Gr. siculum* (?), fig. 15, *Gr. increscens*, fig. 16, *a, b, Gr. poly-*

* See Mr. Bauerman's section of the Mokattam Cliff, Quart. Journ. Geol. Soc. London, vol. xxv. p. 40, where references are made to the works of Figari Bey and Oscar Fraas. See also Russegger's 'Reisen in Europa, Asien, und Afrika,' &c. 5 vols. and Atlas, 1841-42.

stigma, and fig. 17, *Gr. rhomboidale*, are various *Textilaria*; figs. 8–14 and 17 are of the *gibbosa*-group, with tendencies towards the *agglutinans* type; figs. 15 & 16 belong to the *sagittula* type. Fig. 18, *Gr. phyllodes*, seems to be *Bolivina punctata* (?). Fig. 19, *Gr. thebaicum* (?), with its delicate misty shell, is probably *Virgulina Hemprichii*, which will be further noticed in describing the next plate. Fig. 20, *Gr. attenuatum* (?) may be a small *Textilaria*; indeed it corresponds with the first few chambers of fig. 17. Figs. 21, *Gr. phyllodes* (?), 22 & 23, *Gr. attenuatum* (“*Text. aciculata*, 1838, proves to be fragments of several small species of *Grammostomum*”), and 24, *Strophoconus*? (*Gram.*?) *teretiusculus*, are rather broad individuals of *Bolivina punctata*, or may be grouped as *B. dilatata*. Fig. 25, *Proroporus*? (*Gram.*?) *pachyderma*, passes well as a coarse-shelled *Text. agglutinans*. Figs. 26 & 27 (?), *Polymorphina gyzensis* (“compare *Grammobotrys* and *Sphaeroidina*”), evidently a puzzling form to the author, is especially so as a figure. It has relatively large swollen segments, like a full-plaited “chignon,” and has the aspect of a *Polymorphina* in some respects; but it shows no aperture, and is probably a *Textilaria*.

Figs. 28, *Rotalia aspera*, and 29, *Planulina globigerina* (?), are *Planorbulina tuberosa*, varr., near *Pl. Haidingerii*. The next three are probably *Globigerinae*—namely, figs. 30, *Rotalia incremens*, 31, *Planulina Isidis*, and 32, *Allothea rotalia* (“*Rotalia globulosa*, 1838”). Figs. 33 & 34, *Globigerina cretæ* (“*Rosalina foveolata*, 1838”), is the typical *Glob. bulloides*, D’Orb. Fig. 35, *Planulina Pharaonum*, is a variety of *Pulvinulina Menardii*, near *pulchella*. Fig. 36, *Plan. incurva*, answers to *Plan. ariminensis*. Fig. 37, *Nonionina Hemprichii*, is very near *N. scapha*. Fig. 38, *Planulina pyramidum* (“1838; small specimen”), is without doubt an *Operculina complanata*. Fig. 39, *Plan.? eurytheca* is a young *Planorbulina*, probably of the *ammonoides* group. Fig. 40, *Rotalia incrassata* (“*Planulina turgida*, 1838”) may be catalogued as a small *Cristellaria cultrata*. Fig. 41, *Planulina heptas*, is a young *Planorbulina farcta*, sublimbate perhaps, but scarcely to be referred, for want of specialization, to any particular variety, though probably tending towards *Pl. ammonoides*. Figs. 42 & 43, *Planulina lenticulina*? (“compare *Rotalia lenticulina*”). Here we have gradations of form from the loosely set, lobate, round-chambered (42) *Pl. globulosa* (Ehr.), through a more compactly grown shell (43), to figs. 41 & 39, above noticed.

Figs. 44, *Planulina? eurytheca*, and 45, *Pl. hexas*, belong to *Cristellaria cultrata*; the latter figure shows a very slight

keel. Fig. 46, *Nonionina Hemprichii* (?), is a true *Rotalia*, very near *R. Beccarii*, var. *ammoniformis*. Fig. 47, *Planulina*? *umbilicata*, appears to be *Crist. cultrata*; also figs. 48, *Pl.*? *ampla*, 49, *Pl.*? *involuta*, and 50, *Pl.*? *ampliata*. Fig. 51, *Rotalia auricula*, is also a *Cristellaria*, somewhat produced, as is common in connexion with the rapid increase of the segments in size. Fig. 52, *Quinqueloculina*? *caudata*, is indeterminate.

A. The weathered surface of a piece of Egyptian Nummulitic Limestone. B. Weathered piece of limestone largely composed of "*Planulina pyramidum*" (see fig. 38). C. The dust of the Nummulitic Limestone, magnified 300 diameters, part seen by transmitted, part by reflected light: "no Chalk Morpholites" (Coccoliths). D. Similar dust, but without the finest particles. E. The *Nummulites*, of natural size: 1, *a, b*, *N. placentula*; 2, *a, b, c*, *N. gyzensis*; 3, *a, b, c*, *N. seminulum*, which, together with *N. cellulosus* and "*Planulina pyramidum*," are easily seen by the naked eye.

1. *Nummulina placentula*, Ehr., is the *Nautilus major* of Forskål (see Ann. Nat. Hist. ser. 3. vol. viii. p. 235), which name was evidently meant for the largest of the common Nummulites of Gyzeh (sometimes $1\frac{1}{2}$ inch across). Some of these are sufficiently large and thin for the typical *N. complanata*, Lamarck (*op. cit.* pp. 232 & 234); but Ehrenberg's figure (1, *a, b*) does not exceed in size some illustrating *N. gyzehensis* in D'Archiac & Haime's 'Foss. Ind.' p. 94, pl. 2. figs. 6-8. *N. placentula* (*N. major*) and *N. gyzehensis*, therefore, are the same, differing only in size.

2. *N. gyzehensis* (Forskål). These smaller specimens, indicated by Forskål and figured by Ehrenberg, are probably such as have a large primordial chamber* and relatively great thickness, referred to *op. cit.* p. 233. *N. curvispira*, Meneghini, as figured by D'Archiac & Haime, 'Foss. Ind.' pl. 6. fig. 15, is not only one of these subvarieties, but possibly the one alluded to by Forskål and Ehrenberg.

3. *N. seminulum*, Ehr., had not been figured by Ehrenberg when D'Archiac & Haime published their important and exhaustive work on Nummulites. There can be little doubt that it is the same as their well figured and described *N. Guettardi* ('Foss. Ind.' 1853, p. 130, pl. 7. figs. 18, 19).

4. "*N. cellulosus*" may possibly be another name for the small forms of *N. gyzehensis*.

The Foraminifera shown on plate XXIII. (as those also on

* This kind of growth characterizes Ehrenberg's proposed genus *Monetulites*, Abhandl. 1856, p. 145, note.

plates XXIV., XXV., XXVI.) indicate a sea-depth of from 30 to 40 fathoms. In broad terms, they may be said to be not of shallow water nor of very great depths, neither littoral nor abyssal, but decidedly within 20 and 90 fathoms.

Species and notable Varieties of Foraminifera from the Nummulitic Limestone of Gyzeh and Mokattam, Egypt, figured by Ehrenberg.

1. *Lagena globosa* (Montagu).
2. *Cristellaria cultrata* (Montf.).
3. *Bolivina punctata*, D'Orb.
4. — dilatata, Reuss.
5. *Virgulina Hemprichii* (Ehr.).
6. *Textilaria agglutinans*, D'Orb.
7. — sagittula, DeFrance.
8. — gibbosa, D'Orb.
9. — globulosa, Ehr.
10. *Globigerina bulloides*, D'Orb.
11. *Planorbulina farcta* (F. & M.), varr.
12. — globulosa (Ehr.).
13. — ammonoides (Rss.).
14. — ariminensis (D'Orb.).
15. *Pulvinulina Pharaonum* (Ehr.).
16. *Rotalia ammoniformis* (Lam.).
17. *Nonionina scapha* (F. & M.).
18. *Operculina complanata* (DeFrance).
19. *Nummulina gyzehensis* (Forskål).
20. — curvispira, Meneg.
21. — Guettardi, D'Arch. & Haime.

VII. *Limestone from the Tombs at Thebes, Egypt.* (Abhandl. 1838, p. 94, table XIV., pl. 4. no. viii.; Annals Nat. Hist. vol. vii. July 1841, p. 374 &c.)

This very interesting Foraminiferal Limestone, "halibiolith" (Ehrenberg), or marine organic rock, is, both by relative position* and contents, older than the Nummulitic Limestone. The presence of *Globigerina cretacea*, D'Orb., goes far to prove this halibiolithic formation to be of Secondary age.

The limestones of Benisouef, Siout, and Thebes, on the western banks of the Nile, are represented in this analysis.

Plate XXIV. figs. 1, 2, *Cenchridium dactylus* ("compare Monatsber. 1845, p. 358"). This is a long-ovate and sub-

* See Newbold's description and section, Quart. Journ. Geol. Soc. vol. iv. p. 328; also Russegger's 'Reisen' and Atlas, 1841-42.

cylindrical Entosolenian *Lagena*, probably *L. emaciata*, Reuss. Figs. 3 & 4, *C. oliva*, the Entosolenian *Lagena globosa* (Montagu). Fig. 5, *Miliola striata*, is the *Lagena costata* of Williamson. Fig. 6, *Nodosaria monile*, = *N. pyrula*, D'Orb. Fig. 7, *N. tumescens*, = *N. ovicula*, D'Orb. Fig. 8, *Vaginulina cretæ*, = *V. lævigata*, Roemer (three early chambers). Fig. 9, *V. bullosa*, = *V. leguminiformis* (Batsch), three early chambers. Really, however, figs. 8 & 9 are the young of one species, with slightly different proportions. Fig. 10, *V. subulata*, = *V. lævigata*, Roemer; four early chambers of a larger and stronger shell than fig. 8.

Figs. 11, *Textilaria subtilis*, 12, *T. globulosa*, γ. *amplior*, 13, 14, *T. globulosa* (1838), 15, *T. inflata*, are small individuals, perhaps subvarietal, of *T. gibbosa*, D'Orb. Figs. 16 & 17, *T. linearis*, = *Bolivina punctata*. Fig. 18, *Grammostomum polystigma*, = *Text. sagittula*. Fig. 19, *Gram. cribrorum*, = *Boliv. punctata*. Figs. 20 & 21, *Gram. thebaicum*, = *Boliv. dilatata*. Figs. 22 & 23, *Gram. connivens*, are the young of the same.

Figs. 24 & 25, *Gram. lingua*, are *Virgulina squamosa*; 24 is typical, 25 is subvarietal. Fig. 26, *Strophoconus?* (*Grammostomum?*) *teretiulusculus*, and 27, *Str.?* (*Gram.?*) *polytrema*, are *Virgulina Schreibersii*, the latter quite typical.

Figs. 28, *Stroph.?* (*Gram.?*) *leptoderma*, 29, *Stroph. ovum*, 30, *Stroph.?* (*Gram.?*) *leptoderma*, 31, *Stroph. spicula*, 32, *Stroph.?* *Hemprichii*, and 33, *Textilaria?* (*Grammobotrys?*) *thebaica*, are all of one species, *Virgulina Hemprichii* (Ehr.), of variable shape, but with persistently subarenaceous shell. See 'Geol. Mag.' vol. viii. pp. 508 & 509. This species is well illustrated by many figures in other plates, which we shall have to notice in treating of the 'Mikrogeologie;' and we are well acquainted with it in the recent state from the Indian seas. Fig. 32 exhibits a typical complanate individual of advanced growth.

Fig. 34, *Polymorphina prisca*, = *P. compressa*, D'Orb. This is the only *Polymorphina* on this plate, although we at first accepted some other figures as such (in the "Monograph on *Polymorphina*," Trans. Linn. Soc. vol. xxvii.). Figs. 35 to 41 are young *Globigerinæ*. We know of but one real species of *Globigerina* (*Gl. bulloides*) in both recent and fossil state, though about twenty-five reputed species have been described and figured, and others recorded. Of the varieties, *Gl. cretacea*, D'Orb., is one of the best marked, and it occurs on this plate (fig. 49). Some of the young forms here mentioned decidedly belong to it; but figs. 35 & 36 in particular may be true *Gl. bulloides*. The names given are:—figs. 35, 36, *Ro-*

talia rudis (" *R. laxa*, juv.?"); 37, 38, *R. globulosa* (1838); 39, *R. leptospira*; 40, *R. senaria*; 41, *R.?* *pertusa* (" *Rosalina pertusa*, 1838, in part").

Fig. 42, *Rotalia pachyphysa*, is a young lobulate *Planorbulina farcta*, near *Pl. (Truncatulina) lobatula*. Figs. 43, *Rot. quaterna*, β . *floscularis* ("compare *Planulina flos*"), & 44, *a, b*, *Planulina porosa* (" *Rosalina lævigata*, 1838, in part"), are small *Planorbulinae Haidingerii* (D'Orb.). Figs. 45, *Plan. centoculus*, and 46, *Pl. megapora*, are characteristically the young of *Planorbulina vulgaris*. Fig. 47, *Planulina flos* ("compare *Rotalia quaterna*, β . *floscularis*"), is a young delicate *Planorbulina Haidingerii*. Fig. 48, *Planulina depressa*, is a young *Planorbulina*, with granular or rough surface, near *Haidingerii*, possibly *Pl. Ungeriana*. Fig. 49, *Globigerina foveolata* (" *Rosalina foveolata*, 1838"), is the typical *G. cretacea*, D'Orb. (see above). Fig. 50, *Planulina prorotetras*, is a roundish *Planorbulina tuberosa* (F. & M.), or may be said to be the spiral centre of a *Planorbulina* of the *vulgaris* subtype, which would afterwards grow less regularly and become outspread with somewhat concentric chambers. The notch of the aperture on the right-hand side of the figure is characteristic. Figs. 51, *Planulina millepora*, and 52, *Pl. pardalis*, are *Planorbulina (Anomalina) ammonoides* (Reuss). Fig. 53, *Prorospira princeps*, is *Planulina ariminensis*, D'Orb. Figs. 54, *Planulina ampliata*, and 55, *Pl. ammonis*, are *Planorbulina ammonoides*. Figs. 56 & 57, *Pl. integra* (56, with entire margin; 57, sublobate), are small *Planorbulinae*. Figs. 58, *a, b*, *Pl. heteropora*, are *Planorb. ammonoides*. Figs. 59, *Pl.?* *umbilicata* (" *Pl. millepora*, juv.?"), probably the young of fig. 62, 60, *Pl. ampliata* (?), 61, *Pl. integra*, 62, *Rotalia Hemprichii* (rough shell, with rapid increase of the whorls), are all *Planorbulinae*, near *Pl. ammonoides*; or these, with the foregoing, may be described as spiral beginnings of such *Planorbuline* varieties as grow in outspread forms in the shallow water, and, when attached, become mostly thick-walled.

Fig. 63, *Planularia thebaica*, is probably a small *Cristellaria (Saracenaria) italica*. Fig. 64, *Spiroloculina dilatata*. From the aspect of the shell, it seems to have become smoothly and finely arenaceous—an interesting feature. Fig. 65, *Quinqueloculina? nodulus*. A *Quinqueloculina*, probably *Q. seminulum*; but it seems to be the central portion only.

Figs. 66 & 67 are stellate spicules(?).

A. Fine dust, mainly composed of Coccoliths (*cyatholiths*) &c.

B. Group of the Foraminifera without the finer particles.

These belong to a depth of about 30 or 40 fathoms.

Species and notable Varieties from the Limestone of the Catacombs at Thebes, Upper Egypt, figured by Ehrenberg.

1. *Lagena emaciata*, Reuss.
2. — *globosa* (Montagu).
3. — *costata* (Williamson).
4. *Nodosaria pyrula*, D' Orb.
5. — *ovicula*, D' Orb.
6. *Vaginulina lævigata*, Rømer.
7. — *leguminiformis* (Batsch).
8. *Cristellaria italica* (Defrance).
9. *Polymorphina compressa*, D' Orb.
10. *Bolivina punctata*, D' Orb.
11. — *dilatata*, Reuss.
12. *Virgulina squamosa*, D' Orb.
13. — *Schreibersii*, Czjzek.
14. — *Hemprichii* (Ehrenb.).
15. *Textilaria sagittula*, Defrance.
16. — *gibbosa*, D' Orb.
17. — *globulosa*, Ehr.
18. *Globigerina bulloides*, D' Orb.
19. — *cretacea*, D' Orb.
20. *Planorbulina farcta* (F. & M.).
21. — *vulgaris*, D' Orb.
22. — *Haidingerii*, D' Orb.
23. — *ammonoides* (Rss.).
24. — *ariminensis* (D' Orb.).
25. *Spiroloculina*.
26. *Quinqueloculina*.

VIII. & IX. *White, hard, thick Limestone from the Antilibanon, Syria.* (Monatsbericht, 1842, p. 127.)

This halibiolithic formation also seems to be of Cretaceous age, as stated by Ehrenberg. M. P. E. Botta published some geological observations on the Libanus and Antilibanus in 1833 (4to, Paris); but Russegger's 'Reisen in Europa, Asien, und Afrika, &c.' with Atlas, 1841-42, is the only work we have been able to refer to for a section of the Antilibanus. Russegger explains the structure of that range to consist of:—(1) near Baalbec, Upper Chalk, covered here and there with Tertiary beds; (2) flanking hills, reaching to a considerable height, of Lower Chalk and Greensand, rising up from the west, and resting on the (3) hard anticlinal Jurassic rocks of the lofty central range. On the eastern side, the same succession of strata, in reverse, dip away one after the other among the low flanking hills, and the Upper Chalk disappears under the

Tertiary beds and alluvium of Damascus. We presume that Dr. Ehrenberg's specimen came from one of the upper white limestones.

(VIII.) Pl. xxv. i. A. fig. 1. *Miliola elongata*, a *Lagena* very similar to *L. distoma*, P. & J., but more patulous at the extremities. Figs. 2 & 3, *Nodosaria procera*, 4, *N. laevis*, 5, *N. subulata*, and, 6, *N. turgescens*, are varieties of *N. ovicula*, D'Orb., passing into a more compact form; 3 & 6 = *N. ovicula*; 2, 4, & 5 have more closely set chambers, resembling *N. filiformis*, D'Orb.; 5, in particular, is a thick, coarse, rough shell. Fig. 7, *Frondicularia nodosaria*, is an attenuate simple *Nodosaria* of the *radicula* type (such as *N. subnodosa*, Reuss, 1851, from Lemberg), with overlapping chambers*, which, seen in section, have somewhat of a chevron-like aspect. Figs. 8, *Textilaria globulosa*, α , 9, *T. globulosa*, γ . *amplior*, 10, *T. inflata*, and 11, *T. globulosa*, γ . *amplior*, are *T. globulosa*, Ehr., the small arrested form belonging to *T. gibbosa*, D'Orb. Figs. 12, *Grammostomum subacutum*, and 13, *Text. globulosa* (?) are larger *T. gibbosæ*, with a tendency towards *T. agglutinans*. Fig. 14, *Gram. spatiosum*, is a good *Bolivina punctata*. Fig. 15, *Gr. laxum* (?), with its rather cloudy shell, is probably *Virgulina Hemprichii* (Ehr.). Figs. 16, *Gr. polytheca*? ("compare *G. laterale*"), showing side views of its loop-like apertures, 17, 18, *Gr. caloglossa*, and 19, 20, *Gr. polytheca* (?), all belong to *Bolivina punctata*; fig. 20 has a rather broad shell, therein approaching *B. dilatata*; fig. 21, *Gr. costulatum*, is a *Bolivina*, near *B. costata*, gently sulcate, with pores in the furrows.

Fig. 22, *Gram. micromega*, is a piece of a large *Textilaria* of the *sagittula* group, and fig. 23, *Gr.*? (*Strophoconus*?) *leptoderma*, seems to be its young form. Fig. 24, *Gram. eurytheca*, is *Text. sagittula*. Figs. 25 & 26, *Bigenerina libanotica*, is *Polymorphina compressa*. Figs. 27 & 28, *Rotalia haliotis*, is a thin-walled, thickly perforated *Planorbulina farcta*, with rapidly increasing whorls and the last chamber much produced. Such are common in the Mediterranean.

Figs. 29, *Planulina stigma*, 30, *Globigerina libani* ("compare *Gl. stellata*"), and 31, *Pl. pachyderma*, show three successive sizes of the typical *Glob. cretacea*, D'Orb. Fig. 32, *Planulina argus*, is *Planorbulina farcta*. Figs. 33, *Planulina monticulosa*, and 34, *Rotalia laxa*, belong to a rough variety of *Planorb. farcta*, granular and coarsely perforate. Figs. 35, *Rotalia protolepta*, 36, *Planulina saxipara*, 37, *Pl. leiopentas*,

* Such is the main character of Ehrenberg's genus *Encorycium*, Monatsber. for 1858, pp. 11 & 19.

and, 38, *Pl. eusticta*, are common, young, sublobate and limbate *Planorbulinae globulosæ* (Ehr.). Fig. 39, *Planulina syriaca*, is a *Planorbulina* like *Pl. Haidingeri*.

Fig. 40, *Planulina umbilicata*, is a small ill-grown *Cristellaria cultrata*. Fig. 41, *Plan. membranacea*, is *Pulvinulina Karsteni*. Figs. 42, *Ptygostomum senarium*, and 43, *Pt. quinarium*, are young specimens of *Planorbulina vulgaris*, coarsely porous, lobate, limbate, and with patulous apertures. Such as these soon take on an irregularly concentric growth, with bi- or multi-oscuate chambers. Figs. 44, *Planulina leptostigma*, α , 45, *Rotalia ammonis*, 46, *Pl. cornu*, 47, *Pl. leptostigma*, β , and, 48, *Rotalia depressa*, are young forms of *Planorbulina* (*Planulina*) *ariminensis*.

A. Grains of the limestone (magn. 300 linear), consisting chiefly of Foraminifera, with some Coccoliths (?) and stellate spicules (?). Magnified 300 diam.

This Foraminiferal fauna lived at about 30 or 40 fathoms depth.

(IX.) Pl. xxv. II. B. Figs. 1, 2, *Nodosaria libanotica*, = *N. ovicula*, with thick-shelled and elongate chambers, near *N. Mariae*, D'Orb., and *N. (D.) Lorneiana*, D'Orb.

Fig. 3, *Grammostomum polystigma*, is *Textilaria sagittula*. Fig. 4, *Gr. convergens*, is *T. agglutinans*. Fig. 5, *Rotalia ibex*, is *Planorbulina ariminensis*. Fig. 6, *R. senaria*, is a small limbate *Planorbulina*. Fig. 7, *R. laxa*, the same as fig. 4, the young of *Planorb. vulgaris*. Fig. 8, *Nonionina Astræa*, is too porous and has its chambers relatively too large for *Nonionina*: it seems to stand between figs. 28 & 32, more delicate and neater than either in its shell and pores; the setting-on of the chambers is Nonionine or Operculine, and too symmetrical in appearance even for *Anomalina* among the *Planorbulines*. We must leave it doubtful. Fig. 9, *Rotalia quaterna*, β . *floscularis* ("compare *Planulina flos*"), is a young *Planorb. farcta*. Fig. 10, *Planulina septenaria*, is a young *Pl. vulgaris* with rather falcate chambers. Fig. 11, *Pl. ampliata*, is *Planorb. ammonoides*. Figs. 12–15 are stellate spicules; figs. 16, 17, enlarged Cyatholiths and fragments.

B. Grains of the limestone, consisting of Foraminifera, Coccoliths, &c. Magnified 300 times linear.

Belonging to about 30 or 40 fathoms depth.

Species and notable Varieties of Foraminifera from the White Limestone of the Antilibanon, figured by Ehrenberg.

1. *Lagena elongata* (Ehr.). VIII.
2. *Nodosaria ovicula*, D'Orb. VIII., IX.
3. — *filiformis*, D'Orb. VIII.

4. *Nodosaria subnodosa*, *Rss.* VIII.
5. *Cristellaria cultrata* (*Montf.*). VIII.
6. *Polymorphina compressa*, *D' Orb.* VIII.
7. *Bolivina punctata*, *D' Orb.* VIII.
8. ——— *costulata* (*Ehr.*). VIII.
9. *Virgulina Hemprichii* (*Ehr.*).? VIII.
10. *Textilaria agglutinans*, *D' Orb.* VIII.
11. ——— *sagittula*, *Defr.* VIII., IX.
12. ——— *gibbosa*, *D' Orb.* VIII.
13. ——— *globulosa*, *Ehr.* VIII.
14. *Globigerina cretacea*, *D' Orb.* VIII.
15. *Planorbulina farcta* (*F. & M.*). VIII.
16. ——— *vulgaris*, *D' Orb.* VIII., IX.
17. ——— *globulosa* (*Ehr.*). VIII.
18. ——— *Haidingerii* (*D' Orb.*). VIII.
19. ——— *ammonoides* (*Rss.*). IX.
20. ——— *ariminensis* (*D' Orb.*). VIII., IX.
21. *Pulvinulina Karsteni* (*Rss.*). VIII.

X. *Grey Limestone of the Arabian Coast near Haman Faraun, near Sinai.* (*Monatsber.* 1838, p. 89, table xv. pl. 4. fig. 9.)

Mr. Bauerman supplies some notes on the geology of the coast near this promontory (which he terms "Hammam Faraoun") in the *Quart. Journ. Geol. Soc. London*, vol. xxv. p. 23, pl. 1. fig. 2. See also Russegger's 'Reisen,' &c.

Pl. xxv. III. c. Fig. 1. *Textilaria brevis* (" *Textularia brevis*, 1838"), the same as fig. A, 9; the young of *T. gibbosa*.

C. Grains of the limestone (magnified 300 diams.), consisting of Foraminifera and Coccoliths (cyatholiths and discoliths), and comprising *Textilaria striata*, *Ehr.*; "*T. brevis* and *T. dilatata* (1838)," = *T. globulosa*; and "*Rotalia globulosa* (1838)" = *Planorbulina globulosa*.

These also seem to belong to a fauna inhabiting 30 or 40 fathoms depth.

XI. *White thick Limestone of Cattolica, Sicily.* (*Monatsber. Berl. Akad. Wiss.* 1838, pp. 176, 192. *Abhandlungen*, 1838, table VII. pl. 4. fig. vi.)

This halibiolith is regarded as of Cretaceous date by Ehrenberg. Some of its Foraminifera (as *Virgulina paradoxa*) support the view. It was formed in deeper waters than the foregoing, at about 90 fathoms.

Pl. xxvi. fig. 1, *Oolina sicula*, is *Lagena sulcata*. Fig. 2, *Miliola levis*, may be arranged with *Lagena elongata* (*Ehr.*).

Fig. 3, *Miliola?* (*Vaginulina?*) *pusilla*, is indeterminable. Fig. 4, *Nodosaria?* *sicula*, = two early chambers of a *Nodosaria* or, rather, of *Glandulina lævigata*. Fig. 5, *Dentalina sphærophora*, is *Nodosaria gracilis*, D'Orb., after Soldani. Fig. 6, *Nodosaria leptosphæra*, is *N. ovicula*, like figs. 1 & 2, in pl. xxv. II. B. Fig. 7, *Vaginulina Hoffmanni*, is one of the simplest forms of *V. lævigata*, Rœm. Fig. 8, *Vag.?* *tenuis*, is indeterminable. Figs. 9 & 10, *Textilaria globulosa*, β . *obtusa* (" *T. glob.* 1838 "), = *T. gibbosa*. Figs. 11 & 12, *Grammostomum?* (*Strophoconus?*) *leptoderma*, is *Virgulina Schreibersii*. Fig. 13, *Gram. apiculatum*, is *Vulvulina pennatula* (Batsch), narrow variety, with aculeate ends to the chambers. Figs. 14 & 15, *Gr. phyllodes*, = *Bolivina punctata*. Fig. 16, *Gr. siculum* (" *Text. aciculata*, 1838, in part "), is a rather broad *Bol. punctata*. Fig. 17, *Gr. polystigma*, is *Text. sagittula*.

Fig. 18, *Proroporus siculus*, is probably *Polymorphina Thouini*. Figs. 19, *Gram. turio*, 20, *Strophoconus spicula*, 21, *Str. ovum*, 22, *Str.* (*Gram.?*) *stiliger*, 23, *Str.?* (*Gram.?*) *acanthopus*, and 24, *Str. efflorescens*, are *Virgulina Hemprichii*, mostly very young; and some are apiculate at the base. Fig. 25, *Stroph. teretiusculus* (?), is a *Virgulina Schreibersii*, becoming biserial. Figs. 26, *Vaginulina?* *paradoxa*, and 27, *V. obscura*, are cylindrical arcuate *Virgulinæ Hemprichii*, such as are found in Jurassic clays, Gault, and Chalk.

Fig. 28, *Polymorphina uvula*, = *P. problema*. Figs. 29, *Biloculina?* *incisa*, 30, *B.?* *tenuis*, and 31, *B.?* *integra*, are young (Adelosine) *Quinqueloculinæ*. Fig. 32, *Planulina argulus*, is a *Planorbulina globulosa* with large pores. Figs. 33, *Rotalia protolepta*, 34, *R. protacmæa*, 35, *R. globulosa*, and, 36, *R. quaterna?* (all "*R. globulosa*, 1838 "), are young individuals and arrested forms of *Planorbulina farcta*.

Fig. 37, *Planulina leiopentas* (?), yellow in colour, looks like *Pulvinulina Menardii*; but its pores are too large; it may be a *Planorbulina* near *Pl. Haidingerii*. Fig. 38, *Rotalia leptospira*, yellow in tint, has the appearance of *Pulvinulina canariensis* (D'Orb.), but is doubtful; it also may be a *Planorbulina*. Figs. 39 & 40, *Planulina porosa* (" *Rosalina lævigata*, 1838, in part ") is *Planorbulina Haidingerii*, subvar.; and 41, a, b, *Pl. ocellata* (" *Rosalina ocellata*, 1838 ") is almost the same.

Figs. 42, *Planulina incurvata*, and 43, *Pl. membranacea*, are a young and an older specimen of *Pulvinulina Menardii* (D'Orb.). Figs. 44, *Globigerina?* *cretæ* (" *Rosalina foveolata*, 1838 "), and 45, *Gl. stellata* ("compare *Gl. libani*"), are *Globigerina bulloides*, characteristic. Figs. 46, *Planulina angusta*, and 47, *Pl. micromphala*, = *Planorbulina ammonoides*,

of slightly varying outlines (see pl. xxiii. &c.). Figs. 48 & 49, *Pl. sicula*, 1838, seem to comprise a *Rotalia*? (48) and a *Planorbulina*? (49). Figs. 50, *Pl. micromphala* (?), and 51, *Pl. marmorata*, are *Cristellaria rotulata*. Fig. 52, *Pl. spira*, is probably a *Planorbulina*. Fig. 53, *Cristellaria? Hoffmanni*, is a beautiful *Crist. cultrata*, with flattened form, thick septa, and very broad keel.

Fig. 54 are stellate spicules (?). A. Some of the powdered limestone, magnified 300 diams., shows, besides Foraminifera, many Cyatholiths &c. B. Foraminifera without the finer particles.

This group also belongs to a sea of moderate depth, about 50 to 90 fathoms.

Species and notable Varieties of Foraminifera from the White Limestone of Cattolica, Sicily, figured by Ehrenberg.

1. *Lagena sulcata* (W. & J.).
2. ——— *elongata* (Ehr.).
3. *Glandulina lævigata*, D' Orb.
4. *Nodosaria gracilis*, D' Orb.
5. ——— *ovicula*, D' Orb.
6. *Vaginulina lævigata*, Rœm.
7. *Cristellaria rotulata* (Lam.).
8. ——— *cultrata* (Montf.).
9. *Polymorphina Thouini*, D' Orb.
10. ——— *problema*, D' Orb.
11. *Bolivina punctata*, D' Orb.
12. *Virgulina Schreibersii*, Czjz.
13. ——— *Hemprichii* (Ehr.).
14. ——— ——— *stiligera* (Ehr.).
15. ——— ——— *paradoxa* (Ehr.).
16. *Textilaria sagittula*, Deifr.
17. ——— *gibbosa*, D' Orb.
18. *Vulvulina apiculata* (Ehr.).
19. *Globigerina bulloides*, D' Orb.
20. *Planorbulina faretta* (F. & M.).
21. ——— *globulosa* (Ehr.).
22. ——— *ammonoides* (Rss.).
23. ——— *Haidingerii* (D' Orb.).
24. *Pulvinulina Menardii* (D' Orb.).
25. *Quinqueloculina* (young).

XII. *Foraminifera from the Chalk of Meudon, France.* (Monatsberichte k. Berliner Akad. Wiss. 1838, p. 192; Abhandlungen, 1838, table vi. pl. 4. fig. v.)

The next two plates in the 'Mikrogeologie' are of great

interest to geologists at home; for they contain a faithful portraiture of the very minute Foraminifera of the Chalk of Gravesend in Kent, and of Meudon, near Paris. They were therefore taken in hand by us not long since, as the means of correcting and augmenting the catalogue of fossil Foraminifera from the Chalk; and the results appeared in the 'Geological Magazine,' vol. viii. pp. 506 & 563 *et seq.* We have little to add to our remarks there offered, and here reproduced, except that, for the sake of convenience, as usual in the case of Rhizopods, we are willing to enter under catalogue-names a few more of the subvarieties, and to make some slight revision in the lists representing the two plates.

In No. 89 of the 'Geological Magazine,' p. 511, we merely indicated the genera and species of Foraminifera found by Dr. Ehrenberg in the White Chalk of Meudon, near Paris, and figured in his 'Mikrogeologie, 1854. In our list twenty species were enumerated (with the nomenclature now in use) as the result of our study of the fifty-six forms figured and separately named in his plate of Meudon Foraminifera*. To render our work more useful to rhizopodists and bibliographers, we proceeded, in No. 90 of the same Magazine, to take the figures in succession, noting that, as we had before stated, the grouping on the plate has a more natural association of allied forms than that shown by the numerical order.

Pl. XXVII. fig. 1, *Miliola ovum*, = *Lagena globosa*. Fig. 2, *Nodosaria turgescens*, is one and a half of the last chambers of a compact variety of the simple *N. ovicula*. Figs. 3, *Textilaria striata* (1838), 4, *T. sulcata*, and 5, *T. dilatata* (" *T. brevis*?, 1838"), belong to Ehrenberg's *T. striata*, a subspecies or notable variety, worthy of a binomial term. Fig. 6, *Text. globulosa* (1838), is the small or young form of *T. gibbosa*, D'Orb., and for convenience is often referred to by the name given by Ehrenberg. Fig. 7 a-d, *T. linearis*, = *Bolivina punctata*. Fig. 8, *Text. aculeata* (" *T. aspera*, 1838, in part"), is a thick-walled form of *Textilaria gibbosa*, produced and aculeate on the edges at the outer angle or base of each chamber, and would be conveniently distinguished by the name here given; but D'Orbigny had previously called it *subangulata*. Figs. 9, a, b, *Grammostomum pachyderma* (" *Text. aciculata*, 1838, = several thin species of *Grammostomum*"), and 10, *Gr. angulatum*, are specimens of a coarse-shelled *Bolivina punctata*. Fig. 11, *Gr. polystigma*, = *Text. sagittula*. Fig. 12, *Gr. thebaicum*, seems to be an oblong *Textilaria agglutinans*, with a growth like that of *T. sagittula*; but *Gr. thebaicum*,

* The description of this plate is reprinted, with revision, from the 'Geological Magazine,' vol. viii. pp. 563, 564.

pl. xxiv. figs. 20, 21, certainly appears to be *Bolivina dilatata*. Fig. 13, *Gr. platystigma*, is *Bol. dilatata*. Fig. 14, *Polymorphina asparagus*, is *Virgulina squamosa*; so also is fig. 15, *Grammostomum lingua*. Fig. 16, *Gr. macilentum*, is a very neatly Textilariiform *V. squamosa* (*V. tegulata*, Reuss). Fig. 17, *Strophoconus efflorescens*, is a rather twisted *V. squamosa*. Fig. 18, *Grammostomum* (*Polymorphina*?) *myoglossum*, is a fragment of apparently a *V. squamosa* of regular growth.

Figs. 19, *Loxostomum subrostratum*, and 20, *Lox. rostratum*, are varieties of *Text. agglutinans*, becoming Bigenerine (passing into *Bigenerina*) by the aperture getting more and more terminal in successive chambers (fig. 20 shows the more advanced stage of the transition). Figs. 21 & 22, *Lox. aculeatum*, is a pouting Bigenerine *Textilaria*, tending towards *Sagrina rugosa*, D'Orb. (*Heterostomella*, Reuss). The aperture is entire (not ragged or prickly, as in the figures of some *Polymorphinæ* in other plates), and lipped, as in *Uvigerina*. The edges of the shell are aculeate by the production of the base of each chamber.

Fig. 23, *Strophoconus polymorphus*, = *Virgulina Schreibersii*. Fig. 24, *Str. spicula*, = *V. squamosa*; so also fig. 25, *Grammostomum gracile*. Figs. 26 & 28, *Strophoconus polymorphus*, and 27, *Str.* (*Grammost.*?) *ovum*?, are *Virg. Schreibersii*. Fig. 29, *Proroporus cretæ*, = *Polymorphina Thouini*. Figs. 30 & 31, *Grammobotrys*? *parisiensis*, = *Sphæroidina bulloides*; and probably also 32, *Pleurites cretæ*. Figs. 33 & 34, *Sphæroidina parisiensis*, = (33, probably and 34, certainly) *Sph. bulloides*. Fig. 35, *Guttulina aculeata*, and 36, *Gut. turrita*, are *Verneuilina pygmæa* (Egger); but fig. 35 has the outer margins of its chambers more or less aculeate, therein approaching *V. spinulosa*, Reuss. Fig. 37, *Nonionina*? *ocellata*, is *Cristellaria cultrata*.

Figs. 38-45 and 47 are various individuals of the neat little variety of *Planorbulina farcta* known as *Pl. ammonoides* (Reuss), very common in the Chalk: thus figs. 38, *a, b*, 39, & 40, *Planulina micromphala*, = "*Pl. turgida*, 1838, in part;" fig. 41, *Pl. angusta*; 42, *a, b*, *Pl. annulosa*; 43, *Pl. leptostigma*; 44 & 45, *Pl. ampla*; 47, *Pl. ampliata*. Fig. 46, *Pl. euomphala*, is a slightly keeled *Cristellaria cultrata*. Fig. 48, *Pl. umbilicata*, is *Pulvinulina truncatulinoides* (D'Orb.), seen from the upper (flat) surface. Figs. 49 & ? 50, *Pl. heteromphala*, seem to be small varieties of *Planorbulina farcta*, approaching *Pl. (Truncatulina) lobatula*; such are not rare in the Chalk. It is difficult to correlate the many small *Planorbulinæ* and *Truncatulinæ*, from the Chalk, figured by D'Orbigny, Reuss, and Ehrenberg.

Fig. 49 is perhaps comparable with D'Orbigny's *Rotalina umbilicata* from the Chalk, which we refer to *Rotalia* proper. Fig. 51, *Rotalina umbilicata*, is a side view of *Pulv. truncatulinoides* (D'Orb.), not quite so angular in its profile as the recent specimen figured in 'Hist. Nat. des Iles Canaries &c., Foraminifères,' pl. 2. figs. 25-27. This species is figured also by Soldani, 'Testaceographia,' vol. i. p. 58, pl. 46. fig. *nn*. It is a variety of *Pulv. Menardii*, and closely related to *Pulv. Micheliniana* and *Pulv. crassa*, both found in the Chalk. (See Phil. Trans. vol. clv. p. 393.) Fig. 52, *Planulina picta*, = *Pulv. Micheliniana* (D'Orb.). Figs. 53-58 are young, and 59 an adult, *Globigerina cretacea*, D'Orb., a rather discoidal form of *Gl. bulloides*, D'Orb. (53, *Rotalia quaterna*; 54, *R. rosa*; 55, *R. pachyomphala*; 56, *R. globosa-ampliata*; 57 & 58, *R. aspera*; 59, *Globigerina cretæ*, referred with doubt to *Gl. bulloides* in 1838.) The young flattish *Globigerinæ* closely resemble young *Planorbulinæ*. Figs. 60-64 are young and arrested specimens of *Planorbulina farcta*. (60, *Rotalia globulosa-tenuior*, = "*R. glob.*, 1838;" 61, *R. senaria*; 62, *R. densa*; 63, *R. glomerata*, = "*R. senaria*?" 64, *R. cretæ*, rough-shelled.)

Spongoliths and Coccoliths occur among the other figures on this plate.

The depth of sea indicated by these Foraminifera is from 100 to 150 fathoms.

We must not lose sight of the large number of good-sized Foraminifera from the Chalk of France and England described and figured by Alcide D'Orbigny in the 'Mémoires Soc. Géol. France,' 1840, vol. iv. pt. 1. These were enumerated by Mr. Weaver in 'Ann. & Mag. Nat. Hist.' vol. vii. pp. 395, 396, with transcripts of D'Orbigny's notes on their distribution at Meudon, Sens, St. Germain, and elsewhere in France, and in England as far as he knew at the time.

Of the fifty-four named Foraminifera of D'Orbigny's list we should be inclined to group many as varieties, instead of species; but that does not concern us at present. Some of the generic names, however, should be corrected according to later knowledge. Thus No. 54, *Sagrina rugosa*, should be *Heterostomella rugosa*; for D'Orbigny had already named a peculiar Uvigerine form "*Sagrina*" (*S. pulchella*), and for this Textilarian form, departing from its true type, no name but Reuss's *Heterostomella* has been satisfactorily given. See Geol. Mag. vol. viii. p. 508. Nos. 53-51, Prof. Reuss prefers to separate the sandy *Textilarieæ*, such as these, under the name *Plecanium*. No. 48, *Pyrulina*, is merged in *Polymor-*

phina. No. 47, *Uvigerina tricarinata*, is one of the Textilian Foraminifera that has not only departed from the common type, and become three-sided (*Verneuilina*), but has taken on a pouting form of aperture (in this resembling *Uvigerina*): thus it lays claim to a distinct subgeneric name, and has been called *Tritaxia* by Reuss. Nos. 46–42, *Bulimina*: these, being rough and somewhat sandy, are grouped under *Ataxophragmium* by Reuss. Nos. 39, 38, 37, 34, 33, 32, 31, & 30, grouped as *Truncatulina*, *Rosalina*, and *Rotalina*, are more or less characteristic forms of the subfamily *Rotalinæ* (Carpenter), and may be thus grouped:—

Planorbulina Voltziana (30, *Rotalina*), belonging to the same group as *Pl. kalebergensis* (D'Orb.).

— Lorneiana (38, *Rosalina*), belonging to the same group as *Pl. ammonoides* (Rss.), and *Pl. badenensis* (D'Orb.).

— Clementiana (39, *Rosalina*), an ornate variety of *Pl. tuberosa* (F. & M.).

— (subgen. *Truncatulina*) Beaumontiana (37, *Truncatulina*), merely a thick convex *Tr. lobatula* (W. & J.).

Pulvinulina Micheliniana (31, *Rotalina*). } See above,

— crassa (33, *Rotalina*). } p. 294.

— Cordieriana (34, *Rotalina*). Feebler than *P. Micheliniana*.

Rotalia umbilicata (32, *Rotalina*). Of the same group as *R. Soldanii* and *R. orbicularis*; and not only existing in the Adriatic, as stated by D'Orbigny, but found fossil in the Tertiary beds of Italy.

We can now-a-days indicate many more living analogues, and, indeed, identical representatives, of the Chalk Foraminifera than M. D'Orbigny recognized in 1840; and we believe he was wrong in supposing that *Fron diculariæ* like those of the Chalk live in the Adriatic*. Doubtless, however, he was quite correct in saying that the sea in which the Chalk was formed continued from western Europe into the English area, was of a warm climate, free from shore-currents, and contained species of Foraminifera that have lived on to the present day. We may well add:—that it was of very great extent and of considerable depth, though not so deep as our Atlantic; that some uninterrupted water-areas have continued its oceanic existence, under various and great modifications, to the present day; that the Foraminiferal *species* which have persisted in its depths throughout the enormous time required for such changes of land and sea, were not uniformly represented

* He seems to have met with some *derived* fossil forms in the sea-sand.

by the same *varieties* that existed when the Chalk was formed ; and that the Atlantic ooze, in which other Mollusks, Echinoderms, Crustacea, and Vertebrata than those of the Chalk occur, cannot be regarded as "Chalk" in a strictly geological or palæontological sense. In a lithological (or halibiolithological) sense—that is, with reference to their general origin from calcareous organisms, and regarded as having been all similarly formed in successive, never quite disconnected, but partially continuous oceans—nearly all limestones would come under the geological name of the oldest of the known series ; but, although supported by the known occurrence of persistent Foraminiferal types through period after period, such a classification would be vague and useless.

On this interesting geological subject see also Mr. Prestwich's Anniversary Address to the Geological Society of London, Feb. 17, 1871 (Quart. Journ. Geol. Soc. No. 106). The number of species and notable varieties of Foraminifera common to the Chalk and the North-Atlantic ooze, as shown by our table in that Address, is now known to be greater, since our correlation of the Chalk specimens figured in the 'Mikrogeologie' with other published forms. Both in this instance and in the description of the North-Atlantic Foraminifera (Phil. Trans. 1865) we had to refrain from reference to Dr. Ehrenberg's 'Mikrogeologie' and previous memoirs, not having had the opportunity of working over this great store of information, and at the same time having recognized how little the apparent conclusions of the veteran naturalist coincided with those arrived at by others. Now that our bibliographic studies bring us, in chronological order, to the earliest of Dr. Ehrenberg's memoirs, we have willingly entered on the somewhat arduous and responsible labour of comparing and identifying as far as possible all the Foraminifera he has so abundantly provided in his successive publications.

*Species and notable Varieties from the Chalk of Meudon,
figured by Ehrenberg.*

1. *Lagena globosa* (Montagu).
2. *Nodosaria ovicula*, D' Orb.
3. *Cristellaria cultrata* (Montfort).
4. *Polymorphina Thouini*, D' Orb.
5. *Bolivina punctata*, D' Orb.
6. *Virgulina squamosa*, D' Orb.
7. ——— *tegulata*, Reuss.
8. ——— *asparagus* (Ehr.).
9. ——— *Schreibersii*, Czjzek.
10. *Textilaria agglutinans*, D' Orb.

11. *Textilaria sagittula*, DeFrance.
12. ——— *gibbosa*, D'Orb.
13. ——— *subangulata*, D'Orb.
14. ——— *globulosa*, Ehr.
15. *Heterostomella aculeata* (Ehr.).
16. *Verneuilina pygmæa* (Egger).
17. *Sphæroidina bulloides*, D'Orb.
18. *Globigerina cretacea*, D'Orb.
19. *Planorbulina ammonoides* (Reuss).
20. ——— *globulosa* (Ehr.).
21. *Pulvinulina truncatulinoides* (D'Orb.).
22. ——— *Micheliniana* (D'Orb.).

XIII. *Foraminifera from the Chalk of Gravesend, in Kent, England.* (Monatsberichte Berl. Akad. Wiss. 1838, pp. 193, 194. Abhandlungen, 1838, pp. 92, 133–135, table iv. pl. 4. fig. 4.)

In Pl. XXVIII. of the 'Mikrogeologie' are figured numerous Foraminifera, mostly very small, discovered by Dr. Ehrenberg in English Chalk, soft and white, from Gravesend, near London*; they are magnified 300 times in linear dimensions. These are referred to in the 'Monatsberichte' of the Berlin Academy for 1838 (where some of them are stated to have been found in the Chalk of Brighton also), and in the 'Abhandlungen' for 1838. An able abstract of this and another memoir in the 'Abhandlungen' was made by the late T. Weaver, F.R.S., F.G.S., in 1841, and published in the 'Phil. Mag.' ser. 3. vol. xviii. pp. 375 & 443 &c., and in the 'Annals and Mag. Nat. Hist.' vol. vii. pp. 296, 374, &c. In Taylor's 'Scientific Memoirs,' vol. iii., is a full translation, with the original plates, of Ehrenberg's memoir "on the numerous Animals of the Chalk Formation which are still found living," from the Berlin Acad. Transact. for 1840.

The results of our careful examination of Ehrenberg's figures are as follows:—

Fig. 1, *Miliola lævis*, is probably a single joint or a detached chamber of a *Nodosaria*. Ehrenberg's "*Miliola*" is for the most part the same as *Lagena* and *Orbulina* of other authors. Fig. 2, *Nodosaria anglica*, is *N. ovicula*, D'Orb., with a rather excentric aperture. Fig. 3, *N. monile*, is a variety of *N. ovicula*, D'Orb., with rather short chambers. Fig. 4, *Vaginulina nodulosa*, is a variety of Roemer's *V. lævigata*, with a peculiar

* The description of this plate is here revised and reprinted from the 'Geological Magazine,' vol. viii. no. 11, November 1871.

(concretionary?) shell-structure. Fig. 5, *Vaginulina cretæ* (*brachyarthra*), seems to be (if really flat, as is probable) *V. longa* (Cornuel). Fig. 6. *Textilaria striata*, Ehr. 1838; more fully illustrated in pl. xxxii. I. figs. 4 *a*, 4 *b*, 7, and II. 6, 18, from the Missouri and Mississippi Chalk. Fig. 7. A broad individual of *T. striata*. Fig. 8, *Text. ampliata* (" *T. aspera*, 1838"), is a young *T. gibbosa*, D'Orb., with roughish shell. Figs. 9 & 10, *Text. globulosa** (1838), arrested *T. gibbosæ*. Figs. 11, *T. leptotheca*, and 12, *T. globulosa ampliata*, are individuals of *T. gibbosa*. Fig. 13, *Loxostomum curvatum*, is an arcuate *T. agglutinans*, the later chambers of which have the aperture higher and higher up, thus passing, in its quasi-generic character, from *Textilaria* proper into *Vulvulina*. Indeed it may be the young of Ehrenberg's *Lox. anglicum* (fig. 19 of the same plate), which is a rather narrow and neat *Vulvulina pennatula* (Batsch). Fig. 14, *Grammostomum scabrum*, seems to be only a small coarse-shelled *T. agglutinans*, D'Orb. Figs. 15 & 16, *Gr. polytrema*, is *Virgulina Schreibersii*, Czjzek. Fig. 17, *Gr. aculeatum*, is a variety of *Verneuilina triquetra* (Münster), with aculeate edges, like *V. spinulosa*, Rss., Denks. Akad. Wien, 1850, vol. i. pl. 47. fig. 12: it is seen from one of its three flat sides. Fig. 18, *Textilaria aculeata* is a small rough *T. agglutinans*, with flattish chambers, such as D'Orbigny has named *T. subangulata*. Fig. 19. See above. Fig. 20, *Proroporus cretæ*, is *Polymorphina Thouini*, D'Orb. (see the "Monograph on *Polymorphina*" † by Brady, Parker, and Jones, Linn. Soc. Trans. 1870, vol. xxvii. p. 232). Figs. 21, *Bigenerina cretæ*, and 22, *B. acanthopora*, are also *P. Thouini* (*loc. cit.*). Fig. 23, *B. apiculata*, is *P. compressa*, "Mon. Polym." p. 227. Fig. 24, *Loxostoma vorax*, is also *Polym. compressa*, and should be added to the synonyms in the "Monograph Polym." p. 227.

Figs. 25, *Loxostomum tumens*, and 26, *Lox. aculeatum*, are slightly differing individuals of *Heterostomella aculeata* (Ehr.). This may be described as a prickly loose-grown *Textilaria*, which, having ceased to grow in the typical manner (with a double row of alternating chambers), has continued with a single row (as a *Bigenerina*); and these have not only got terminal instead of lateral apertures, but have become lipped as in *Sagrina rugosa*, D'Orb. (1840). D'Orbigny, however, had applied the name "*Sagrina*" to a Uvigerine Foraminifer

* Well figured in Eley's 'Geology in the Garden,' 1859, pl. 2. fig. 9, pl. 9. fig. 9 *c* and in figs. 39 & 39 *c*, of pl. 7; p. 194 & c. Geol. Mag. vol. ix. p. 124.

† Some of Ehrenberg's figures quoted in this Monograph as *Polymorphinæ*, we find, on fuller consideration, to be *Virgulinæ* & c.

(*S. pulchella*) in 1839. In 1866 Reuss published the name *Heterostomella* as distinctive of the Textilarian *Sagraina* (Sitzungsb. Akad. Wien, vol. lii.). Ehrenberg's "*Loxostomum*," though older (1854), is so misapplied by him (to *Polymorphina*, *Vulvulina*, and a transitional form between the latter and *Textilaria* proper) that naturalists may well hesitate to use it. *Heterostomella aculeata* is figured also in pl. xxvii. figs. 21, 22.

Fig. 27, *Polymorphina turio*, is a narrow and typical specimen of *Virgulina Schreibersii*, Czjzek, which is subgenerically related to *Bulimina*. Figs. 28 & 29, *Pleurites? calciparus*, 30, *Sphæroidina cretacea*, and 32, *Grammobotrys anglica*, are broad and flattish individuals of *Virgulina Hemprichii* (Ehr.). This species is well figured (under many different names) in the 'Mikrogeologie.' It is very variable in form, but constant in the cloudy, or seemingly muddy, opacity of its shell—a structure beautifully engraved in pl. xxix. fig. 38, and elsewhere. This species is very common in the Indian seas, with its misty, dull shell, of variable growth, sometimes regularly Virguline, with alternate chambers, sometimes passing into *Bulimina* proper, sometimes short and nearly round, like *Cassidulina* and in other subvarietal shapes. It is the only *Virgulina* that takes on a sandy condition, becoming subarenaceous, and thereby very delicately rugose. Ehrenberg appears to have first noticed it in the Tertiary Limestone from Thebes, Egypt. In pl. xxiv., illustrating the Foraminifera from that rich rock, he gives the name *Strophoconus Hemprichii* to a fine complanate specimen (fig. 32); some smaller individuals (figs. 29, 30, 31) he puts under the same genus, and another as "*Textilaria?* or *Grammobotrys*." His "*Strophoconi*" are all either *Virgulinae* or *Buliminae*; therefore the name is not required. Other instances of *Virgulina Hemprichii* (fossil) occur at pl. xix. fig. 86 (?), Ægina; xxi. fig. 88, Oran; xxiii. fig. 19, Mokattam; xxv. fig. 15 (?), Antilibanon; xxvi. figs. 19–24, 26, 27, Cattolica; xxix. figs. 32–36, Moën Chalk; xxx. figs. 18, 19, 21, Rügen Chalk; xxxii. II. figs. 18, 20, Mississippi Chalk; xxxiii. XIII. fig. 27 (?), San Francisco. Of these some are remarkable; for instance, the *Vaginulina? paradoxa* and *V. obscura* (pl. xxvi. figs. 26, 27) are nearly cylindrical and subarcuate, such as occur in the Jurassic Clays, in the Gault, and in the Chalk*; they are old "Secondary" *Virgulinae*. A variety (pl. xxx. fig. 18), termed "*Polymorphina nucleus*," shows a passage into *Cassidulina*. An out-

* Such a *Virgulina* from the English Chalk is figured in Eley's 'Geology in the Garden,' 1859, pl. 2. fig. 12, and pl. 8. fig. 12 c; p. 195 &c.

spread, rhomboidal, and suboblong Textilariiform variety is seen in pl. xxxii. II. figs. 18 & 20, termed "*Grammostomum tessera*" and "*Pleurites? americanus*."

Pl. XXVIII. figs. 31, *Heterostomum cyclostomum*, and 33, *Grammostomum platytheca*, are young, broad, coarse-shelled *Textilaria gibbosa*. Fig. 32. See above. Figs. 34-42 *a*, variously named "*Rotalia*" (including *Rotalia globulosa*, 1838, figs. 40, 41), are so many individuals of *Globigerina cretacea*, D'Orb., an outspread flattish variety of *Gl. bulloides*, D'Orb., smooth in the youngest (41, 42), coarser and prickly in older specimens.

Fig. 43, *Planulina omphalolepta* (*Pl. turgida*, 1838), is a small and somewhat complanate *Cristellaria rotulata* (Lamk.) or feebly keeled *Cr. cultrata* (Montf.). Fig. 44, *Pl. annulosa*, is a still smaller specimen. Fig. 45, *a, b*, *Pl. odontophæna*, is *Crist. cultrata* (Montf.). Fig. 45 *a* has tear-like and ridgy exogenous growths of shell-matter near the umbilicus, but no umbo. Fig. 46, *Pl. hexas* (*Rosalina globularis?*, 1838), is *Cr. cultrata* with a small keel. Fig. 47, *Rotalia prætexta*, is a produced suboval individual of *Crist. cultrata*. Fig. 48, *Planulina adpersa*, is probably a small *Cr. cultrata* or *rotulata*: in fact figs. 43-48 show various stages and conditions of growth of the common *Cristellaria* of the Chalk in its umbilicate condition, and with more or less of a keel or crest. Fig. 49, *Pl. umbilicata*, also 54, *Cristellaria megalomphala*, and 55, *Cr. anglica*, are limbate specimens of *Cr. cultrata*—that is, having the shell thickened over the septal lines.

Figs. 50, *Rotalia lenticulina*, 51, *R. londinensis*, and 52, *R. lepida*, are small individuals of *Planorbulina ammonoides*.

Fig. 53, *R. picta?* This is *Pulvinulina Micheliniana* (D'Orb.), seen from its flat (upper) spiral face. The same species is represented in pl. xxvii. fig. 52, by a rather larger specimen ("*Planulina picta*") from the Chalk of Meudon, viewed through the vertical thickness of the shell from its high umbilical (lower) face. This belongs to a large family of Rotaline Foraminifera, which group themselves around *Pulvinulina repanda* (Fichtel & Moll). It belongs more especially to the subgroup of which *P. Menardii* is the type. This attains its best growth at about 100 fathoms in the existing seas, but lives well at abyssal depths, even at more than two miles depth; whilst, on the contrary, in shallow water it degenerates into *bizarre* varieties. D'Orbigny's *Rotalia crassa*, figured on the same plate (Mém. Soc. Géol. Fr. iv. pl. 3. f. 7, 8), is also a variety of *Pulvinulina Menardii*. These are found in existing seas under the conditions mentioned above, and are abundant in the Gault, Chalk-marl, and Chalk.

The other objects from the Chalk shown in this interesting plate are some siliceous and calcareous Sponge-spicula, some Morpholites, or Coccoliths (a Cyatholith without its centrum), and two Diatoms, *Fragilaria rhabdosoma*, 1838, and *Fr. pinnata*, 1844 (*Fr. striolata*, 1838).

The sea-depth for these Foraminifera was from 100 to 150 fathoms.

Species and noteworthy Varieties from the Chalk of Gravesend, figured by Ehrenberg.

According to our views, as explained above and in our papers "on the Nomenclature of the Foraminifera" in the 'Ann. Nat. Hist.,' and in other memoirs, we regard Dr. Ehrenberg's figures of the Foraminifera from the Chalk of Gravesend as referable to:—

1. *Nodosaria ovicula*, D'Orb.
2. *Vaginulina lævigata*, Ræmer.
3. ——— *longa* (Cornuel).
4. *Cristellaria cultrata* (Montfort).
5. *Polymorphina Thouini*, D'Orb.
6. *Virgulina Schreibersii*, Czjzek.
7. ——— *Hemprichii* (Ehr.).
8. *Textilaria agglutinans*, D'Orb.
9. ——— *gibbosa*, D'Orb.
10. ——— *subangulata*, D'Orb.
11. ——— *striata*, Ehr.
12. ——— *globulosa*, Ehr.
13. *Heterostomella tumens* (Ehr.).
14. ——— *aculeata* (Ehr.).
15. *Verneuilina spinulosa*, Reuss.
16. *Vulvulina** *pennatula* (Batsch).
17. *Globigerina cretacea*, D'Orb.
18. *Planorbulina ammonoides* (Rss.).
19. *Pulvinulina Micheliniana* (D'Orb.).

We must not lose sight of the fact that the specimens figured in the 'Mikrogeologie' are for the most part very minute, such as lie among the finer débris of washed Chalk; whilst those treated of by D'Orbigny, Reuss, Williamson, Eley, and

* This is a *Grammostomum* with Ehrenberg. Supposing that "*Grammostomum*" was intended for the compressed Textilian forms with terminal slit-like apertures, we formerly adopted it in preference to the name given by D'Orbigny. But, as it is indiscriminately applied by its author to *Polymorphina*, *Bolivina*, *Virgulina*, and *Textilaria*, as well as to the subgenus above indicated, there are strong reasons against its use in our nomenclature.

others have been larger individuals picked out by means of hand-lenses from the coarser dust of the disintegrated material. The great difference of size, however, among individual Foraminifera carries but little weight in the determination of species; for the conditions, not only of growth, but of feeding-ground, depth of water, and climate affect them so greatly, that a form which may be gigantic in one *habitat* will be arrested or dwarfed in another, retaining all the essential characteristics of shape and structure which are required for its specific identification.

With respect to the *Foraminifera Rotalina* (Carpenter) of the English and European Chalk, we may notice that among Ehrenberg's figures we recognize:—

- Planorbulina farcta (*F. & M.*).
- Haidingerii (*D' Orb.*).
- ammonoides (*Rss.*).
- ariminensis (*D' Orb.*).
- globulosa (*Ehr.*).
- Pulvinulina spatiosa (*Ehr.*).
- truncatulinoides (*D' Orb.*).
- Micheliniana (*D' Orb.*).
- caracolla (*Rœm.*).

D'Orbigny found in English Chalk all the Rotalines he got from the French Chalk (see above, p. 295). In our own collection we have from—

1. *The Upper Chalk of Thorpe, near Norwich*:—

- Planorbulina ammonoides (*Rss.*).
- Ungeriana (*D' Orb.*).
- Haidingerii (*D' Orb.*).
- (Truncatulina) lobatula (*W. & J.*).
- Rotalia umbilicata, *D' Orb.*

2. *The Chalk of Gravesend*:—

- Planorbulina ammonoides (*Rss.*).
- Ungeriana (*D' Orb.*).
- (Planulina) ariminensis (*D' Orb.*).
- (Truncatulina) lobatula (*W. & J.*).
- Pulvinulina Micheliniana (*D' Orb.*).
- Rotalia umbilicata, *D' Orb.*

Of most of these there are also local subvarieties, corresponding more or less closely not only with those named by D'Orbigny, but also with many of the numerous *Rotaline*

varieties and subvarieties figured and described by Reuss and others.

On close examination of specimens and collation of lists, we find that, as with *Globigerinæ*, so with *Rotalinæ*, it is by the *increase of varieties* the distinction is chiefly made between the Foraminiferal faunæ of the past and of the present seas.

[To be continued.]

XXX.—*On a Four-bearded Water-Terrapin from North Australia.* By Dr. J. E. GRAY, F.R.S. &c.

THE British Museum has received a very young freshwater Terrapin belonging to the family Hydraspidæ, from Cape York, North Australia. It agrees with the genus *Elseya* in having no nuchal shield, and in having the back of the neck furnished with regular longitudinal rows of small conical spines. The skin over the temporal muscles is divided into irregular convex tubercles; the crown of the head is covered with a continuous soft skin, which becomes hard when dried.

This specimen differs from all the known species of *Elseya* in having four beards—that is to say, two short cylindrical beards on each side of the hinder edge of the lower beak. The two front are in the place where beards are usually found in the genus, the two hinder at some distance behind them.

The head and back of the neck are dark olive; the beaks are greyish white, with a broad white streak from the angle of the mouth extending behind towards the shoulders. This streak is separated from the white throat by a black streak on its lower side, which is extended in front, and forms a narrow margin to the back edge of the lower beak. The back of the shell is dark olive, the areolæ occupying nearly the whole of the plates; the front marginal shields with numerous minute spines; nuchal shield none. The underside of the marginal shields and the sternum white, with a very narrow edge to the marginal plates; a dark oval spot on each side of the suture between the second and third and hinder plates.

This may be the type of a new genus characterized by the four beards; but I think it is most likely an accidental variety of *Elseya latisternum*. We must wait until we obtain more specimens to determine this point, more especially as the top of the head wants the hard surface of the older specimen of that genus.



Parker, W K and Jones, T. Rupert. 1872. "XXIX.—On the nomenclature of the Foraminifera." *The Annals and magazine of natural history; zoology, botany, and geology* 9, 280–303. <https://doi.org/10.1080/00222937208696581>.

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