

II. — ON A *PATELLINA*-LIMESTONE AND ANOTHER FORAMINIFERAL LIMESTONE FROM EGYPT.

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(PLATE II.)

THE specimens dealt with in this paper were collected by the Officers of the Geological Survey of Egypt, and I have been requested by Dr. H. Woodward, on behalf of Captain H. G. Lyons, R.E., F.G.S., the Director-General, to give an account of the various species of Foraminifera met with during the progress of the Survey.

THE *PATELLINA*-LIMESTONE.

These specimens bear the Survey label No. 11c (827). The rock occurs on a plateau between Cairo and Suez, the geological position of which Mr. Barron is inclined to consider as the base of the Miocene grits and marly clays (letter dated 29th July, 1899). The exact locality whence these samples came is situated six kilometres west of Camp 35, in lat. N. $30^{\circ} 17' 55''$, long. E. $32^{\circ} 18' 14''$.

The rock is of the greatest interest on account of the presence of a new species of *Patellina*, which constitutes a large proportion of the limestone. The relative abundance of the *Patellinae* in the rock can be well seen in the photograph (Pl. II, Fig. 1) of a thin section taken haphazard from the rock-specimen. This genus appears to be hitherto quite unknown in the limestones of Egypt.

Besides *Patellinae* there are other foraminifera associated with it in this rock, belonging to the genera *Biloculina*, *Miliolina*, *Orbiculina*, *Alveolina*, *Bigenerina*, *Discorbina*, *Truncatulina*, *Gypsina*, *Polytrema*, and *Nonionina*.

The limestone is ochreous-yellow to pale brown in colour. The matrix of the rock is somewhat spongy, cavities caused by chemical solution and recrystallization being seen here and there, whilst in section the foraminifera other than the *Patellinae* frequently have a space between the wall of the test and the matrix by which it is partially filled. When the rock is crushed for the extraction of the smaller organisms the casts fall out, leaving the walls of the tests adhering to the matrix.

The microscopic structure of the enclosing rock-mass is distinctly crystalline, which condition is probably due to subsequent molecular disturbance of the calcareous mud in which the foraminifera were embedded, and which has resulted in the formation of a granular calcitic material, in which scalenohedra are an abundant crystalline form, especially on the borders of the cavities.

Besides foraminifera there are some obscure examples of polyzoa. An ostracod (*Bairdia*, described below) also occurs in some numbers, represented both in section and by a specimen isolated from the rock.

Scattered through the rock are some rounded grains of quartz averaging 1 mm. in diameter, and often containing strings of minute inclusions or gas cavities.

OSTRACODA.

Family BAIRDIIDÆ.

BAIRDIA, McCoy [1844].

BAIRDIA SUBDELTOIDEA (Münster).

Cythere subdeltoidea, Münster, 1830, Jahrb. Min., p. 64; 1835, p. 446.

Bairdia subdeltoidea (Münster), Jones & Sherborn, 1887, p. 387; idem, 1889, Mon. Tert. Entom., p. 16, pl. i, figs. 15*a*, *b*. Egger, 1895: Naturhist. Vereins Passau, Jahresb. 16, p. 42, pl. ii, figs. 20*a*, *b*.

The specimens found in the Egyptian limestone are of medium size, with the valves united. In the sections of the rock they occur with some frequency. The species has a rather wide range in time, since it is characteristic and common in all the Cretaceous deposits beginning at the Aptian, or Lower Greensand of England; and it also occurs in beds of Middle Eocene age at Bracklesham and in the older Pliocene of Northern Italy.

? Lower Miocene: from a plateau between Cairo and Suez. Frequent.

FORAMINIFERA.

Family MILIOLIDÆ.

Subfamily MILIOLINÆ.

BILOCULINA, d'Orbigny [1826].

BILOCULINA BULLOIDES, d'Orbigny.

"Conchula minima, etc.," Plancus, 1739: De Conch. min. nat., p. 23, pl. ii, fig. 6.

Biloculina bulloides, d'Orb., 1826: Ann. Sci. Nat., vol. vii, p. 297, No. 1, pl. xvi, figs. 1-4; Modèle, No. 90.

B. Peruviana, id., 1839: Foram. Amér. Mérid., p. 68, pl. ix, figs. 1-3.

B. ringens (Lam.), Parker, Jones, & Brady, 1865: Ann. Mag. Nat. Hist., ser. iii, vol. xvi, p. 35.

B. lucernula (pars), Schwager, 1866: Novara-Exped., Geol. Theil., vol. ii, p. 202, pl. iv, figs. 17*a*, *b*.

B. bulloides, d'Orb., Terquem, 1882: Mém. Soc. géol. France, sér. iii, vol. ii, p. 153, pl. xxiii, fig. 38.

Miliolina ringens (Lam.), Goës, 1882: K. Svenska Akad. Handl., vol. xix, p. 131, pl. x, figs. 363-365, 386?

Biloculina bulloides, d'Orb., Brady (= *B. lucernula*, Schwager, Schlumberger), 1884: Rep. "Challenger," vol. ix, p. 142, pl. ii, figs. 5, 6. Schlumberger, 1887: Bull. Soc. géol. France, sér. iii, vol. xv, pp. 574-579, pl. xv, figs. 10-13 and woodcuts 1-5. Egger, 1895: Abhandl. k. bayer. Akad. Wiss., vol. xviii, Abth. 2, p. 217, pl. i, figs. 16-18. Rupert Jones, 1895: Mon. Foram. Crag, pt. ii, pp. 101 and 102.

B. bulloides is quite a common species in the *Patellina*-limestone. On crushing the rock the little subspherical tests are seen amongst the débris, and projecting from the surfaces of the larger fragments. They often have the shell-wall perfect, and are occasionally noticed as casts. The contour of the test in these Egyptian specimens is very typical, having a globose penultimate chamber and a slightly elongated aboral neck. Passage forms occur which link this species with its more pyriform variety next described.

Although *B. bulloides* ranges throughout the Tertiary fossiliferous strata to recent times, yet the fossil forms seem to be distinct in some of their characters, as shown by Schlumberger.

? Lower Miocene : from a plateau between Cairo and Suez. Common.

BILOCULINA BULLOIDES, var. INORNATA, d'Orb.

Biloculina inornata, d'Orb., 1846 : Foram. Foss. Vienne, p. 266, pl. xvi, figs. 7-9.

B. bulloides, d'Orb., var. *truncata-gracilis*, Reuss, 1867 : Sitzungsber. Akad. Wiss. Wien, vol. lv, p. 69, pl. ii, fig. 2.

B. bulloides, var. *inornata*, d'Orb., Rupert Jones, 1895 : Mon. Foram. Crag (Pal. Soc.), pt. ii, pp. 101-2, pl. vii, figs. 1a-c.

The slightly elongate variety of *B. bulloides* may be referred to *B. inornata* of the Vienna Tertiaries. It is not so common as the typical *B. bulloides* in this Egyptian limestone, but is represented, nevertheless, by several good examples.

Besides its original occurrence in the Miocene of the Vienna Basin, this variety has been found in many fossiliferous deposits of Pliocene age.

? Lower Miocene : between Cairo and Suez. Frequent.

MILIOLINA, Williamson [1858].

MILIOLINA OBLONGA (Montagu).

Vermiculum oblongum, Montagu, 1803 : Test. Brit., p. 522, pl. xiv, fig. 9.

Miliolina seminulum (L.), var. *oblonga* (Montagu), Williamson, 1858 : Recent Foram. Gt. Brit., p. 86, pl. vii, figs. 186, 187.

M. oblonga (Mont.), Brady, 1884 : Rep. Chall., vol. ix, p. 160, pl. v, figs. 4a, b. De Amicis, 1893 : Boll. Soc. Geol. Ital., vol. xii, fasc. 3, pp. 27, 178, 179, 317. Goës, 1894 : K. Svensk. Akad. Handl., vol. xxv, No. 9, p. 110, pl. xx, figs. 850, 850f. Rupert Jones, 1895 : Mon. Foram. Crag, pt. ii, p. 120, pl. iii, figs. 31, 32; pl. v, fig. 5. Millett, 1898 : Journ. Roy. Micr. Soc., p. 267, pl. v, figs. 14a, b.

Examples of this somewhat variable species were found with both the triloculine and the quinqueloculine forms. The triloculine variation is more typical. The quinqueloculine form seems to be somewhat closely allied with *Miliolina alveoliniformis*, Brady, and also with Schlumberger's subgeneric type of *Pentellina*.

Miliolina oblonga dates back as far as the Eocene period, and it is found living at the present day, usually in shallow water.

? Lower Miocene : from a plateau between Cairo and Suez. Rare.

MILIOLINA SUBROTUNDA (Montagu).

Vermiculum subrotundum, Montagu, 1803 : Test. Brit., pt. ii, p. 521.

Quinqueloculina subrotunda (Mont.), d'Orb., 1826 : Ann. Sci. Nat., vol. vii, p. 302, No. 36.

Miliola (*Quinqueloculina*) *subrotunda* (Mont.), Parker & Jones, 1865 : Phil. Trans., vol. clv, p. 411, pl. xv, fig. 38.

Miliolina subrotunda (Mont.), Brady, 1884 : Rep. Chall., vol. ix, p. 168, pl. v, figs. 10, 11.

M. subrotunda (Walker & Boys), Goës, 1894 : Kongl. Svenska Vet.-Akad. Handl., vol. xxv, p. 109, pl. xix, figs. 846, 847.

M. subrotunda (Mont.), Rupert Jones, 1895 : Mon. Foram. Crag, pt. ii, p. 120, woodcut, fig. 9. Millett, 1898 : Journ. Roy. Micr. Soc., p. 502.

The specimens from the Egyptian limestones are very typical.

As a fossil this species dates from Miocene times. It is an essentially shallow-water form at the present day, and this is the case with the other *Miliolines* recorded from the Egyptian Miocene limestone.

? Lower Miocene : from a plateau between Cairo and Suez. Frequent.

MILIOLINA TRIGONULA (Lamarck).

Miliolites trigonula, Lamarck, 1804 : Ann. du Muséum, vol. v, p. 351, No. 3. 1822 : Anim. sans Vert., vol. vii, p. 612, No. 3.

Triloculina Austriaca, d'Orb., 1846 : Foram. Foss. Vienne, p. 275, pl. xvi, figs. 25-27.

Miliolina trigonula (Lamarck), Williamson, 1858 : Recent Foram. Gt. Brit., p. 83, pl. vii, figs. 180-182. Schwager, 1883 : Palæontographica, vol. xxx, Pl. Theil, p. 86, pl. xxiv (i), figs. 6a-d. Brady, 1884 : Rep. Chall., vol. ix, p. 164, pl. iii, figs. 14-16. Sherborn & Chapman, 1889 : Journ. Roy. Micr. Soc., p. 484, pl. xi, fig. 1. Terrigi, 1891 : Mem. Roy. Com. Geol. Ital., vol. iv, pt. i, p. 66, pl. i, fig. 4. Goës, 1894 : Kongl. Svenska Vet.-Akad. Handl., vol. xxv, p. 115, pl. xxii, fig. 870. Millett, 1898 : Journ. Roy. Micr. Soc., p. 503.

There is some variability in the dimensions of the Egyptian specimens, but they are otherwise characteristic. Schwager has recorded this species from the cherty *Alveolina*-limestone, between Siut and Farâfrah ; in the *Miliolina*-limestone of the Arabian Desert at Wady Natfe ; also similar forms near Minieh and Mokattam.

M. trigonula dates from the Eocene period, and is also found fossil in Miocene strata and onwards to the present day.

? Lower Miocene : from a plateau between Cairo and Suez. Frequent.

MILIOLINA INFLATA (d'Orbigny).

Triloculina inflata, d'Orb., 1826: Ann. Sci. Nat., vol. vii, p. 300, No. 10. Römer, 1838: Neues Jahrbuch, p. 393, pl. iii, fig. 72. Michelotti, 1841: Mem. Soc. Ital. Sci., vol. xxii, p. 299, pl. iii, fig. 11. D'Orb., 1846: Foram. Foss. Vienne, p. 278, pl. xvii, figs. 13-15.

Quinqueloculina inflata (d'Orb.), Parker, Jones, & Brady, 1871: Ann. Mag. Nat. Hist., ser. iv, vol. viii, p. 249, pl. viii, fig. 16.

Triloculina inflata, d'Orb., Terquem, 1878: Mém. Soc. géol. France, sér. iii, vol. i, p. 56, pl. v (x), figs. 16a-18b. Idem, 1882: ibid., vol. ii, p. 165, pl. xvii [xxv], figs. 4-6.

Miliolina lucens, Schwager, 1883: Palæontographica, vol. xxx, Pal. Theil, p. 87, pl. xxiv, figs. 7a-d.

The inflated varieties of the type *M. seminulum* may be referred to the above specific name. *M. inflata* is a common Tertiary form, and is most typical in the Eocene and Miocene formations. Schwager records his *M. lucens* from the cherty *Alveolina*-limestone and marl between Siut and Farâfrah; on the Nekeb-el-Farudj; in the upper beds of El Guss-Abu-Said, and in the *Alveolina*-limestone of Wady Natfe in the Arabian Desert.

? Lower Miocene: from a plateau between Cairo and Suez. Frequent.

MILIOLINA SEMINULUM (Linné).

Serpula seminulum, Linné, 1767: Syst. Nat., 12th ed., p. 1,264, No. 791; 1788, 13th (Gmelin's) ed., p. 3,739, No. 2.

Vermiculum intortum, Montagu, 1803: Tert. Brit., p. 502.

Quinqueloculina seminulum (L.), d'Orb., 1826: Ann. Sci. Nat., vol. vii, p. 303, No. 44.

Miliolina seminulum, Williamson, 1858: Recent Foram. Gt. Brit., p. 85, pl. vii, figs. 183-185.

Quinqueloculina seminulum, Jones, Parker, & Brady, 1866: Foram. Crag, p. 9, pl. iii, figs. 35, 36.

Miliolina seminulum, Greene, 1871: Manual Protozoa, p. 15, fig. 3g.

Quinqueloculina semilunum [*seminulum*] (L.), Terquem, 1875: Anim. plage Dunkerque, fasc. 1, p. 40, pl. vi, fig. 8.

Miliolina seminulum (L.), Brady, 1884: Rep. Chall., vol. ix, pp. 157-160 (woodcuts, figs. 3a-c); pl. v, fig. 6. Sherborn & Chapman, 1886: Journ. Roy. Micr. Soc., ser. ii, vol. vi, p. 742, pl. xiv, fig. 1. Rupert Jones, 1895: Mon. Foram. Crag, pt. ii, p. 116. Millett, 1898: Journ. Roy. Micr. Soc., p. 505.

M. seminulum is a common species in the *Patellina*-limestone from Egypt, and the specimens are well developed.

As a fossil this foraminifer dates from the Lower Eocene period, and it is also a well-known shallow-water species at the present day.

? Lower Miocene: from a plateau between Cairo and Suez. Common.

MILIOLINA POLYGONA (d'Orbigny).

Quinqueloculina polygona, d'Orb., 1839: De la Sagra, Hist. Phisiq., etc., Cuba, "Foraminifères," p. 198, pl. xii, figs. 21–23.

Miliolina seminulum (L.), Goës, 1882, "Ret. Rhiz. Caribb. Sea": Svenska Vet.-Akad. Handl., vol. xix, No. ix, figs. 353, 354.

Miliolina Gussensis, Schwager, 1883: Palæontographica, vol. xxx, Pal. Theil., p. 85, pl. xxiv (i), figs. 5a–d.

M. polygona (d'Orb.), Goës, 1894: Svenska Vet.-Akad. Handl., vol. xxv, No. 9, p. 111, pl. xxx, figs. 854–854g; idem, 1896, Bull. Mus. Comp. Zool. Harvard, vol. xxix, No. 1, pt. xx, p. 83, pl. viii, figs. 11–18.

This species in the Egyptian limestone varies much as to size, but the specimens are constant in the characters of the test.

The specimens named *M. Gussensis* by Schwager were found in the argillaceous beds with *Operculina libyca* of El Guss-Abu-Said (Libyan Stage).

In recent soundings this form affects warm areas, usually in the neighbourhood of coral reefs. Goës found this species in the West Indies at a depth from 300 to 400 fathoms.

? Lower Miocene: from a plateau between Cairo and Suez. Frequent.

Subfamily PENEROPLIDINÆ.

ORBICULINA, Lamarck [1816].

ORBICULINA ADUNCA (Fichtel & Moll).

Nautilus orbiculus, Fichtel & Moll, 1803: Test. Micr., p. 112, pl. xxi.

N. angulatus, idem: ibid., p. 113, pl. xxii.

N. aduncus, idem: ibid., p. 115, pl. xxiii.

Orbiculina adunca (Fichtel & Moll), Lamarck, 1816: Tabl. Encycl. et Méth., pl. cccclxviii, figs. 2a–c. D'Orbigny, 1839: Foram. Cuba (in Sagra's "Hist. phisiq. Cuba"), p. 81, pl. viii, figs. 8–14. Brady, 1884: Rep. Chall., vol. ix, p. 209, pl. xiv, figs. 1–13. Agassiz, 1888: Three Cruises "Blake," ii, p. 160, figs. 486, 487.

Both casts and perfect specimens of *Orbiculina* occur in the *Patellina*-limestone.

O. adunca is known from Eocene and Miocene rocks, and at the present time it is confined to fairly shallow water of warm areas.

? Lower Miocene: from a plateau between Cairo and Suez. Common.

Subfamily ALVEOLININÆ.

ALVEOLINA, d'Orbigny [1826].

ALVEOLINA ELLIPSOIDALIS, Schwager.

Alveolina ellipsoidalis, Schwager, 1883: Palæontographica, vol. xxx, Pal. Theil., p. 96, pl. xxv (ii), figs. 1a–i and 2a–c.

Examples of the above species are quite common in the *Patellina*-limestone, and one perfect enough for identification was isolated

by crushing the rock. It is probable, but not quite certain in the absence of sections, that the *Alveolina Hauerii* of d'Orbigny¹ from the Miocene of Nussdorf is of the same type. Schwager's specimens came from the *Alveolina*-limestone of the Wady Natfe in the Arabian Desert (Libyan Stage).

? Lower Miocene : from a plateau between Cairo and Suez. Common.

ALVEOLINA LEPIDULA, Schwager. (Pl. II, Fig. 1.)

Alveolina lepidula, Schwager, 1883 : Palæontographica, vol. xxx, Pal. Theil, p. 98, pl. xxv (ii), figs. 3a-g.

This species, viewed towards the septal face, gives an ovate, pointed outline. It was suggested by Schwager that it may represent an immature stage of the foregoing species. It was found by that author associated with *A. ellipsoidalis* from the Wady Natfe, Arabian Desert.

? Lower Miocene : from a plateau between Cairo and Suez. Very common.

Family TEXTULARIIDÆ.

Subfamily TEXTULARIINÆ.

BIGENERINA, d'Orbigny [1826].

BIGENERINA CAPREOLUS (d'Orbigny).

Vulvulina capreolus, d'Orb., 1826 : Ann. Sci. Nat., vol. vii, p. 264, No. 1, pl. xi, figs. 5, 6 ; Modèle, No. 59.

Schizophora Neugeboreni (?), Reuss, 1861 : Sitzungsber. böhm. Gesellsch. Wiss., vol. ii, p. 13.

Grammostomum capreolus (d'Orb.), Parker & Jones, 1863 : Ann. Mag. Nat. Hist., ser. iii, vol. xi, p. 93.

Textilaria flabelliformis (young stage), Gümbel, 1868 : Abhandl. bayer. Akad. Wiss., Cl. ii, vol. x, p. 647, pl. ii, figs. 83a, b.

Venilina Hæringensis, Gümbel, 1868 : ibid., p. 649, pl. ii, fig. 84 (bis), a, b.

Schizophora Hæringensis, Hantken, 1872 : Mittheil. Jahrb. ungar. geol. Anstalt., vol. i, p. 136, pl. ii, figs. 17a, b.

Bigenerina capreolus (d'Orb.), Brady, 1884 : Report Chall., vol. ix, p. 372, pl. xlv, figs. 1-4.

A good vertical section of the above species occurs in one of the slides. It is recognized by the pointed aboral end and the fine arenaceous structure of its test.

As a fossil *B. capreolus* makes its first appearance in the Eocene of the Bavarian Alps ; it was also found in the *Clavulina-Szaboi* beds of Hungary ; and it is known from the newer Tertiaries of Italy (Mio-Pliocene). The depths at which this species occurs in recent deposits ranges from fairly shallow water to about 700 fathoms. At the present day it is generally found in the North Atlantic Ocean.

? Lower Miocene : from a plateau between Cairo and Suez. One specimen.

¹ Foram. Foss. Vienne, 1846, p. 148, pl. vii, figs. 17, 18.

Family ROTALIIDÆ.

Subfamily ROTALIINÆ.

PATELLINA, Williamson [1858].

GENERIC SYNONYMY.¹

Orbitolites, pars, Lamarck [1801], DeFrance.

Madreporites, Blumenbach [1805].

Orbulites, Lamarck [1816].

Cyclolina, pars, d'Orbigny [1846], Carter.

Orbitolina, d'Orbigny [1847], Bronn, d'Archiac, Gras, Parker & Jones, Carter, Martin.

Orbitulites, Bronn [1848].

Patellina, Williamson [1858], Carpenter, Parker & Jones, Brady, Alcock, Parfitt, G. M. Dawson, Miller & Van den Broeck, Robertson, Schulze, Terquem, Siddall, Berthelin, Shone, Wright, Fritsch, Hantken, Zittel, Howchin, Chapman.

Conulites, Carter [1861].

The above synonymy is given in order that the claim of *Patellina* as the name of the genus may be readily seen. The subject of the nomenclature has already been discussed by Carpenter, Parker, & Jones,² and, later, by Professor Rupert Jones.³

It will perhaps be useful to point out briefly the shortcomings of the various names earlier than *Patellina*.

Orbitolites is now retained for one of the two types originally confused under the same name.

Madreporites does not stand according to the Strickland Rule No. 11, since it implies a false relationship; moreover, the name was previously used by Deluc (1802) in connection with *Orbitolites*.

Orbulites, an improved form of *Orbitolites*, was used by Lamarck when describing specimens belonging to that and the present genus.

Cyclolina used to denote a depressed, complanate form, probably of the present genus, but by no means typical.

Orbitolina appears to have been originally used in the sense of a recent form of *Orbitolites*, which was at the time thought to be a fossil genus, the terminations *ina* and *ites* being used by Lamarck and others for recent and fossil specimens respectively. This generic term has been largely used on the Continent to designate the *Patellinæ* with large tests and thick shell-walls, and which are so common in various Cretaceous beds in France, Spain, and Switzerland. Should these particular forms be proved to possess hyaline or tubulated shell-structure, there is no ground for retaining the name even as an isomorphic arenaceous group with *Patellina*.

Orbitulites is evidently a misspelling.

¹ For references see Sherborn's Index to Genera and Species of the Foraminifera, 1896.

² Introd. Foram., 1862, p. 229. Also Ann. Mag. Nat. Hist., ser. III, vol. xii (1863), p. 212.

³ Cat. Foss. Foram. Brit. Mus., 1882, p. 84.

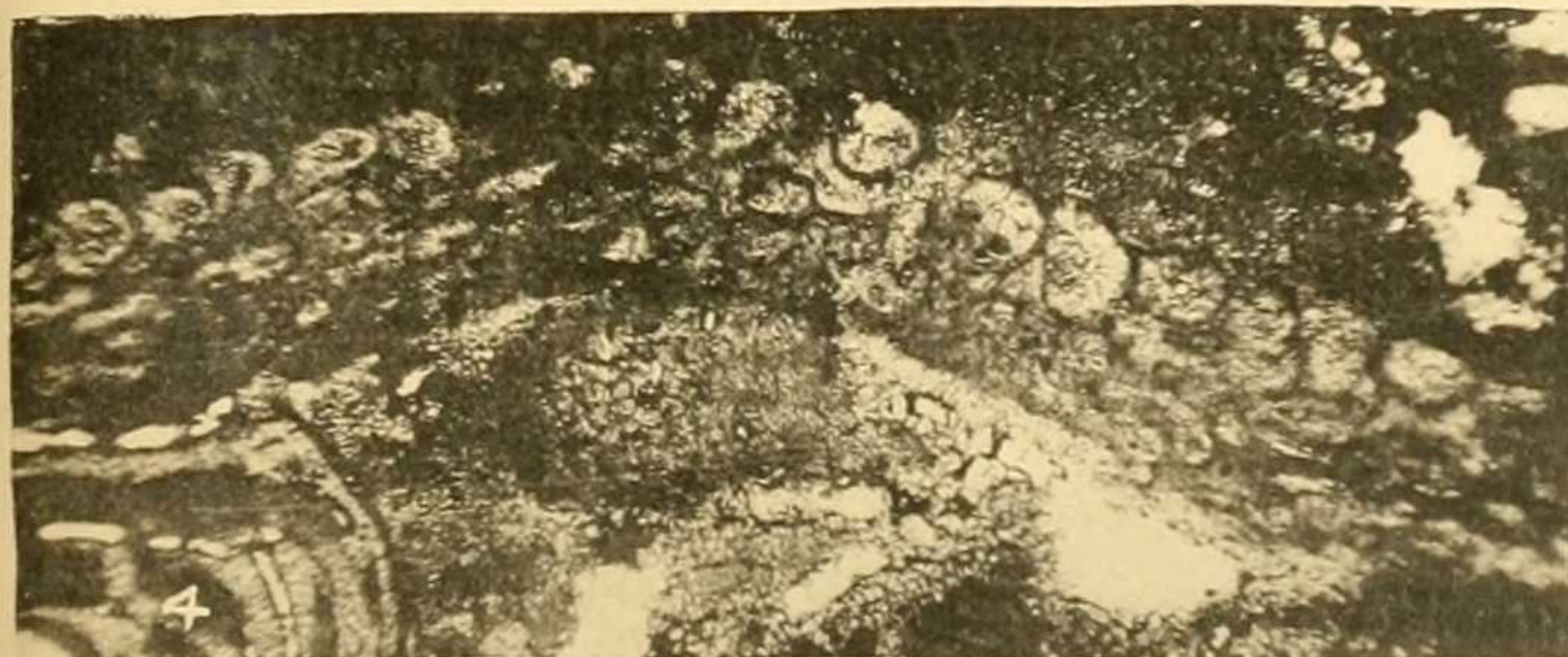
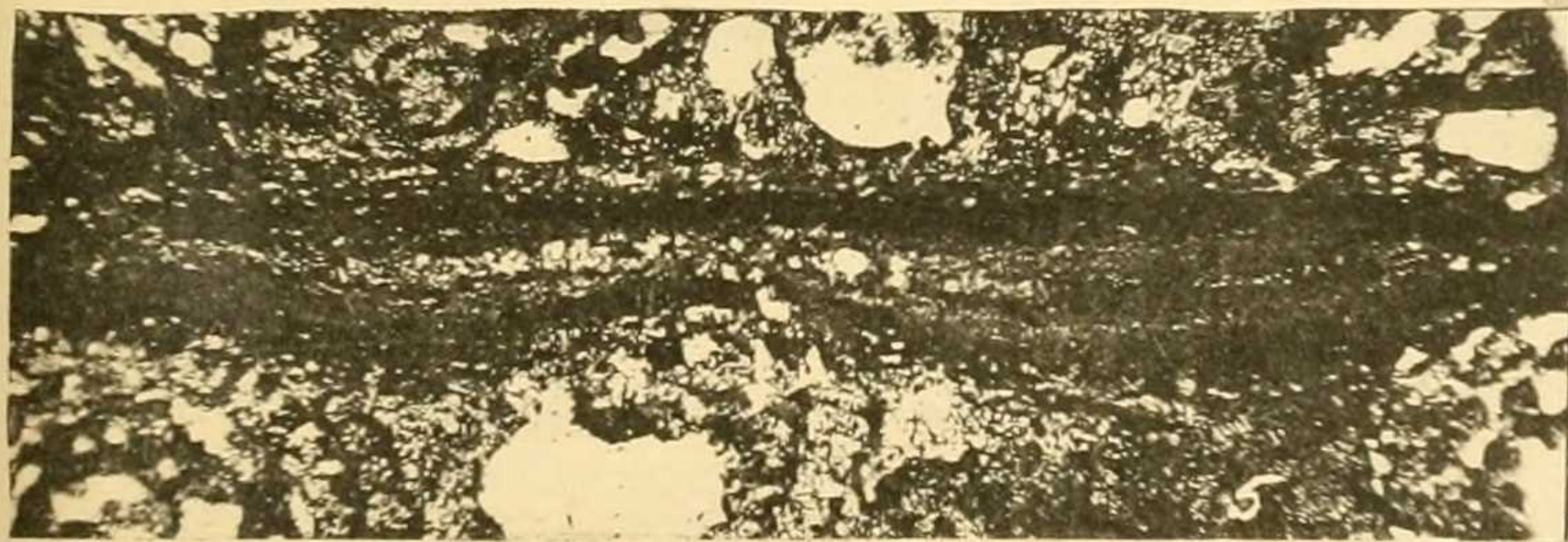
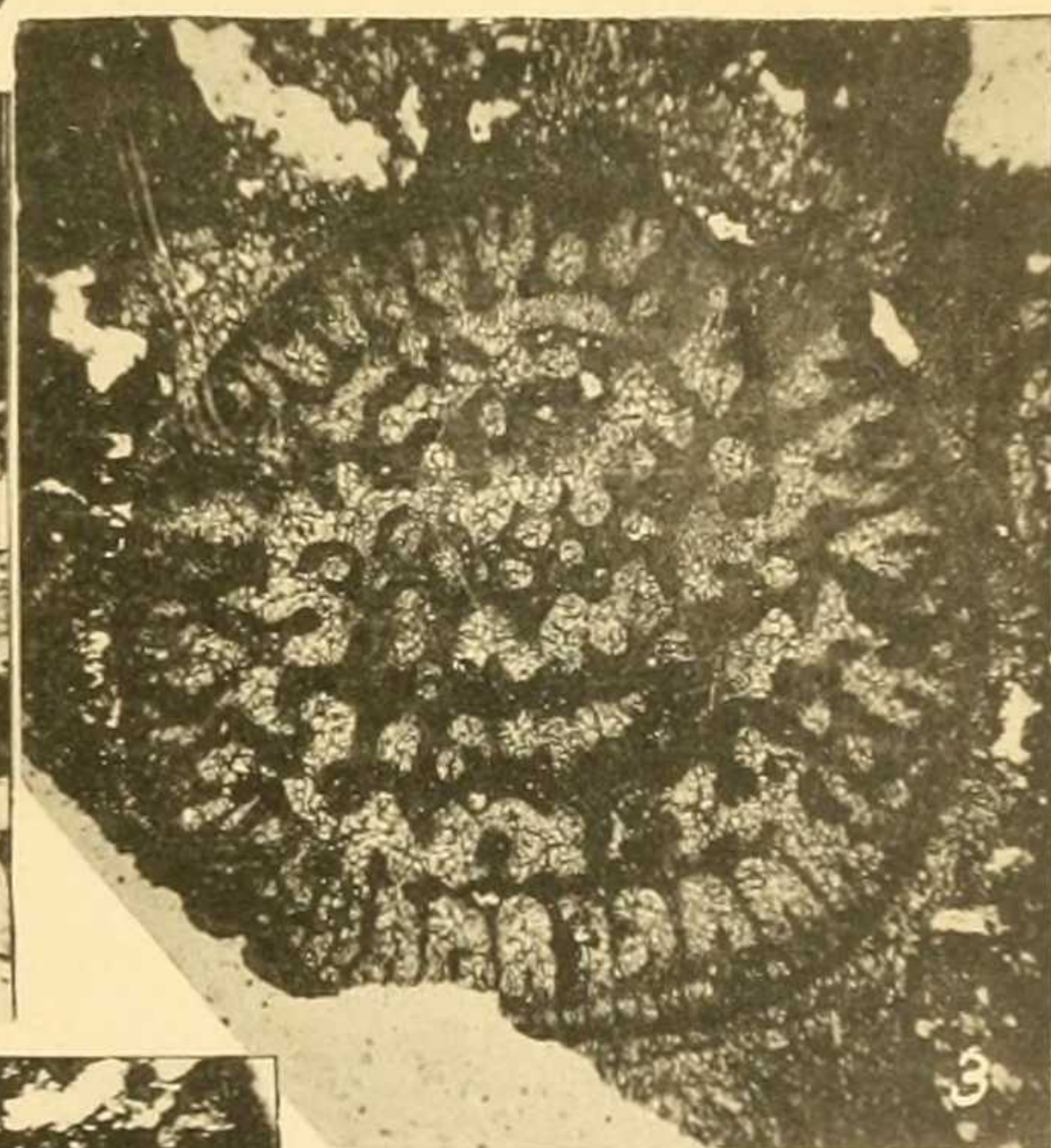
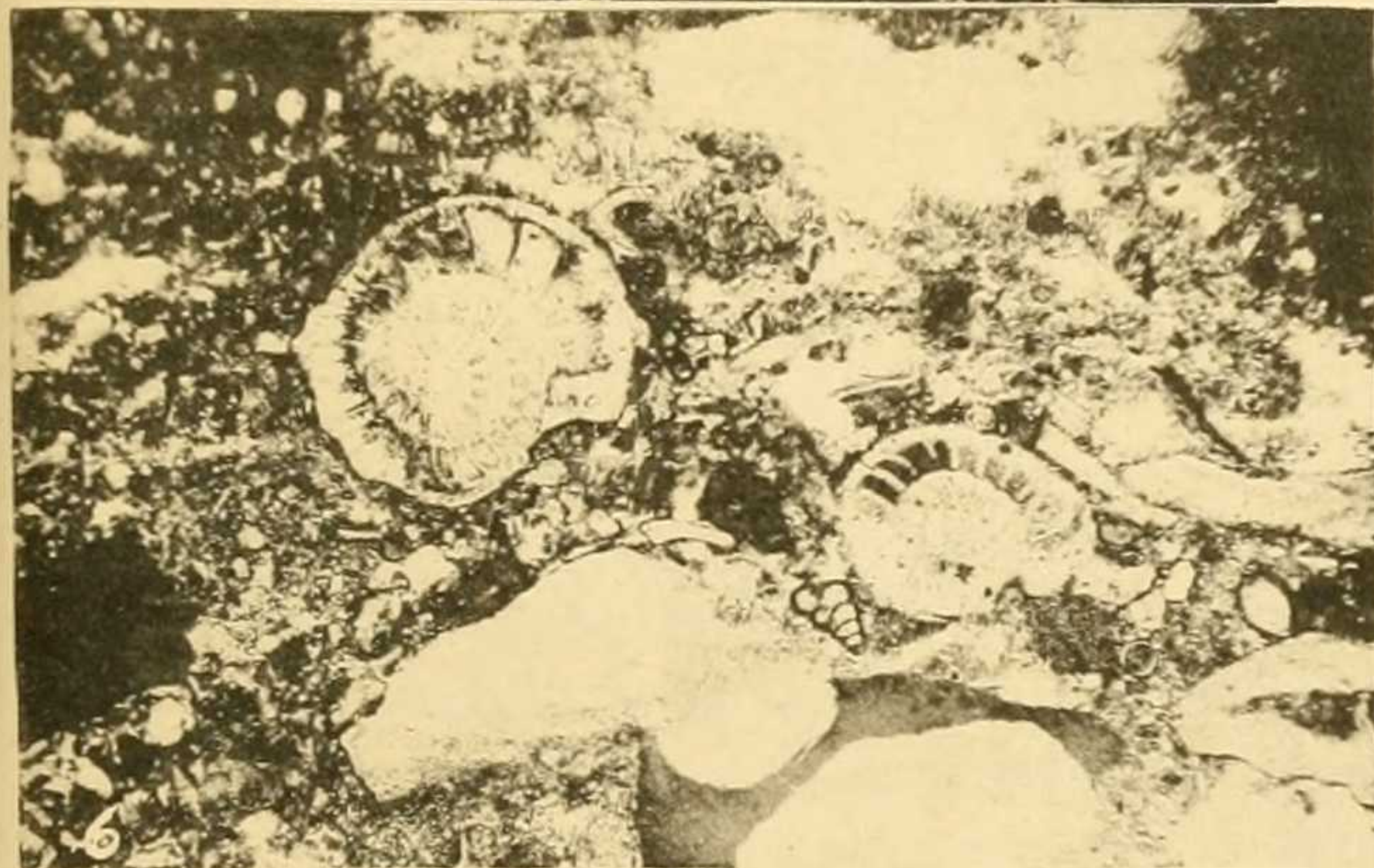
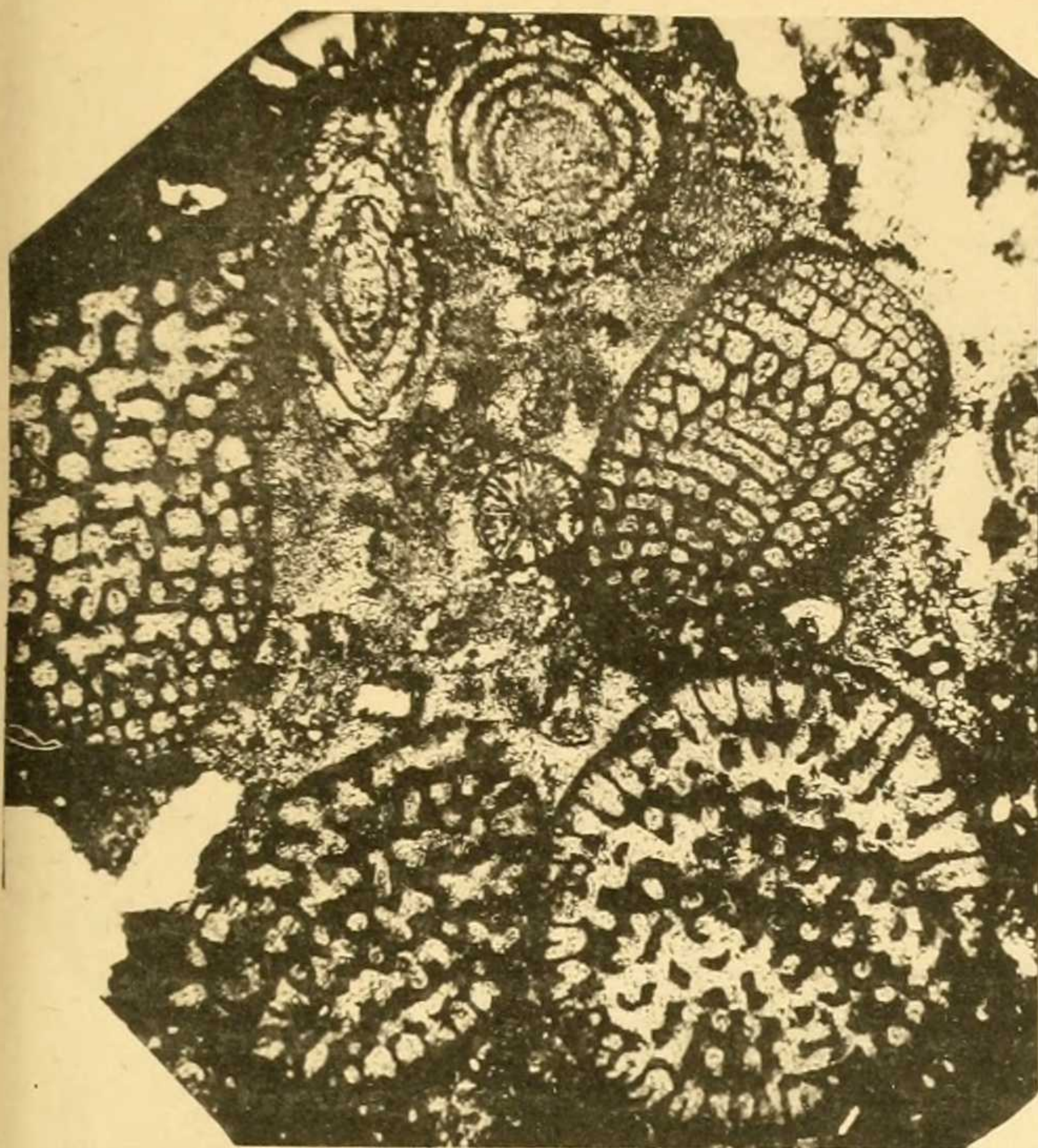


PHOTO.

MORGAN & KIDD, COLLOTYPE.

TERTIARY FORAMINIFERA FROM EGYPT.

Patellina was well described by Williamson, who took the typical little *P. corrugata* for the purpose. This form is quite hyaline throughout. In most cases the large fossil forms above referred to show very little evidence of hyaline structure, but it is extremely probable that this absence of tubulation is due to recrystallization of the calcitic substance of the shell-wall. In the Egyptian *Patellina*, however, by careful examination under high powers, a distinct but extremely fine tubulation can be made out in portions of the shell-wall better preserved, the tubules sometimes radiating in a characteristic manner.

Conulites was founded on specimens of *Patellina* from India, but described at later date than Williamson's type-form. This form approximates very closely to the Egyptian species in general structure.

The whole group of the *Patellinae* require a systematic and exhaustive study, and this I believe is being undertaken by Mr. A. Vaughan Jennings, who possesses a valuable collection of material for the purpose. I will here express my sincere thanks to Mr. Jennings for much assistance in making comparison with specimens of *Patellina* from his collection.

^a
_r PATELLINA EGYPTIENSIS, sp. nov. (Pl. II, Figs. 1-3.)

Test conoidal, in vertical section nearly equilateral, the two sides slightly convex, straight, or incurved in the middle of the test; base circular in outline, and with a slightly convex surface; peripheral edge rounded. The chambers are arranged on two plans, consisting (1) of an internal cone of chamberlets arranged at the apex in a spiral, and afterwards annular, or discoidal, each disc being subdivided into chamberlets by labyrinthic or irregular septa, the chamberlets alternate with those above and below; (2) of a cortical or external layer of rectangular chambers, partially subdivided by imperfect septa attached to the outer wall of the chamber and projecting inwards. The spire at the apex or aboral end of the test is large and simple, consisting of about one and a half turns, and in some cases the primordial sphere is well shown. The primordial chamber is most frequently megalospheric, measuring about $\frac{1}{16}$ inch (.416 mm.) in diameter; one sphere of the microspheric type measures $\frac{1}{32}$ inch (.26 mm.) in diameter.

In vertical section the cone is seen to be divided laterally by curved floors parallel with the convex surface of the base. These are subdivided somewhat irregularly by vertical septa in the central area. Average height of test, $\frac{1}{2}$ inch (5 mm.); average diameter at the base, $\frac{1}{8}$ inch (4.16 mm.).

AFFINITIES.—The present species differs considerably in point of structure from the large Cretaceous *Patellinae*, the chief distinction of the latter forms being the more or less hemispherical or spherical shape of the chambers constituting the cortical layer. In the Tertiary specimens the cortical chambers are decidedly rectangular.

I have lately taken the opportunity of examining the specimens

of ‘*Conulites*’ *Cooki*,¹ both in the collection at the British Museum (Natural History)² and in the Carter Collection at the Geological Society, in order to make a comparison of the Indian with the Egyptian species. In the collection at the Geological Society’s Museum the best specimens of *Patellina Cooki* are mounted on slide No. 40 of the Carter Collection, and are numbered 2 (from Kelat), 3 (from Sind), and 4 (from Arabia). The sections of *P. Cooki* show the cortical layer to consist of rectangular chambers, but these, unlike the Egyptian specimens, are without the secondary imperfect septa or dissepiments seen in the latter.

Some West Indian specimens of Miocene age kindly lent me by Mr. Jennings show this secondary septation of the cortical layer, but the chambers in these are more crowded and narrower than in *P. Egyptiensis*, and the species is probably new.

It is interesting to note that *Patellina Cooki* is associated with the following foraminifera in the Indian limestone as given by Carter in the paper above mentioned, namely: *Alveolina elliptica*, *Nummulites obesa*, *N. perforata*, *N. Carteri*, *Assilina exponens*, *A. spira*, and *Orbitoides dispansa*. The limestone in which these foraminifera occur appear to belong to the Kirthar Group (Eocene);³ In these Eocene beds the shell-structure exhibits the simplest plan. In the Egyptian beds, probably Lower Miocene, we have the intermediate stage in the development of the cortical layer. Finally, in the West Indian Miocene, presumably newer in age, the transition of the outer chambers is carried out still further.

Thus there appears to be a progression of this form in a westerly direction.

? Lower Miocene: from a plateau between Cairo and Suez. Very abundant, forming about 50 per cent. of the bulk of the rock.

DISCORBINA, Parker & Jones [1862].

DISCORBINA, sp., near *D. GLOBULARIS* (d’Orbigny).

Rosalina globularis, d’Orb., 1826: Ann. Sci. Nat., vol. vii, p. 271, pl. xiii, figs. 1–4; Modèle, No. 69.

Discorbina globularis (d’Orb.), Parker, Jones, & Brady, 1865: Ann. Mag. Nat. Hist., ser. III, vol. xvi, p. 30, pl. ii, fig. 69.

Our specimen occurs in a section of the rock, but there is little doubt, from the thick peripheral wall and globular segments, that it is referable to the above species. It is a well-known fossil in Middle Eocene, Miocene, and Pliocene beds.

? Lower Miocene: from a plateau between Cairo and Suez. One specimen.

¹ See Carter, 1861, Journ. Bombay Br. Roy. As. Soc., vol. vi, p. 83. Also Ann. Mag. Nat. Hist., ser. III, vol. viii, p. 457, pl. xv, fig. 7.

² To Mr. R. B. Newton and Mr. W. R. Jones I am indebted for their kind attention when examining these specimens at the British Museum and the Geological Society.

³ See Manual of Geology of India, 1893, Medlicott & Blanford, 2nd ed., revised by R. D. Oldham, pp. 305–7.

TRUNCATULINA, d'Orbigny [1826].

TRUNCATULINA UNGERIANA (d'Orbigny).

Rotalina Ungeriana, d'Orb., 1846: Foram. Foss. Vienne, p. 157, pl. viii, figs. 16-18.

Truncatulina Ungeriana (d'Orb.), Reuss, 1866: Denk. Akad. Wiss. Wien, vol. xxv, p. 161, No. 10. Brady, 1884: Rep. Chall., p. 664, pl. xciv, figs. 9a-c.

The example found is very typical, and has the form of the test well preserved; it was obtained by powdering the rock. The above species makes its appearance in beds of Cretaceous age, and it occurs commonly throughout the Tertiary formations.

? Lower Miocene: from a plateau between Cairo and Suez. One specimen.

Subfamily TINOPORINÆ.

GYPSINA, Carter [1877].

GYPSINA CRASSITESTA, sp. nov. (Pl. II, Fig. 4.)

Test hyaline and adherent; coarsely perforate; consisting of series of dome-shaped segments overlying one another alternately and in about five or more successive layers. The first series of chambers more spherical than the later ones. The test is adherent to thin shell fragments or consolidated pieces of sand. Average diameter of the chambers, $\frac{1}{8}$ inch (.26 mm.). The largest specimen found measures $\frac{9}{16}$ inch (9 mm.) in length; height, $\frac{1}{8}$ inch (.75 mm.).

The recent *Gypsina inhærens* (Schultze)¹ has a similar habit of growth to this species, but it is usually much thinner in its shell-wall. The present species has coarse tubuli, such as is often present in *Gypsina*. The nature of the thick walls also reminds one of a similar character seen in *Carpenteria*. *Gypsina vesicularis*, var. *discus*, Goës,² may also be compared with the above species with regard to the depressed form of the test, especially in one of our specimens, where the peripheral edge is neatly rounded off.

? Lower Miocene: from a plateau between Cairo and Suez. Frequent.

POLYTREMA, Risso [1826].

POLYTREMA PAPYRACEA, sp. nov. (Pl. II, Fig. 5.)

Test adherent, consisting of layers of somewhat acervuline but much elongated chambers, extending along the plane of attachment. The test often attains the length of $\frac{1}{4}$ inch (6.25 mm.); greatest thickness, $\frac{1}{8}$ inch (.694 mm.).

A passage form between this species and the well-known recent *Polytrema miniaceum* (L.) has been found in certain Tertiary and recent limestones, and will shortly be described. The present species is distinguished by its limited extent and compressed lenticular shape.

¹ *Acervulina inhærens*, Schultze, 1854: "Organismus Polythal.," p. 68, pl. vi, fig. 12.

² Bull. Mus. Comp. Zool. Harvard, 1896, vol. xxix, No. 1 (xx), p. 74, pl. vii, figs. 4-6.

? Lower Miocene: from a plateau between Cairo and Suez. Frequent.

Family NUMMULINIDÆ.

Subfamily POLYSTOMELLINÆ.

NONIONINA, d'Orbigny [1826].

NONIONINA BOUEANA, d'Orbigny.

Nonionina Boueana, d'Orbigny, 1846: *Foram. Foss. Vienne*, p. 108, pl. v, figs. 11, 12.

This species is represented both by casts and sections in the Egyptian limestone. In the casts the retral processes of the segments are faithfully reproduced, and the umbilical protuberance is well shown. The general form of the test is subcircular, compressed, with a rather sharp keel, and numerous narrow chambers.

Fossil specimens of this shallow-water form have been recorded from the Oligocene of Germany and the Miocene of the Vienna Basin and Southern Italy; and I have lately identified a variety of this species in the Miocene of California.

? Lower Miocene: from a plateau between Cairo and Suez. Common.

With regard to the age of the foregoing species of foraminifera in the *Patellina*-limestone, should the exact stratigraphical horizon of the rock as Lower Miocene be confirmed, it is of much interest to note the general aspect of the fauna, which strongly tends to confirm this idea, although there are one or two exceptions, such as the presence of *Alveolinæ* found by Schwager much lower in the series (Libyan Stage) in Egypt. Since no Nummulites have been observed in our rock-specimens we cannot but regard the occurrence of the *Alveolinæ* as indicating an upward range of considerable extent.

LIMESTONE WITH *OPERCULINA*, ETC.

These specimens are labelled Box D, 5, 6, and 7 (1,257), near Erment, right bank of Nile Valley. Captain Lyons considers these beds to be of Pliocene age. The colour of the limestone is of a pale cream to a whitish tint. The foraminifera are not numerous in this rock, but *Operculina* may be detected on the fractured surfaces. In section the rock is a fine granular or crystalline limestone, with some included fragments of a denser and somewhat amorphous-looking limestone scattered through it, especially in specimen D 6. There are also traces of lamellibranch shells and echinoderm spines. The organisms in this rock are deposited very uniformly, their length coinciding with the plane of bedding, so that the sections taken at right angles to one another show the shells cut in two directions, longitudinal and transverse, in the separate slides. The foraminifera are fairly numerous, but rather small, and comprise the genera *Textularia*, *Globigerina*, *Gypsina*, *Amphistegina*, and *Operculina*.

FORAMINIFERA.

Family TEXTULARIIDÆ.

Subfamily TEXTULARIINÆ.

TEXTULARIA, Defrance [1824].

TEXTULARIA SAGITTULA, Defrance.

Textularia sagittula, Defrance, 1824: Dict. Sci. Nat., vol. xxxii, p. 177; vol. liii, p. 344; Atlas Conch., pl. xiii, fig. 5. Brady, 1844: Rep. Chall., vol. ix, p. 361, pl. xlii, figs. 17, 18.

Several sections of this species occur in the limestone. It is easily recognized by its elongated contour and numerous chambers.

T. sagittula has a wide range in time, being known as far back as the Aptian.

Pliocene: near Erment, right bank of Nile Valley. Frequent.

TEXTULARIA AGGLUTINANS, d'Orbigny. (Pl. II, Fig. 6.)

Textularia agglutinans, d'Orb., 1839: Foram. Cuba, p. 136, pl. i, figs. 17, 18, 32-34. Brady, 1884: Rep. Chall., vol. ix, p. 363, pl. xliii, figs. 1-3.

The specimen found in the limestone from Egypt is typical in form, but rather small. In the fossil condition this species occurs as far back as the Carboniferous Limestone formation.

Pliocene: near Erment, right bank of Nile Valley. One specimen.

Family GLOBIGERINIDÆ.

GLOBIGERINA, d'Orbigny [1826].

GLOBIGERINA CONGLOBATA, Brady.

Globigerina conglobata, Brady, 1879: Quart. Journ. Micr. Sci., vol. xix, n.s., p. 72; idem, 1884, Rep. Chall., vol. ix, p. 603, pl. lxxx, figs. 1-5; pl. lxxxii, fig. 5.

The examples of the above species found in the *Operculina*-limestone are fairly typical, but are somewhat rounder in outline than recent specimens. *G. conglobata* appears to make its first appearance in beds of Miocene age.

Pliocene: near Erment, right bank of Nile Valley. Frequent.

Family ROTALIIDÆ.

Subfamily TINOPORINÆ.

GYPSINA, Carter [1877].

GYPSINA VESICULARIS? (Parker & Jones).

Orbitolina vesicularis, Parker & Jones, 1860: Ann. Mag. Nat. Hist., ser. III, vol. vi, p. 31, No. 5.

Gypsina vesicularis (Parker & Jones), Carter, 1877: Ann. Mag. Nat. Hist., ser. iv, vol. xx, p. 173.

There is a fragment of a *Gypsina* occurring in one of our slides, which seems to come nearest to the structure seen in *G. vesicularis*; on the other hand, there is just the possibility that it is an irregular

example of the more regularly-built *G. globulus* (Reuss). Both species date from the Miocene.

Pliocene : near Erment, right bank of Nile Valley. A fragment.

Family NUMMULINIDÆ.

Subfamily NUMMULITINÆ.

AMPHISTEGINA, d'Orbigny [1826].

AMPHISTEGINA LESSONII, d'Orbigny.

Amphistegina Lessonii, d'Orb., 1826 : Ann. Sci. Nat., vol. vii, p. 304, No. 3, pl. xvii, figs. 1-4 ; Modèle, No. 98.

A. mamillata, d'Orb., 1846 : Foram. Foss. Vienne, p. 208, pl. xii, figs. 6-8.

A. rugosa, id. : ibid., p. 209, pl. xii, figs. 9-11.

A. gibbosa, Williamson, 1851 : Trans. Micr. Soc. Lond., ser. i, vol. iii, p. 110, pl. xvii, figs. 1, 2.

A. Lessonii, d'Orbigny : Parker, Jones, & Brady, 1865, Ann. Mag. Nat. Hist., ser. iii, vol. xvi, p. 34, pl. iii, fig. 92.

A. semicostata, Kaufmann, 1867 : Geol. Beschreib. des Pilatus, p. 149, pl. viii, fig. 18.

Hemistegina rotula, id. : ibid., p. 150, pl. viii, fig. 19.

A. Lessonii, d'Orb., Moebius, 1880 : Foram. Mauritius, p. 99, pl. x, figs. 10-14 ; pl. xi, figs. 1-3.

A. Parisiensis, Terquem, 1882 : Mém. Soc. géol. France, sér. iii, vol. ii, Mém. iii, p. 124, pl. xiii, figs. 3a, b.

A. Lessonii, d'Orbigny, Brady, 1884 : Rep. Chall., vol. ix, p. 740, pl. cxi, figs. 1-7.

The above synonymy refers especially to the thick varieties of *A. Lessonii*, since the examples met with in the *Operculina*-limestone belong to that group. The specimens are well-grown, and exhibit in all cases a well-developed cone of non-tubulous shell material.

Typical specimens of *A. Lessonii* date from the Eocene period, and they abound in some rocks of Miocene and Pliocene ages.

Pliocene : near Erment, right bank of Nile Valley. Frequent.

OPERCULINA, d'Orbigny [1826].

OPERCULINA AMMONOIDES (Gronovius). (Pl. II, Figs. 6, 7.)

Nautilus ammonoides, Gronovius, 1781 : Zooph. Gron., p. 282, No. 1,220, and p. v (expl. Tab.).

N. Balthicus, Schroeter, 1782, Naturforscher, vol. xvii, p. 120 ; 1783, Einleitung, vol. i, p. 20, pl. i, fig. 2.

Operculina complanata (Defrance), Parker & Jones, 1857 : Ann. Mag. Nat. Hist., ser. ii, vol. xix, p. 285, pl. xi, figs. 3, 4.

O. ammonoides (Gronovius), Parker & Jones, 1861 : Ann. Mag. Nat. Hist., ser. iii, vol. viii, pp. 229, 230.

Brady, 1884 : Rep. Chall., vol. ix, p. 745, pl. cxii, figs. 1, 2.

A. Silvestri, 1893 : Mem. Pontif. Accad. N. Lincei, vol. ix, p. 217, pl. vi, fig. 5.

Rupert Jones, 1897 : Mon. Foram. Crag, pt. iv, p. 364, pl. vii, figs. 34a, b. Also, var. *curvicamerata*, Jones, ibid., p. 365, pl. v, fig. 33.

The Egyptian specimens are neat and typically shaped. The septation, however, is rather more crowded and narrower than usual. In vertical section the test appears to be somewhat strongly limbate. In the limestones from near Erment this species is very common, but does not constitute a large proportion of the rock.

It is interesting to note that the previous geological occurrences of *O. ammonoides* agree with the age of these present rocks, since it has been met with in beds not older than the Pliocene of Calabria; it was also found in the English Coralline Crag, and it has been noted from the Pleistocene of Norway. As a recent organism it occurs in fairly shallow water, and has a wide geographical range, including the Mediterranean and the Gulf of Suez.

Pliocene: near Erment, right bank of Nile Valley. Very common.

EXPLANATION OF PLATE II.

- FIG. 1.—Limestone with *Patellina Egyptiensis*, sp. nov., and *Alveolina lepidula*, Schwager. ? Lower Miocene: between Cairo and Suez. $\times 12$.
 FIG. 2.—Vertical sections of *Patellina Egyptiensis*, showing the primordial spire. ? Lower Miocene: between Cairo and Suez. $\times 16$.
 FIG. 3.—Basal section of *Patellina Egyptiensis*, showing the central and cortical arrangement of the septa. ? Lower Miocene: between Cairo and Suez. $\times 16$.
 FIG. 4.—*Gypsina crassitesta*, sp. nov., vertical section. ? Lower Miocene: between Cairo and Suez. $\times 16$.
 FIG. 5.—*Polytremma papyracea*, sp. nov., median section. ? Lower Miocene: between Cairo and Suez. $\times 16$.
 FIG. 6.—Limestone with *Operculina ammonoides* (Gronovius) in median section, and *Textularia agglutinans*, d'Orb. From specimen D 5. Pliocene: near Erment, right bank of Nile Valley. $\times 13$.
 FIG. 7.—Limestone with *Operculina ammonoides* (Gronovius) in vertical section. From specimen D 5. Pliocene: near Erment, right bank of Nile Valley. $\times 15$.

SPECIES OF FORAMINIFERA DESCRIBED IN THIS PAPER.

- | | | |
|--|----|-------------------------------------|
| 1. <i>Biloculina bulloides</i> , d'Orb. | ? | L. Miocene: between Cairo and Suez. |
| 2. ,, ,, var. <i>inornata</i> , d'Orb. | ,, | ,, |
| 3. <i>Miliolina oblonga</i> (Montagu) | ,, | ,, |
| 4. ,, <i>subrotunda</i> (Montagu) | ,, | ,, |
| 5. ,, <i>trigonula</i> (Lam.) | ,, | ,, |
| 6. ,, <i>inflata</i> (d'Orb.) | ,, | ,, |
| 7. ,, <i>seminulum</i> (Linné) | ,, | ,, |
| 8. ,, <i>polygona</i> (d'Orb.) | ,, | ,, |
| 9. <i>Orbiculina adunca</i> (Fichtel & Moll) | ,, | ,, |
| 10. <i>Alveolina ellipsoidalis</i> , Schwager | ,, | ,, |
| 11. ,, <i>lepidula</i> , Schwager | ,, | ,, |
| 12. <i>Textularia agglutinans</i> , d'Orb. | | Pliocene: near Erment. |
| 13. ,, <i>sagittula</i> , DeFrance | | ,, |
| 14. <i>Bigenerina capreolus</i> (d'Orb.) | ? | L. Miocene: between Cairo and Suez. |
| 15. <i>Globigerina conglobata</i> , Brady | | Pliocene: near Erment. |
| 16. <i>Patellina Egyptiensis</i> , sp. nov. | ? | L. Miocene: between Cairo and Suez. |
| 17. <i>Discorbina globularis</i> ? (d'Orb.) | ,, | ,, |
| 18. <i>Truncatulina Ungeriana</i> (d'Orb.) | ,, | ,, |
| 19. <i>Gypsina vesicularis</i> ? (Parker & Jones) | | Pliocene: near Erment. |
| 20. ,, <i>crassitesta</i> , sp. nov. | ? | L. Miocene: between Cairo and Suez. |
| 21. <i>Polytremma papyracea</i> , sp. nov. | ,, | ,, |
| 22. <i>Nonionina Boueana</i> , d'Orb. | ,, | ,, |
| 23. <i>Amphistegina Lessonii</i> , d'Orb. | | Pliocene, near Erment. |
| 24. <i>Operculina ammonoides</i> (Gronovius) | ,, | ,, |

OSTRACODA.

- Bairdia subdeltoidea* (Münster) . . . ? L. Miocene: between Cairo and Suez.

memory green in the hearts of a large circle, to whom, although occupying quite humble positions, he had endeared himself for all time by calling them *his friends*.

TITLES OF PROF. RUSKIN'S PAPERS PRINTED IN THE GEOLOGICAL MAGAZINE.

1. "Notes on the Shape and Structure of some parts of the Alps, with reference to Denudation." Vol. II (1865), pp. 49-54 and 193-196, Pl. VI and Woodcuts.
2. "On Banded and Brecciated Concretions." Vol. IV (1867), pp. 337-339, Pl. XV.
3. "On Brecciated Formations." Vol. IV (1867), pp. 481, 482, Pl. XX.
4. "On Brecciated Concretions." Vol. V (1868), pp. 12-18, Pl. III and Woodcuts; pp. 159-161, Pl. X; and pp. 208-213, Pl. XIII and Woodcuts.
5. "On Brecciated Concretions." Vol. VI (1869), pp. 529-534, Pl. XIX and Woodcuts.
6. "On Banded and Brecciated Concretions." Vol. VII (1870), pp. 10-14, Pl. II and Woodcuts.

MISCELLANEOUS.

PRESENTATION OF A TESTIMONIAL TO THE REV. PROFESSOR WILTSHIRE, M.A., D.Sc., F.L.S., F.G.S., ETC., Honorary Secretary of the Ray and Palæontographical Societies.—A well-attended meeting of the members of the Palæontographical and Ray Societies was held at the Geological Society's Apartments, Burlington House, on Tuesday, December 19; the Rt. Hon. Sir John Lubbock, Bart.,¹ P.C., M.P., D.C.L., LL.D., F.R.S., President of the Ray Society, in the chair, supported by Dr. Henry Woodward, F.R.S., F.G.S., President of the Palæontographical Society. The object of the joint meeting was to present to the Rev. Prof. Wiltshire, the Hon. Secretary of both the above-named Societies, his portrait in oils, an illuminated address, and a cheque for £138—the balance of the sum subscribed after defraying expenses—in recognition of the services rendered by him to these Societies and to Palæontology and Zoology during a period of more than thirty years. The portrait was executed by Miss Atkinson, the illuminated address by Miss G. M. Woodward. Among those present were—The Right Rev. Bishop Mitchinson, Master of Pembroke, Oxford; Professor T. McKenny Hughes, F.R.S., and Professor W. J. Lewis, of Cambridge; the Rev. R. A. Bullen, the Rev. G. F. Whidborne, V.P. Pal. Soc., the Rev. H. H. Winwood, Dr. W. T. Blanford, F.R.S., Mr. John Hopkinson, Professor T. Rupert Jones, F.R.S., Sir Owen Roberts, Dr. D. H. Scott, F.R.S., Mr. F. W. Rudler, F.G.S., and Mr. A. Strahan; many ladies were also present. The presentation address was delivered by Sir John Lubbock, and the Rev. Professor Wiltshire responded. Speeches were also made by Dr. Woodward, Professor T. McKenny Hughes, Rev. G. F. Whidborne, and the Rev. H. H. Winwood; 132 subscribers took part in the testimonial.

CORRIGENDA.—In Mr. F. Chapman's paper on *Patellina*-limestone, which appeared in our last issue, the following corrections should be made: pp. 11, 12, and 17, for *Patellina Egyptiensis* read *Patellina Ægyptiensis*; pp. 13 and 17, for *Polytrema papyracea* read *Polytrema papyraceum*.—Also on p. 40, line 20 from foot, for "Applied Geology," read "Applied Geography."

¹ Now "Lord Avebury."

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JANUARY, 1900.

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