VIII.—*Additional Note on the Foraminifera of the London Clay exposed in the Drainage Works, Piccadilly, London, in* 1885.

By C. Davies Sherborn, F.G.S., and Frederick Chapman.

(*Read 8th May*, 1889.)

Plate XI.

In a former paper on this subject, published in the Journal for 1886, eighty-eight well-marked varieties of Foraminifera were described from the London Clay of Piccadilly, London, thus bringing up the total number of forms recorded from the formation to 136. In the present communication we briefly describe twenty-eight forms, twenty-one of which are new to the London Clay. The fact that one of our former "species" required further consideration and examination led us to manipulate the remainder of samples of the clay collected in 1885, and carefully re-examine our earlier washings, in the hope of finding more specimens worth attention. In this we were successful, and are now enabled to amend our views upon the form previously described as *Lagena oviformis*, and also to make some interesting additions to our knowledge of the London Clay foraminiferal fauna. All the specimens here described were obtained from the "black-bed" referred to at p. 740 of our former paper.

EXPLANATION OF PLATE XI.

Fig. 1.—*Miliolina trigonula* (Lamarck).
„ 2, 3. „ *venusta* (Karrer).
„ 4, 5.—*Cornuspira involvens*, Reuss.
„ 6. „ *carinata* (Costa),
„ 7.—*Ammodiscus incertus* (d'Orbigny).
„ 8.—*Haplophragmium agglutinans* (d'Orbigny).
„ 9.—*Thurammina papillata* Brady.
„ 10.—*Textularia agglutinans*, var. *porrecta* Brady.
„ 11.—*Clavulina parisiensis* d'Orbigny.
„ 12.—*Chilostomella ovoidea* Reuss.
„ 13. „ *oviformis* Sherborn and Chapman.
„ 14.—*Nodosaria simplex* Silvestri.
„ 15. „ *radicula*, var. *annulata* Terq. and Berth.
„ 16. „ „ var. *ambigua* Neugeboren.
„ 17, 18. „ *longiscata* d'Orbigny.
„ 19. „ sp.
„ 20. „ *oligotoma* Reuss.
„ 21, 22. „ *catenulata* Brady.
„ 23. „ *obliquata* (Batsch).
„ 24.—*Dentalina sulcata* (Nilsson).
„ 25.—*Vaginulina* sp. (? deformed).
„ 26. „ *legumen* (Linné), var.
„ 27.—*Marginulina attenuata* Neugeboren.
„ 28. „ *costata* (Batsch).
„ 29.—*Pullenia quinqueloba* (Reuss).
„ 30–32.—*Pulvinulina elegans* (d'Orbigny).
„ 33.—*Discorbina rugosa* (d'Orbigny).
„ 34.—*Anomalina grosserugosa* (Gümbel).

All figures are × 20.

(The specimens will be deposited in the British Museum.)

Miliolina Williamson [1858].

Miliolina trigonula (Lamarck), plate XI. fig. 1. *Miliolites trigonula* Lamarck, Ann. Muséum, v. (1804) p. 351, No. 8; *Triloculina trigonula* (Lam.) d'Orbigny, Ann. Sci. Nat., vii. (1826) p. 229, No. 1, plate xvi. figs. 5–9; Modèle, No. 93.—Common, but very small; the specimen figured is large in comparison with the others found in the Piccadilly Clay. Previously recorded from Sheppey and Haverstock Hill.

Miliolina venusta (Karrer), plate XI. figs. 2, 3. *Quinqueloculina venusta* Karrer, Sitz. k. Ak. Wiss. Wien, lvii. (1868) p. 147, plate ii. fig. 6.—Four individuals. New to the London Clay. Dr. Karrer's specimens came from the Miocene of Kostej.

Cornuspira Schultze [1854].

Cornuspira involvens (Reuss), plate XI. figs. 4, 5. *Operculina involvens* Reuss, Denkschr. k. Ak. Wiss. Wien, i. (1849) p. 370, plate xlv. fig. 20; *Cornuspira involvens* Reuss, Sitz. k. Ak. Wiss. Wien, xlviii. 1863, p. 39, plate i. fig. 2.—One specimen found by Mr. A. M. Davies in a sample of clay given him by one of us. Previously recorded from the London Clay of Sheppey by Mr. Shrubsole.

Cornuspira carinata (Costa), plate XI. fig. 6. *Operculina carinata* Costa, Atti Acc. Pontan., vii. (1856) p. 209, plate xvii. fig. 15 *a*, *b*. —One individual, which, though damaged, still preserves its characters. This specimen almost exactly corresponds to the form figured by Reuss, from the Septarienthon of Offenbach, as *C. Bornemanni*, Sitz. k. Ak. Wiss. Wien, xlviii. 1863, p. 39, plate i. fig. 3, which is the same form as *C. carinata* (Costa). New to the London Clay.

Haplophragmium Reuss [1860].

Haplophragmium agglutinans (d'Orbigny), plate XI. fig. 8. *Spirolina agglutinans* d'Orbigny, Foram. Foss. Vienne, 1846, p. 137, plate vii. figs. 10–12.—One example. New to London Clay.

Thurammina Brady [1879].

Thurammina papillata Brady, plate XI. fig. 9. Brady, Quart. Journ. Micr. Sci., xix. (1879) p. 45, plate v. figs. 4–8.—Not previously recorded from Tertiary beds. Dr. Haeusler * has described numerous varieties from the Jurassic of Switzerland, and Dr. Uhlig † from beds of the same horizon in Austria and Wurtemberg.

Ammodiscus Reuss [1861].

Ammodiscus incertus (d'Orbigny), plate XI. fig. 7. *Operculina incerta* d'Orbigny, Foram. Cuba, 1839, p. 71, pl. vi. figs. 16, 17.—

* Neues Jahrb., 1883 (1), p. 60; Annals Mag. Nat. Hist. 5, xi. 1883, p. 262; Quart. Journ. Geol. Soc., xxxix. 1883, p. 27; Neues Jahrb. BB iv. (1), 1885, p. 30.

† Neues Jahrb., 1882, p. 152.

One specimen. Previously recorded from four localities of the London Clay. (See the former paper, p. 760, *Trochammina*.)

Textularia Defrance [1824].

Textularia agglutinans d'Orbigny, var., plate XI. fig. 10. D'Orbigny, Foram. Cuba, 1839, p. 136, plate i. figs. 17, 18, 32–34. —This variety of *T. agglutinans*, with its rounded chambers and subcylindrical form, is comparable with Brady's var. *porrecta* (Report, 'Challenger,' 1884, p. 364, plate xliii. fig. 4).

Clavulina d'Orbigny [1826].

Clavulina parisiensis, d'Orbigny, plate XI. fig. 11. D'Orbigny, Ann. Sci. Nat., vii. (1826) p. 268, No. 3; Modèle, No. 66.—The specimen mentioned at p. 743 of our former paper is here figured, and is the only example found which shows the characteristic triangular shape of the early chambers. Dr. Brady mentions its occurrence in abundance in the London Clay near Clapham Common.*

Chilostomella Reuss [1849].

Chilostomella ovoidea Reuss, plate XI. fig. 12. Reuss, Denkschr. k. Ak. Wiss. Wien, i. (1849) p. 380, plate xlviii. fig. 12 *a–e*.—One specimen. New to the London Clay.

Chilostomella oviformis Sherborn and Chapman, plate XI. fig. 13. *Lagena (Obliquina) oviformis*, Sherborn and Chapman, Journ. R. Micros. Soc., ser. 2, vi. 1886, p. 745, plate xiv. figs. 19 *a–d*.—The erroneous reference of this form to *Lagena* was principally due to the fact that the interiors of the specimens described were occupied by sand. We have now been so fortunate as to secure a few more specimens which have the internal structure preserved, and we have no hesitation in referring the form to *Chilostomella*. This is also the opinion of Dr. Brady who has kindly examined our specimens. The interest of this form of *Chilostomella* lies in the fact that the successive external chamber envelopes the whole of the previous structure, and thus presents what appears to be a test of a single chamber. We give a dotted outline of the internal structure restored from several partially perfect individuals, and have nothing to add to the original description of the exterior.

Nodosaria Lamarck [1816].

Nodosaria simplex Silvestri, plate XI. fig. 14. Silvestri, Atti Acc. Gioenia Sci. Nat., vii. (1872) p. 95, plate xi. figs. 268–72.—One small individual. New to the London Clay.

Nodosaria radicula, var. *annulata* Terquem and Berthelin, plate XI. fig. 15. *Glandulina annulata* Terq. & Berth., Mém. Soc. Géol. France, sér. 2, x. (1875) Mém. 3, p. 22, plate i. fig. 25.—One example. New to the London Clay.

* Report 'Challenger,' 1884, p. 395.

Nodosaria radicula, var. *ambigua* Neugeboren, plate XI. fig. 16. *Nodosaria ambigua* Neugeboren, Denkschr. k. Ak. Wiss. Wien, xii. (1856) p. 71, plate i. figs. 13–16.—Two or three examples. Not previously recorded from the London Clay.

Nodosaria longiscata d'Orbigny, plate XI. figs. 17, 18. D'Orbigny, Foram. Foss. Vienne, 1846, p. 32, plate i. figs. 10, 11. *Nodosaria arundinea* Schwager, Sherborn and Chapman, Journ. R. Micros. Soc., ser. 2, vi. (1886) p. 747, plate xiv. figs. 28, 29. *Nodosaria longiscata* d'Orbigny, Brady, Quart. Journ. Geol Soc., xliv. 1888, p. 6.—Since the critical remarks, in our former paper, on d'Orbigny's figures, Dr. Brady has kindly shown us some of the original specimens examined by d'Orbigny, sent to him by Dr. Karrer, of Vienna. We have therefore had the opportunity of verifying Dr. Brady's conclusion that d'Orbigny, although he figured only the "sugar-loaf" form, included the whole of these smooth, slender, reed-like Nodosariæ in one "species." We are much indebted to Dr. Karrer and Dr. Brady for the examination of this form, as the varying conditions of the chambers have unfortunately given rise to almost endless specific naming. Fig. 18 is the particular variety which was named by Terquem *N. sublongiscata* * ; it shows four chambers, and is unusually perfect compared with the specimens generally found in the London Clay. Fig. 17 is an interesting example, showing the initial chambers.

Nodosaria sp., plate XI. fig. 19.—The internal cast of two chambers of a Nodosarian, the upper of which shows fine longitudinal striæ.

Nodosaria oligotoma Reuss, plate XI. fig. 20. Reuss, in Geinitz, Palæontographica, xx. part 1 (1872) p. 135, plate xxxiii. fig. 16.—One of the numerous varieties of Linné's *Nodosaria raphanus*, figured by Reuss as *N. oligotoma*. One specimen. New to the London Clay.

Nodosaria catenulata Brady, plate XI. figs. 21, 22. Brady, Report, 'Challenger,' 1884, p. 515, plate lxiii. figs. 32–34.—The two fragments figured are all that were found. New to the London Clay.

Nodosaria obliquata (Batsch), plate XI. fig. 23. *Nautilus obliquatus* Batsch, Sechs Kupfertafeln Conch. Seesandes, 1791, plate ii. figs. 5 *a*, *b*, *c*.—Two fragments only found. New to the London Clay.

Dentalina d'Orbigny [1826].

Dentalina sulcata (Nilsson), plate XI. fig. 24. *Nodosaria sulcata* Nilsson, Petrif. Suecana, pt. 1, 1827, p. 33, plate ix. fig. 19.—Only the fragment figured was found. Not previously recorded from the London Clay.

Vaginulina d'Orbigny [1826].

Vaginulina legumen (Linné), var., plate XI. fig. 26. *Nautilus legumen* Linné, Syst. Nat., ed. 10, 1758, p. 711, No. 248.—This elegant little specimen we regard as a variety of Linné's well-characterized "species."

* Mém. Ac. Imp. Metz, xlii. (1862), p. 437, figs. *a*, *b*, in text.

Vaginulina sp. plate XI. fig. 25.—A small, compressed, and deformed (?) Nodosarian of doubtful relationship.

Marginulina d'Orbigny [1826].

Marginulina attenuata Neugeboren, plate XI. fig. 27. Neugeboren, Verh. Mitth. Siebenbürgen Ver. Nat., Jahrg. ii. (1851) p. 121, plate iv. figs. 3–6.—The name *M. attenuata* may reasonably be made to include the whole of the unornamented elongated *Marginulinæ* figured by Neugeboren on his plate iv. Indeed, in his later paper (ibid., Jahrg. xi. 1860, p. 55) he has referred three of his former species (*M. Orbignyana*, *M. Reussiana*, and *M. irregularis*) to *M. attenuata*, thus showing that he did not then agree with the specific value of gradational varieties. Our specimen is the only one found. Not previously noted from the London Clay.

Marginulina costata (Batsch), plate XI. fig. 28. *Nautilus* (*Orthoceras*) *costatus*, Batsch, Sechs Kupfertafeln Conch. Seesandes, 1791, p. 2, plate i. figs. 1 *a–g*.—Only this specimen found. New to the London Clay.

Pullenia Parker and Jones [1862].

Pullenia quinqueloba (Reuss), plate XI. fig. 29. *Nonionina quinqueloba* Reuss, Zeitschr. Deutsch. Geol. Ges., iii. (1851) p. 47, plate v. figs 31 *a*, *b*.—Only one specimen of this slightly compressed form has been found; it shows, however, all the characteristics of Reuss's variety. New to the London Clay.

Discorbina Parker and Jones [1862].

Discorbina rugosa (d'Orbigny), plate XI. fig. 33. *Rosalina rugosa* d'Orbigny, Foram. Amér. Mérid., 1839, p. 42, plate ii. figs. 12–14.—One specimen, which has lost the final chamber, occurs in the Piccadilly washings. New to the London Clay.

Anomalina d'Orbigny [1826].

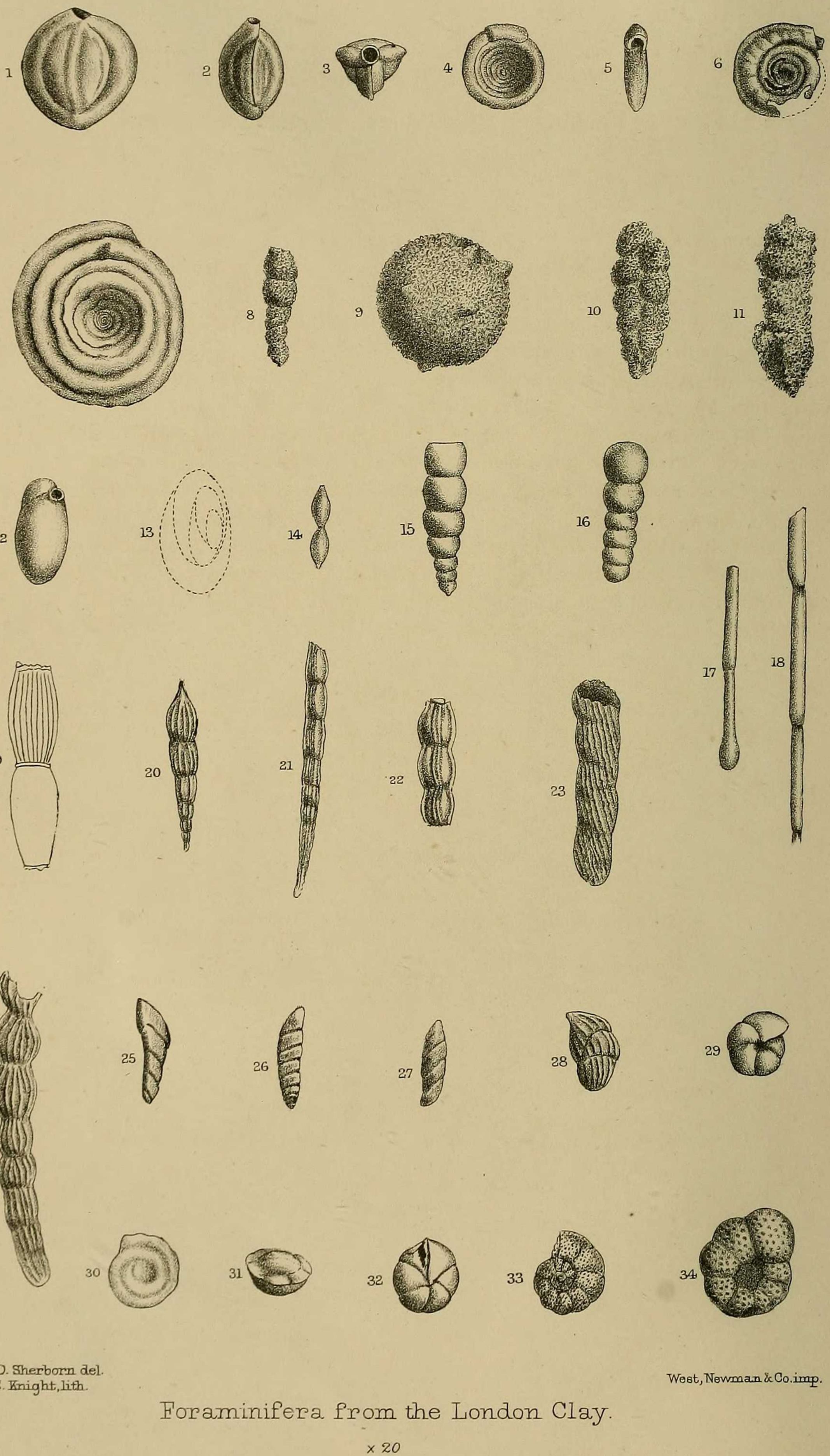
Anomalina grosserugosa (Gümbel), plate XI. fig. 34. *Truncatulina grosserugosa* Gümbel, Abh. k.-bay. Ak. Wiss., x. (1868) p. 660, plate ii. fig. 104 *a*, *b*; *Anomalina* sp. Sherborn and Chapman, Journ. R. Micros. Soc., ser. 2, vi. (1886) p. 757, fig. 156.—Having found more specimens of this form, we are able to assign it definitely to Gümbel's "species," according to the suggestion expressed in our former paper.

Pulvinulina Parker and Jones [1862].

Pulvinulina elegans (d'Orbigny), plate XI. figs. 30–32. *Rotalia* (*Turbinulina*) *elegans* d'Orbigny, Ann. Sci. Nat., vii. (1826) p. 276, No. 54; *Pulvinulina elegans* (d'Orbigny), Brady, Report 'Challenger,'

ix. (1884) p. 699, plate cv. figs. 3 *a*, *b*, *c*.—Numerous small specimens of this form, which, according to Parker, Jones, and Brady,* passes insensibly into *P. Partschiana* d'Orbigny, occur in our last washings. It has previously been recorded by Professors Rupert Jones and Parker from the London Clay of the bed of the Thames at Chelsea, and from Wimbledon.

* The *Pulvinulina elegans* group, including *P. Partschiana*, were fully treated of by Parker and Jones in 1865. Phil. Trans., clv. pp. 392, 393, 397, pl. xvi. figs. 44–46.



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Foraminifera from the London Clay.

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A. W. BENNETT, M.A., B.Sc., F.L.S.,
Lecturer on Botany at St. Thomas's Hospital,

F. JEFFREY BELL, M.A., F.Z.S.,
Professor of Comparative Anatomy in King's College,

JOHN MAYALL, Jun., F.Z.S.,

R. G. HEBB, M.A., M.D. (*Cantab.*),

AND

J. ARTHUR THOMSON, M.A.,
Lecturer on Zoology in the School of Medicine, Edinburgh,

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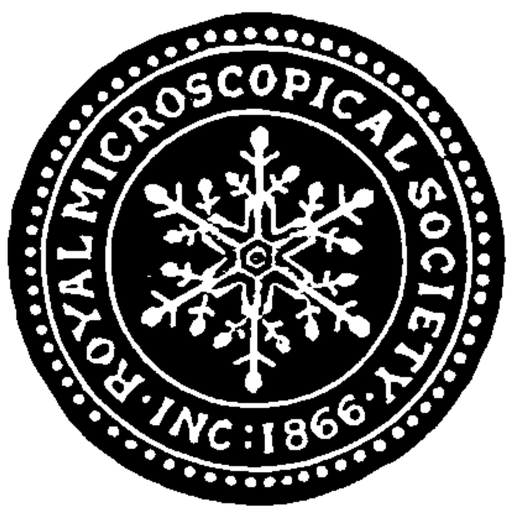

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