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XVIII.—On the nomenclature of the Foraminifera

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XVIII.—*On the Nomenclature of the Foraminifera.* By W. K. PARKER, F.R.S., T. RUPERT JONES, F.G.S., and H. B. BRADY, F.L.S., F.G.S.

[Continued from vol. iv. p. 392.]

Part XIV.—*The Species enumerated by D'Orbigny in the 'Annales des Sciences Naturelles,' 1826, vol. vii.**

IV. *The Species founded upon the Figures in Soldani's 'Testaceographia ac Zoophytographia.'*

[Plates VIII.—XII.]

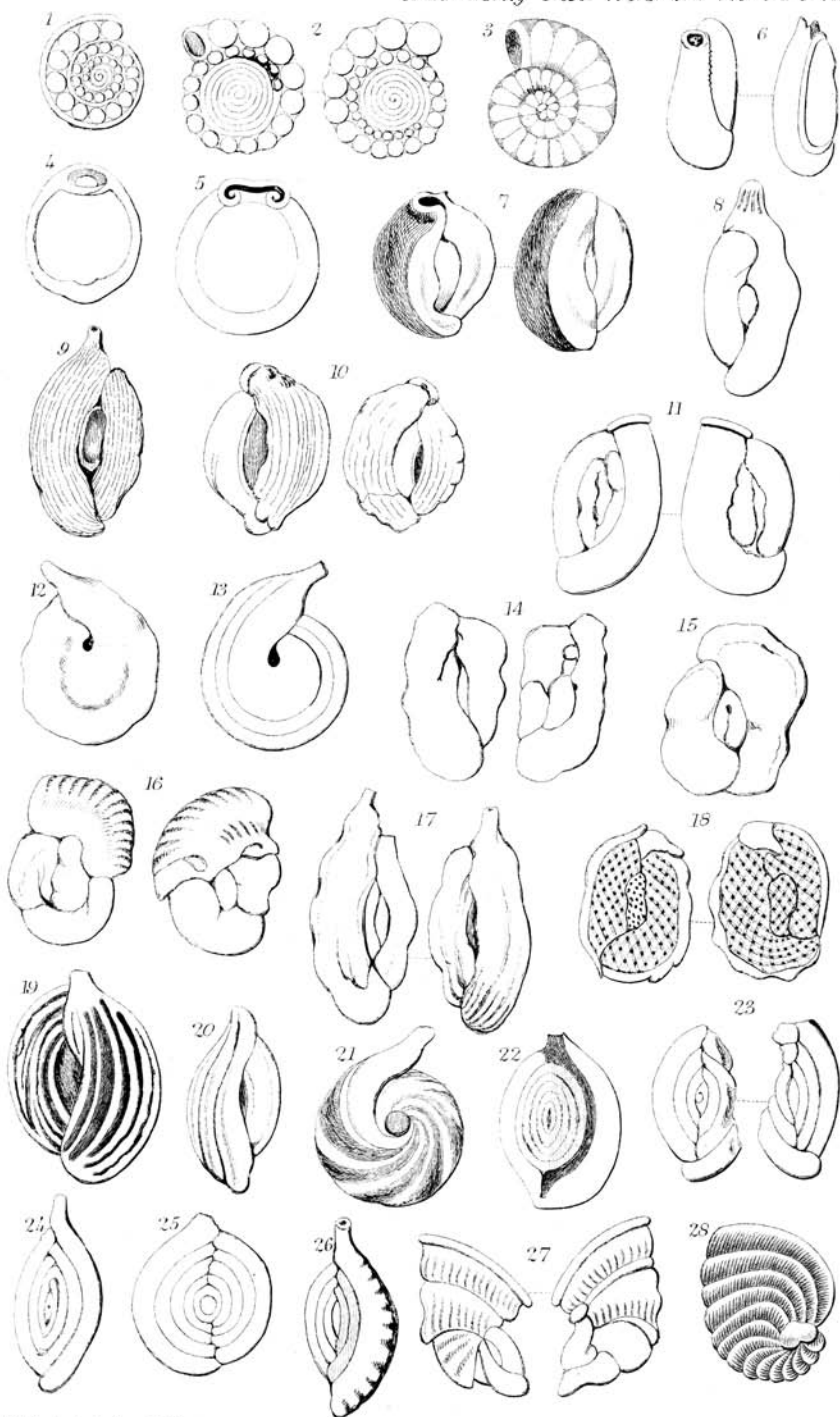
WITH all its faults, and they are neither few nor small, the 'Tableau Méthodique' by Alcide Dessalines D'Orbigny † must be regarded as the alphabet of the nomenclature of the Foraminifera. It is true that a considerable number of the specific names therein enumerated, and accepted by naturalists, are derived from treatises of earlier date (a few from Linné, Batsch, Walker, and Montagu; a larger series from Fichtel and Moll, Lamarek, and Defrance): but these specific terms were mostly picked out, one here, another there, from figured associates with which they have no real relationship. From this statement we might except Fichtel and Moll's beautifully illustrated memoir, all the figures in which, save the first, refer to the Foraminifera ‡, and Batsch's 'Sechs Kupfertafeln,' which are exclusively devoted to the same family §; but it is to be remembered that the former is only an instalment of an

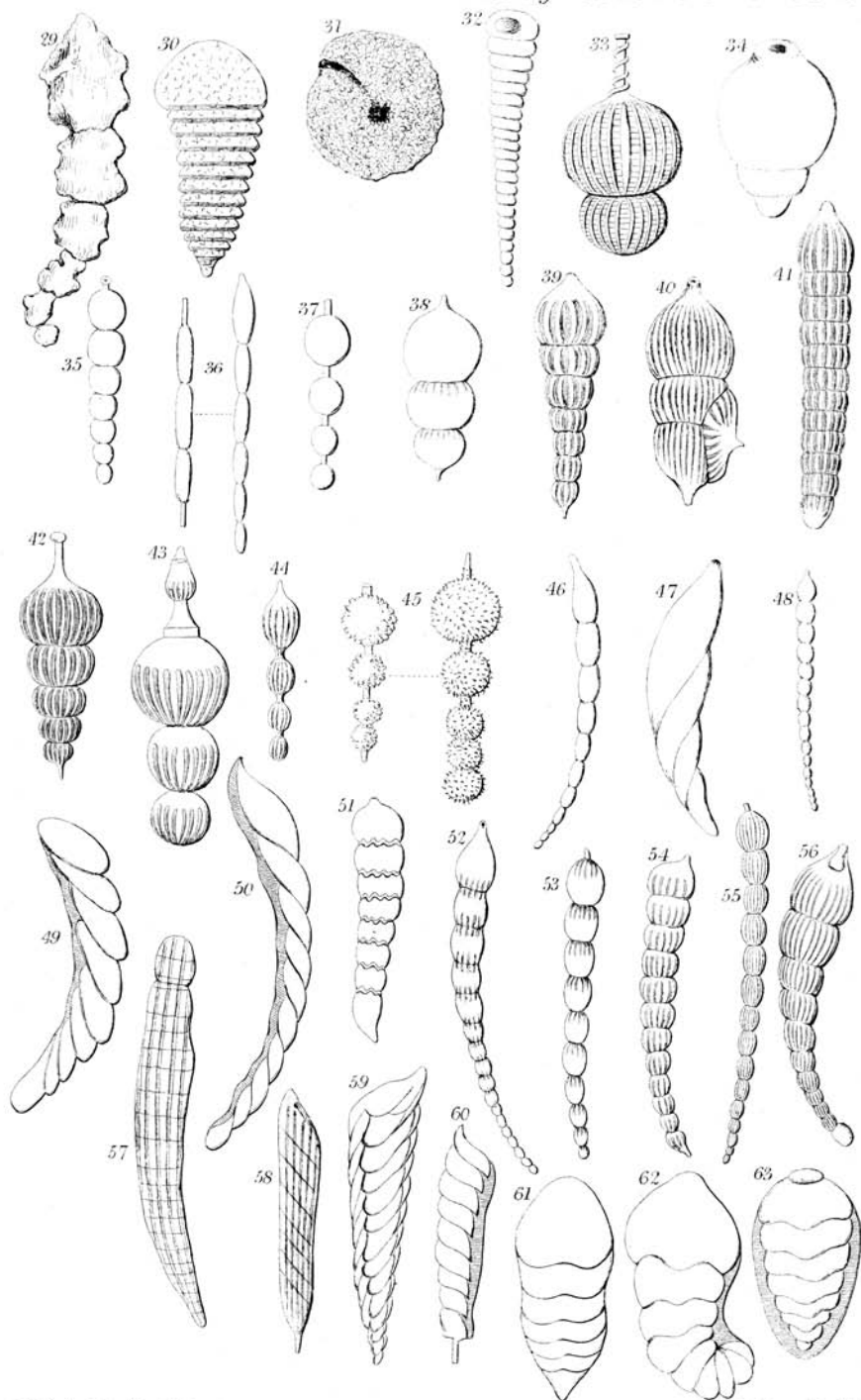
* Continued from Ann. Nat. Hist. ser. 3. vol. xvi. p. 41.

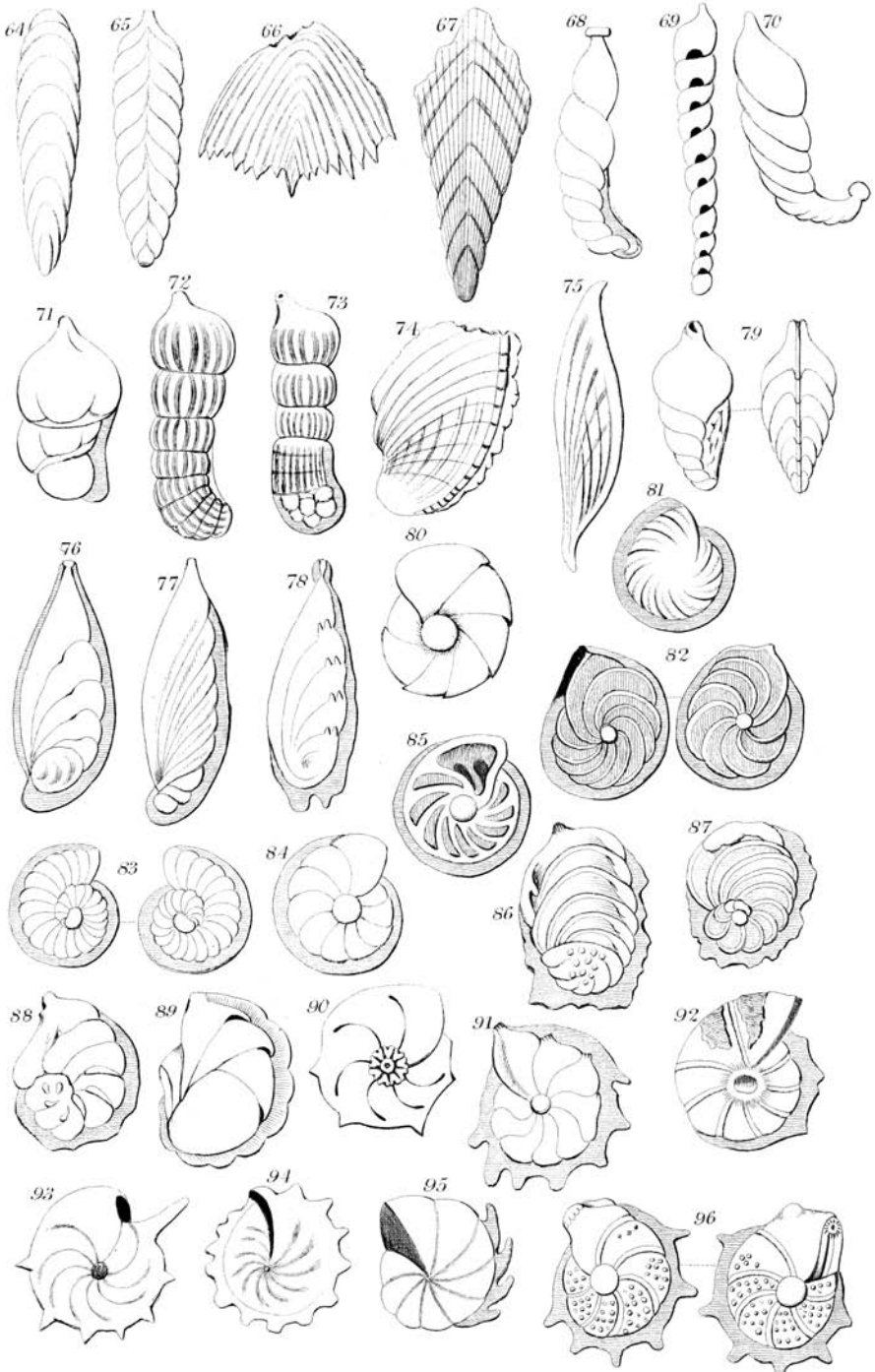
† See Ann. Nat. Hist. ser. 3. vol. xii. p. 429.

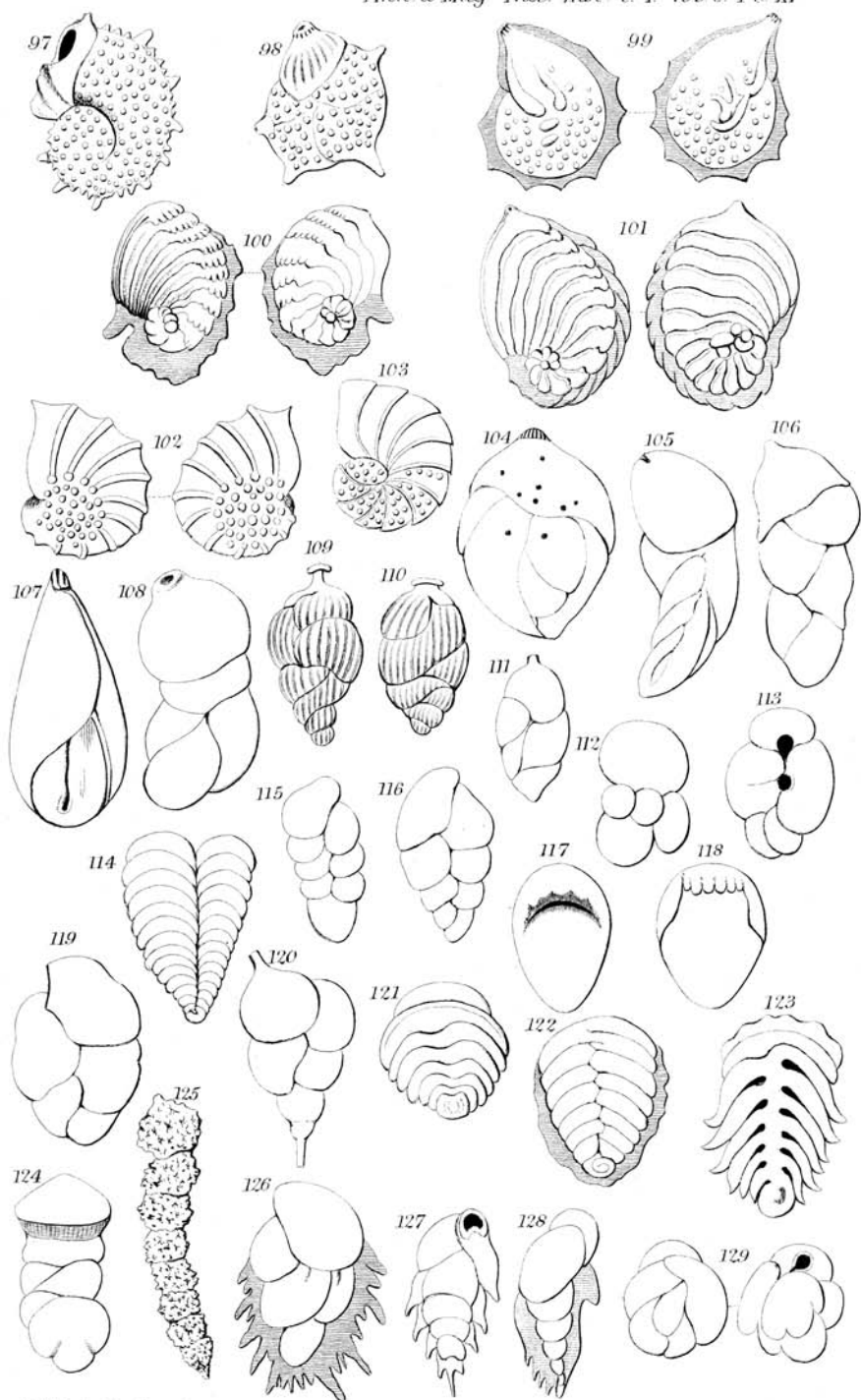
‡ See Ann. Nat. Hist. ser. 3. vol. v. pp. 98–116, and pp. 174–183.

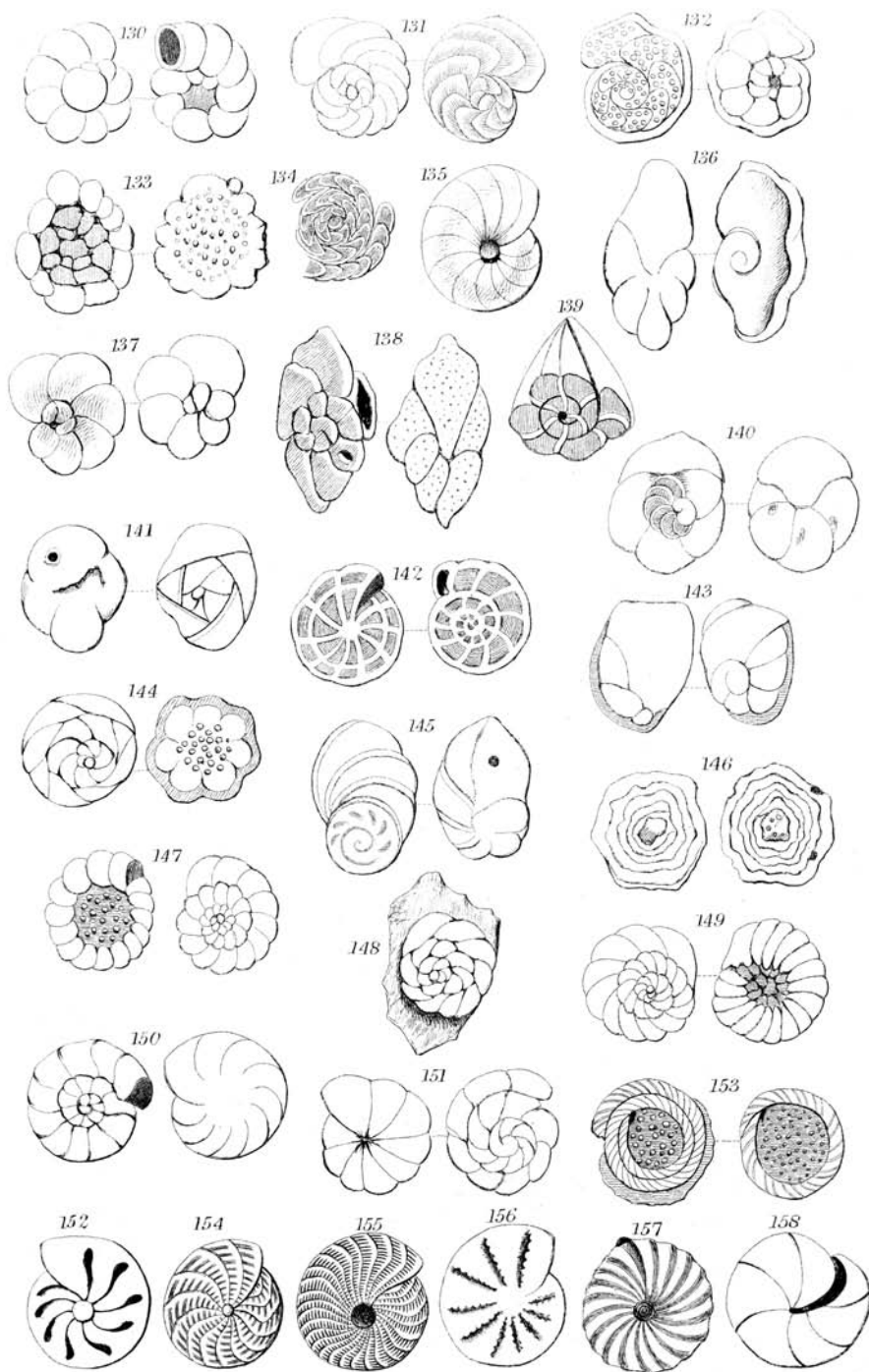
§ *Ibid.* vol. xv. pp. 225–232.











unfinished work, and the latter represents, in all, something less than a score of species without arrangement or reference to each other.

In the 'Tableau Méthodique,' however, not only are the Foraminifera separated (though on wrong grounds) from their supposed congeners, but all the species known up to the time of its publication are grouped in a perfectly intelligible though artificial way. It is, in point of fact, a classified index to about 550 species, with copious references to figures and descriptions given by earlier writers, and illustrated by seven excellent plates of well-selected typical forms.

In two previous papers (Parts X. and XII. of the present series; see Ann. Nat. Hist. Dec. 1863 and July 1865 respectively) some portions of the 'Tableau' have been critically reviewed, namely:—1st, the species (sixty-three in number) adopted from earlier authors, with four others named by D'Orbigny from previously published figures (except Soldani's); 2ndly, the twenty-six species of which drawings are given in the plates appended to the memoir (Ann. Sci. Nat. vol. vii. plates 10–17*); and, 3rdly, species, a hundred in number, illustrated by models†. Our present task, the longest and most difficult, perhaps also the most important, is to give the result of a critical examination of the species based upon the figures in Soldani's 'Testaceographia.'

For reasons which will appear as we proceed, the Soldanian forms named by D'Orbigny have never received proper recognition from naturalists; we are glad therefore to be able to append to the present synopsis a set of outlines, carefully reduced from the figures in the 'Testaceographia' referred to in the 'Tableau Méthodique,' which, as there is often a difficulty in obtaining access to the originals, may form a useful basis for future students.

A few words at the outset on the work itself and its author can scarcely be out of place.

Of Soldani's personal history we know but little, and that

* Ann. Nat. Hist. ser. 3. vol. xii. p. 438 &c. In this critical notice, one species (No. 11, *Heterostegina depressa*, p. 305. no. 2, pl. 17. figs. 5–7) was inadvertently omitted.

† See Ann. Nat. Hist. ser. 3. vol. xvi. pp. 15 *et seq.*, pls. 1–3. The four livraisons of 100 models seem to have been followed by another livraison (5^{me}), which we have not seen. It is referred to in the 'Monograph of the Foraminifera of Cuba,' p. xxi, *note*; and Modèle No. 113, livr. 5 (*Citharina*), and Modèle No. 114, livr. 5 (*Hauerina*) are mentioned at p. xxxvii and p. xxxviii respectively. A second edition of the models is noticed as having been brought out, in 1843, by Prof. W. C. Williamson, in the bibliographic list, p. 103, of his "Monograph Rec. Brit. Foram." (Ray Soc.).

chiefly from the biographical article* by De Angelis in the 'Bibliographie Universelle,' Supplement, vol. xliii. 1825.

Of the two works with which Soldani's name is chiefly connected, the smaller and less important was published first. It is entitled 'Saggio orittografico ovvero Osservazioni sopra le Terre nautilitiche ed ammonitiche della Toscana,' is dedicated to the reigning Grand Duke of Tuscany, and dated from Sienna, 1780. This was but preliminary to the greater effort; and as the principal part of the volume and nearly all the plates were reprinted as an Appendix to the 'Testaceo-

* SOLDANI (AMBROISE), naturalist, born at Prato-Vecchia, in Tuscany, about 1736. Entered the order of St. Romuald, and, whilst pursuing his religious duties, found time to devote himself to geological research, particularly in respect to microscopic shells and the evidences they appeared to afford of ancient changes in the earth's surface. Boys and Walker in England, Fichtel and Moll in Germany, and Bianchi (Janus Plancus) in Italy, had already begun to appreciate the importance of this branch of natural history; and, impressed with the same view, Soldani began early to study the minute organisms which exist in myriads in the strata of the hills about Sienna and Volterra. His first work on the subject obtained for him, on the one hand, the protection of the Grand Duke of Tuscany, who nominated him to the Professorship of Mathematics in the University of Sienna, and, on the other, the criticism of certain savants, who reproached him with want of order and exactitude in the classification of his fossils and the localities set down for them. These reproaches were but little deserved, as his avowed object had been to collect materials only, leaving the question of systematic arrangement to others, having been discouraged by the imperfection of the old systems from adopting any of them. The classification of Linné was not sufficiently detailed to embrace the new species, and that of Müller, based on the organization of the Mollusca, presented obstacles in its application to animals of which, though similar in some points of external appearance, the anatomy was still very imperfectly understood.

Soldani, however, was not deceived as to the real wants of geology; and he prepared to accumulate facts, with the intention of publishing his geological descriptions on the plan adopted by Cuvier and Brongniart for the environs of Paris. Why this project was relinquished, after having been partially carried out, is not known.

In 1794, his talent for observation was turned in another direction by a shower of *aërolites* which fell in that year near Sienna, and he devoted himself to the study of the phenomena of *aërolites*, volcanoes, and earthquakes. His publications on these meteorological subjects brought him into collision with the leading physicists of his day, though in the end he did not fail to secure the admiration of his fellow-labourers in science and the esteem of the religious fraternity to which he belonged. The former nominated him as Perpetual Secretary to the Academy of the "Fisiocritici" of Sienna; the latter advanced him to the dignity of General of the Order of the Camaldules. He died in Florence, July 14, 1808; and his funeral *éloge* was pronounced by his fellow-worker Bianchi.

It is needless to add the list of his works, of which eight are mentioned by De Angelis: the first two alone, the 'Saggio orittografico' and the 'Testaceographia ac Zoophytographia' are concerned in the subject of the present paper.

graphia,' and subsequent references to them are made in this relation, we need not dwell further upon it.

The book with which we are at present concerned, the *magnum opus* of the author, is the 'TESTACEOGRAPHIA.' This monument of patient labour and accurate observation consists of two folio volumes*, illustrated by 228 plates engraved on copper†. It was published at Sienna between the years 1789 and 1798, and is now extremely rare. We have heard that a considerable portion of the edition was burnt as unsaleable, but we cannot vouch for the truth of the statement. Of its scarcity at the present day, however, there can be no doubt. Eight or ten years ago, the late Dr. Falconer purchased in Italy the copy now in the library of the Royal Society; and more recently the Literary and Philosophical Society of Newcastle-upon-Tyne has obtained from a German source a fine copy that appears to have been presented by Soldani to one of his friends. These are the only perfect examples‡ of the work which we know of in this country; and we would here express our thanks to the Council of the Royal Society and to the Committee of the Literary and Philosophical Society of Newcastle for the protracted loan we have enjoyed of their respective copies during the preparation of the present paper.

The following is a brief summary of the contents of this

* Usually found in *four* volumes, the *first* having been issued in three parts, separate, but consecutively paged.

† The elegance of the engraved dedications and subsidiary titlepages deserves remark; and we must draw attention to the vignettes No. 1 (by Cyrus Sanctius) at page 1 of vol. i.; No. 2, on the titlepage of part 2. vol. i. (repeated in part 3); and No. 3, on the titlepage of vol. ii., not only as pictures of the reverend naturalist and some of his friends and acquaintances, and as illustrations of the costumes and magnifying-glasses of the last century, and of the internal arrangements of Soldani's own cabinet, with the artist at work and congenial friends around (in No. 1), but also as depicting characters and habits of far greater persistence than the individuals and furniture surrounding the enthusiastic microscopist of Sienna. In No. 2 especially has the artist fixed with the strongest lines of satire the earnest patience of the enlightened and willing teacher,—the dullness of the would-be learner, clever by nature, but blunted by years of respectable ignorance of every thing but diplomacy or trade,—the politely masked but almost utter *insouciance* of the well-to-do nobody,—and the self-satisfied, contemptuous, blank ignorance of the ecclesiastic. No. 3 illustrates a group of gentlemen more or less interested in the minutæ shown them in the microscope by perhaps Soldani himself. Their interest in the matter varies much: one is willingly attentive; one almost repents of his having come; and the third is making his adieux with real or feigned admiration of the little curiosities he leaves upon the table.

‡ Two parts only (vol. i. parts 1 & 2) are in the British Museum.

rare work, with the titles of the volumes exactly as they stand in the original:—

Vol. i. part 1. Testaceographiæ ac Zoophytographiæ parvæ et microscopiciæ tomus primus, in quo minuta et minima testacea ac zoophyta maris nativa in tres classes distributa vasculis inclusa æneisque tabulis insculpta describit et explicat Ambrosius Soldani in regio Senarum lycæo matheseos professor. Accedit supplementi loco analysis marini sedimenti ex diversis locis collecti, quæ omnia novum veluti Museolum conficiunt. Senis, MDCCLXXXIX. Super. Perm. In typographia Francisci Rossi. Prostat Florentiæ apud Josephum Molini.

Index rerum quæ hoc volumine continentur, p. xxxi.

Classis prima: Testæ Univalves non polythalamæ.

Caput I. Cochleæ, cum quibusdam earum Operculis; ubi de Turbinibus, ut dicunt, sinistrorsum versis. Pp. 1 &c. Pl. 1–22. [Young Gasteropods and a few Foraminifera.]

Cap. II. Patellæ, Auris Marina, aliæque Testæ Univalves in se complicatæ. Pp. 26 &c. Pl. 23–25 (part). [Limpets &c.]

Cap. III. Testæ Tubuliticæ ac Vermiculares, etiam cochleatæ pseudoparasiticæ. Pp. 29 &c. Pl. 25 (part)–32. [Pteropods, Dentalia, Serpulæ, Nubeculariæ, &c.]

Classis secunda: Testæ polythalamæ et uniloculares minimæ.

Cap. IV. Nautili et Hammoniæ (“Ammoniæ” in the text). Pp. 35 &c. Pl. 33–63. [Foraminifera. Fossil specimens in pl. 55–63.]

Cap. V. Exuviæ Marinorum Vermium Nautiliformes et Hammoniformes, seu Nautilis et Hammoniis persimiles. (Aliæ Testæ Hammoniformes, seu exuviæ marinorum Vermium memoratis Nautilorum et Hammoniarum generibus similes. Ubi de testis pseudo-parasiticis, et Pediculis Pinnarum.) Pp. 69 &c. Pl. 64–93. [Foraminifera.]

Vol. i. part 2. Testaceographiæ &c., tomi primi pars altera, in qua &c. insculpta describere et explicare pergit Ambrosius Soldani in regio Senarum lycæo matheseos professor. Senis, MDCCXCI. Super. Perm. &c.

Caput VI. De Orthoceratiis* diversæ speciei ac formæ. Pl. 94–108. [Foraminifera: “Orthoceratia.”]

Cap. VII. Testæ Multiloculares, vel Uniloculares minimæ, pleræque vitreo-lucidæ; figura cordiformes, globosæ, subglobosæ, globuliferæ, item ovals, piriformes, fusiformes, &c. (Polymorpha, seu Testæ Cordiformes, Subcordiformes, Sphæricæ, Oviformes, Oliviformes, Pyriformes; item Tuberosæ, Globuliferæ, &c., Polythalamæ, vel Monothalamæ; fere omnes minimæ.) Pp. 101 &c. Pl. 109–133. [Foraminifera. “Testæ polymorphæ,” pl. 109–131; “Polymorpha,” pl. 132, 133.]

Dissertatio geologica de Agro Clusentinate et Valdarnensi. Pl. 134–141 (“Fossilia Dissertationis”); pl. 142, “Lapididina Fessu-

* The word “Orthoceratium” (as well as the word “Orthoceras”) is used as a nominative noun by Soldani; and the plural nominative of both words is with him *Orthoceratia*.

lana." [Pl. 134-137, mostly Foraminifera; 138-141, fossil wood, corals, &c.]

Vol. i. part 3. Testaceographiæ &c. tomi primi pars tertia, in qua &c. describit et explicat Ambrosius Soldani &c. Accedit Supplementum analysim continens marini sedimenti. Senis, MDCCXCV. Super. Perm. In typographia Francisci Rossi. Prostant Florentiæ apud Josephum Molini fasciuli octo.

Classis tertia. Testæ Bivalves, sive Conchulæ; item Echini; Frumentaria; Corpuscula maris dubia; ac Zoophyta.

Caput VIII. Testæ Bivalves, sive Conchulæ; ubi de Echinis, eorumque Aciculis minimis. Pp. 209 &c. Pl. 143-151. [Pl. 147 & 148 (part), Ostracoda; pl. 149 (part), 150, 151 (part), Brachiopods.]

Cap. IX. Frumentaria diversæ speciei ac formæ. Pp. 223 &c. Pl. 152-160. [Pl. 152-159, 160 (part), *Miliola*; pl. 160 (part), *Cornuspira*.]

Cap. X. Corpuscula maris *Dubia* et *Incerta*: item Zoophyta vel Lithophyta quædam, eorumque partes. Pp. 235 &c. Pl. 161-179. [Foraminifera, Polyzoa, Echinoderms, &c.)

Supplementum Analysim continens Marini Sedimenti.

Cap. XI. De Limo, qui latet in fundo Maris. Pp. 252 &c.

Cap. XII. De Concretionibus Zoophyticis, earumque testaceo pulvere. Pp. 261 &c.

Cap. XIII. De Sedimine Maris litoreo, ejusque arenulis. Pp. 265. Index. Pp. 275 &c.

Vol. ii. Testaceographiæ ac Zoophytographiæ parvæ et microscopiciæ tomus secundus, in quo minutas Testas maris fossiles, item lacustres, earumque varietates Iconibus ære inculptis exprimit, ac geologicis et oryctographicis Animadversionibus illustrat Ambrosius Soldani, in Regia Senensi Universitate Matheseos Professor. Accedit ad majorem totius operis Illustrationem Appendix, quæ est in fine Opusculi *Saggio orittografico** olim editi, cum ejusdem Tabulis æneis xxiii. Senis, MDCCXCVIII. Super. Perm. In Typographia Francisci Rossi et Filii. Prostant Florentiæ apud Josephum Molini.

Sectio prima. De Testis fossilibus, ac Sedimentis origine marinis.

Caput I. De argilla Sanquiricensi, ejusque testis minutis. Pp. 1 &c. Pl. 1-6. [Foraminifera.]

Cap. II. De terra prope Senas locis dictis *i Donnini* et *il Cerajolo*;

* *Saggio orittografico*, ovvero Osservazioni sopra le terre Nautilitiche ed Ammonitiche della Toscana. Con Appendice o Indice Latino Ragionato de' piccoli Testacei, e d' altri fossili d' origine marina per schiarimento dell' Opera. Dedicato &c. dal Padre D. Ambrogio Soldani, Abbate Camaldolese. In Siena, MDCCLXXX. (Pp. 146, tabb. 25.)

This edition has two more plates (Bovine Bones &c.) than above indicated; and the text of the Appendix in the 1780 edition has seven additional paragraphs of description besides those in the reprint in 'Testaceographia,' vol. ii., besides having much fuller details.

ubi de Abyssio Maris. Pp. 26 &c. Pl. 7-16. (Mollusks, Ostracods, Foraminifera, Polyzoa, &c.)

Cap. III. De terra lateritia loco dicto *S. Lazzaro*; ubi de Stratis. Pp. 42 &c.

Cap. IV. De terra plastica l. d. *Borro Cieco*, ac de Frumentariis. Pp. 48 &c. Pl. 17-20. [Foraminifera.]

Cap. V. De terra arenaria l. d. *Costa Fabri*; ubi de locis olim submarinis. Pp. 55 &c.

Cap. VI. De terra calcareo-arenaria conchyliifera, l. d. *Laterino* (prope Senas extra portam dictam *di Laterino*). Pp. 62 &c.

Cap. VII. De glareis (in collibus Florentiam inter et Senas,—prope castrum *S. Quirici*; non longe e monte *Radicofanensi*; in Clusentino; in superiore valle *Arni*; extra portam *Ovile* Senarum; extra portam *Pisini* Senarum, &c.); ubi de stratis conchyliiferis. Pp. 69 &c. Pl. 21, 22 (*Q*). [Foraminifera, Ostracoda, Polyzoa, &c.]

Cap. VIII. De vertice Montis Volterrarum, ejusque arenulis conchyliiferis. Pp. 77 &c.

Pl. 22 (part), 23, 25 (*C, D*). [Pl. 24, *Perna*. Pl. 25. figs. *E, F, G*, are Liassic Ammonites from Dorsetshire (“Devon” by mistake in the text), England, given to Soldani by William Thomson. Polyzoa, Echinoderms, Mollusks, *Chara*, Foraminifera, &c.]

Cap. IX. De inferiore parte ejusdem Montis, ac de rupe Echinorum. Pp. 81 &c.

Cap. X. De quatuor in Etruria Conchyliorum fossilium generibus prorsus exoticis. Pp. 90 &c.

Cap. XI. De Arenulis terrisque phosphorescentibus. Pp. 95 &c.

Sectio secunda. De Lacubus, eorumque hodiernis et antiquis sedimentis.

Cap. XII. De Lacubus in genere. Pp. 104 &c.

Cap. XIII. De fossula perennis aquæ in Clusentino, ac de *Spiro-vulis* et *Lenticulis* petrefactis. Pp. 106 &c. Pl. 25 (*H-M*), 26 (*N, O, P*).

Cap. XIV. De Testis in aquis thermalibus ac palustribus in vicinia Civitatis Massæ. Pp. 112 &c.

Cap. XV. De Lacu Blentinensi, ejusque limo. Pp. 115 &c.

Cap. XVI. De antiquo Lacu in Valle Arni superiore, ejusque Conchyliis fossilibus; ubi de Ossibus Elephantinis. Pp. 118 &c. Pl. 26 (*Q, R*).

Cap. XVII. De antiquo Lacu inter *Staggia* et *Poggibonsi*, ac de limo maris inferiori. Pp. 124 &c. Pl. 26 (*S, T, V, X*).

Cap. XVIII. De antiquo Lacu Sarteanensi. Pp. 129 &c.

Cap. XIX. De Sedimento lacustri prope Civ. Collensem, ejusque tartareis Concretionibus. Pp. 131 &c.

Cap. XX. De terra lacustri l. d. *Badia all' Isola*. Pp. 135 &c.

Sectio tertia, seu Appendix *, quæ Testas ac Fossilia in Vascularibus 288 contenta præsertim minima exhibet, et eorum Icones explicat. Pp. 137 &c.

* This is a *Catalogue raisonné* reprinted, in an abstract form, and with a condensed introduction, from the Appendix to the ‘Saggio oritografico’ above mentioned.

We now turn to the 'Tableau Méthodique' and the Soldanian figures cited therein as illustrations of D'Orbigny's views in respect to species.

The carelessness with which the references were made has been a cause of many difficulties and some uncertainty: our corrected copy of D'Orbigny's memoir shows upwards of fifty errors of reference, more or less important, besides the numerous clerical mistakes which disfigure its pages. We have therefore in some instances had to depart from the literal reading of the text in seeking an intelligible basis for our notes. Where the corrections admit of little or no doubt, they are adopted without any special remark; but in a few cases, in which the clue to the author's intention is not so manifest, the fact is duly noticed in its place in the following pages. In the 'Tableau' the parts of the 'Testaceographia' are alluded to almost invariably as vol. 1, 2, 3, & 4; in the 'Cuba' Monograph and other of D'Orbigny's papers, the original designations are given, namely, Vol. I. part 1, part 2, part 3, and Vol. II. This latter mode of reference, having advantages alike of correctness and uniformity, has been used throughout these notes.

The plates appended to the present paper consist of carefully reduced copies of Soldani's figures *in outline*. Where reference is made by D'Orbigny to several figures, the best example has been selected. No attempt has been made to improve upon the originals; nor, except in a few cases in which figures, upside down (according to present ideas), have been reversed, has any alteration whatever been intentionally made in respect of them. In Soldani's plates the drawing is often rugged, sometimes rude; but it is always nervous and expressive, and, up to his knowledge, characteristic. He does not often attempt to have the *texture* of the shell represented by his artists, being unaware of its importance; and he frequently omits to indicate the position or form of the aperture: but, notwithstanding these drawbacks, he seldom leaves his meaning in doubt; and the student of the Rhizopoda of the Italian peninsula, whether of the living fauna of the Adriatic or of the fossil microzoa of the Sub-Apennine strata, may recognize in his figures a very large proportion of the organic forms met with at the present day. Soldani's sagacity, too, in grouping together the genera of nearest alliance is markedly shown. Indeed D'Orbigny might have drawn much more largely than he did on the stores of the 'Testaceographia' with advantage to science.

It appears to us that, in using Soldani's engraved figures as published representations of certain Foraminifera, D'Orbigny

rarely, if ever, recorded any one of them as illustrative of a typical form under the impression that it deserved special notice and name. In general, if not always, he selected the figures because they seemed to him to be good or fair illustrations of specimens that he himself obtained from the several recent and fossil sea-sands enumerated at pages 249, 250 of the *Ann. Sc. Nat.* vol. vii. as having been given to him by his friends. Among these communications were fossil sands from Sienna and other parts of Italy, some packets of which had been given by *Soldani* to M. Fleurian de Bellevue. In recording the "localities" of the species illustrated in the 'Testaceographia,' D'Orbigny seems to have ignored Soldani's account of their finding-places and habitats altogether. We have compared the localities recorded by the two writers; and when Soldani's and D'Orbigny's statements do not coincide, we have added Soldani's in brackets; and in these cases so much is added to our knowledge of the distribution of these Foraminifera. It is occasionally impossible to get the exact habitat for the Soldanian figures, as they were drawn from individuals of a mixed group of supposed or real allies, taken from two or more places, especially (for instance) from both the Adriatic and the Tuscan sea.

In quoting Soldani's descriptive appellations of the forms selected afterwards by D'Orbigny as types of binomial species (or, rather, as published representations of Foraminifera that he met with in recent or fossil sea-deposits from various parts of the world), we have either taken the general name Soldani gave to the set that he grouped together (and then it appears for the most part in the *plural*), or, whenever possible, we have taken the term that he applied to the individual shell (and then it is in the *singular*). As Soldani did not, however, use the Linnean mode of nomenclature, the terms applied by him to individuals and groups would not necessarily have been adopted by D'Orbigny even if he had studied the text with the intention of learning Soldani's views.

1. *Nodosaria* (*Glandulina*) *lævigata*, D'Orbigny.

Pl. IX. fig. 34.

"Polymorpha *Sphærule vitreæ læves*;" Soldani, *Testac.* vol. i. pt. 2. p. 115, pl. 118. fig. *E.* D'Orbigny, *Ann. Sc. Nat.* vol. vii. p. 252, no. 1.

"*Hab.* Recent in the Adriatic; fossil near Sienna." (*Mediterranean* [?], *Soldani*.)

This has been noticed in a previous paper on some of D'Orbigny's species (*Ann. Nat. Hist.* ser. 3. vol. xii. p. 439). It represents a good subtype of the *Nodosarina*. Soldani's

figure is from a somewhat ill-grown specimen, with large open aperture.

2. *Nodosaria ovicula*, D'Orb. Pl. IX. fig. 36.

"*Orthoceras Farcimen*;" Soldani, Testac. vol. ii. p. 35, pl. 10. figs. *h-m*.
D'Orb. *op. cit.* p. 252. no. 6.

"*Hab.* Fossil near Sienna."

A delicate moniliform *Nodosaria*, with long elliptical distinct segments. Our outlines are copied from figures *h* & *k*.

3. *Nodosaria hirsuta*, D'Orb. Pl. IX. fig. 45.

"*Orthoceratia quasi hispida*;" Soldani, Testac. vol. ii. p. 15, pl. 2. fig. *P*.
"*Orthoceratia hispida*;" *ibid.* p. 36, pl. 11. figs. *n-z, A, B*. D'Orb. *op. cit.* p. 252. no. 7.

"*Hab.* Recent in the Adriatic; fossil near Sienna." (Fossil at Donnini and Cerajolo, *Soldani*.)

A straight, few-chambered *Nodosarian*, having its surface studded with acicular exostoses. D'Orbigny subsequently (1846, For. Foss. Vienne, p. 35, pl. 1. figs. 24, 25) changed the trivial name to that originally given by Soldani; it therefore now stands as *Nodosaria hispida*. Of our two outlines (fig. 45) the first represents Soldani's "quasi-hispid," the second his "hispid" variety.

4. *Nodosaria orthocera*, D'Orb. Pl. IX. fig. 32.

"*Tubulus amulatus*;" Soldani, Testac. vol. i. pt. 1. p. 33, pl. 27. figs. *xx, yy*.
D'Orb. *op. cit.* p. 252. no. 8.

"*Hab.* Mediterranean."

We cannot follow D'Orbigny in referring these figures to *Nodosaria*. They differ one from the other; both are indeterminate, although fig. *xx* (figured) has an appearance much like that of the *Clavuline* forms of *Valulina*, "*Clavulina clavulus*," Ann. N. H. ser. 3. vol. v. p. 469.

5. *Nodosaria semistriata*, D'Orb. Pl. IX. fig. 38.

"*Orthoceras*;" Soldani, Testac. vol. i. pt. 2. p. 92, pl. 96. fig. *T*. D'Orb. *op. cit.* p. 252. no. 9.

"*Hab.* Fossil near Sienna." (Mediterranean[?], *Soldani*.)

This is but a subvariety of *N. radícula*, Linn., its claim to distinction resting upon a number of obscure short striæ or costæ on the upper portion of the chambers. Soldani makes no special mention of the figure in his description of the plate; and it has probably been adopted by D'Orbigny from its corresponding with specimens which occurred in his own investigations.

6. *Nodosaria dubia*, D'Orb. Pl. IX. fig. 30.

"*Orthoceratia Zoophytica minuscula*," Soldani, Testac. vol. i. pt. 2. p. 93, pl. 98. fig. *A*. D'Orb. *op. cit.* p. 252. no. 10.

"*Hab.* Fossil, near Sienna." (Mediterranean, *Soldani*.)

This is a short-jointed variety of *Lituola Soldanii*. The description of the specimen, not less than the figure, indicates the arenaceous structure of the test. It may be convenient to reserve the trivial name for the short, many-chambered, orthocerine *Lituolæ*.

7. *Nodosaria interrupta*, D'Orb. Pl. IX. fig. 51.

"*Orthoceratia Baculi*," Soldani, Testac. vol. i. pt. 2. p. 96, pl. 102. fig. *B*. D'Orb. *op. cit.* p. 252. no. 11.

"*Hab.* Fossil near Sienna." (Mediterranean, *Soldani*.)

A somewhat irregular, limbate *Dentalina*, analogous to *Nodosaria limbata*, D'Orb., in the straight series. The sutural limbanation is given by Soldani as a zigzag line of clear shell-substance.

8. *Nodosaria glabra*, D'Orb. Pl. IX. fig. 35.

"*Orthoceratia Arthrocentæ*," Soldani, Testac. vol. ii. p. 15, pl. 2. fig. *N*. "*Orthoceras Baculus*," *ibid.* p. 16, pl. 2. figs. *V*, *X*. D'Orb. *op. cit.* p. 253. no. 12.

"*Hab.* Fossil at Sienna." (Near Sienna, *Soldani*.)

Fig. *N* is a narrow *N. radícula*. Fig. *V* differs from *N. radícula* only in the increased number of chambers and their regular size, the specimen being long and subcylindric; whilst fig. *X* is rather less regular and somewhat curved. Soldani's figures have from seven to thirteen smooth globular chambers of nearly equal size. The name may be useful as a sub-varietal term for specimens with these characters; but no greater significance can be attached to it. (Fig. *N* is copied.)

9. *Nodosaria pyrula*, D'Orb. Pl. IX. fig. 37.

"*Orthoceras Monile*," Soldani, Testac. vol. ii. p. 35, pl. 10. figs. *b*, *c*. D'Orb. *op. cit.* p. 253. no. 13.

"*Hab.* Fossil at Sienna." (Near Sienna, *Soldani*.)

Soldani's figures represent smooth-shelled, few-chambered *Nodosariæ*, with globular (fig. *b*) or elliptical (fig. *c*) segments connected by cylindrical tubes. Professor Williamson's drawing of the same species (Rec. For. Gt. Br., pl. 2. fig. 39), in which the stoloniferous tube is formed by the gradual tapering of the segments, shows the form as it more commonly occurs. (Fig. *b* is copied.)

10. *Nodosaria filiformis*, D'Orb. Pl. IX. fig. 48.

"Orthoceratia filiformia aut capillaria;" Soldani, Testac. vol. ii. p. 35, pl. 10. fig. e. D'Orb. *op. cit.* p. 253, no. 14.

"Hab. Fossil at Sienna." (Near Sienna, *Soldani*.)

The curvature of the axis being recognized as a divisional character, this should be *Dentalina filiformis*. It is a fair representative of the attenuated forms of *Dentalina*, having very numerous, distinct, elliptical segments.

11. *Nodosaria scalaris*, D'Orb. Pl. IX. fig. 39.

"Orthoceratia;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. fig. V. D'Orb. *op. cit.* p. 253, no. 18.

"Hab. Recent in the Adriatic."

This may be fairly placed under *N. raphanus*, Linn. The name "*scalaris*" had been previously adopted by Batsch for a somewhat different form.

12. *Nodosaria sulcata*, D'Orb. Pl. IX. fig. 40.

"Polymorpha Pineiformia;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 127. fig. C. D'Orb. *op. cit.* p. 253, no. 21.

"Hab. Recent in the Adriatic; fossil at Leognan, near Bordeaux, and at Castel-Arquato, Italy." (Mediterranean [?], *Soldani*.)

This is a short *Nodosaria raphanus*, but with an extraordinary lateral chamber, overriding the first two chambers. How specimens with so odd a malformation should have turned up under circumstances so diverse as indicated by the localities quoted by D'Orbigny, we cannot explain. It is quite possible that D'Orbigny ignored the malformation, whilst Soldani was led by it to associate his specimen with others that we recognize as *Uvigerinæ*.

13. *Nodosaria rapa*, Lamarck*. Pl. IX. fig. 41.

"Orthoceratia;" Soldani, Testac. vol. i. pt. 2, p. 91, pl. 94. fig. T. D'Orb. *op. cit.* p. 253, no. 27.

"Hab. Recent in the Adriatic, near Rimini." (Mediterranean or Adriatic†, *Soldani*.)

This is *Nodosaria raphanistrum*, Linné, sp. (Ann. N. H. ser. 3. vol. iii. p. 478). D'Orbigny refers to figures in the

* There is no "*N. rapa*" recorded by Lamarck (Ann. N. H. ser. 3. vol. v. pp. 287-289); but this name occurred to D'Orbigny probably through the intermediation of the French word "*rave*," which has reference to both of the latin terms "*raphanus*" and "*rapa*."

† A large group of different Foraminifera are in this as in other instances described as having been obtained from the two seas; and as only one specimen has been selected, it is impossible to localize it exactly.

works of Gaultieri, Plancus, and Montagu. An extended synonymy of the species will be found in our "Monograph of the Foraminifera of the Crag" (Palæontographical Society).

14. *Nodosaria longicauda*, D'Orb. Pl. IX. fig. 42.

"*Orthoceratia Flosculi*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 95. figs. *B-M*. D'Orb. *op. cit.* p. 254. no. 28.

"*Hab.* Fossil near Sienna." (Mediterranean, *Soldani*.)

A common recent form, well figured by Professor W. C. Williamson under the name *Nodosaria radícula* (Rec. For. Gt. Br. pl. 2. figs. 36-38); but, as we have before stated, Batsch's name *N. scalaris* takes precedence. Soldani also refers to pl. 5. figs. 3, *A*, *B*, *C*, *D*, in his 'Appendix,' as being the same (fossil at Coroncina).

Soldani's figured specimens have from two to five segments, and vary in the relative size, proportional enlargement, and approximation of the segments. Fig. *L*, with its eccentric stolon-tube, and its produced and somewhat hooked first chamber, approaches *Marginula falx*, J. & P., with which also pl. 96. fig. *P*, and pl. 102. fig. *C*, have relationship. See Quart. Journ. Geol. Soc. vol. xvii. p. 302.

15. *Nodosaria cancellata*, D'Orb. Pl. IX. fig. 33.

"*Orthoceratia Flosculi*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 95. fig. *A*. D'Orb. *op. cit.* p. 254. no. 29.

"*Hab.* Fossil near Sienna." (Mediterranean, *Soldani*.)

It is a matter of extreme difficulty to judge between the occasional double-celled specimens of *Lagena* and the arrested *Nodosariæ**. The transverse as well as longitudinal markings on Soldani's figure leave us with little doubt that he has met with a double specimen of *Lagena melo*. The reticulate ornament, however, is becoming better known as a Cristellarian (*Nodosarine*) ornament by the discoveries of our German fellow-workers. The spiral ornamentation of the neck occurs in both *Nodosaria* and *Lagena*, though more frequently in the latter.

16. *Nodosaria Soldanii*, D'Orb. Pl. IX. fig. 43.

"*Orthoceras Rapistrum* (num *Raphani* vel *Raphanistri* species?);" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 104. fig. *I*. D'Orb. *op. cit.* p. 254. no. 10.

"*Hab.* Fossil near Sienna." (Mediterranean or Adriatic, *Soldani*.)

A straight *Nodosarian*, with few, globular, semisulcate or semicostate chambers; the grooves (or ribs?) commence at the

* With increased examination, more and more double *Lagenæ* turn up (in Grignon sands especially).

base of the chambers, and extend above the middle of each. The worthy Tuscan naturalist's collection seems to have been rich in ornamental and odd-growing varieties. The specimen he has here chosen for delineation has a little abortive terminal chamber, like a pinnacle, surmounting those formed on the normal plan. *Nodosaria Soldanii* differs from *N. semistriata* in having the upper third of the chambers smooth, whilst the latter has its costæ confined to the upper portion.

17. *Nodosaria nodosa*, D'Orb. Pl. IX. fig. 55.

"*Orthoceratia filiformia* aut *capillaria*;" Soldani, Testac. vol. ii. p. 35, pl. 10. figs. *f, g*. D'Orb. *op. cit.* p. 254. no. 31.

Hab. "Fossil near Sienna."

A Dentaline or curved Nodosarian, long, slender, and many-chambered. The segments are regular and elliptical, and are furnished on their exterior with delicate parallel longitudinal striæ. (Fig. *f* is copied.)

18. *Nodosaria flexuosa*, D'Orb. Pl. IX. fig. 53.

"*Orthoceratia filiformia*;" Soldani, Testac. vol. ii. p. 35, pl. 10. fig. *d*. D'Orb. *op. cit.* p. 254. no. 32.

Hab. No locality given by D'Orbigny. (Fossil near Sienna, *Soldani*.)

It may be worth while to recognize this variety as *Dentalina flexuosa*. The figure represents a very slightly curved, deep-sutured, semistriate form, the striæ marking the upper third of each chamber.

19. *Nodosaria nitida*, D'Orb. Pl. IX. fig. 44.

"*Orthoceratia Arthrocnæ*;" Soldani, Testac. vol. ii. p. 15, pl. 2. fig. *O*. D'Orb. *op. cit.* p. 254. no. 33.

"*Hab.* Fossil at Coroncina, Italy." (San Quirico, *Soldani*.)

A small striate *Nodosaria*, deeply constricted at its septa, and having few, distinct, oval or fusiform segments. A less robust form than *N. scalaris*, and less neatly finished as to base and terminal neck than that species generally is.

20. *Nodosaria (Dentalina) communis*, D'Orb. Pl. IX. fig. 46.

"*Orthoceras Farcimen*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. *O*. D'Orb. p. 254. no. 35.

"*Hab.* Recent in the Adriatic." (Mediterranean or Adriatic, *Soldani*.)

The common smooth type of the subgenus, equally abundant in the recent and fossil condition. We have endeavoured to tabulate the names under which it has been alluded to by

various authors, in our 'Monograph of the Foraminifera of the Crag.' The oldest name given to this variety was Lamarck's "*Nodosaria dentalina*," and apt enough with that quasi-generic prefix; but the inconvenience of the trivial being the same as the subgeneric name, and the wide acceptance of D'Orbigny's term, have induced us to retain the latter.

21. *Nodosaria (Dentalina) obliqua*, D'Orb. Pl. IX. fig. 47.

"*Orthoceras intortum*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. F. D'Orb. *op. cit.* p. 254. no. 36.

"*Hab.* Recent in the Adriatic." (Mediterranean or Adriatic, *Soldani*.)

See note on the same variety in our paper on the "Models" (Ann. N. H. ser. 3. vol. xvi. p. 19). We ought to have there added that the trivial name had been preoccupied by Linné for the Dentaline form of *N. Raphanus* (= *D. Cuvieri*, D'Orb.).

D'Orbigny's reference to another of Soldani's figures (pl. 107. fig. *f*) is obviously an error.

22. *Nodosaria (Dentalina) arcuata*, D'Orb. Pl. IX. fig. 49.

"*Orthoceras intortum mammillare*;" Soldani, Testac. vol. i. pt. 2. p. 92, pl. 97. fig. *ee*. D'Orb. *op. cit.* p. 254. no. 38.

"*Hab.* Recent in the Adriatic." (Mediterranean, *Soldani*.)

A much-curved, smooth *Dentalina*, with the chambers set on very obliquely; the chambers inflated and distinct on the convex side of the shell, but gradually thinning towards the concave margin. In Soldani's figure the shell appears to be bordered by a smooth even carina on the concave side.

23. *Nodosaria (Dentalina) carinata*, D'Orb. Pl. IX. fig. 50.

"*Orthoceras obliquum*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. *N*. D'Orb. *op. cit.* p. 255. no. 39.

"*Hab.* The Adriatic Sea." (Mediterranean or Adriatic, *Soldani*.)

A somewhat similar variety to the last (*D. arcuata*); indeed, if we do not place the two under the same trivial name, it is only from the desire to give our author the benefit of a doubt. It is a long, slender *Dentalina*, with a large number of very oblique chambers, and an apparently well-defined carina of considerable width running the whole length of the concave side.

24. *Nodosaria (Dentalina) scoriurus*, Montfort.

Pl. IX. fig. 29.

"*Orthoceras*?" Soldani, Testac. vol. i. pt. 3. p. 239, pl. 162. fig. *K*. D'Orbigny, *op. cit.* p. 255. no. 40.

"*Hab.* Recent in the Adriatic." (Mediterranean, *Soldani*.)

Soldani is manifestly in great doubt about the nature of this arenaceous form. He puts it in a plate amongst "*Dubia ac Zoophyta*;" and in his descriptive text we find this note:—"Quæ supersunt reliqua, *I* & *K*, mihi ignota prorsus sunt, nisi fortassè *K* ad *Orthoceratis* speciem aliquam pertinereat."

D'Orbigny, in accordance with his system of classification, had no alternative but to place it amongst the *Dentalinæ*, and rightly enough gave to it Montfort's specific name, that author having copied Soldani's figure, with the name *Reophax scorpiorus*. It belongs, however, as we have long ago shown, to an entirely distinct family of Foraminifera, and finds its natural place in the genus *Lituola*. This species has been already alluded to in a review of the Foraminifera named by Denys de Montfort, Ann. Nat. Hist. ser. 3. vol. vi. p. 346. no. 61; see also *ibid.* vol. v. p. 297.

25. *Nodosaria (Dentalina) aciculata*, D'Orb. Pl. IX. fig. 52.

"*Orthoceras Cuspis*;" Soldani, Testac. vol. i. pt. 2. p. 98. pl. 105. fig. *L*. D'Orb. *op. cit.* p. 255. no. 41.

"*Hab.* Adriatic Sea." (Mediterranean or Adriatic, *Soldani*.)

A variety of *Dentalina* not very commonly met with, but occurring sometimes in habitats favourable to the genus. Its peculiarity consists in the very short longitudinal costæ on the constricted portions of the test between the chambers, the prominent parts of the test being smooth. *D. intermittens* of Roemer and *D. Buchi* of Reuss also possess these features.

26. *Nodosaria (Dentalina) Cuvieri*, D'Orb. Pl. IX. fig. 57.

"*Orthoceras varietas Raphani* vel *Raphanistri*;" Soldani, Testac. vol. i. pt. 2. p. 97, pl. 103. fig. *I*. D'Orb. *op. cit.* p. 255. no. 45.

"*Hab.* Recent in the Adriatic." (Mediterranean, *Soldani*.)

A somewhat irregular shell, with a large number of short, compact, cylindrical chambers, marked by a series of stout, unbroken, longitudinal ribs. This is the *Nodosaria obliqua*, Linné, sp. (Ann. N. H. ser. 3. vol. iii. p. 477), coming, of course, under the *Dentalina* division of the genus, owing to its curvature. There is another "*D. obliqua*" (see No. 21, a sub-variety of *D. communis*); but we prefer to keep "*obliqua*" for Linné's *Dentalina* variety of *N. raphanus*, as above stated, as an early and apt name.

27. *Nodosaria (Dentalina) substriata*, D'Orb. Pl. IX. fig. 54.

"*Orthoceras*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. fig. *S*. D'Orb. *op. cit.* p. 255. no. 46.

"*Hab.* Fossil at Coroncina." (Mediterranean or Adriatic, *Soldani*.)

A neat substriate variety, the striae springing from the base of each chamber and extending about three-fourths the way to its summit.

28. *Nodosaria (Dentalina) cornicula*, D'Orb. Pl. IX. fig. 56.

"*Orthoceras Corniculum*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. K. D'Orb. *op. cit.* p. 255. no. 47.

"*Hab.* Fossil, Coroncina." (Mediterranean or Adriatic, *Soldani*.)

This may be accepted as a convenient subvarietal term for a Dentaline *N. raphanus* (*D. obliqua*), having a smooth globose primordial segment, larger than those that immediately follow. The later chambers rapidly increase in size; the last, or tenth, is nearly twenty times as long as the second.

29. *Fron dicularia alata*, D'Orb. Pl. X. fig. 66.

"*Nautili caudiformes*;" Soldani, Testac. vol. ii. p. 13, pl. 1. fig. C. D'Orb. *op. cit.* p. 256. no. 2.

"*Hab.* The Adriatic." (Fossil near Sienna, *Soldani*.)

A very short wide *Fron dicularia*; the lower ends of the chambers irregular and pointed. We doubt the locality given by D'Orbigny for *Fron dicularia* in a recent state (see Quart. Journ. Geol. Soc. vol. xvi. p. 300). If *Fron diculariæ* were found by him in the shallow lagoons of the Adriatic, they must have been derived from Tertiary clays. Soldani speaks of this species as common in the fossil state in the clays of San Quirico, Monte Ilco, and the neighbourhood of Sienna.

30. *Fron dicularia striata*, D'Orb. Pl. X. fig. 67.

"*Orthoceras Cuspis*;" Soldani, Testac. vol. ii. p. 34, pl. 9. figs. Q, R. D'Orb. *op. cit.* p. 256. no. 3.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani*.)

A striate variety of the normal form of *Fron dicularia*. (Fig. R is copied.)

31. *Fron dicularia pupa*, D'Orb. Pl. X. fig. 64.

"*Orthoceras Cuspis*;" Soldani, Testac. vol. ii. p. 34, pl. 9. fig. S. D'Orb. *op. cit.* p. 256. no. 4.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani*.)

This appears to be a passage-form between *Fron dicularia* and *Lingulina*. Such specimens are not uncommon; and it may be convenient, therefore, to retain the name.

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32. *Frondicularia digitata*, D'Orb. Pl. X. fig. 65.

"*Orthoceras Cuspis*;" Soldani, Testac. vol. ii. p. 34, pl. 9. fig. *P.* D'Orb. *op. cit.* p. 256. no. 6.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani*.)

A long *Frondicularia*, with chambers of nearly even size; the sides almost parallel.

33. *Lingulina carinata*, D'Orb. Pl. IX. fig. 61.

"*Testæ Ouales, oliviformes, pyriformes, fusiformes, &c.*;" Soldani, Testac. vol. ii. p. 37, pl. 12. fig. *P.* D'Orb. *op. cit.* p. 257. no. 1.

"*Hab.* The Antilles, and, according to Soldani, fossil in the neighbourhood of Sienna."

Noticed previously, in treating of the Models, Ann. N. H. ser. 3. vol. xvi. p. 23.

34. *Lingulina alata*, D'Orb. Pl. IX. fig. 63.

"*Orthoceratia Zoophytica subcordiformia*;" Soldani, Testac. vol. i. pt. 2. p. 94, pl. 99. fig. *N.* D'Orb. *op. cit.* p. 257. no. 2.

"*Hab.* The Adriatic." (Mediterranean, *Soldani*.)

This is *Lingulina carinata* with the edge extended so as to produce a thin even-margined keel.

35. *Lingulina Soldanii*, D'Orb. Pl. XI. fig. 121.

"*Orthoceras Pupa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 108. figs. *E, F.* D'Orb. *op. cit.* p. 257. no. 3.

"*Hab.* The Adriatic."

Soldani's figures are obscure; but they are probably intended to represent somewhat unusually short specimens of *Grammostomum pennatula*, Batsch, sp. (= *Vulvulina capreolus*, D'Orb.), with spiral commencement. The entire plate is devoted to varieties of this Textularian genus, mostly with the early segments spirally arranged, and some with a uniserial termination. See also Nos. 59 & 60, further on.

36. *Vaginulina striata*, D'Orb. Pl. IX. fig. 58.

"*Hortoceratia Vaginulam gladii referentia*;" Soldani, Testac. vol. ii. App. p. 141, pl. 6. figs. 44, *n, N.* D'Orb. *op. cit.* p. 257. no. 3.

"*Hab.* Recent in the Adriatic." (Fossil at Coroncina and Monte Ilco, *Soldani*.)

It is convenient to keep this trivial name for those flat *Vaginulinæ* whose surface is traversed from end to end with striæ, as distinct from the biconvex forms, with less regular costæ, comprised under the name *V. linearis* (see 'Monograph

Foram. Crag,' p. 66); nevertheless the distinction cannot be regarded as one of much morphological importance.

37. *Vaginulina marginata*, D'Orb. Pl. IX. fig. 59.

"Orthoceras, *Vaginulæ* species;" Soldani, Testac. vol. i. pt. 2. p. 97, pl. 103. fig. *M*. D'Orb. *op. cit.* p. 258. no. 7.

"*Hab.* The Adriatic." (Mediterranean, *Soldani*.)

A marginate *Vaginulina*, with peculiar limbate sutures. For a synopsis of the subgenus *Vaginulina*, see our 'Monogr. Foram. Crag,' l. c.

38. *Vaginulina caudata*, D'Orb. Pl. IX. fig. 60.

"Orthoceratia *Vaginula*;" Soldani, Testac. vol. ii. p. 14, pl. 1. figs. *F*. *G*. D'Orb. *op. cit.* p. 258. no. 8.

"*Hab.* The Adriatic." (Fossil, San Quirico, *Soldani*.)

Our outline is copied from fig. *G*, the other drawing (*F*) being somewhat doubtful and probably representing a smooth *Uvigerina*. The specimen represented is a straight Vaginuline Nodosarian, with a wide carina on the inner or concave margin, and a long spine projecting from the apex or the earliest chamber. Such forms may frequently be met with both recent and fossil, but seldom with the mucro inserted abruptly on the square end of the test, as given in the figure.

39. *Marginulina raphanus*, Linn. sp. Pl. X. fig. 72.

"Orthoceratia *Raphanus*, *Raphanistrum*, & *Rapistrum*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. figs. *N*, *P*, *Q*, *R*, *X*, *Y*. D'Orb. *op. cit.* p. 258. no. 1.

"*Hab.* Recent in the Adriatic; fossil at Castel-Arquato, Italy." (Mediterranean and Adriatic, *Soldani*.)

Noticed in our review of the Models; see also our Monograph of the Crag Foraminifera, and other papers.

Amongst Soldani's figures above quoted, fig. *N* represents the true *Nodosaria raphanus*, and fig. *R* is *N. obliqua*; but plenty of intermediate grades are known to connect these with the Marginuline individuals.

40. *Marginulina hirsuta*, D'Orb. Pl. XI. fig. 125.

"Orthoceratia *Villosa* seu *rudia*;" Soldani, Testac. vol. i. pt. 2. p. 96, pl. 101. figs. *ll-co*. D'Orb. *op. cit.* p. 259. no. 5.

"*Hab.* The Adriatic." (Mediterranean, and fossil at San Quirico, *Soldani*.)

We are not disposed to regard Soldani's figures, taking them all together, as referable to the *Nodosarinæ* at all. They appear to us somewhat unusually rugose examples of the

Textularian subgenus *Bigenerina* (such as *B. digitata* and *B. nodosaria*), running into Clavuline forms, with too little distinctive character to need a separate varietal name.

Fig. *mm* is non-segmented, but has an abnormal lateral chamber; fig. *oo* has one constriction; fig. *nn* shows three; fig. *ll* seven; and all are possibly *Lituolæ*. Some similar forms are represented on the succeeding plate 102, together with other rugose Nodosarine forms. Taking them all together, we may say that Soldani had here mingled rough dimorphous *Textulariæ* with some straight *Lituolæ*, and at least one spinous *Nodosaria*.

41. *Marginulina carinata*, D'Orb. Pl. IX. fig. 62.

"*Orthoceratia Zoophytica elongata*;" Soldani, Testac. vol. i. pt. 2. p. 92, pl. 97. figs. *hh*, *mm*. D'Orb. *op. cit.* p. 259. no. 8.

"*Hab.* Fossil at Coroncina." (Mediterranean*, *Soldani*.)

Of the two figures referred to we have copied only one (*mm*); for, though the arrangement of chambers is very similar in the other, the term "*carinata*" could not with any fitness be applied to it. In Mr. Parker's collection are some fine specimens of this form, taken off Sicily, which far better help an understanding of its peculiarities than the figures. The earlier chambers are coiled in a subglobular manner, embracing, and to a great extent hiding, one another; then follow a number which are merely curved; and the shell is terminated by a straight linear series, with all of the segments more or less flattened and showing a tendency to expand backwards on either edge. The concave side of the shell has a carina extending in a curved line from the centre of the first chamber to the wide portion of the terminal one.

Possibly it may be best to regard this as a dimorphous variety of *Lingulina carinata*, though it might with equal reason be assigned to the genus *Flabellina*.

42. *Marginulina subtilius*, D'Orb. Pl. X. fig. 73.

"*Orthoceras Subtilius*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 104. figs. *F*, *G*. D'Orb. *op. cit.* p. 259. no. 9.

"*Hab.* The Adriatic." (Mediterranean or Adriatic; *Soldani*.)

These are modifications of the typical *M. raphanus*; fig. *F* (copied) has the earlier chambers somewhat flattened and smooth.

* These and many other recent Foraminifera of the Mediterranean, off the Tuscan shore and neighbouring islands, Soldani obtained one by one, on breaking up the hard calcareous concretions of zoophytes and lithophytes, including white and red corals.

43. *Marginulina lævigata*, D'Orb. Pl. X. fig. 68.

"Orthoceras *Lituitata*;" Soldani, Testac. vol. i. pt. 2. p. 95, pl. 100. figs. *bb*, *cc*. D'Orb. *op. cit.* p. 259. no. 10.

"*Hab.* The Adriatic." (Mediterranean and Adriatic, *Soldani**.)

Soldani's figure *bb* is a large and much curved *Dentalina communis* (or narrow *Marginulina lituus*); fig. *cc*, which we have copied, only differs from *Marginulina lituus* in degree of curvature and in a partial carina on the concave margin of the earlier chambers.

44. *Marginulina lituus*, D'Orb. Pl. X. fig. 70.

"Orthoceras *Serrula*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 106. figs. *aa*, *bb*. D'Orb. *op. cit.* p. 259. no. 11.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani*.)

A useful species, embracing the smooth, much-curved, Marginuline *Nodosariæ* that have many very oblique chambers. Soldani and D'Orbigny notice it as a recent form; but it is not uncommon as a fossil from the Liassic age onwards.

45. *Marginulina lobata*, D'Orb. Pl. X. fig. 71.

"Polymorpha *Subovalia*;" Soldani, Testac. vol. i. pt. 2. p. 115, pl. 117. fig. *p*. D'Orb. *op. cit.* p. 259. no. 12.

"*Hab.* The Adriatic." (Mediterranean, *Soldani*.)

A short, thick-set, few-chambered *Marginulina*, with a partial carina on the concave edge, and strongly limbate sutures.

46. *Marginulina consecta*, D'Orb. Pl. X. fig. 69.

"Nuclei in thalamis Orthoceratiorum nati;" Soldani, Testac. vol. i. p. 51, pl. 17. figs. *R*, *S*. D'Orb. *op. cit.* p. 259. no. 13.

"*Hab.* Fossil at Coroncina." (Borro Cieco, *Soldani*.)

We see no reason to doubt Soldani's statement that these, and several other specimens figured in his fourth volume, are casts (obtained by the use of acid in some cases), and not perfect fossils. On any other supposition it would be difficult to understand the drawings he refers to. These are casts of straight *Marginulinae*.

* Figs. *bb*, *cc*, with other *Nodosariæ*, are described by Soldani as having been obtained from the sea-mud of the Port Ferrajo (Elba) and at the Island Giglio, from the zoophytic concretions (Tuscan Sea), and from the shore at Rimini (Adriatic); but rare at the last place.

47. *Planularia auris*, DeFr. Pl. X. fig. 74.

"*Orthoceras Auris*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 104. fig. *A*.
D'Orb. *op. cit.* p. 260. no. 6.

"*Hab.* Var. *α*. Recent in the Adriatic; fossil at Castel-Arquato. Var. *β*. Recent in the Mediterranean."

This is the *Planularia auris* of DeFrance. See Ann. Nat. Hist. ser. 3. vol. xii. p. 215. no. 107.

48. *Planularia crepidula*, Fichtel & Moll., sp.

Pl. X. fig. 77.

"*Nautili Lituitati*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 58. fig. *bb*.
D'Orb. *op. cit.* p. 260. no. 6.

"*Hab.* The Antilles, and, according to Fischer, the Gulf of Tuscany." (Fossil near Sienna, *Soldani*.)

[*Note.* One of the many misprints in the 'Tableau Méth. de Céphalopodes' occurs in the reference to this species. "Fig. 66" is given in D'Orbigny's text; but this, we think, can only be intended for *bb*. At p. 292. no. 11, figs. *aa, bb, cc* of this plate (all allies of *C. crepidula*) are referred to all together as *Cristellaria elongata*.]

In Ann. Nat. Hist. ser. 3. vol. v. pp. 114 & 115, Fichtel and Moll's "*Nautilus crepidula*" is defined as "a delicate, elongate, Marginuline, flattened *Cristellaria*," "which by innumerable linkings, passes into *C. calcar*," and "runs insensibly into *C. cassis* on one hand, and on the other into the Planularian section of the *Vaginulinæ*." Soldani's fig. *bb* and his fig. *aa* (D'Orbigny's *Cristellaria elongata*, no. 127) are there referred to as attenuate *Cristellariæ* similar to *C. crepidula*, F. & M. sp., but keeled. Fig. *dd*, one of the subcostate Planularian forms, has no keel, and so far satisfies the strict requirements of subvarietal collocation; but the keeled forms are no less closely related. (See succeeding note on No. 49.) We are inclined to regard them all as *C. crepidula*; and if the keeled forms are to be indicated by a name, D'Orbigny's "*Cr. elongata*"* well serves the turn, having the same relation to *C. cultrata* that *C. crepidula* has to *C. rotulata*. Soldani, Testac. vol. ii. Appendix, p. 146, pl. 18. figs. 91, *r, R*, represent a fine *C. crepidula* from San Quirico.

49. *Planularia rostrata*, D'Orb. Pl. X. fig. 75.

"*Nautili Lituitati Cuspides*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 58. fig. *dd*. D'Orb. *op. cit.* p. 260. no. 7.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani*.)

* The same as D'Orbigny's *Cristellaria lanceolata*, For. Foss. Vien. p. 89, pl. 3. figs. 41, 42.

An elegant, narrow Planularian *Cristellaria* (figs. *cc* and *dd* are subcostate) with attenuate, almost mucronate, extremities. (D'Orbigny's reference is to pl. 68—evidently an error.)

Figs. *cc* & *dd* have elongate riblets on the lower (earlier) part of the shell, better shown in pl. 59. fig. *pp*, in vol. i. The series under notice, figs. *aa*–*dd*, are dimorphous varieties, showing the transition from relatively broad-chambered *Planularia* to those with extremely narrow, elongate, and sub-parallel chambers, and having their original Cristellarian growth more and more definitely succeeded by subsequent chambers set on at a considerable angle, as on either side of a *Flabellina*.

50. *Bigennerina lævigata*, D'Orb. Pl. XI. fig. 124.

"*Orthoceratia Baculi*;" Soldani, Testac. vol. i. pt. 2. p. 96, pl. 103. fig. *D*. D'Orb. *op. cit.* p. 261. no. 3.

"*Hab.* The Adriatic."

This may be accepted as the Nodosarian form of *Textularia gibbosa*; that is to say, it is a short stout variety of *Bigennerina* with somewhat irregular inflated chambers.

51. *Textularia obtusa*, D'Orb. Pl. XI. fig. 115.

"*Polymorpha Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 127. fig. *H*. D'Orb. *op. cit.* p. 262. no. 1.

"*Hab.* The Adriatic." (With a variety of other Foraminifera: a few from the Adriatic, many from the Mediterranean, and some fossil from near Sienna, *Soldani*.) See note on *Textularia gibbosa*, no. 54.

52. *Textularia lævigata*, D'Orb. Pl. XI. fig. 116.

"*Polymorpha Janiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 132. figs. *L*, *M*? D'Orb. *op. cit.* p. 262. no. 4.

"*Hab.* The Adriatic." (Mediterranean[?], *Soldani*.)

See note on *Textularia gibbosa*, No. 54. Fig. *L* has eight chambers: fig. *M* is smaller and younger, with only four chambers; but it is apiculate.

53. *Textularia punctulata*, D'Orb. Pl. XI. fig. 117.

"*Nautili amphorarii vel janiformes*;" Soldani, Testac. vol. ii. Appendix, p. 141, pl. 7. figs. 46, *e*, *E*. D'Orb. *op. cit.* p. 262. no. 4.

"*Hab.* The Adriatic."

See note on *Textularia gibbosa*, No. 54. D'Orbigny regards this figure as "*vue en devant*;" but it is really a minute and young shell seen edgewise, and showing only the edge of the first chamber and the aperture of the second.

54. *Textularia gibbosa*, D'Orb. Pl. XI. fig. 118.

"Polymorpha *Janiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 132. figs. I, K. D'Orb. *op. cit.* p. 262. no. 6.

"*Hab.* Recent in the Adriatic; fossil at Castel-Arquato." (Mediterranean [?], *Soldani*.)

These also are broadly ovate edge-views of two young shells, one apiculate and the other bluntly angular at the apex. The four *Textulariæ* above enumerated may, so far as we can gather from Soldani's figures, be taken as belonging to the same group, of which *T. gibbosa* (as we know it from the Models) is the best central representative. The figures of *T. gibbosa* selected by D'Orbigny give us little or no assistance in the determination of the characters of the species; but in D'Orbigny's Model no. 28 we have the deficiency supplied. (See Ann. Nat. Hist. ser. 3. vol. xvi. p. 23, pl. 2. fig. 60.) The figure alluded to as *T. obtusa* (No. 51) shows more inflated chambers and a proportionally longer and more parallel-sided shell than in *T. laevigata* (No. 52). There is nothing in Soldani's figure named by D'Orbigny *T. punctulata* (no. 53) to found a species upon. Of these four names we propose only to accept one; and we prefer *Textularia gibbosa*, not only because the Model no. 28 seems the most trustworthy basis, but because it also presents the peculiarities developed to their full extent.

55. *Textularia sagittula*, DeFrance. Pl. XI. fig. 114.

"Polymorpha *Sagittulæ*;" Soldani, Testac. vol. i. pt. 2. p. 120, pl. 133. fig. T. D'Orb. *op. cit.* p. 263. no. 20.

"*Hab.* Living on the shores of the Mediterranean; fossil at Castel-Arquato." (Mediterranean or Adriatic, *Soldani*.)

A good subtype; but Soldani's figure of a minute specimen is rough and inaccurate, as was frequently the case when the objects were too small for his artist's microscopical apparatus. This species is noticed in the paper on the species enumerated by De Blainville and DeFrance (Ann. Nat. Hist. ser. 3. vol. xii. pp. 217, 218).

56. *Textularia echinata*, D'Orb. Pl. XI. fig. 126.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 127. fig. K. D'Orb. *op. cit.* p. 263. no. 24.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani*.)

Soldani's drawing seems rather to be intended for *Bulimina aculeata*, D'Orb.; and an adjoining figure (*I*) on the same plate confirms this view.

57. *Textularia caudata*, D'Orb. Pl. XI. fig. 120.

"Polymorphum *triangulare*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 132. fig. G. D'Orb. *op. cit.* p. 263, no. 25.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani*.)

This appears to be a minute abnormal *Textularia*, or some other Enallostegian form, produced at the apex into a cylindrical stem, and having on the last chamber a subcylindrical tube, or process, pointing upwards and outwards.

58. *Textularia tuberosa*, D'Orb. Pl. XI. fig. 119.

"Polymorpha Janiformia;" Soldani, Testac. vol. ii. p. 39, pl. 14. fig. h. D'Orb. *op. cit.* p. 263, no. 26.

"*Hab.* The Adriatic." (Fossil near Sienna, *Soldani*.)

A short, inflated, broad-mouthed *Textularia*, belonging probably to *T. gibbosa*.

59. *Vulvulina pupa*, D'Orb. Pl. XI. fig. 122.

"Orthoceratia *Pupa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 108. figs. vv, xx. D'Orb. *op. cit.* p. 264, no. 2.

"*Hab.* The Adriatic." (Rimini shore, *Soldani*.)

Accepting *Grammostomum* as a Textularian subgenus, comprising the short, wide, thin-edged varieties, which are usually, though not invariably, limbate at the sutures, this may be regarded as a useful subordinate form, characterized by its well-defined carinate margin. See also No. 35, p. 162.

Soldani's remarks on the *Grammostoma* figured on his plate 108 are so strikingly illustrative of the slow progress of naturalists in the recognition and discrimination of Foraminifera, so expressive of his own patient research and of his openness to conviction by the teaching of fellow-workers, and, further, so suggestive of a broad knowledge and wise foresight as to the probable requirements of the complete study of Foraminifera, that we reproduce his own words:—

"Post diutina super his Corpusculis observationem placuerat prius ea in album Testarum Hammoniformium referre: at post acceptam epistolam Cl. Modeerii ad Cap. IV. recensitam, ad Orthoceratia transtuli. Si cui forte magis lubeat de his novum genus conficere nec nos obstatum. Hoc tantum monere oportet, has Testas, quas pro coronide hujus capituli [Cap. VI. De Orthoceratiis] heic reponimus, esse raras; et in hoc Vase [CCXL.] contentas n. 26. Summa difficultate ab arenulis littoris Ariminensis excerptas: ac proinde testamur, in aliis littoribus omnibus, tum etiam in fundo maris [Tyrrheni], et in concretionibus zoophyticis per nos hactenus expensis, eas omnino desiderari. Ex hoc vel unico exemplo edoctus quis non dixerit, ad locupletiolem acquirendam Testarum [cogni-

tionem], maria inter se longe dissita, diversos ejusdem maris sinus ac fundos, variasque pelagi plagas prorsus requiri?" (p. 100.)

60. *Vulvulina elegans*, D'Orb. Pl. XI. fig. 123.

"Orthoceratia *Pupa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 108. fig. *D*.
D'Orb. *op. cit.* p. 264. no. 3.

"*Hab.* —?" (No locality is given by D'Orbigny; but Soldani's figures were taken from Adriatic specimens collected on the shore at Rimini.)

This (*Grammostomum elegans*) has a dentate margin, caused by the extension of the outer end of each segment so as to form a pointed process, which is generally somewhat curved upwards.

61. *Dimorphina tuberosa*, D'Orb. Pl. XI. fig. 108.

"Orthoceras *tuberosum*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 106. fig. *gg*. D'Orb. *op. cit.* p. 264. no. 1.

"*Hab.* The Mediterranean."

See note on Model no. 60, Ann. N. H. ser. 3. vol. xvi. p. 28, and our Monograph of the *Polymorphinæ*, Linn. Soc. Trans. vol. xxvii. p. 249.

62. *Polymorphina tuberosa*, D'Orb. Pl. XI. fig. 105.

"Orthoceratia *tuberosa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 107. fig. *kk*.
D'Orb. *op. cit.* p. 265. no. 6.

"*Hab.* The Mediterranean, on the shores of Corsica."
(Tuscan shore, *Soldani*.)

Irregularly grown *Polymorphinæ*, which need not be separated from *P. compressa*. Our outline is copied from the least irregular of Soldani's figures.

63. *Polymorphina Soldanii*, D'Orb. Pl. XI. fig. 106.

"Orthoceratia *tuberosa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 107. fig. *nn*.
D'Orb. *op. cit.* p. 265. no. 12.

"*Hab.* The Adriatic, near Rimini."

A subcylindrical variety, with chambers arranged very much as in some *Uvigerinæ*, and attenuated towards their base as alar or overlapping lobes, with a tendency to open with basal orifices along the margins. See also our Monograph of the *Polymorphinæ*, l. c. p. 235, pl. 40. fig. 20.

64. *Polymorphina (Globulina) ovata*, D'Orb.

Pl. XI. fig. 104.

"*Polymorpha subcordiformia* vel *oviformia*;" Soldani, Testac. vol. i. pt. 2. p. 114, pl. 112 (not 182). fig. *gg*. D'Orb. *op. cit.* p. 266. no. 22.

"*Hab.* Living in the Adriatic, near Rimini; fossil near Bordeaux and near Beauvais."

Two figures of the opposite sides of an ovate *Polymorphina*, probably best referred to the type, *P. lactea*.

65. *Polymorphina (Pyrulina) gutta*, D'Orb.

Pl. XI. fig. 107.

"Polymorphum;" Soldani, Testac. vol. i. pt. 2 (omitted at p. 116), pl. 122. fig. *gg*? D'Orbigny, *op. cit.* p. 267. no. 28.

"*Hab.* Fossil at Castel-Arquato." (Not mentioned in Soldani's text.)

Previously noticed among the species illustrated by D'Orbigny's own plates in the 'Annales,' Ann. N. H. ser. 3. vol. xii. p. 440, and in our Monogr. *Polymorphinæ*, Linn. Trans. vol. xxvii. p. 218.

66. *Uvigerina pygmæa*, D'Orb. Pl. XI. fig. 109.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 130. figs. *ss*, *tt*. D'Orb. *op. cit.* p. 269. no. 2.

"*Hab.* Fossil in the neighbourhood of Sienna." (Mediterranean or Adriatic; and perhaps fossil near Sienna, *Soldani*.)

Our figure is copied from *ss*; the other reference is to an ill-grown arrested specimen of the same species. See notes on Models no. 67 &c., and especially Phil. Transact. vol. clv. p. 363.

67. *Uvigerina nodosa*, D'Orb. Pl. XI. fig. 110.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 126. figs. *xx*, *yy*, *zz*, *A*, *B*. D'Orb. *op. cit.* p. 269. no. 3.

"*Hab.* The Adriatic." (Mediterranean or Adriatic; probably fossil near Sienna, *Soldani*.)

These five figures are all *U. pygmæa*, not differing amongst themselves more than may be seen in any batch of recent specimens. (Fig. *zz* is copied.)

68. *Uvigerina nodosa*, var. β , D'Orb. Pl. XI. fig. 111.

"Testæ pineiformes minusculæ;" Soldani, Testac. vol. ii. p. 18, pl. 4. figs. *E*, *F*, *G*, *H*. D'Orb. *op. cit.* p. 269. no. 3.

"*Hab.* The Adriatic." (Fossil at San Quirico, *Soldani*.)

A somewhat mixed lot, not easily referable to any single species, but belonging to the *Uvigerine* type. All of them have smooth shells; and fig. *H* resembles *U. irregularis*. Fig. *G* is a *Sagrina* (dimorphous or Clavuline *Uvigerina*; see Ann. N. H. ser. 3. vol. v. p. 469); the others are broad smooth forms. (Fig. *E* is copied.)

69. *Bulimina trilobata*, D'Orb. Pl. XI. fig. 127.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 131. fig. xx. D'Orb. *op. cit.* p. 269. no. 6.

"*Hab.* The Adriatic, near Rimini." (Mediterranean or Adriatic, *Soldani*.)

This is *Bulimina aculeata*, D'Orb. See next paragraph.

70. *Bulimina aculeata*, D'Orb. Pl. XI. fig. 128.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. pp. 118, 119, pl. 127. fig. I, pl. 130. fig. vv. D'Orb. *op. cit.* p. 269. no. 7.

"*Hab.* The Adriatic, near Rimini." (Mediterranean or Adriatic, *Soldani*.)

Morphologically similar to *B. marginata*, but having a series of long spines fringing the outer margins of the segments, in place of the finely serrate edges exhibited by that species.

71. *Rosalina mediterraneensis*, D'Orb. Pl. XII. fig. 141.

72. " " " Pl. XII. fig. 140.

"*Hammonia subconica*" &c.; Soldani, Testac. vol. i. pt. 1. p. 56, pl. 36. figs. Y, Z? D'Orb. *op. cit.* p. 271. no. 2.

"*Hab.* The Mediterranean, attached to seaweed."

These two figures represent different subvarietal forms of *Pulvinulina*. Soldani's fig. Z (our Pl. XII. fig. 140) is so little differentiated from the type *P. repanda* that it needs no distinctive name; his other figure (Y, our Pl. XII. fig. 141) may be adopted as a variety under D'Orbigny's name. For an account of *Pulvinulina repanda* and its varieties, see Phil. Trans. vol. clv. pp. 390 &c.

Figs. S, V, X all represent *Pulvinulina repanda*, var. *pulchella*, more or less modified (fig. X is *P. Boueana*, D'Orb. sp.); so also pl. 35. fig. R is *P. pulchella*; and in pl. 37, fig. A is perhaps a young *P. repanda*; fig. B is *P. concentrica*, P. & J., found at depths of 40 fathoms and more in the British seas and elsewhere; figs. C, D, F are modifications of *P. repanda*; whilst pl. 38. fig. G is a variety near *P. caracolla*; pl. 37. fig. E is *Pulvinulina auricula*, F. & M.; and pl. 35. fig. T is *Rotalia Beccarii*, var. *ammoniformis*.

73. *Rosalina Soldanii*, D'Orb. Pl. XII. fig. 144.

74. " " " Pl. XII. fig. 148.

"*Hammonia Trochi*;" Soldani, Testac. vol. i. pt. 1. p. 61, pl. 51. fig. kk?, ll. D'Orb. *op. cit.* p. 271. no. 9.

"*Hab.* ——" (Mediterranean, *Soldani*.)

These figures appear to be referable to two different types.

The first of them, *kk* (our fig. 144), is a variety of *Pulvinulina repanda*, near *P. antillarum* and *P. Karsteni* in the morphological series; the other, fig. *ll* (our fig. 148), is more like a true *Rotalia*, and, in absence of any very satisfactory data, may be regarded as an accidentally adherent specimen of the typical *R. Beccarii*.

75. *Rotalia Brongniartii*, D'Orb. Pl. XII. fig. 143.

"*Hammonia subconica*" &c.; Soldani, Testac. vol. i. pt. 1. p. 56, pl. 38. fig. H. D'Orb. *op. cit.* p. 273. no. 27.

"*Hab.* Fossil at Castel-Arquato." (Mediterranean, *Soldani*.)

This is *Pulvinulina auricula*, F. & M., sp.

76. *Rotalia communis*, D'Orb. Pl. XII. fig. 145.

"*Hammonia subconica*" &c.; Soldani, Testac. vol. i. pt. 1. p. 56, pl. 38. fig. L. D'Orb. *op. cit.* p. 273. no. 29.

"*Hab.* The Adriatic, near Rimini; the Mediterranean, near Agde" (Tuscan shore, *Soldani*); "the shores of Africa and Madagascar; fossil on the shores of the Tau lagoon" (South France).

This is a *Pulvinulina*, not differing greatly from the *P. pulchella* of the Models. It is an elongate form, not so symmetrically or neatly made as the "Model" referred to, so far as one can judge by Soldani's somewhat rude and indefinite figure.

77. *Rotalia (Turbinulina) italica*, D'Orb.

Pl. XII. fig. 147.

"*Hammonia conico-tuberculata*;" Soldani, Testac. vol. i. pt. 1. p. 56, pl. 35 (not 26). fig. R [P]. (Mediterranean, *Soldani*).

"*Hammonia globoso-rotundata*;" Soldani, Testac. vol. ii. App. p. 139, pl. 2. figs. 21, *f*, *F*, *G*. (Higher pits on Mount Volterro, *Soldani*.) D'Orb. *op. cit.* p. 275. no. 43.

"*Hab.* Living in the Mediterranean at Civit  Vecchia; fossil at Castel-Arquato and at Saucats."

Very ambiguous, owing to D'Orbigny's careless references. "Plate 26" is an obvious error; and if we turn to pl. 35, which tallies with the letterpress reference, we find in fig. *P* (not *R*, which is *Pulvinulina pulchella*) the tuberculate form of *R. Beccarii*, corresponding to the figs. *F*, *G* in the Appendix, from which our outlines are copied. The whole of these figures, however, may be properly placed with the typical *Rotalia Beccarii*, the tubercles on the under surface probably representing nothing more than a modification of the sutural granulation of this species. *Rotalia Beccarii* and its relationships are treated of in Phil. Trans. vol. clv. pp. 387 &c.

78. *Rotalia* (*Turbinulina*) *Siennensis*, D'Orb.

Pl. XII. fig. 130.

"*Hammonia univoluta*;" Soldani, Testac. vol. ii. App. p. 139, pl. 3. figs. 22, *h*, *H*, *I* [?]. D'Orb. *op. cit.* p. 275. no. 50.

"*Hab.* Fossil in the neighbourhood of Sienna."

This is another case of difficulty, arising from incorrect quotations. D'Orbigny has "pl. 4. figs. *K*, *L*," which represent small Gasteropods or spiral Annelids, and are further shown to be wrong by the letterpress reference. Turning to pl. 3, the first four figures, *H*–*L*, all seem to represent small varieties of *Planorbulina*; and as *H* & *I* correspond with *Soldani's* text-name, quoted by D'Orbigny, we have made our copy from them, and taken them as the basis for determination.

Figs. *H*, *I* are probably *Planorbulina Ungeriana*, D'Orb. sp., especially resembling its barely separable subvariety known as *Pl. Akneriana* (D'Orb.); and *K*, *L* (belonging to Soldani's "*Hammonia concavo-umbilicata*") seem to be *Pl. ammonoides*, D'Orb. sp.

79. *Rotalia* (*Turbinulina*) *elegans*, D'Orb.

Pl. XII. fig. 142.

"*Nautili Ammoniformes* sive *trochiformes*;" Soldani, Testac. vol. ii. App. p. 138, pl. 2. figs. 13, *q*, *Q*, *R*. D'Orb. *op. cit.* p. 276. no. 54.

No locality given. (Fossil at Coroncina, *Soldani*.)

This is *Pulvinulina elegans*, a good representative of an important section of the genus. It is not uncommon in deep water, and is often met with as a fossil in Tertiary clays.

80. *Rotalia* (*Turbinulina*) *ammoniformis*, D'Orb.

Pl. XII. fig. 149.

"*Hammonia Beccarii* seu *vulgarissimæ*;" Soldani, Testac. vol. i. pt. 1. p. 55, pl. 34. fig. *K*. D'Orb. *op. cit.* p. 276. no. 55.

"*Hab.* Fossil at Coroncina." (In the Mediterranean, and fossil at Sienna, *Soldani*.)

The large, finely made, many-chambered variety of *Rotalia Beccarii*, found at Rimini, in the Adriatic. Soldani says of it:—"Omnium hujus speciei Hammoniarum, quæ hucusque ad manus nostras venerunt, maximæ." It differs from *R. Beccarii* chiefly in its lower surface, which shows the inner turns of the spire to a considerable extent, and is free from the granulation and sutural ruggedness which are usually marked characters in the type. D'Orbigny's locality for the variety as a fossil must stand on his own authority. Soldani mentions it as a constituent of the littoral sands of the Adriatic,

and as being found abundantly fossil in the sands near Sienna.

81. *Globigerina bulloides*, D'Orb. Pl. XI. fig. 112.

"Polymorpha *Tuberosa* et *Globulifera*;" Soldani, Testac. vol. i. pt. 2. p. 117, pl. 123. figs. *H*, *I*, *O*, *P*. D'Orb. *op. cit.* p. 277. no. 1.

"*Hab.* The Adriatic, near Rimini."

Noticed in previous papers, especially in Phil. Trans. vol. clv. pp. 365 &c.

Fig. *H* seems to be a few-celled *Globigerina*; so also fig. *M*. Indeed, excepting fig. *K* (*Cassidulina*), all the figures of pl. 123 are *Globigerinae*, and all of pl. 124, except perhaps fig. *Z*; also all of pl. 125, and half of those of pl. 126.

82. *Globigerina elongata*, D'Orb. Pl. XI. fig. 129.

"Polymorpha *Tuberosa* et *Globulifera*;" Soldani, Testac. vol. i. pt. 2. p. 117, pl. 123. figs. *K*. D'Orb. *op. cit.* p. 277. no. 4.

"*Hab.* Recent in the Adriatic, near Rimini; fossil at Castel-Arquato." (Mediterranean, *Soldani*.)

Though these two figures of the minute specimen are rude, and, owing to the nature of the engraving, there is no indication of the texture of the shell, we have no hesitation in assigning these figures to the genus *Cassidulina*; the aperture and general arrangement of the segments equally point to this conclusion. They may perhaps be best placed with *C. oblonga*.

83. *Globigerina helicina*, D'Orb. Pl. XI. fig. 113.

"Polymorpha *globulifera*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 130. figs. *pp*, *qq*, *rr*. D'Orb. *op. cit.* p. 277. no. 5.

"*Hab.* The Adriatic, near Rimini." (Mediterranean and Adriatic, *Soldani*.)

A large, many-chambered, lobular variety, which we have found convenient to retain. (Fig. *qq* is copied.) These show a tendency to have bilobate segments, whilst No. 81 shows trilobation.

84. *Gyroidina lævigata*, D'Orb. Pl. XII. fig. 150.

Soldani, Testac. vol. ii. App. p. 141, pl. 8. figs. 33, *aa*, *AA*, *BB*. D'Orb. *op. cit.* p. 278. no. 2.

"*Hab.* The Adriatic, near Rimini." (Fossil near Sienna &c., *Soldani*.)

Not separable from the *Gyroidina orbicularis* of the "Models."

The generic term *Gyroidina* is needless; all the species

described by D'Orbigny are true *Rotaliæ*. These specimens are from the fossil shell-dust of Sienna and San Quirico.

85. *Gyroidina Soldanii*, D'Orb. Pl. XII. fig. 151.

"*Nautilus Melo spiralis*;" Soldani, Testac. vol. i. pt. 1. p. 59, pl. 46. figs. *rr*, *ss*. D'Orb. *op. cit.* p. 278. no. 5.

"*Hab.* The Adriatic, near Rimini." (Mediterranean, and fossil near Sienna, *Soldani*.)

See note on "Model" no. 36, Ann. N. H. ser. 3. vol. xvi. p. 25; and Phil. Trans. vol. clv. p. 389.

86. *Truncatulina tuberculata*, D'Orb. Pl. XII. fig. 136.

"*Hammonia tuberculatæ*" &c.; Soldani, Testac. vol. i. pt. 1. p. 58, pl. 45. figs. *ii*, *kk*, *ll*, *mm*. D'Orb. *op. cit.* p. 279. no. 1.

"*Hab.* Living on the shores of the Mediterranean and on the European shores of the Atlantic; fossil at Bordeaux, at Paris, and at Castel-Arquato."

This is *Truncatulina lobatula*, W. & J. sp. See note on "Model" no. 37; also Ann. N. H. ser. 3. vol. iv. p. 339, and Phil. Trans. vol. clv. p. 381.

On Soldani's pl. 41 most of the figures refer to *Tr. lobatula*; all but fig. *N* on pl. 42; all on pl. 43; most, if not all, on pl. 44; all on pl. 45. They are of irregular growth, mostly adherent, and closely embracing.

87. *Truncatulina refulgens*, Montfort, sp. Pl. XII. fig. 139.

"*Hammonia Balanus* seu *Balanoidea*;" Soldani, Testac. vol. i. pt. 1. p. 58, pl. 46. figs. *nn* [?], *oo*. D'Orb. *op. cit.* p. 279. no. 5.

"*Hab.* Adriatic, near Rimini; Mediterranean, off Corsica; South Seas, at Rawack, Madagascar, and Cape of Good Hope." (Mediterranean, *Soldani*.)

See note on Model no. 77, and particularly Ann. Nat. Hist. ser. 3. vol. vi. p. 340. Montfort's drawing of his "Genre 31" (*Cibicides refulgens*) is a bad copy of Soldani's fig. *oo*.

Both Soldani and D'Orbigny have been misled by the isomorphism which exists between the two groups *Planorbulina* (including *Truncatulina*) and *Pulvinulina*, in associating the two figures *nn* and *oo* under the same name. It is difficult to speak with certainty from engravings on copper, in a matter requiring nice discrimination with respect to shell-texture and the like; but we feel assured that the first figure (*nn*) represents a *Pulvinulina*—the *Rotalina truncatulinoides* of D'Orbigny (Foram. de Canaries, pl. 2. figs. 25–27), a subvariety of *Pulvinulina Menardii*, and near *P. Micheliniana*, *P.*

crassa, and *P. nitida* (Phil. Trans. vol. clv. p. 393). Fig. *oo* is really a *Truncatulina*.

88. *Truncatulina variabilis*, D'Orb. Pl. XII. fig. 138.

"Testæ hammoniformes, *plano-cochleatæ*, *tuberosæ*, *articulatæ*," &c.; Soldani, Testac. vol. i. pt. 1. pp. 77-80, pls. 70-92. D'Orb. *op. cit.* p. 279. no. 8.

"*Hab.* The Mediterranean."

Soldani devotes nearly twenty-four of his folio plates (pl. 93. figs. *kk-oo*) might have been added by D'Orbigny) to the illustration of the outspread, irregular, and usually adherent varieties of *Truncatulina*; in all there are no less than 284 figures. Never was a subspecific form so well depicted in all its modifications.

Possibly this form in all its phases may be best placed under *Truncatulina tuberosa*, F. & M. sp. (Ann. N. H. ser. 3. vol. v. pp. 177-179). Our limits preclude the reproduction of more than one of Soldani's figures; and this, of course, gives no idea of the range of variation so laboriously and clearly exemplified by the indefatigable Soldani and his artists (Ciro Santi and A. Costa).

89. *Planulina Ariminensis*, D'Orb. Pl. XII. fig. 131.

"*Ammonia foliaceæ*;" Soldani, Testac. vol. ii. App. p. 140, pl. 3. figs. 25, *o*, *O*, *P*.

"*Hammonia subrotundæ*;" Id. *ibid.* vol. i. pt. 1. p. 61, pl. 50. fig. *ee*. D'Orb. *op. cit.* p. 280. no. 1.

"*Hab.* The Adriatic, near Rimini." (Mediterranean, and fossil at Coroncina, *Soldani*.)

Figs. *O*, *P* are copied, which have little of the sutural limbation characterizing the best-grown specimens, such as D'Orbigny's Model no. 49, and Soldani's pl. 50. fig. *ee*. Indeed it is rather D'Orbigny's *Anomalina rotula* (For. Foss. Vien. pl. 10. figs. 10-12), one of the feeblest of the neat flat *Planorbulina* (*Planulina*), that we have here before us.

90. *Planulina incerta*, D'Orb. Pl. XII. fig. 137.

"*Ammonia Plano-convexæ*;" Soldani, Testac. vol. ii. App. p. 140, pl. 3. figs. 26, *q*, *Q*, *R*. D'Orb. *op. cit.* p. 280. no. 3.

"*Hab.* The Adriatic." (Fossil, rare near Sienna, *Soldani*.)

Apparently a young specimen of *Truncatulina lobatula*, the upper view disclosing a little more of the interior whorl of chambers than usual in typical examples.

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91. *Planulina Soldanii*, D'Orb. Pl. XII. fig. 132.

"*Hammonia subrotundæ*;" Soldani, Testac. vol. i. pt. 1. p. 61, pl. 50. fig. Z.

"*Hammonia planæ rotundæ*;" Id. ibid. p. 62, pl. 53. fig. xx. D'Orb. *op. cit.* p. 280. no. 4.

No locality given. (Mediterranean, *Soldani*.)

A complanate thin *Planorbulina*, differing from *P. Ariminensis* chiefly in possessing a narrow carina round the shell. One of the figures (the upper side?) comprised in the second reference has large conspicuous foramina, as also other *Planorbulinae* in the same and in the foregoing (52) plate and elsewhere. (Pl. 53. fig. xx copied.)

92. *Planorbulina Mediterranensis*, D'Orb.

Pl. XII. fig. 133.

"*Corpuscula plano-papillosa*;" Soldani, Testac. vol. i. pt. 3. p. 238, pl. 161. figs. E, F, G, pl. 162. fig. H. D'Orb. *op. cit.* p. 280. no. 2.

"*Hab.* The Mediterranean, growing attached to various bodies."

See note on Model no. 79, and Phil. Trans. vol. clv. p. 380.

93. *Planorbulina vermiculata*, D'Orb. Pl. XII. fig. 146.

"*Placentulæ*;" Soldani, Testac. vol. i. pt. 3. p. 237, pl. 161. figs. A, B, C. D'Orb. *op. cit.* p. 280. no. 3.

"*Hab.* The Mediterranean" *.

A rare, but distinct, vermiculate species of *Pulvinulina*. Phil. Trans. vol. clv. pp. 390, 393. (Fig. B is copied.)

94. *Soldania carinata*, D'Orb. Pl. X. fig. 83.

"*Nautili*;" Soldani, Testac. vol. ii. App. p. 145, pl. 18. figs. 91, p, P, Q. D'Orb. *op. cit.* p. 281. no. 1.

"*Hab.* Fossil at Coroncina." (San Quirico, *Soldani*.)

By Soldani's figure the shell appears to have a diameter of nearly one-seventh of an inch, and seems referable to *Cristellaria*, and near to *C. cultrata*. We accept it as a beautiful, explanate, keeled *Cristellaria*, orbicular, with numerous short chambers, and umbonate.

95. *Soldania spirorbis*, D'Orb. Pl. XII. fig. 153.

"*Porpitæ soluti*;" Soldani, Testac. vol. ii. App. p. 140, pl. 4. figs. 34, g, G, h, H. D'Orb. *op. cit.* p. 281. no. 2.

"*Hab.* Fossil at Coroncina." (Cormons, Forojulio, *Soldani*.)

* "Reperiuntur in fundo maris ad Portum Ferrarium et Liburnensem, et quidem copiosè, ut patet ex hoc vasculo, in quo 1662 continentur sub pondere granorum sex."

These can only be referable to *Nummulina*. Soldani's sketches, *g, h*, indicating the natural size, are as large as our outlines; and his other figures show some of the characters of *Nummulina exponens*.

96. *Soldania nitida*, D'Orb. Pl. XII. fig. 134.

Soldani, Testac. vol. i. pt. 2. p. 151, pl. 135. fig. I. D'Orb. *op. cit.* p. 281. no. 3.

"*Hab.* Fossil at Coroncina." (Fossil at Clusenti, *Soldani*.)

If D'Orbigny found the exact counterpart of this, it was curious; and if he did not, why he should have chosen a drawing of a quite indeterminable fragment as the foundation of a species, we cannot tell. Soldani explicitly states that the figure does but represent a section:—"Alterum [*I*] est Hammonia, sive potius Nautilus dimidiatus." It may possibly be a fragment of a *Planorbulina*; beyond this we can offer no suggestion.

[To be continued.]

XIX.—On the *Alauda bimaculata* of *Ménétriés*. By R. B. SHARPE, F.L.S. &c., Librarian to the Zoological Society of London.

THROUGH the kindness of Canon Tristram and other friends, I have had a large series of Calandra Larks submitted to me lately, with a view to identify the species which belong to the European fauna. Hitherto only one species has been admitted as European, viz. the ordinary Calandra Lark, *Melanocorypha calandra* (L.); but Dr. Tristram, writing in 'The Ibis' for 1868 (p. 208), remarks, in the course of his essay on the Ornithology of Palestine:—

"Before concluding these notes on the Passerine birds of Palestine, I must state that, on going through my collection recently, in company with the editor of this Journal, we were satisfied that the Calandra Lark of Mount Hermon and Lebanon must be distinguished from the common Calandra of the plains and of Southern Europe. It is smaller and more slender, with a very decided rufous tint on the whole of its plumage; but especially the outer rectrices are without any white, while in the true *M. calandra* (L.) the outer tail-feathers are wholly white. But before describing the species as new, I am anxious to have an opportunity of examining Persian and Affghan specimens."

I am indebted to the reverend gentleman for the loan of the specimens on which the above remarks were founded, and I