1917.

WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 72.

Palæontological Contributions

TO

The Geology of Western Australia.

SERIES VI., Nos. XI. and XII.

BY

F. CHAPMAN, A.L.S., F.R.M.S., Etc.,
Palæontologist, The National Museum, Melbourne, Victoria,
and
R. ETHERIDGE, Jr.,
Curator, The Australian Museum, Sydney, New South Wales.

Issued under the Authority of
THE HON. R. T. ROBINSON, K.C., M.L.A., MINISTER FOR MINES.

WITH FIFTEEN PLATES AND ONE MAP.

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PREFATORY NOTE.

The two contributions to which the Geological Survey is indebted to the authors have been received since the publication of the last of the palæontological series (Bulletin 58) was issued in 1914.

The first contribution is from the pen of Mr. Frederick Chapman of the National Museum, Melbourne, who has been engaged for a year or two past upon a study of the *Foraminifera* and *Ostracoda* of the Gingin "Chalk," and in this report makes an important contribution to the palæontology of the Cretaceous Rocks of the State, as developed in this locality. Mr. Chapman, who is recognised as one of the world's leading specialists on Foraminifera, regards the Gingin beds as belonging rather to the Albian-cum-Cenomanian horizon or the lower part of the Upper Cretaceous, than the Aptian or Lower Cretaceous; a correlation which is paralleled as the result of his investigations into the Ostracods from Gingin.

It is interesting to note that in Bulletin 55, which contains an account by Mr. Etheridge of some Cretaceous fossils from Gingin, the close relationship between the beds of India and Western Australia was pointed out. The Cretaceous Rocks of South Africa, as pointed out by Mr. Chapman, show a striking faunal resemblance to those of Australia, and thus afford another instance of the intimate geological kinship existing between the countries bordering the Indian Ocean—a resemblance, as has already been pointed out, obtaining in the Pre-Cambrian, and the Palæozoic Rocks of these widely separated areas.

The second contribution by Mr. R. Etheridge upon the occurrence of *Girvanella* in the Cambrian Rocks of Kimberley makes a further addition to our scanty knowledge of the palæontology of this important formation.

A. Gibb Maitland

GOVERNMENT GEOLOGIST.

Geological Survey Office,
Beaufort Street, Perth,
16th January, 1917.

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TABLE OF CONTENTS.

	Page
Prefatory Note	4
XI.—Monograph of the Foraminifera and Ostracoda of the Gingin Chalk	9–59
Introduction	9
Notes on the Washings of Gingin Chalk	10
Previous Records of Cretaceous Foraminifera in other parts of Australia	11
General Remarks on the Foraminifera Fauna of Gingin	14
The Foraminifera	15
Literature referred to in the Text—Foraminifera	48
General Remarks on the Ostracodal Fauna of Gingin	51
The Ostracoda	52
Literature referred to in the Text—Ostracoda	59
XII.—Girvanella in the Cambrian Rocks of North-West Australia ...	89–90
Geological Map of Gingin	Frontispiece
Plates I.–XIV.	60–87
Plate XV.	88
Index	

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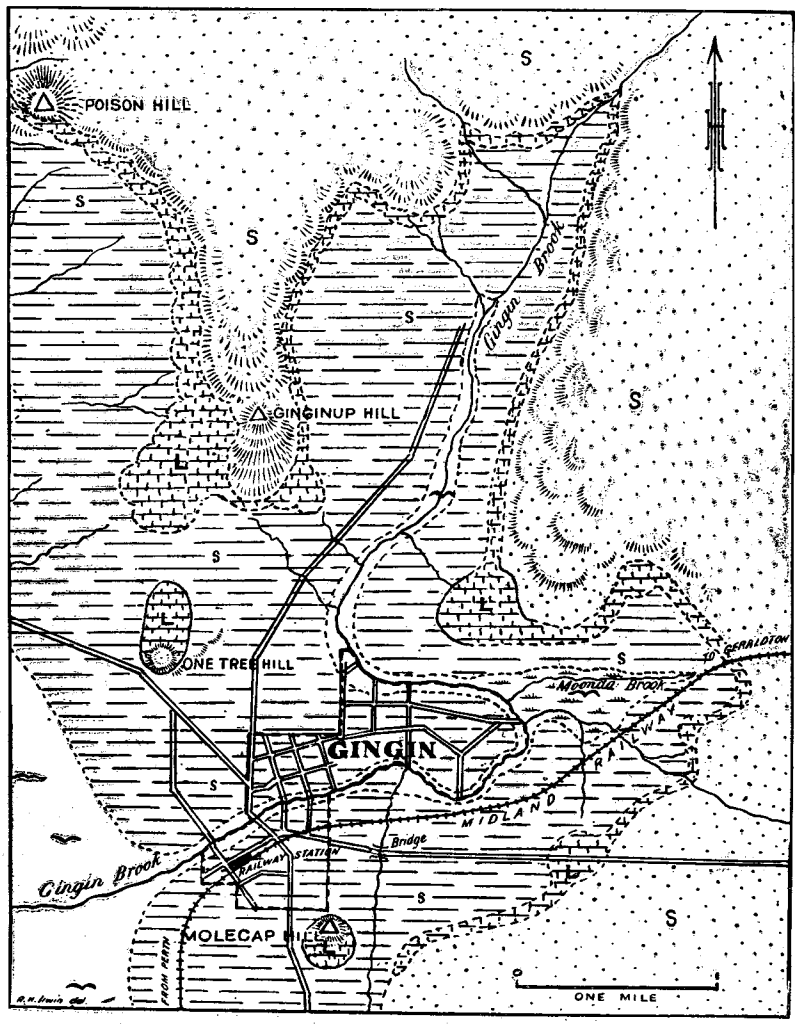
GEOLOGICAL MAP OF GINGIN.

Geol. Survey. Frontispiece. *Bulletin No. 72.*



EXPLANATION

ALLUVIUM	~
FERRUGINOUS SANDSTONE	S
GINGIN "CHALK" & CLAY	L
VARIEGATED CLAY (& Shale)	s

Boundaries obscured by drift sand and superficial deposits.

Palæontological Contributions

TO

The Geology of Western Australia.

SERIES VI.

XI.—Monograph of The Foraminifera

AND

Ostracoda of The Gingin Chalk.

BY

FREDERICK CHAPMAN, A.L.S., F.R.M.S., Etc.,

Palæontologist, The National Museum, Melbourne.

WITH FOURTEEN PLATES, I.—XIV.

Introduction.

The highly fossiliferous rock from One Tree Hill, Gingin, Western Australia, is remarkable for being the only known occurrence of an Australian Chalk so nearly equivalent in age, structure, and organic contents to the Chalk of Upper Cretaceous age in Europe and North America.

Our knowledge of this Chalk, up to the present, has been well summarised by Ludwig Glauert,* formerly Field Geologist to the Western Australian Geological Survey, who gives a plan and section of the geology of the district. The section at One Tree Hill Quarry recorded by Glauert is:—

Soil and subsoil, averaging 12 inches.
Band of white limestone without fossils, 18 inches.
Bed of Chalk, richer in Alumina and Silica as it is followed downwards; at 15 feet resembling a greenish glauconitic clay.

The chemical composition of this Chalk is given by the Government Geologist of Western Australia, Mr. A. Gibb Maitland, in a note to Mr. Howchin's paper on the "Foraminifera from a Cal-

* The Geological Age and Organic Remains of the Gingin "Chalk."—Bull. Geol. Surv., W. Australia, No. 36, 1910, pp. 115-127.

careous Marlstone, Gingin,"* the analysis of which was made by E. S. Simpson :—

Silica	15·09
Carbonic Acid	33·02
Sulphuric anhydride	·13
Lime	42·41
Magnesia	1·32
Iron protoxide	1·16
Iron peroxide	trace
Alumina	3·15
Water (combined)	1·18
Water (hygroscopic)	1·99
	99·45

The large fossils obtained from the Gingin Chalk have been already described by R. Etheridge, jun., whose paper "The Cretaceous Fossils of the Gingin Chalk "† enumerates a Sponge, a Coral, Echinoid spines, Worm tubes, a Cirripede, Brachiopods, Bivalves, Gasteropods, Cephalopods and Fish teeth. In comparing the Gingin Chalk with the Cretaceous elsewhere, Mr. Etheridge‡ believes it to be connected with the Indian Cretaceous System, which has "been paralleled with the European Upper Cretaceous." At the same time Mr. Etheridge points out that the relationship of the Western Australian fossils is rather with the Rolling Downs Formation than with the Desert Sandstone, generally termed "Upper Cretaceous."

In Mr. Walter Howchin's paper already referred to,§ a list of the Foraminifera from Gingin, together with comments on their age and distribution, is given ; in all 37 species. These are now included together with the results of an examination of a large quantity of material which the Government Geologist of Western Australia has placed in my hands for description. Before undertaking the investigation of this material Mr. Howchin had signified his wish that I should amplify the work on this particular rock, upon which he had already written. It is only right to state here that the sample with which Mr. Howchin was supplied was not nearly so rich as that forming the basis of the present work.

Notes on the Washings of Gingin Chalk.

The finest material derived from the washings consists largely of the somewhat problematic algæ termed coccoliths. These bodies, shaped something like flattened shirt-studs, are, in the fossil condition, very characteristic of the Upper Cretaceous in

* Bull. Geol. Surv., W. Australia, No, 27, 1907, p. 38.
† *Ibid.*, No. 55, 1913, p. 9.
‡ Loc. cit., p. 24.
§ Bull. Geol. Surv., W. Australia, No. 27, 1907. p. 38.

Europe, but are not confined to this horizon. They are also met with sparingly in the Lias, as recorded by Rothpletz and Schwarz, and more abundantly in the Tertiary marls of Barbados : while, in the living condition they form a large proportion of the finer part of *Globigerina* ooze. The medium fine washings are crowded with the tests of *Guembelina globulosa*, together with some *Globigerinae* as *G. aequilateralis* and *G. marginata*, and *Anomalina ammonoides*. Other organic particles consist of sponge spicules and prismatic fragments of *Inoceramus* shells.

The coarser washings are mainly foraminiferal tests and valves of Ostracoda with some shell-fragments and an occasional ossicle of *Antedon*. The abundance of the microzoa resembles that seen in washings of the Chalk-marl of Kent.

Previous Records of Cretaceous Foraminifera in other Parts of Australia.

Mr. Walter Howchin, F.G.S., has published a complete census of the Cretaceous Foraminifera of Australia to 1893, in the Report of the Adelaide Meeting of the Australasian Association for the Advancement of Science (September, 1893). Fifty-six species are listed therein. Of these, twenty are common to the locality of Gingin, viz. :—

Sigmoilina celata, Costa sp.
Haplophragmium agglutinans, d'Orb. sp.
Placopsilina cenomana, d'Orb.
Ammodiscus incertus, D'Orb. sp.
Verneuilina [*Guembelina*] *polystropha*, Reuss. sp.
Gaudryina pupoides, d'Orb.
Nodosaria communis, d'Orb.
Nodosaria soluta, Reuss.
Vaginulina legumen, L. sp.
Marginulina costata, Batsch sp.
Marginulina glabra, d'Orb.
Cristellaria acutauricularis, F. and M. sp.
Cristellaria gibba, d'Orb.
Cristellaria schloenbachi, Reuss.
Cristellaria rotulata, Lam. sp.
Polymorphina angusta, Egger.
Polymorphina lactea, W. and J. sp.
Anomalina ammonoides, Rss. sp.
Truncatulina lobatula, W. and J. sp.
Pulvinulina elegans, d'Orb. sp.

By far the larger number of the Cretaceous species previously known were obtained from Central Australia by Mr. Howchin, who described the fossils obtained by boring for artesian water at Hergott, Tarkaninna, Mirrabuckinna, William Creek, and Wilcannia. From these artesian bores fifty-one species were recorded.

Two new species were described by Mr. Howchin,* viz., *Haplophragmium australe* and *Patellina jonesi*, but these have not yet been met with at Gingin.

The Tarkaninna bore passed through 1,226 feet of Cretaceous rocks. Twenty species of foraminifera were found in this material by Mr. Howchin. They are :—

Hyperammina vagans, Brady.
Reophax fusiformis, Will. sp.
Haplophragmium agglutinans, d'Orb. sp.
Haplophragmium canariense, d'Orb. sp.
Haplophragmium australe, Howchin.
Thurammina compressa, Brady
Sigmoïlina celata, Costa sp.
Bigenerina digitata, d'Orb.
Bigenerina nodosaria, d'Orb.
Verneuilina [*Guembelina*] *polystropha*, Rss. sp.
Gaudryina pupoides, d'Orb.
Gaudryina scabra, Brady.
Gaudryina siphonella, Rss.
Vaginulina legumen, L. sp.
Marginulina costata, Batsch sp.
Marginulina glabra, d'Orb.
Cristellaria crepidula, F. and M. sp.
Cristellaria gibba, d'Orb.
Anomalina ammonoides, Rss. sp.
Pulvinulina elegans, d'Orb. sp.

At Hergott (two bores) the following species were noted :—
Hyperammina vagans, Brady.
Reophax ampullacea, Brady.
Reophax difflugiformis, Brady.
Reophax fusiformis, Will. sp.
Reophax scorpiurus, Montf. sp.
Haplophragmium agglutinans, d'Orb. sp.
Haplophragmium aequale, Roemer. sp,
Haplophragmium glomeratum, Brady.
Haplophragmium canariense, d'Orb. sp.
Haplophragmium australe, Howchin.
Placopsilina cenomana, d'Orb.
Thurammina compressa, Brady.
Ammodiscus incertus, d'Orb. sp.
Bigenerina digitata, d'Orb.
Bigenerina nodosaria, d'Orb.
Verneuilina [*Guembelina*] *polystropha*, Rss. sp.
Gaudryina pupoides, d'Orb.
Gaudryina siphonella, Rss.
Lagena laevis, Mont. sp.
Nodosaria communis, d'Orb.

* Trans. R. Soc., S. Austr., 1895, pp. 198 and 200, pl. X.

Nodosaria farcimen, Soldani.
Nodosaria pauperata, d'Orb.
Nodosaria radicula, L. sp.
Nodosaria soluta, Rss.
Nodosaria subtertenuata, Schwager.
Lingulina carinata, d'Orb.
Frondicularia complanata, Defr.
Frondicularia sp.
Vaginulina legumen, L. sp.
Vaginulina linearis, Mont. sp.
Marginulina costata, Batsch sp.
Marginulina glabra, d'Orb.
Cristellaria acutauricularis, F. and M. sp.
Cristellaria cassis, F. and M. sp.
Cristellaria crepidula, F. and M. sp.
Cristellaria gibba, d'Orb.
Cristellaria rotulata, Lam. sp.
Cristellaria schloenbachi, Rss.
Polymorphina angusta, Egger.
Polymorphina lactea, W. and J. sp.
Polymorphina rotundata, Born.
Spirillina ? vivipara, Ehr.
Spirillina margaritifera, Brady.
Patellina jonesi, Howchin.
Discorbina vilardeboana, d'Orb. sp.
Anomalina ammonoides, Rss. sp.
Truncatulina lobatula, W. and J. sp.
Pulvinulina elegans, d'Orb. sp.
? *Amphistegina lessonii*, d'Orb.

From Mirrabuckinna, about 20 miles N. of the head of Lake Torrens, the foraminifera noted were :—

Reophax fusiformis, Will. sp.
Reophax scorpiurus, Montfort.
Haplophragmium agglutinans, d'Orb. sp.
Haplophragmium canariense, d'Orb. sp.
Sigmoilina celata, Costa sp.

From William Creek, about 125 miles N.W. of Hergott were found :—

Haplophragmium canariense, d'Orb. sp.
Gaudryina siphonella, Rss.
Vaginulina legumen, L. sp.
Marginulina glabra, d'Orb.
Cristellaria gibba, d'Orb.

From the Wilcannia Bore :—

Bigenerina nodosaria, d'Orb.

From the Rolling Downs Formation, of Wollumbilla, Queensland, Chas. Moore noted * nine species of foraminifera, four of

* Australian Mesozoic Geology and Palæontology. Quart. Journ. Geol. Soc., Vol. XXVI., 1870, pp. 239 and 242.

which are common to the Cretaceous of Central Australia. Moore's list is as follows :—

Nodosaria communis, d'Orb.
Vaginulina striata, d'Orb.
Cristellaria acutauricularis, F. and M. sp.
Cristellaria acutauricularis var. *longicostata*, Moore (probably *C. costata*, F. and M. sp.).
Cristellaria cultrata, var. *radiata*, Moore (probably *C. subalata*, Rss.).
Polymorphina lactea, W. and J. sp.
Polymorphina gibba, d'Orb.
Truncatulina lobatula, W. and J. sp.
Truncatulina ungeriana, d'Orb. sp.

General Remarks on the Foraminiferal Fauna of Gingin.

The most striking generic components of this foraminiferal fauna are *Nodosaria*, *Frondicularia*, and *Cristellaria*. They are the most abundant types, and, judging from recent soundings in which they occur, indicate a moderately deep sea with warm temperate conditions. Pelagic forms like *Globigerina* and *Sphaeroidina* and the thin-shelled *Pulvinulinae* are not so strongly represented that they point to the existence at that time and place of an open ocean, but rather lead one to assume that the Cretaceous seas of the Australian area where these deposits were laid down, were of the nature of deep gulfs running into the continent.

The species and varieties of foraminifera from Gingin here recorded total 134. They are generically comprised as follows :—

	spp.		spp.
Spiroloculina ..	2	*Nodosaria*	21
Miliolina	2	*Frondicularia* ..	17
Massilina	1	*Marginulina* ..	3
Rhizammina ..	1	*Vaginulina* ..	3
Haplophragmium ..	1	*Cristellaria*	25
Placopsilina ..	2	*Flabellina*	2
Haplostiche ..	1	*Polymorphina* ..	5
Ammodiscus ..	2	*Sagraina*	3
Textularia	4	*Ramulina*	1
Verneuilina ..	1	*Vitriwebbina* ..	1
Bigenerina ..	1	*Globigerina* ..	6
Spiroplecta ..	3	*Sphaeroidina* ..	1
Guembelina ..	3	*Discorbina*	1
Gaudryina	2	*Truncatulina* ..	4
Clavulina	1	*Anomalina*	1
Bulimina	1	*Pulvinulina* ..	3
Bolivina	1	*Rotalia*	3
Lagena	4	*Nonionina*	1

Of the total number in this fauna, about 59 species a. ~tricted to the Cretaceous in other parts, chiefly in Europe. As to the question of the particular horizon in the Cretaceous system which these foraminifera denote, it may be pointed out that a fairly large number of the species have never been recorded elsewhere except from the Gault (Albian or lower part of the Upper Cretaceous); whilst some, like *Guembelina globulosa*, are Senonian in aspect. On the whole, however, the fauna is decidedly of Albian *cum* Cenomanian relationship, and not Aptian or Lower Cretaceous.

THE FORAMINIFERA.

FAM. MILIOLIDÆ.

SUB-FAM. MILIOLININÆ.

GENUS SPIROLOCULINA, *d'Orbigny.*

Spiroloculina (?) grata, *Terquem.*

Spiroloculina (?) *grata*, Terq. Howchin, 1907,* p. 39.

This species, recorded with reservation by Mr. Howchin, was represented by a fragment only. I have not met with it during the present examination of the material.

Spiroloculina asperula, *Karrer.*

(Plate I., fig. 1.)

Spiroloculina asperula, Karrer, 1868, p. 136, pl. I., fig. 10. Chapman, 1891, p. 573, pl. IX., fig. 4. Howchin, 1907, p. 39.

Several examples occur in these washings, some exactly matching the Gault specimens found by the author at Folkestone. It is also a Miocene and living species. Howchin notes it as a common form in the Gingin Chalk.

GENUS MILIOLINA, *Williamson.*

Miliolina oblonga, *Montagu, sp.*

Miliolina oblonga, Mont. sp. Howchin, 1907, p. 39.

This species was recorded as rare in the Gingin Chalk by Mr. Howchin. It was not met with in the present sample of washings.

Miliolina venusta, *Karrer sp.*

(Plate I., fig. 2, pl. XII., fig. 112.)

Quinqueloculina venusta, Karrer, 1868, p. 147, pl. II., fig. 6.

Miliolina venusta, Karrer sp. Chapman, 1891, p. 573, pl. IX., figs. 5*a*, *b* (non 6). Idem, 1899, p. 50.

This species was common in the upper zones of the Gault at Folkestone; and in the Cambridge Greensand, a derivative bed equivalent to the Gault. It is also an Eocene and Miocene fossil, and occurs in recent soundings in deep water.

Several specimens were found in the Gingin Chalk exactly resembling those from the English Gault.

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* For full references *see* bibliography at end.

GENUS MASSILINA, *Schlumberger*.

Massilina ginginensis, *sp. nov.*,

(Plate I., fig. 3.)

(?) *Miliolina venusta*, Karrer sp. Chapman, 1891, p. 573, pl. IX., fig. 6.

Description.—Test broadly ovate, depressed, with a prominent central quinqueloculine series of chambers surrounded by planulate and crescentic biserial chambers. Length, ·757mm. ; width, ·6mm.

Observations.—This foraminifer is probably the same as that figured as a broad variety of *M. venusta* by the writer, from the Gault of Folkestone. It is a more compact shell, with thicker periphery, than *M. secans*.

FAM. ASTRORHIZIDÆ.

SUB-FAM. RHABDAMMININÆ.

GENUS RHIZAMMINA, *Brady*.

Rhizammina indivisa, *Brady*.

(Plate I., fig. 4.)

Rhizammina indivisa, Brady, 1884, p. 277, pl. XXIX, figs. 5–7. Chapman, 1898, pl. II, p. II., fig. 4. Egger, 1899, p. 15, pl. II., figs. 17–19.

The writer has previously found this species in the Gault of Folkestone and the Chalk-marl of Charing, both in Kent, England ; whilst Egger recorded it from the Chalk-marl of Bavaria. It occurs living in seas of moderate depth.

One specimen.

FAM. LITUOLIDÆ.

SUB-FAM. LITUOLINÆ.

GENUS HAPLOPHRAGMIUM, *Reuss*.

Haplophragmium agglutinans, *d'Orbigny sp.*

(Plate II., fig. 10.)

Spirolina agglutinans, d'Orbigny, 1846, p. 137, pl. VII., figs. 10–12. *Haplophragmium agglutinans*, d'Orb. sp., Chapman, 1892, p. 324, pl. V., fig. 14. Egger, 1899, p. 138, pl. I., figs. 38–41, 47, 48.

This species is as old as the Carboniferous, and ranges upwards through the Lias, the Upper Cretaceous (Gault), and Miocene deposits to the present day.

The Gingin specimens closely resemble the small varietal form with high chambers found in the Folkestone Gault by the writer. The specimens figured by Egger from the Chalk-marl of the Upper Bavarian Alps are also closely comparable to the present one.

GENUS PLACOPSILINA, *d'Orbigny*.

Placopsilina vesicularis, *Brady*.

Placopsilina vesicularis, Brady, Howchin, 1907, p. 39.

This species was noted by Mr. Howchin from the Gingin Chalk, and he also remarked its occurrence in the Gault and in the living condition.

Placopsilina cenomana, *d'Orbigny.*

(Plate I., fig. 5.)

Placopsilina cenomana, d'Orbigny, Reuss, 1854, p. 71, pl. XXVIII., figs. 4, 5. Chapman, 1892, p. 324, pl. VI., fig. 4.

Lituola cenomana, d'Orb. sp., Perner, 1892, p. 52, pl. II., figs. 1–6 ; pl. IV., fig. 15. Egger, 1899, p. 136, pl. III., figs. 21, 22.

Placopsilina cenomana, d'Orb., Chapman, 1899, p. 53.

This well-known Cretaceous fossil has been recorded from the Folkestone Gault and from the Bavarian Chalk-marl, as well as from Jurassic beds. Perner obtained it from the Cenomanian of Bohemia. It is a shallow water form in recent deposits.

The figured specimen is typical of the species, and is one of several found in the Gingin Chalk.

GENUS HAPLOSTICHE, *Reuss.*

Haplostiche soldanii, *Jones and Parker sp.*

(Plate I., fig. 6.)

Lituola soldanii, Jones and Parker, 1860, p. 307, No. 184.

Haplostiche soldanii, J. and P. sp., Brady, 1884, p. 318, pl. XXXII., figs. 12–18. Egger, 1899, p. 18, pl. III., figs. 12, 13 ; pl. XXII., figs. 29, 30.

As a Tertiary fossil this species is well distributed, but until Egger's discovery of it in the Chalk-marl of the Upper Bavarian Alps, the records did not date earlier than the Miocene.

In its short, subglobular habit the present specimen approaches *H. sherborni* of the English Gault.* In the living state it is usually dredged from moderate depths in low latitudes.

SUB-FAM. TROCHAMMININÆ.

GENUS AMMODISCUS, *Reuss.*

Ammodiscus incertus, *d'Orbigny* sp.

(Plate I., fig. 7.)

Operculina incerta, d'Orbigny, 1839, p. 71, pl. VI., figs. 16, 17.

Ammodiscus incertus, d'Orb. sp., Brady, 1884, p. 330, pl. XXXVIII., figs. 1–3.

Cornuspira foliacea, Philippi sp. Chapman, 1891, p. 575, pl. IX., figs. 13*a*, *b*.

This species has a wide distribution as a living form. In the fossil condition it dates from the Silurian epoch. The apparently porcellaneous *Cornuspiræ* of the Folkestone Gault were found to be arenaceous, and hence the correction as given above. Very rare in the present sample.

* Chapman, Journ. Roy. Micr. Soc., Lond., 1892, p. 325, pl. VI., figs. 6–8.

Ammodiscus gaultinus, *Berthelin.*

(Plate I., fig. 8.)

Ammodiscus gaultinus, Berthelin, 1880, p. 19, pl. I., figs. 3*a*, *b*. Egger, 1899, p. 16, pl. I., figs. 1, 3, 8, 9, 30, 31.

This species was originally described by Berthelin from the Albian Gault clays of Montcley, France, and has since been recorded from the Chalk-marl of the Upper Bavarian Alps by Dr. Egger. Probably the form described under *Ophthalmidium tumidulum*, from the Folkestone Gault, by the writer, should be referred to the above species.

Only one specimen found.

Fam. TEXTULARIIDÆ

Sub-fam. Textulariinæ.

Genus Textularia, *Defrance.*

Textularia turris, *d'Orbigny.*

(Plate I., fig. 9.)

Textularia turris, d'Orbigny, 1840, p. 46, pl. IV., figs. 27, 28. Brady, 1884, p. 366, pl. XLIV., figs. 4, 5. Chapman, 1892, p. 328, pl. VI., fig. 19. Egger, 1899, p. 29, pl. XIV., fig. 29.

A typical Cretaceous species, occurring in both the lower and the upper divisions of that series in Europe.

This species was recorded by Mr. Howchin as rare in the Gingin Chalk. In the present sample several fine specimens were found, some of large size.

Textularia trochus, *d'Orbigny.*

Textularia trochus, d'Orbigny, Howchin, 1907, p. 40.

Mr. Howchin found several examples of this form, including one fine specimen. None occurred in my sample.

Textularia gibbosa, *d'Orbigny.*

(Plate II., fig. 11.)

Textularia gibbosa, d'Orb., Chapman, 1907, p. 25, pl. III., fig. 54. Howchin, 1907, p. 40.

Mr. Howchin remarks on the species as follows :—

"Numerous examples referable to this type occur and show much variation as to size, some being small and stunted, others longer and tapering. The last two chambers, in all cases, are larger and more inflated than the others. In a few instances the aboral extremity is acuminate."

Several examples were found by the writer, all of which were small.

T. gibbosa is usually a Tertiary fossil, but has also been recorded from the Carboniferous of England, Scotland, Belgium, and Russia. It occurs in the living condition in the Mediterranean and elsewhere.

Textularia gramen, *d'Orbigny.*
(Plate II., fig. 12.)

Textularia gramen, d'Orbigny, 1846, p' 248, pl. XV., figs. 4–6. Chapman, 1892, p. 328, pl. VI., figs. 17*a*, *b*. Egger 1899, p. 25, pl. II., figs. 27, 28.

T. gramen is a well-known fossil in the Gault and Chalk-marl deposits of Europe, and its range extends through the Tertiaries to recent soundings.

One specimen found.

GENUS VERNEUILINA, *d'Orbigny.*

Verneuilina spinulosa, *Reuss.*

Verneuilina spinulosa, Reuss, Howchin, 1907, p. 40.

Howchin records one example from the Gingin Chalk. It appears to be absent from my sample.

GENUS BIGENERINA, *d'Orbigny.*

Bigenerina compressiuscula, *sp. nov.*
(Plate II., figs. 13, 14.)

Description.—Test elongate-ovate, compressed. Chambers at aboral end irregularly textularian with the extremity sometimes acuminate, afterwards uniserial, short and wide. Aperture prolonged, tubular. Texture moderately coarsely arenaceous, but with smooth surface.

Length.—2·1 mm. ; greatest width, ·074 mm.

Observations.—This species reminds one of *Spiroplecta prælonga*, Reuss sp., but that the later segments are uniserial ; the examples found being fairly constant in this last respect.

Bigenerina arenacea, Bagg,* is related to this form, but has a broader shell and is less flattened in contour ; whilst its biserial commencement is more regular than in ours.

Common in the sample from Gingin.

GENUS SPIROPLECTA, *Ehrenberg.*

Spiroplecta sagittula, *Defrance sp.*
(Plate II., fig. 15.)

Textularia sagittula, Defr., Chapman, 1892, p. 328, pl. VI., fig. 16. Egger, 1899, p. 26, pl. XIV., figs. 44, 45. Howchin, 1907, p. 40.

Spiroplecta sagittula, Defr. sp., Chapman, 1907, p. 27, pl. III., figs. 58, 59.

Mr. Howchin records some small but well-formed specimens from the Gingin Chalk.

The figured specimen represents the only example found in the material submitted, and is shorter and broader than the living forms. The specimen figured from the Gault is more acute aborally, as is also the Bavarian Chalk-marl specimen figured by Egger.

* Bagg. Proc. U.S. Nat. Mus., vol. 34, 1908, p. 132, pl. V., fig. 46. Cushman, Bull. 71, U.S. Nat. Mus., 1911, p. 29, Text fig. 50A, B.

Spiroplecta anceps, *Reuss sp.*
(Plate II., fig. 16 ; pl. XII., fig. 114.)

Textularia anceps, Reuss, 1845–6, pt. I., p. 39, pl. VIII., fig. 79 ; pl. XIII., fig. 2.

Spiroplecta anceps, Reuss sp., Chapman, 1892[2], p. 751, pl. XI., fig. 6.

Textularia anceps, Reuss, Egger, 1899, p. 25, pl. XXIV., figs. 35, 36.

This species resembles *S. carinata*, d'Orb. sp. but has a shorter and broader test with fewer chambers.

It is of frequent occurrence in the present sample, and closely resembles the English Gault specimens. Egger's shells from the Bavarian Chalk-marl are more attenuated in outline.

Spiroplecta prælonga, Reuss. sp.
(Plate XII., fig. 113.)

Textularia prælonga, Reuss, 1845–6, pt. I., p. 39, pl. XII., fig. 14.
Spiroplecta prælonga, Rss. sp., Chapman, 1892[2], p. 3, pl. XI., fig. 5.
Textularia prælonga, Rss., Chapman, 1894[4], p. 698.

The figured specimen from the present series is a short form of the above species which has been previously noted from the Lower Greensand (Aptian) of Surrey, the Gault of Folkestone, the Red Chalk of East Anglia and the Plänermergel of Bohemia.

One example from the Gingin Chalk.

Genus Guembelina, *Egger.*
Guembelina globulosa, *Ehrenberg sp.*
(Plate II., fig. 17.)

Textularia globulosa, Ehrenberg, 1838, p. 135, pl. IV., fig. B., frequens.

Textularia globulosa, Ehrenb., Reuss, 1845–6, pt. I., p. 39, pl. XII., fig. 23.

Guembelina globulosa, Ehr. sp., Egger, 1899, p. 32, pl. XIV., fig. 43.
Textularia globulosa, Ehr., Howchin, 1907, p. 40.

This and the two succeeding species have been placed in the genus *Guembelina* by Egger on account of the distinctive bulimine commencing series of chambers which afterwards takes on the biserial textularian character.

Mr. Howchin records this species as rare from the Gingin Chalk. It is fairly abundant in the finer siftings of my samples.

A very characteristic species of the Upper Chalk of Europe and America.

Guembelina globifera, *Reuss. sp.*
(Plate II., fig. 18.)

Textularia globifera, Reuss, 1860, p. 232, pl. XIII., figs. 7*a*, *b*, 8.
Guembelina globifera, Reuss sp., Egger, 1899, p. 33, pl. XIV., figs. 35, 36, 53–55.

This species is rare in the present sample. It occurred previously in the Chalk-marl of Westphalia and the Upper Bavarian Alps.

Guembelina polystropha, *Reuss sp.*
(Plate II., fig. 19.)

Bulimina polystropha, Reuss, 1845–6, pt. II., p. 109, pl. XXIV., fig. 53.

Guembelina polystropha, Reuss sp., Egger, 1899, p. 34, pl. XIV., figs. 31–34, 40.

Verneuilina polystropha, Rss. sp., Howchin, 1907, p. 40.

Mr. Howchin records this species as occurring in considerable numbers. It does not appear to be common in the present sample. It is distinguished from the two preceding species by the much longer test and strongly twisted aboral extremity. The figured specimen is an elongate variety.

A common Chalk-marl species. The recent specimens assigned to this form seem to belong to a distinct species.

GENUS GAUDRYINA, *d'Orbigny.*

Gaudryina pupoides, *d'Orbigny.*
(Plate II., fig. 20.)

Gaudryina pupoides, d'Orbigny, 1840, p. 44, pl. IV., figs. 22–24. Chapman, 1892[2], p. 752, pl. XI., figs. 8*a*, *b*. Idem, 1899, p. 59, Egger, 1899, p. 37, pl. IV., figs. 19, 20.

This familiar Gault and Chalk-marl species is fairly frequent in the present sample. The recent specimens usually assigned to *G. pupoides* have been lately renamed by J. Cushman* on account of the more tapering and aborally pointed test of the recent form.

Gaudryina rugosa, *d'Orbigny.*
(Plate II., fig. 21.)

Gaudryina rugosa, d'Orbigny, 1840, p. 44, pl. IV., figs. 20, 21. Reuss, 1845–6, pt. I., p. 38, pl. XII., figs. 15, 24. Egger, 1899. p. 37, pl. IV., figs. 14, 15.

This species is typically Cretaceous, but also ranges through the Tertiary and later formed deposits. The Cretaceous form usually has a smaller triserial commencement than in living examples.

Very common in the present washings from Gingin.

Clavulina communis, *d'Orbigny.*
(Plate II., fig. 22.)

Clavulina communis, d'Orbigny, 1826, p. 268. Idem, 1846, p. 196, pl. XII., figs. 1, 2. Cushman, 1911, p. 73, text-figs. 115–117.

This species has hitherto been noted only from Tertiary and recent deposits, commencing its history in the Eocene of the South of France and the London Basin.

Its advent in Cretaceous times in Australia is particularly interesting.

Two typical specimens occur in the present sample from Gingin.

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* *G. bradyi*, Cushman, Mon. Foram., N. Pacific Ocean.—Bull. 71, U.S. Nat. Mus., 1911, p. 67, text. fig. 107, *a–c*.

SUB-FAM. BULIMININÆ.

GENUS BULIMINA, *d'Orbigny.*

Bulimina variabilis, *d'Orbigny.*

(Plate XII., fig. 115.)

Bulimina variabilis, d'Orbigny, 1840, p. 40, pl. IV., figs. 9–12. Reuss, 1845–6, pt. I., p. 37, pl. VIII., figs. 56, 76, 77. Eley, 1859, p. 198, pl. V., fig. 29.

This is a familiar Chalk fossil. It has been recorded from the Chalk-marl and Cenomanian of Bohemia and the Chalk of France and England.

One specimen from Gingin.

GENUS BOLIVINA, *d'Orbigny.*

Bolivina obsoleta, *Eley sp.*

(Plate XII., fig. 116.)

Textularia obsoleta, Eley, 1859, p. 195, pl. II., fig. 11 ; p. 202, pl. VIII., fig. 11*c*.

T. quadrilatera, Schwager, 1866, p. 253, pl. VII., fig. 103. Brady, 1884, p. 358, pl. XLII., figs. 8–12.

The Cretaceous specimens have a narrower habit of growth than the Pliocene or recent ; otherwise there is no difference between them. Eley's specimens came from the English Chalk.

Common in the fine washings of Gingin.

FAM. LAGENIDÆ.

SUB-FAM. LAGENINÆ.

GENUS LAGENA, *Walker and Boys.*

Lagena globosa, *Montagu sp.*

(Plate III., fig. 23.)

Lagena globosa, Montagu sp., Brady, 1884, p. 45, pl. LVI., figs. 1–3. Chapman, 1893, p. 579, pl. VIII., figs. 1*a*, *b* Egger, 1899, p. 102, pl. V., fig. 3. Howchin, 1907, p. 40 (*L. globulosa*).

The range of typical forms of this species extends from the Lias to recent.

This species is recorded by Howchin as rare. In the present sample it occurs with some frequency.

Lagena apiculata, *Reuss sp.*

(Plate III., fig. 24.)

Oolina apiculata, Reuss, 1851, p. 22, pl. I., fig. I.

Lagena apiculata, Reuss sp., Burrows, Sherborn and Bailey, 1890, p. 555, pl. IX., figs, 6, 7, 9–11. Chapman, 1893, p. 581, pl. VIII., figs. 2*a*, *b*, 3*a*, *b*. Egger, 1899, p. 103, pl. V., fig. 32.

L. apiculata is a very characteristic species in Cretaceous deposits in Europe ; it also occurs sporadically throughout the Tertiaries, and is still found living.

Three typical specimens occurred in the Gingin Chalk.

Lagena aspera, *Reuss.*
(Plate III., fig. 25.)

Lagena aspera, Reuss, 1861, p. 305, pl. I., fig. 5. Chapman, 1893, p. 582, pl. VIII., fig. 8. Egger, 1899, p. 106, pl. V., fig. 10.

This species has an extensive range, from the Lias to recent. The specimen here figured has the usual roughened or papillate surface, whilst the form of the test is subglobose and slightly flattened.

Only one specimen was found in the Gingin Chalk.

Lagena hispida, *Reuss.*

Lagena hispida, Reuss, Howchin, 1907, p. 40.

Mr. Howchin records a specimen of this form having a "Test globular and hispid, without long neck."

This species did not occur in the present sample.

SUB-FAM NODOSARIINÆ.

GENUS NODOSARIA, *Lamarck.*

SUB-GENUS DENTALINA, *d'Orbigny.*

Nodosaria (Dentalina) pauperata, *d'Orbigny.*
(Plate III., fig. 26.)

Dentalina pauperata, d'Orbigny, 1846, p. 46, pl. I., figs. 57, 58. Bornemann, 1855, vol. VII., p. 324, pl. XIII., fig. 7.

Nodosaria (D.) pauperata, d'Orb., Chapman, 1893, p. 588, pl. VIII. fig. 32. Egger, 1899, p. 60, pl. VI., fig. 20.

This species ranges from the Lias to recent soundings. It is of frequent occurrence in the Chalk and Gault. Very rare in the present series.

Nodosaria (D.) distincta, *Reuss.*
(Plate III., fig. 27.)

Dentalina distincta, Reuss, 1860, p. 184, pl. II., fig. 5.

Previously described from the Chalk of Westphalia. The species resembles a short, irregularly chambered form of *N. (D.) farcimen*, Soldani.

Several specimens occur in the Gingin Chalk.

Nodosaria (D.) soluta, *Reuss.*
(Plate III., fig. 28.)

Dentalina soluta, Reuss, 1851, p. 60, pl. III., figs. 4*a*, *b*

Nodosaria (D.) soluta, Reuss, Chapman, 1893, p. 587, pl. VIII., fig. 26.

Nodosaria soluta, Bornemann, Egger, 1899, p. 59, pl. VI., fig. 23 ; pl. VII., fig. 3.

N. soluta, Rss., Howchin, 1907, p. 41.

This species ranges from the Cretaceous to recent. The Chalk specimens as a rule have the chambers more closely conjoined.

Mr. Howchin records this species from Gingin.

It is quite a common form in the present sample.

Nodosaria (D.) soluta, var. discrepans, *Reuss.*
(Plate III., fig. 29.)

Dentalina discrepans, Reuss, 1860, p. 184, pl. III., fig. 7.
Nodosaria (D.) discrepans, Reuss, Chapman, 1893, p. 587, pl. VIII., fig. 27.
Nodosaria discrepans, Rss., Egger, 1899, p. 69, pl. VII., fig. 19.

This variety appears to be confined to the Cretaceous, having occurred in the Gault of Folkestone, and the Chalk of Westphalia and the Bavarian Alps.

A few examples from the Gingin Chalk.

Nodosaria (D.) annulata, *Reuss.*
(Plate III., figs. 30, 31.)

Nodosaria annulata, Reuss, 1844, p. 210. Idem, 1845–6, pt. I., p. 27, pl. VIII., figs. 4 and 67 ; pl. XIII., fig. 21.
Dentalina annulata, Reuss, 1851, p. 26, pl. I., fig. 13.
Nodosaria annulata, Reuss, Egger, 1899, p. 63., pl. VII., figs. 9–11.

This species is perhaps the most abundant of the *Nodosariæ* in the Gingin Chalk. It is as variable as it is common. The earlier chambers are closely cateniferous, and towards the end of the series become more separate and inflated as in *N. (D.) soluta.* The short, inflated varieties resemble *Nodosaria limbata*, d'Orbigny, from the Chalk of the Paris Basin and elsewhere.

N. (D.) annulata is typically Cretaceous but has also occurred in the Tertiaries of Italy.

Nodosaria (D.) communis, *d'Orbigny.*
(Plate III., fig. 32.)

Dentalina communis, d'Orbigny, 1840, p. 13, pl. I., fig. 4.
Nodosaria (D.) communis, d'Orb., Reuss, 1845–6, pt. I., p. 28., pl. XII., fig. 21. Chapman, 1893, p. 590, pl. IX., fig. 1.
Nodosaria communis, d'Orb., Egger, 1899, p. 65, pl. VI., fig. 4.

This species has a wide geological range and is always fairly common in Cretaceous deposits.

Several typical specimens occur in the Gingin Chalk.

Nodosaria (D.) consobrina, *d'Orbigny*, var. emaciata, *Reuss.*
(Plate III., fig. 33.)

Dentalina emaciata, Reuss, 1851, p. 63, pl. III., fig. 9.
Nodosaria (D.) consobrina, var. *emaciata*, Rss., Brady, 1884, p. 502, pl. LXII., figs. 25, 26. Howchin, 1907, p. 41.

The long attenuated form of *N. (D.) consobrina* is fairly well distributed through the Tertiaries and recent deposits. It is interesting to find it in the Australian Cretaceous, which occurrence thereby extends its range.

Mr. Howchin records this variety as common in the Gingin Chalk. Several specimens were found in the present sample.

Nodosaria (Dentalina) legumen, *Reuss.*
(Plate XII., fig. 119.)

Nodosaria (*Dentalina*) *legumen*, Reuss, 1845–6, pt. I., p. 28, pl. XIII., figs. 23, 24.

Nodosaria legumen, Reuss, 1860, p. 187, pl. III., fig. 5. Egger, 1899, p. 54, pl. V., figs. 36–39 ; pl. VI., figs. 1–3.

The solitary specimen occurring in the present series is a short, few-chambered form similar to some figured by Dr. Egger from the Bavarian Chalk-marl. It is a well-known species in the Gault faunas of France and England, and the Chalk-marl of Germany and Poland.

Nodosaria (D.) lorneiana, *d'Orbigny.*
(Plate IV., fig. 34.)

Dentalina lorneiana, d'Orbigny, 1840, p. 14, pl. I., figs. 8, 9.

Nodosaria lorneiana, d'Orbigny, Reuss, 1845–6, pt. I., p. 27, pl. VIII., fig. 5.

Nodosaria (*D.*) *lorneiana*, d'Orb., Chapman, 1893, p. 588, pl. VIII., figs. 30, 31. Egger, 1899, p. 56, pl. VI., figs. 21, 22.

This is a typical Cretaceous form, resembling a *N.* (*D.*) *consobrina* with longish elliptical chambers scarcely increasing in size with growth.

Recorded from the Gault and Chalk of England, and from the Chalk of Aix la Chapelle, Rügen, Bavaria, and Bohemia.

Common in the Gingin Chalk.

Nodosaria (D.) filiformis, *d'Orbigny.*
(Plate IV., fig. 35.)

Nodosaria filiformis, d'Orbigny, 1826, p. 253, No. 14. Reuss, 1845–6, pl. I., fig. 28 ; pl. XII., fig. 28.

Dentalina filiformis, Reuss, 1860, p. 188, pl. III., fig. 8.

Nodosaria (*D.*) *filiformis*, d'Orb., Brady, 1884, p. 500, pl. LXIII., figs. 3–5.

Nodosaria filiformis, Reuss, Egger, 1899, p. 67, pl. VI., figs. 28–30.

The species range from the Lias through the Cretaceous and Tertiaries to recent deposits, where it is found in moderately deep water. Reuss' specimens were found in the Chalk of Bohemia and Westphalia, whilst Egger found it in the Bavarian Chalk-marl.

Very rare in the Gingin Chalk.

Nodosaria (D.) retrorsa, *Reuss sp.*
(Plate IV., fig. 36.)

Dentalina retrorsa, Reuss, 1864, p. 46, pl. III., fig. 27.

Nodosaria (*D.*) *retrorsa*, Reuss, Brady, 1884, p. 507, pl. LXIII., fig. 7.

Nodosaria retrorsa, Reuss, Egger, 1899, p. 81, pl. IX., fig. 25.

This species, which was earlier known as an Oligocene fossil, and a still-living form (off the Ki Islands, 580 fathoms), has more lately been described from the Chalk of Bavaria by Dr. Egger.

Our specimens are typical, and the species is not uncommon in the Gingin Chalk.

Nodosaria (D.) intercellularis, *Brady*.
(Plate IV., fig. 37.)

Nodosaria (*D.*) *intercellularis*, Brady, 1884, p. 515, pl. LXV., figs. 1–4. Chapman 1893, p. 591, pl. IX., fig. 8.

It is of much interest to find this species, originally found living off Bermuda at 435 fathoms and which was subsequently obtained by the writer from the Gault of Folkestone, in the West Australian Cretaceous.

One typical specimen from Gingin.

Nodosaria (D.) costellata, *Reuss*.
(Plate IV., fig. 38.)

Nodosaria costellata, Reuss, 1845–6, pt. I., p. 27, pl. XIII., fig. 18.

Nodosaria (*D.*) *costellata*, Rss., Chapman, 1893, p. 590, pl. IX., fig. 3.

Nodosaria costellata, Rss., Egger, 1899, p. 74, pl. VIII., figs. 13, 19.

This is a distinctly Cretaceous form, occurring in the Plänermergel of Bohemia, the Chalk-marl of the Bavarian Alps, and the Gault of Folkestone.

The figured specimen has the surface entirely costate, but the ribs are slightly stronger on the sutures. As a rule the costæ do not extend beyond the constricted area between the chambers.

One specimen found in the present sample.

Nodosaria (D.) obliqua, *Linné sp.*
(Plate IV., fig. 39.)

Nodosaria obliqua, L. sp., Brady, 1884, p. 513, pl. LXIV., figs. 20–22. Howchin, 1907, p. 41.

This typically ornamented and central type-form of the costate nodosarines is found in all fossiliferous deposits dating from the Permian to the present day.

Specimens comparable with that figured are not uncommon in the present sample from Gingin. Mr. Howchin records one specimen from the same deposit.

Nodosaria (D.) sulcata, *Nilsson*.
(Plate IV., fig. 40.)

Nodosaria sulcata, Nilsson, 1827, p. 8, pl. IX., fig. 19. Reuss, 1845–6, pt. I., p. 26, pl. XIII., fig. 17.

Nodosaria (*D.*) *sulcata*, Nilsson, Sherborn and Chapman, 1889, p. 486, pl. XI., fig. 24.

Nodosaria sulcata, Nilsson, Egger, 1889, p. 75, pl. VIII., fig. 24.

This is one of the strongly sulcate dentaline forms in which the costæ are not oblique as in *N.* (*D.*) *obliqua*. It is typically Cretaceous, but has also occurred in certain Tertiary deposits, as the London Clay. Amongst Cretaceous localities we may mention the Paris Basin, Rügen, Lemberg, Bavaria, and Bohemia.

Not uncommon in the Gingin Chalk.

Nodosaria (D.) paupercula, *Reuss.*

(Plate IV., fig. 41.)

Nodosaria paupercula, Reuss, 1845–6, pt. I., p. 26, pl. XII., fig. 12.
Dentalina paupercula, Rss., Berthelin, 1880, p. 43, pl. II., figs. 17*a*, *b*.
Nodosaria (*D.*) *paupercula*, Rss., Chapman, 1893, p. 593, pl. IX., figs. 13, 14.
N. paupercula, Rss., Egger, 1899, p. 72, pl. VIII., fig. 7.

This is a rather common species in the Gingin Chalk.

The specimens agree precisely with those from the English and French Gault, and the Chalk of Bavaria, Saxony, and the Isle of Rügen.

Nodosaria subtertenuata, *Schwager.*

(Plate XII., fig. 117.)

Nodosaria subtertenuata, Schwager, 1866, p. 235, pl. VI., fig. 74. Brady, 1884, p. 507, pl. LXII., figs. 7, 8. Howchin, 1894, p. 364.

This species was originally recorded from the Pliocene of Kar-Nicobar, and Brady subsequently found it in recent soundings off the Ki Islands near Japan in 129 fathoms. Since then Mr. Howchin has discovered it in the Cretaceous foraminiferal deposits of Hergott township, Bore No. 2. It is therefore extremely interesting to find it in the present washings from Gingin.

Not uncommon ; specimens quite typical.

Nodosaria vertebralis, *Batsch sp.*

Nodosaria vertebralis, Batsch sp., Howchin, 1907, p. 41.

Mr. Howchin records one or two fragments from the Gingin Chalk. It has previously occurred in the fossil state in Tertiary beds, and is well known as a recent form. It was not met with in my sample.

Nodosaria obscura, *Reuss.*

(Plate IV., fig. 42.)

Nodosaria obscura, Reuss, 1845–6, pt. I., p. 26, pl. XIII., figs. 7–9. Burrows, Sherborn, and Bailey, 1890, p. 557, pl. IX., fig. 24.
Nodosaria (*D.*) *obscura*, Reuss, Chapman, 1893, p. 593, pl. IX., fig. 16.
Nodosaria obscura, Reuss, Egger, 1899, p. 75, pl. XXIV., fig. 23. Heron-Allen and Earland, 1910, p. 418, pl. VII., fig. 7.

This species differs from typical specimens of *N. raphanus* in the more irregular growth of the test and the obscurely marked septa. It is a common Chalk species.

Moderately common in the Gingin Chalk.

Nodosaria prismatica, *Reuss.*
(Plate IV., fig. 43.)

Nodosaria prismatica, Reuss, 1860, p. 180, pl. II., fig. 2. Idem, 1862, p. 36, pl. II., fig. 7. Burrows, Sherborn, and Bailey, 1890, p. 557, pl. IX., figs. 25*a*, *b*. Chapman, 1893, p. 594, pl. IX., fig. 21. Egger, 1899, p. 77, pl. VIII., figs. 5, 8*a*, *b*.

This is a distinct variety of the *N. raphanus* type, recognised by its narrow rod-like test and evenly spaced costae, which latter feature gives it a polygonal outline in transverse section.

It is moderately common in the Gingin Chalk.

Nodosaria perpusilla, *Chapman.*
(Plate XII., fig. 118.)

Nodosaria perpusilla, Chapman, 1893, p. 591, pl. IX., fig. 6.

This is a very small, slender and finely costate modification of the *N. raphanus* type, and was first described from the Gault of Folkestone.

One specimen from Gingin.

Genus Frondicularia, *Defrance.*
Frondicularia ornata, *d'Orbigny.*
(Plate V., fig. 44.)

Frondicularia ornata, d'Orbigny, 1840, p. 21, pl. I., figs. 37, 38 ; facsimile in Science Gossip, 1870, p. 82, fig. 92. Reuss, in Geinitz, 1845–6, p. 653, pl. XXIV., fig. 20. Egger, 1899, p. 91, pl. X., figs. 15, 16.

This species is a stoutly built, sparsely chambered form of the *F. archiaciana* type. It is restricted to the Chalk and Chalk-marl, but is not at all common at any locality. D'Orbigny's specimens came from the White Chalk of the Paris Basin, whilst Egger had it from the Chalk-marl of the Upper Bavarian Alps.

Rare in the Gingin Chalk.

Frondicularia archiaciana, *d'Orbigny.*
(Plate V., fig. 45.)

Frondicularia archiaciana, d'Orbigny, 1840, p. 20, pl. I., figs. 34–36 ; facsimile in Science Gossip, 1870, p. 82, fig. 91. Reuss, 1845-6, pt. I., p. 31, pl. XIII., fig. 39. Eley, 1859, p. 197, pl. IV., fig. 19 (flint cast). Brady, 1884, p. 520, pl. CXIV., fig. 12. Chapman, 1894, p. 155, pl. III., fig. 6. Perner, 1897, p. 69, pl. V., fig. 3. Chapman, 1899, p. 304. Egger, 1899, p.87, pl. X., figs. 19, 20.

This typically Cretaceous species has survived to the present day, but in the living condition is almost unique, the " Challenger " obtaining it from only one locality, Raines Islet, Torres Strait at 155 fathoms.

It is not uncommon in the Gault, Greensand, and Chalk of Europe and the British Islands.

Several examples occurred in the Gingin Chalk.

Frondicularia chapmani, *Perner.*
(Plate V., fig. 46.)

Frondicularia chapmani, Perner, 1897, p. 69, pl. IV., fig. 17. Howchin, 1907, p. 41.

This species was originally found in the Bohemian Chalk. It is easily distinguished by the smooth, convex faces and elongate lanceolate form, broadest in the upper third, and with concave and rapidly narrowing sides towards the aboral extremity.

Mr. Howchin records several fragmentary specimens of this form from the Gingin Chalk. It is not uncommon in the present sample, but never quite perfect at the commencement of the test.

Frondicularia lanceola, *Reuss.*
(Plate V., fig. 47.)

Frondicularia lanceola, Reuss, 1860, p. 198, pl. V., fig. 1. Chapman, 1894, p. 157, pl. III., fig. 15. Perner, 1897, p. 67, pl. III., fig. 2. Chapman, 1899, p. 302. Egger, 1899, p. 87, pl. XV., figs. 9, 10.

This species is distinguished by its exceptionally slender proportions, and is uniformly narrow, unlike *F. angusta*, Nilsson, and other similar forms, which broaden considerably in their later growth.

F. lanceola has been met with in the Gault of Folkestone, the Cambridge Greensand (probably a remanié bed of Gault age), the Westphalian Chalk and the Chalk marl of Bavaria.

Typical specimens very common in the Gingin Chalk.

Frondicularia inversa, *Reuss.*
(Plate V., figs. 48, 49.)

Frondicularia inversa, Reuss, 1845–6, pt. I., p. 31, pl. XIII., figs. 15–19. Chapman, 1894, p. 155, pl. III., fig. 8. Perner, 1897, p. 69, pl. IV., figs. 5–8. Egger, 1899, p. 90, pl. X., figs. 3, 4. Chapman, 1899, p. 302.

This is a somewhat broad, subrhomboidal shell with numerous acute chambers and plane surface except for the sutural margins which are narrow and in relief. It is a well known Chalk species and its range extends through the Gault and Chalk in Europe and Great Britain.

Not uncommon in the Gingin Chalk.

Frondicularia apiculata, *Reuss.*
(Plate V., fig. 50.)

Frondicularia apiculata, Reuss, 1845–6, pt. I., p. 30, pl. VIII., fig. 24. Idem, 1860, p. 192, pl. V., fig. 2.

This species resembles *F. archiaciana* in general characters but is not so slender, whilst the chambers are more closely set.

Recorded by Reuss from the Bohemian and Westphalian Chalk. Rare in the Gingin Chalk.

Frondicularia sherborni, *Perner.*

(Plate VI., fig. 51.)

Frondicularia sherborni, Perner, 1897, p. 68, pl. IV., fig. 9.

This species is not unlike *F. intermittens*, Reuss, but the chambers are not so clearly marked off, and the striæ are finer and more continuous along the length of the test; it is also more elongate than that species.

Not uncommon at Gingin.

Frondicularia marginata, *Reuss.*

(Plate VI., fig. 52.)

Frondicularia marginata, Reuss, 1845–6, pt. I., p. 30, pl. XII., fig. 9; pt. II., p. 107, pl. XXIV., figs. 39, 40. Idem, 1860, p. 193, pl. V., fig. 3.

This species is of the *F. angusta*, Nilsson type, with a complanate and subelongate shell, but having the external margins rim-like.

It was formerly known from the Bohemian and Westphalian Chalk.

Several specimens occurred in the Gingin Chalk.

Frondicularia decheni, *Reuss.*

(Plate VI., fig. 53.)

Frondicularia decheni, Reuss, 1860, p. 191, pl. IV., fig. 3. Perner, 1897, p. 67, pl. III., fig. 3; pl. V., figs. 6, 15.

A short form of the *F. archiaciana* type, but with almost parallel sides and striated faces.

Known formerly from the Bohemian and Westphalian Chalk.

Several specimens were found in the Gingin Chalk.

Frondicularia gaultina, *Reuss.*

(Plate V., figs. 54, 55.)

Frondicularia gaultina, Reuss, 1860, p. 194, pl. V., fig. 5. Burrows, Sherborn, and Bailey, 1890, p. 558, pl. X., fig. 5. Chapman, 1894, p. 155, pl. III., fig. 7. Perner, 1897, p. 69, pl. IV., fig. 3; pl. V., fig. 1. Howchin, 1907, p. 41.

This species is confined to the Gault and Chalk. The shell shows some latitude in variation, but its general characters are summed up as follows:—Rather broadly hastate, equally pointed at each end; complanate; sutures flush or slightly raised; primordial chamber subovate, small to moderately large and inflated, By increase of breadth this shell appears to pass into *F. guestphalica.* Mr. Howchin also records this species from Gingin.

Not uncommon in the Gingin Chalk.

Frondicularia ungeri, *Reuss.*
(Plate VI., fig. 56.)

Frondicularia ungeri, Reuss, 1862, p. 54, pl. IV., figs. 11 a, b. Berthelin, 1880, p. 61, pl. IV. (XXVII.), fig. 4. Chapman, 1894, p. 157, pl. III., fig. 16. Id., 1899, p. 302. Egger, 1899, p. 89, pl. XIII., figs. 10, 11.

This is a short broad form with only three segments. It was previously known from the North German, French and English Gault, as well as the Cambridge Greensand.

Very rare in the Gingin Chalk.

Frondicularia perovata, *Chapman.*
(Plate VI., fig. 57.)

Frondicularia perovata, Chapman, 1894, p. 158, pl. IV., figs. 5*a*, *b*.

This rather handsome species has hitherto been known only from the English Gault. The West Australian specimen here figured does not show the striated surface seen in the English shell but otherwise it is typical.

Very rare in the Gingin Chalk.

Frondicularia guestphalica, *Reuss.*
(Plate VII., fig. 58.)

Frondicularia guestphalica, Reuss, 1860, p. 195, pl. VI., fig. 2. Chapman, 1894, p. 158, pl. IV., fig. 2. Idem, 1899, p. 303.

This broad, complanate form has been found in the Gault of Folkestone, the Cambridge Greensand, and the Chalk of Westphalia.

Not uncommon in the Gingin Chalk.

Frondicularia intermittens, *Reuss.*
(Plate VII., fig. 59.)

Frondicularia intermittens, Reuss, 1865, p. 460 (name only), pl. —., fig. 11. Howchin, 1907, p. 41.

This form is represented by a fair number of specimens in the present sample, that figured being one of the more robust varieties. I am indebted to my friend Mr. Howchin for a tracing of Reuss' original figure. This species has been already recorded by Mr. Howchin from Gingin.

Frequent in my sample of the Gingin Chalk.

Frondicularia cordai, *Reuss.*
(Plate VII,, fig. 60.)

Frondicularia cordai, Reuss, 1845–6, pt. I., p. 31, pl. VIII., figs. 26–28 ; pl. XIII., fig. 41 and pt. II., p. 108, pl. XXIV., fig. 38. Chapman, 1894, p. 159, pl. IV., fig. 6. Perner, 1897, p. 69, pl. V., fig. 9. Egger, 1899, p. 90, pl. XIII., fig. 21.

A well known Chalk and Gault species.

Very rare in the Gingin Chalk.

Frondicularia lanceolata, *Perner.*

(Plate VII., fig. 61.)

Frondicularia lanceolata, Perner, 1892, p. 60, pl. VII., figs. 12*a*, *b*. Idem, 1897, p. 67, pl. III., fig. 1 ; pl. IV., fig. 2.

This species is recorded by Perner as common in the Chalk of Bohemia.

It may here be noted that a "*Frondicularia lanceolata*" was described by Costa in 1855,* but this has been shown by Dr. A. Silvestri† to be the same as d'Orbigny's *Cristellaria lanceolata* of the Vienna Basin memoir, and therefore Perner's name still holds good.

Not uncommon in the Gingin Chalk.

Frondicularia angusta, *Nilsson.*

(Plate VII., fig. 62.)

Frondicularia angusta, Nilsson, Reuss, 1845–6, pt. I., p. 29, pl. VIII., figs. 13, 14. Idem, 1860, p. 196, pl. IV., fig. 5. Perner, 1897, p. 68, pl. IV., fig. 18 ; pl. V., figs. 4, 8, 11.

This is a thin, complanate form with numerous and narrow chambers, the test being slender at the aboral end and widening rapidly towards the oral extremity. It seems to be a typical Chalk species.

Frequent in the Gingin Chalk.

GENUS MARGINULINA, *d'Orbigny.*

Marginulina costata, *Batsch sp.*

(Plate VII., figs. 63, 64.)

Nautilus (*Orthoceras*) *costatus*, Batsch, 1791, pl. I., figs. 1*a-g*.
Marginulina costata, Batsch sp., Brady, 1884, p. 528, pl. LXV., figs. 10–13. Sherborn and Chapman, 1889, p. 487, pl. XI., fig. 28. Howchin, 1907, p. 42.

The shells from Gingin are all uniformly strongly costate, and therefore agree with Batsch's central type. Although search was made for the finely costate and striate varietal form, named by Reuss *M. striatocostata*, and found in the Gault and Chalk of Europe, none was discovered in the present sample. The species has an extensive geological range, from the Lias to recent. One of the specimens figured shows a cristellarian commencement, as in Brady's "Challenger" specimen on plate LXV., fig. 11.

This species has already been noted by Mr. Howchin as moderately common at Gingin. Very abundant in the present sample.

* Mem. Accad. Sci. Napoli, II., 1855 (1857), p. 372, pl. III., fig. 7.
† Mem. della Pont. Accad. d. Nuovi Lincei, vol. XV., 1898, p. 173.

Marginulina glabra, *d'Orbigny.*

(Plate VII., fig. 65.)

Marginulina glabra, d'Orbigny, 1826, Vol. VII., p. 259, No. 6; Modèle, No. 55. Brady, 1884, p. 527, pl. LXV., figs. 5, 6. Chapman, 1894, p. 160, pl. IV., figs. 11*a*, *b*. Idem, 1899, p. 305.

The figured specimen is quite typical of this species, which has, like the previous form, a very extensive geological range, viz., from the Rhaetic to recent.

Very rare at Gingin.

Marginulina inaequalis, *Reuss.*

(Plate VII., fig. 66.)

Marginulina inaequalis, Reuss, 1860, p. 59, pl. VII., fig. 3. Idem, 1862, p. 59, pl. V., fig. 13; pl. VI., fig. 8. Berthelin, 1880, p. 34. Chapman, 1894, p. 160, pl. IV., fig. 12. Egger, 1899. p. 94, pl. IX., fig. 4.

This species is an elongate modification of *M. glabra*, with a rather irregularly segmented test. It is peculiarly a Cretaceous form and has been recorded from the Gault and Chalk of Europe.

Very rare in the Gingin Chalk.

Genus Vaginulina, *d'Orbigny.*

Vaginulina legumen, *Linné sp.*

(Plate VIII., fig. 67.)

Nautilus legumen, Linné, 1767, p. 1164, No. 288.

Vaginulina legumen, L. sp., d'Orbigny, 1826, p. 257, No. 2. Jones, Parker, and Brady, 1866, p. 64, pl. IV., fig. 9. Brady, 1884, p. 530, pl. LXVI., figs. 13–15. Burrows, Sherborn and Bailey, 1890, p. 559, pl. X., fig. 16. Egger, 1899, p. 98, pl. IX., figs. 29, 30.

The examples in the present series are well developed tests, smooth, elongate, and subovate in section. They show no special characteristics as fossils of a particular horizon, and equally resemble some shells from the Lias as well as others from recent dredgings. Its range is from the Trias to recent.

Very abundant in the Gingin Chalk.

Vaginulina comitina, *Berthelin.*

(Plate VIII., fig. 68.)

Vaginulina comitina, Berthelin, 1880, p. 38, pl. I., figs. 21*a-d*. Chapman, 1894[2], p. 463, pl. VIII., fig. 11.

This fine species has been previously recorded from the Gault of France and England, from the Kentish Chalk or Chalk-marl, and the Cambridge Greensand.

Very rare at Gingin.

Vaginulina strigillata, *Reuss sp.*

(Plate VIII., fig. 69.)

Citharina strigillata, Reuss, 1845–6, pt. II., p. 106, pl. XXIV., fig. 29.

Vaginulina strigillata, Reuss, sp., Chapman, 1894[2], p. 423, pl. VIII., figs. 3*a*, *b* and 4. Egger, 1899, p. 101, pl. X., figs. 7, 9, and 12.

This rather variable form is essentially a Cretaceous species. It has occurred in the Gault and Chalk-marl of Folkestone, the Plänermergel (Cenomanian, etc.), of Bohemia, and the Chalk-marl of Bavaria.

Rare in the Gingin Chalk.

Genus Cristellaria, *Lamarck.*

Cristellaria planiuscula, *Reuss.*

(Plate VIII., fig. 70.)

Cristellaria planiuscula, Reuss, 1862, p. 71, pl. VII., figs. 15*a*, *b*, Berthelin, 1880, p. 53, pl. III., figs. 25*a*, *b*. Chapman, 1894[3]. p. 654, pl. X., figs. 14*a*, *b*. Egger, 1899, p. 114, pl. XII., figs. 7–9.

This species is one of the *C. crepidula* type, and is distinguished by its few chambers and rather short and broad test. Its distribution is limited to the Neocomian of Germany, the Gault of France and England, and the Chalk-marl of Bavaria.

Very rare at Gingin.

Cristellaria trunculata, *Berthelin.*

(Plate XII., fig. 121.)

Cristellaria trunculata (pars) Berthelin, 1880, p. 53, pl. III., figs. 27*a*, *b*. Chapman 1894[3], p. 651, pl. X. figs, 4*a*, *b*. Id., 1899, p. 309. Egger, 1899, p. 111, pl. XII., figs. 18, 19.

C. trunculata is already known from the Gault of France and England, and from the Cambridge Greensand.

One specimen from Gingin.

Cristellaria tripleura, *Reuss.*

(Plate XII., fig. 120.)

Cristellaria tripleura, Reuss, 1860, p. 211, pl. IX., fig. 5. Id., 1862, p. 70. Chapman, 1894[3], p. 652, pl. X., figs. 6*a*, *b*. Egger, 1899, p. 122, pl. XII., figs. 22–24.

This species is one of the smallest of the *Cristellariæ*. It has been found in the Gault of Folkestone and of Westphalia, and the Chalk-marl of Bavaria.

One specimen in the fine washings from Gingin.

Cristellaria lituola, *Reuss.*
(Plate VIII., fig. 71.)

Cristellaria lituola, Reuss, 1845–6, pt. II., p. 109, pl. XXIV., fig. 47. Chapman, 1894[3], p. 650, pl. IX., figs. 14*a*, *b*.

This form is only known from the Plänermergel of Bohemia and the Gault of Folkestone.

Very rare in the Gingin Chalk.

Cristellaria grata, *Reuss.*
(Plate VIII., fig. 72.)

Cristellaria grata, Reuss, 1862, p. 70, pl. VII., figs. 14*a*, *b*. Chapman, 1894[3], p. 713. Egger, 1899, p. 113, pl. XI., figs. 27, 28.

This is an ensiform variation of the *C. crepidula* type with rounded sides and gently curved back. It has been recorded from the Neocomian of Germany and England, and from the Chalk-marl of the Upper Bavarian Alps.

Very rare in the Gingin Chalk.

Cristellaria gladius, *Philippi sp.*
(Plate VIII., fig. 73.)

Marginulina gladius, Philippi, 1843, p. 40, pl. I., fig. 37.

Cristellaria gladius, Phil. sp., Chapman, 1894[3], p. 649, pl. IX., figs. 11*a*, *b*.

Although typically a Chalk form, this species has occurred in the Gault of Folkestone.

Very rare at Gingin.

Cristellaria acutauricularis, *Fichtel and Moll sp.*
(Plate VIII., fig. 74.)

Nautilus acutauricularis, Fichtel and Moll, 1798, p. 102, pl. XVIII., figs. *g-i*.

Cristellaria acutauricularis, F. and M. sp., Brady, 1884, p. 543, pl. CXIV., figs. 17*a*, *b*. Howchin, 1907, p. 42. Sherlock, 1914, p. 260, pl. XIX., fig. 2.

This species passes into *C. navicula* by the compression of the septal face of the last chamber.

C. acutauricularis, as noted by Mr. Howchin, ranges from the Lias to recent. Sherlock has lately recorded it from the Speeton Clay (Lower Cretaceous or Neocomian) of Yorkshire.

Previously recorded by Howchin from the Gingin Chalk as moderately common. Only one typical example found in my sample.

Cristellaria ovalis, *Reuss.*
(Plate VIII., fig. 75.)

Cristellaria ovalis, Reuss, 1845–6, pt. I., p. 34, pl. VIII., figs. 49*a*, *b* ; pl. XII., figs. 19*a*, *b* ; pl. XIII., figs. 60*a*-63*b*. Berthelin, 1880, p. 51. Howchin, 1907, p. 42.

This Gault and Cenomanian species has been recorded by Mr. Howchin from the Gingin Chalk. Several specimens occur in my sample.

Cristellaria schloenbachi, *Reuss.*
(Plate VIII., fig. 76.)

Cristellaria schloenbachi, Reuss, 1862, p. 65, pl. VI., figs. 14, 15. Brady, 1884, p. 539, pl. LXVII., fig. 7. Chapman, 1894,[3] p. 649, pl. IX., figs. 9*a*, *b*. Egger, 1899, p. 110, pl. XII., figs. 38–40 ; pl. XXIV., figs. 30, 31.

This species ranges from the Lower Cretaceous to recent. It is perhaps more typical of Cretaceous deposits than of any other.

Moderately common at Gingin.

Cristellaria bronni, *Roemer sp.*
(Plate VIII., fig. 77.)

Planularia bronni, Roemer, 1841, p. 97, pl. XV., fig. 14.

Cristellaria bronni, Roemer, sp., Reuss, 1862, p. 70, pl. VII., figs. 13*a*, *b*. Chapman, 1894[3], p. 649, pl. IX., figs. 12*a*, *b*, 13*a*, *b*.

This is a Neocomian and Gault species in Europe.

At Gingin *C. bronni* is very rare.

Cristellaria italica, *Defrance sp.*
(Plate IX., fig. 78.)

Saracenaria italica, Defrance, 1824, vol. XXXII., p. 177 ; vol. XLVII., p. 344. Atlas Conch., pl. XIII., fig. 6.

Cristellaria italica, Defr. sp., Brady, 1884, p. 544, pl. LXVIII., figs. 17, 18, 20–23. Chapman, 1894[3], p. 653, pl. X., figs. 10*a*, *b*.

C. italica here passes into the shorter modification, *C. navicula*. Typical specimens range from the Lower Cretaceous to recent. It is known from the Neocomian of Surrey, and from the Gault of England and France.

Rare at Gingin.

Cristellaria navicula, *d'Orbigny.*
(Plate IX., fig. 79.)

Cristellaria navicula, d'Orbigny, 1840, p. 27, pl. II., figs. 19, 20. Reuss, 1845–6, pt. I., p. 34, pl. XII., fig. 27. Chapman, 1894[3], p. 650, pl. X., fig. 1. Egger, 1899, p. 116, pl. XII., figs. 3, 4.

This form is almost restrictedly a Cretaceous one, ranging from the Gault to the Upper Chalk.

Fairly common at Gingin.

Cristellaria triangularis, *d'Orbigny.*
(Plate IX., fig. 80.)

Cristellaria triangularis, d'Orbigny, 1840, p. 27, pl. II., figs. 21, 22. Reuss, 1845–6, pt. I., p. 34, pl. VIII., fig. 48. Chapman, 1894[3], p. 651, pl. X., figs. 3*a*, *b*. Egger, 1899, p. 117, pl. XII., figs. 5, 6.

C. triangularis is typically Cretaceous and seems confined to the upper series of that formation.

Moderately common at Gingin.

Cristellaria latifrons, *Brady.*

(Plate XII., fig. 122.)

Cristellaria latifrons, Brady, 1884, p. 544, pl. LXVIII., fig. 19; pl. CXIII., fig. 11*a*, *b*. Chapman, 1894[3], p. 652, pl. X., figs. 8*a*, *b*.

The above species was represented by a single specimen in the English Gault, and it is here likewise unique. In recent soundings it occurs in fairly deep water.

Cristellaria oligostegia, *Reuss.*

(Plate IX., fig. 81.)

Cristellaria oligostegia, Reuss, 1860, p. 213, pl. VIII., fig. 8. Id., 1862, p. 93, pl. XIII., fig. 2. Marsson, 1878, p. 146. Berthelin, 1880, p. 56. Chapman, 1894[3], p. 651, pl. X., figs. 5*a*, *b*. Idem, 1894[4], p. 713. Id., 1899, p. 310. Egger, 1899, p. 118, pl. XI., figs. 21, 22.

This turgid and sparsely chambered form is well distributed through the Neocomian, Gault, and Chalk of Great Britain and the Continent.

A few specimens were found at Gingin.

Cristellaria gibba, *d'Orbigny.*

(Plate IX., fig. 82.)

Cristellaria gibba, d'Orbigny, 1826, vol. VII., p. 292, No. 17. Brady, 1884, p. 546, pl. LXIX., figs. 8, 9. Burrows, Sherborn, and Bailey, 1890, p. 559, pl. X., figs. 19*a*, *b*. Chapman, 1896, p. 4, pl. I., figs. 7*a*, *b*. Sherlock, 1914, p. 261, pl. XIX., figs. 9*a*, *b*.

Although this species has an extensive geological range, it is never so common as in the Cretaceous strata.

Abundant at Gingin.

Cristellaria articulata, *Reuss sp.*

(Plate IX., fig. 83.)

Robulina articulina, Reuss, 1864, p. 53, pl. V., figs. 62*a*, *b*; Pl. VI., figs. 63*a*, *b*.

Cristellaria articulata, Rss. sp., Brady, 1884, p. 547, pl. LXIX., figs. 10–12.

The earliest geological record of this species hitherto made was the Oligocene of Germany.

A single typical specimen was found in the Cretaceous at Gingin.

Cristellaria subalata, *Reuss.*

(Plate IX., fig. 84.)

Cristellaria subalata, Reuss, 1854, p. 68, pl. XXV., fig. 13. Chapman, 1896, p. 3, pl. I., figs. 3*a*, *b*. Egger, 1899, p. 118, pl. XI., figs. 19, 20.

This species, with raised sutures, is common throughout the Cretaceous, and is met with occasionally in Tertiary deposits.

It is frequent at Gingin.

Cristellaria gaultina, *Berthelin.*

(Plate IX., fig. 85.)

Cristellaria gaultina, Berthelin, 1880, p. 49, pl. III., figs. 15–19.
C. cultrata, Montf. sp., Burrows, Sherborn, and Bailey, 1890, p. 559, pl. X., figs. 18*a*, *b*. Chapman, 1896, p. 7, pl. I., figs. 10*a*, *b*, 11. Egger, 1899, p. 121, pl. XXIII., figs. 4–9. Sherlock, 1914, p. 262, pl. XVIII., figs. 27.

This is a compressed, numerously chambered form of the *C. rotulata* type. It is one of the most abundant of the *Cristellariæ* in the English Gault.

Very abundant at Gingin.

Cristellaria rotulata, *Lamarck sp.*

(Plate IX., fig. 86.)

Lenticulites rotulata, Lamarck, 1804, p. 188, No. 3 ; Tabl. Méthod, pl. CCCCLXVI., fig. 5.

Cristellaria rotulata, Lam. sp., d'Orbigny, 1840, p. 26, pl. II., figs. 15–18. Perner, 1892, p. 62, pl. IV., figs, 1–11. Chapman, 1896, p. 5, pl. I., figs. 8*a*, *b*. Perner, 1897, p. 47, 70, pl. VI., figs. 10, 11. Egger, 1899, p. 122, pl. XI., figs. 3, 4. Howchin, 1907, p. 42. Sherlock, 1914, p. 263, pl. XVIII., fig. 25.

Typical specimens of this well distributed species are not common in my sample from the Gingin Chalk. It was also met with in the same deposit by Mr. Howchin. Its range extends from the Lias to recent.

Cristellaria rotulata, *Lam. sp.*, var. microdiscus, *Reuss.*

(Plate IX., fig. 87.)

Cristellaria macrodisca, Reuss, 1862, p. 78, pl. IX., figs. 5*a*, *b*. Berthelin, 1880, p. 48, pl. III., figs. 6–11.
Cristellaria rotulata, Lam. sp., var. *macrodisca*, Reuss, Chapman, 1896, p. 6, pl. I., figs. 9*a*, *b*.
C. macrodisca, Rss., Egger, 1899, p. 120, pl. XI., figs. 5, 6.

This variety is familiar as a Cretaceous fossil, occurring in the Gault and Chalk-marl of England, France, and Germany.

Frequent at Gingin.

Cristellaria circumcidanea, *Berthelin.*

(Plate X., fig. 88.)

Cristellaria circumcidanea, Berthelin, 1880, p. 52, pl. III., figs. 1*a*, *b*. Chapman, 1896, p. 2, pl. I., figs. 2*a*, *b*. Idem, 1899, p. 310.

A keeled form with numerous, somewhat turgid chambers, and a small but prominent primordial chamber. It has been hitherto recorded only from the Gault of France and England; and from the Cambridge Greensand, a remanié bed of the Gault.

Several specimens of this distinct form were found at Gingin.

Cristellaria diademata, *Berthelin.*

(Plate X., fig. 89.)

Cristellaria diademata, Berthelin, 1880, p. 51, pl. III. figs. 4, 5, 12, 13. Chapman, 1896, p. 8, pl. II., figs. 2*a*, *b*. Perner, 1897, p 71, pl. VII., fig. 7. Egger, 1899, p. 120, pl. XI., figs. 1, 2. Chapman, 1899, p. 311.

A keeled form with undulate edge. The species has been recorded from the Gault of France and England, the Cambridge Greensand and the Chalk-marl of Bavaria. Perner also had it from the beds above the Cenomanian in Bohemia.

One specimen found at Gingin.

Cristellaria orbicularis, *d'Orbigny.*

Cristellaria orbicularis, d'Orbigny, Howchin, 1907, p. 42.

This species has been recorded from the Gingin Chalk by Mr. Howchin. No typical specimens were met with in my sample.

Cristellaria cultrata, *Montfort*, sp.

Cristellaria cultrata, Montfort sp., Howchin, 1907, p. 42.

Recorded by Mr. Howchin from Gingin.

Genus Flabellina, *d'Orbigny.*

Flabellina rugosa, *d'Orbigny.*

(Plate X., fig. 90.)

Flabellina rugosa, d'Orbigny, 1840, p. 23, pl. II., figs. 4, 5, 7. Reuss, 1845–6, pt. I., p. 33, pl. VIII., figs. 31–34; pl. XIII., figs. 49, 53. Idem, 1860, p. 215. Marsson, 1878, p. 140. Chapman, 1892[8], p. 517. Perner, 1897, p. 72, pl. V., figs. 10, 16, 17, 19. Egger, 1899, p. 108, pl. X., figs. 5, 6; pl. XIII., figs. 1, 2.

F. rugosa is a well known Upper Cretaceous foraminifer, confined to the Chalk marl and Chalk, and possibly Upper Greensand (Cenomanian).

It is moderately common at Gingin.

Flabellina interpunctata, *von der Marck.*

(Plate X., fig. 91.)

Flabellina interpunctata, v. der Marck, 1858, p. 53, pl. I., fig. 5. Reuss, 1860, p. 216, pl. IX., fig. 1. Howchin, 1907, p. 42. Heron-Allen and Earland, 1910, p. 422, pl. VIII., fig. 5.

F. interpunctata is typically Upper Cretaceous.

SUB-FAM. POLYMORPHININÆ.

GENUS POLYMORPHINA, *d'Orbigny.*

Polymorphina sororia, *Reuss.*

(Plate X., fig. 92.)

Polymorphina (*Guttulina*) *sororia*, Reuss, 1862, p. 121, pl. II., figs. 25–29.

Polymorphina sororia, Rss., Brady, 1884, p. 562, pl. LXXI., figs. 15–16. Chapman, 1896, p. 12, pl. II., fig. 11. Egger, 1899, p. 126, pl. XVII., figs. 6, 7. Fornasini, 1900, p. 386, woodcut, fig. 36.

P. sororia is not confined to Cretaceous deposits, but is perhaps most abundant in beds of that age. Reuss' original specimens came from the Crag of Antwerp (Lower Pliocene), and it has also occurred in the Middle Oligocene of Germany and the Pliocene of East Anglia. The oldest records are those of Cretaceous age beginning with the Gault.

Frequent in the Gingin Chalk.

Polymorphina angusta, *Egger.*

(Plate X., fig. 93.)

Polymorphina (*Globulina*) *angusta*, Egger, 1857, p. 290, pl. XIII., figs. 13–15. Brady, 1884, p. 563, pl. LXII., figs. 1–3. Chapman, 1896, p. 13, pl. II., fig. 14. Egger, 1899, p. 126, pl. XVII., figs. 8, 9.

This species, as also the foregoing, ranges from the Upper Cretaceous to recent.

Rare at Gingin.

Polymorphina compressa, *d'Orbigny.*

(Plate X., fig. 94.)

Polymorphina compressa, d'Orbigny, 1846, p. 233, pl. XII., figs. 32–34. Brady, Parker, and Jones, 1870, p. 227, pl. XI., figs. 12*a-f*. Brady, 1884, p. 565, pl. LXXII., figs. 9–11.

P. communis, d'Orbigny, Burrows, Sherborn, and Bailey, 1890, p. 561, pl. XI., fig. 11.

P. compressa, d'Orb., Chapman, 1896, p. 14, pl. II., fig. 16.

This species has a wide geological range, beginning with the Lias.

It is rare at Gingin.

Po'ymorphina communis, *d'Orbigny.*
(Plate X., fig. 95.)

Polymorphina (Guttulina) communis, d'Orbigny, 1826, p. 266, pl. XII., figs. 1–4 ; Modéle, No. 62.
Guttulina cretacea, Alth., 1850, p. 262, pl. XIII., fig. 14.
Polymorphina cretacea, Alth. sp., Berthelin, 1880, p. 58.
Polymorphina communis, d'Orb., Brady, 1884, p. 568, pl. LXXII., fig. 19.
P. gibba, d'Orb., Burrows, Sherborn, and Bailey, 1890, p. 561, pl. XI., fig. 13. Chapman, 1896, p. 13, pl. II., fig. 15. Egger, 1899, p. 128, pl. XVII., figs. 36, 37.

The range of this species extends from the Lias to recent. In Cretaceous deposits it occurs in the Neocomian, Gault, and Red Chalk of England, and the Gault of France.

Rare at Gingin.

Polymorphina lactea, *Walker and Jacob sp.*
(Plate X., fig. 96.)

Serpula lactea, Walker and Jacob, 1798, p. 634, pl. XXIV., fig. 4.
Polymorphina lactea, W. and J. sp., Brady, 1884, p. 559, pl. LXXI., fig. II. Chapman, 1896, p. 9, pl. II., fig. 3. Egger, 1899, p. 127, pl. XVII., figs. 14, 15.

Occurs in many Cretaceous deposits in England and the continent. It dates from Jurassic times and its range extends to the recent.

Rare at Gingin.

Genus Sagraina, *d'Orbigny* (*emend. Parker and Jones*).
Sagraina maitlandiana, *sp. nov.**
(Plate X., fig. 97.)

Description.—Test consisting of about six subpyriform to ovate segments arranged in a slightly curved line ; the first segment compound, consisting of a compact uvigerine series terminating in a blunt point at the aboral end. Apertural extremity extended as a tubular projection. Surface of test roughened with numerous blunt prickles.

Length of type specimen, 1·78mm. Diameter of last chamber, ·38mm.

Observations.—This species might easily be mistaken for *Nodosaria hispida*, d'Orbigny, but for the slight irregularity in size of the chambers as they increase in growth, whilst the complex primordial series shows it to belong to *Sagraina*. *Sagraina virgula*, Brady,† appears to be nearest to the above form, but differs essentially in the separation of the later component chambers by a stolon, by the everted mouth and by the hursute rather than asperulose test.

Not infrequent at Gingin.

* Named after Mr. A. Gibb Maitland, Government Geologist of Western Australia, to whom the writer is indebted for the material.
† Rep. Chall, 1884, p. 583, pl. LXXVI., figs. 4–10.

Sagraina asperula, *Chapman.*

(Plate X., fig. 98.)

Sagraina asperula, Chapman, 1896[3], p. 581, pl. XII., fig. 1.

This is a stout form of *Sagraina* with few chambers, which are closely conjoined, and with an obscure separation of the primordial series. Probably "*Dimorphina minuta*" of Dr. Egger* is a slender variety of this form.

S. asperula was previously described from the lower zones of the Gault of Folkestone.

Sagraina monile, *sp. nov.*

(Plate X., fig. 99.)

Description.—Test consisting of a linear series of about four ovoid segments deeply constricted at the sutural lines, the commencing segment pyriform, formed of a complex uvigerine series. Aperture simple, orifice not greatly extended. Surface of test highly polished.

Length, ·62mm. Greatest width, ·15mm.

This species is represented by a single example in the Gingin Chalk.

Sub-fam. Ramulininæ.

Genus Ramulina, *Rupert Jones.*

Ramulina aculeata, *Wright.*

(Plate X., fig. 100.)

Ramulina aculeata, Wright, 1886, p. 331, pl. XXVII., fig. 11.
Lagena hispida, Haeusler, 1887, pp. 185 and 189, pl. V., fig. 12.
Ramulina aculeata, Burrows, Sherborn, and Bailey, 1890, p. 561, pl. XI., fig. 16.
Lagena tuberculata, Perner, 1892, p. 56, pl. V., figs 19*a*, *b*.

Ramulina globulifera, var. *miocaenica*, Rzehak, 1895, p. 222, pl. VI., fig. 6.
R. kittli, Idem, ibid, p. 222, pl. VI., figs. 8, 10.
R. aculeata, Wright, Chapman, 1896[3], p. 583, pl. XII., figs. 7–9. Jones and Chapman, 1897, p. 345, figs. 23–42. Chapman, 1899, p. 314. Egger, 1899, p. 135, pl. II., fig. 3.

This is a typically Upper Cretaceous species, having been found only rarely in later deposits, as the Miocene. It is distinguished from the more typically recent species, *R. globulifera*, by the strong prickly or tuberculate ornament of the test.

Fragmentary specimens occur at Gingin.

* Foram. und Ostrakoden aus dem Kreidemergeln der Oberbayerischen Alpen, 1899, p. 124, pl. XXII. fig. 22.

GENUS VITRIWEBBINA, *Chapman.*

Vitriwebbina laevis, *Sollas sp.*

(Plate XI., fig. 101).

Webbina laevis, Sollas, 1877, pp. 103, 104, pl. VI., figs. 1–3.

Vitriwebbina laevis, Sollas sp., Chapman, 1892[4], p. 53, pl. II., fig. 4 Bagg, 1895, p. 12. Chapman, 1896[2], p. 585, pl. XII., fig, 12. Idem, 1896[3], p. 332, fig. 3. Bagg, 1898, p. 36, pl. II., figs. 4*a*, *b*.

V. sollasi occurs in the Gault and Chalk marl of England and in the Middle Marl of New Jersey (Upper Cretaceous).

Several good examples of this interesting species, attached to shell fragments, occur at Gingin.

FAM. GLOBIGERINIDÆ.

GENUS GLOBIGERINA, *d'Orbigny.*

Globigerina bulloides, *d'Orbigny.*

(Plate XII., fig. 123.)

Globigerina bulloides, d'Orbigny, 1826, vol. VII., p. 277, No. 1. Modèles Nos. 17 and 76. Brady, 1884, pp. 593–5, pl. LXXVII., LXXIX., figs. 3–7. Chapman, 1896[2], p. 587, pl. XIII., fig. Howchin, 1907, p. 42.

This species has been recorded by Mr. Howchin as very common in the Gingin Chalk. A few specimens were also found in the sample received by the writer.

Globigerina cretacea, *d'Orbigny.*

(Plate XI., fig. 102 ; pl. XII., fig. 124.)

Globigerina cretacea, d'Orbigny, 1840, p. 34, pl. III., figs. 12–14. Reuss, 1845–6, pt. I., p. 36, pl. VIII., figs. 55*a*, *b*. Burrows, Sherborn, and Bailey, 1890, p. 561, pl. XI., figs. 18*a-c*. Perner, 1892, p. 64, pl. IX., figs. 7–10. Chapman, 1892[2], p. 517, pl. XV., figs. 13*a-c*. Id., 1896[2], p. 588, pl. XIII., figs. 5, 6. Egger, 1899, p. 169, pl. XXI., figs. 1–3, 10.

The tests in these washings are somewhat undersized. They are of the typical Cretaceous form, and unlike the more recent modification which has a higher and stouter test.

Not rare.

Globigerina aequilateralis, *Brady.*

(Plate XII., fig. 125.)

Globigerina aequilateralis, Brady, 1884, p. 605, pl. LXXX., figs. 18–21. Wright, 1886, p. 332, pl. XXVII., figs. 9*a*, *b*. Chapman, 1892[3], p. 517, pl. XV., figs. 14*a*, *b*. Id., 1896[2], p. 589, pl. XIII., fig. 7. Egger, 1899, p. 169, pl. XXI., figs. 9, 11, 21–23. Idem, 1907, p. 48, pl. VI., figs, 24, 25. Id., 1910, p. 36, pl. IV., figs. 17–19. Cushman, 1914, p. 12, pl. II., figs. 1–3 ; pl. X., fig. 5.

The Cretaceous specimens as a rule are depressed and more closely coiled than the recent examples. Those occurring in the present series are very minute.

Very common in the fine washings of the Gingin Chalk.

Globigerina marginata, *Reuss.*

(Plate XII., fig. 126.)

Rosalina marginata, Reuss, 1845–6, pt. I., p. 36., pl. VIII., figs. 54, 74 ; pl. XIII., fig. 68. Egger, 1899, p. 171, pl. XXI., figs. 12–14.

This and the following species are closely related and have often been confused. Thus Dr. Brady figures a fossil specimen in the " Challenger " Report (pl. LXXXII., fig. 12*a*, *b*) as *G. linnaeana*, but which by its inflated chambers agrees with Reuss' species from the Bohemian Chalk. Both species are superficially rugose and with peripheral limbation, but in *G. linnaeana* the chambers are not inflated. *G. marginata* is a well known Cretaceous species in Europe and England.

Very common at Gingin.

Globigerina linnaeana, *d'Orbigny sp.*

(Plate XI., fig. 103.)

Rosalina linnaeana, d'Orbigny, 1839, p. 101, pl. V., figs. 10–12.

R. canaliculata, Reuss, 1854, p. 70, pl. XXVI., figs. 4*a*, *b*.

Globigerina linnaeana, Brady, 1884, p. 598, pl. CXIV., figs. 21*a-c* (copied from d'Orbigny).

Globigerina canaliculata, Reuss sp., Egger, 1899, p. 172, pl. XXI., figs. 15–17, 24–26.

This form is distinguished by its concave chambers, being isomorphous with *Discorbina concava* and *Truncatulina ariminensis*, as pointed out by Dr. H. B. Brady (Rep. Chall., p. 599).

G. linnaeana occurs in several European Cretaceous faunas as well as in the Crag of East Anglia, and in recent soundings. Mr. Howchin recorded it as very common at Gingin.

Frequent in my sample.

GENUS SPHAEROIDINA, *d'Orbigny.*

Sphaeroidina bulloides, *d'Orbigny.*

(Plate XII., fig. 127.)

Sphaeroidina bulloides, d'Orbigny, 1826, vol. VII., p. 267, No. 1—Modèle, No. 65. Brady, 1884, p. 620, pl. LXXXIV., figs. 1–7. Burrows, Sherborn, and Bailey, 1890, p. 562, pl. XI., figs. 20, 21. Chapman, 1896[2], p. 589, pl. XIII., fig. 8. Egger, 1899, p. 173, pl. XXI., figs. 29. 30.

This well distributed form ranges from the Cretaceous to recent.

A single specimen found at Gingin.

FAM. ROTALIIDÆ.

SUB-FAM. ROTALIINÆ.

GENUS DISCORBINA, *Parker and Jones.*

Discorbina opercularis, *d'Orbigny sp.*

Discorbina opercularis, d'Orbigny sp., Howchin, 1907, p. 43.

This species was recorded by Howchin from the Gingin Chalk, and he remarks that "The examples are small and delicate, but perfectly characteristic. Rather scarce." Not found in my sample.

GENUS TRUNCATULINA, *d'Orbigny.*

Truncatulina lobatula, *Walker and Jacob sp.*

(Plate XI., figs. 14*a*, *b*.)

Nautilus lobatulus, Walker and Jacob, 1784, p. 20, pl. III., fig. 71.
Truncatulina lobatula, W. and J. sp., Brady, 1884, p. 660, pl. XCII., fig. 10; pl. XCIII., figs. 1, 4, 5; pl. CXV., figs. 4, 5. Chapman, 1898, p. 2, pl. I., figs. 2*a*, *b*. Egger, 1899, p. 151, pl. XXIII., figs. 12–14. Howchin, 1907, p. 43.

This usually common and well distributed form is rare at Gingin.

Truncatulina convexa, *Reuss.*

(Plate XI., figs. 105*a*, *b*.)

Truncatulina convexa, Reuss, 1851, p. 36, pl. III., fig. 4. Uhlig, 1886, p. 180, pl. III., fig. 1. Egger, 1899, p. 149, pl. XVIII., figs. 25–27.

T. convexa appears to take the place of *T. lobatula* at Gingin. It is separated from the latter species by its concave superior face and highly convex inferior with inflated chambers. It is a characteristic Cretaceous species occurring in the Chalk of Europe and the Greensand of New Jersey.

Very common in the present sample.

Truncatulina variabilis, *d'Orbigny.*

Truncatulina variabilis, d'Orbigny, Howchin, 1907, p. 43.

Recorded by Howchin from Gingin.

Truncatulina wuellerstorfi, *Schwager sp.*

(Plate XI., fig. 106.)

Anomalina wuellerstorfi, Schwager, 1866, p. 258, pl. VII., figs. 105, 107.

Truncatulina wuellerstorfi, Schwager sp., Brady, 1884, p. 662, pl. XCIII., figs. 8, 9. Uhlig, 1886, p. 174, fig. 3. Chapman, 1898, p. 3, pl. I., figs. 3*a-c*.

This species ranges through the Lower Greensand and Gault of England, the Cenomanian or Middle Marl beds of New Jersey, the London Clay of London, and the Lower Pliocene of Kar Nicobar. It is generally common in recent soundings in high latitudes.

Rare at Gingin.

GENUS ANOMALINA, *d'Orbigny.*

Anomalina ammonoides, *Reuss sp.*

(Plate XI., fig. 107.)

Rosalina ammonoides, Reuss, 1845–6, pt. I., p. 36, pl. XVIII., fig. 53 ; pl. XIII., fig. 66.

Anomalina ammonoides, Rss. sp., Brady, 1884, p. 672, pl. XCIV., figs. 2, 3. Chapman, 1898, p. 4, pl. I., figs. 5*a-c*. Egger 1899, p. 152, pl. XVIII., figs. 10–12.

This species is rare at Gingin.

GENUS PULVINULINA, *Parker and Jones.*

Pulvinulina elegans, *d'Orbigny, sp.*

(Plate XI., fig. 108.)

Rotalia (*Turbulina*) *elegans*, d'Orbigny, 1826, p. 276, No. 54.

Pulvinulina elegans, d'Orb. sp., Parker, Jones, and Brady, 1871, p. 174, pl. XII., fig. 142. Sherborn and Chapman, 1889, p. 487, pl. XI., figs. 30–32. Chapman, 1898, p. 6, pl. I., figs. 8*a-c*.

This species is here represented by the shallow-water variety with depressed test. Rather rare.

Pulvinulina cordieriana, *d'Orbigny sp.*

(Plate XI., figs. 109*a*, *b*.)

Rotalina cordieriana, d'Orbigny, 1840, p. 33, pl. III., figs. 9–11. Egger, 1899, p. 158, pl. XX., figs. 16–18.

Formerly recorded from the White Chalk of the Paris Basin and from the Chalk marl of the Upper Bavarian Alps.

Rare at Gingin.

Pulvinulina spinulifera, *Reuss sp.*
(Plate XI., fig. 110).

Rotalia spinulifera, Reuss, 1862, p. 93, pl. XIII., figs. 3*a*, *b*, 4*a-c*, 5*a-c*.

Epistomina spinulifera, Reuss sp., Uhlig, 1883, p. 768, pl. VII., figs. 5–7.

Pulvinulina spinulifera, Reuss sp., Chapman, 1898, p. 9, pl. II., figs. 1*a-c*.

Rotalina spinulifera, Rss. sp., Egger, 1899, p. 162, pl. XXI., figs. 42–44.

With the exception of its solitary occurrence in the Oxfordian (Upper Jurassic) of Russia, this species appears to be hitherto known only from the Gault and Chalk marl. The West Australian specimens are small and poorly developed compared with specimens from the English Gault.

Rare at Gingin.

GENUS ROTALIA, *Lamarck.*

Rotalia soldanii, *d'Orbigny*, var. nitida, *Reuss.*
(pl. XI., fig. 111.)

Rotalina nitida, Reuss, 1844, p. 214. Idem, 1845–6, pt. I., p. 35, pl. VIII., fig. 52 ; pl. XII., figs. 8, 20.

Placentula nitida, Rss. sp., Berthelin, 1880, p. 69, pl. IV., figs. 11*a-c*.

Discorbina oligostegia, Perner, 1892, p. 65, pl. X., figs. 5*a*, *b*.

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Rotalia soldanii, d'Orb. var *nitida*, Rss., Chapman, 1898, p. 9, pl. II., figs. 2*a-c*.

Rotalina nitida, Rss., Egger, 1899, p. 156, pl. XX., figs. 4–6. Id., 1907, p. 46, pl. VI., figs. 13–15.

This variety is smaller and neater than the specific form. It ranges through the Albian, Cenomanian, and Turonian of Europe (Gault to Chalk marl).

Rather rare at Gingin.

Rotalia beccarii, *Linné.*

Rotalia beccarii, Linné, Howchin, 1907, p. 43.

This species has been recorded by Mr. Howchin as rare at Gingin.

Rotalia broeckiana, *Karrer.*

Rotalia brœckiana, Karrer, Howchin, 1907, p. 43.

Recorded by Howchin as rather scarce at Gingin.

FAM. NUMMULINIDÆ.

SUB-FAM. POLYSTOMELLINÆ.

GENUS NONIONINA, *d'Orbigny.*

Nonionina asterizans, *Fichtel and Moll sp.*

Nonionina asterizans, Fichtel and Moll sp., Howchin, 1907, p. 43.

A single example was recorded from Gingin by Mr. Howchin.

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GENERAL REMARKS ON THE OSTRACODAL FAUNA OF GINGIN.

The following species and varieties are here recorded :—

Paracypris siliqua, Jones and Hinde.
Bairdia arquata, Münster sp.
Macrocypris simplex, Chapman, var. *africana*, var. nov.
Bythocypris howchiniana, sp. nov.
Cythere harrisiana, Jones, var. *reticosa*, Jones and Hinde.
,, *westraliensis*, sp. nov.
,, *lineatopunctata*, Chapman and Sherborn.
Cythereis ornatissima, Reuss. sp.
, ,, var. *nuda*, Jones and Hinde.
,, ,, var. *reticulata*, J. and H.
,, ,, var. *stricta*, J. and H.
,, *quadrilatera*, Römer sp.
,, *rudispinata*, Chapman and Sherborn.
,, *tuberosa*, J. and H.
Cytheropteron concentricum, Reuss sp.
Cytherella muensteri, Römer sp.
,, *ovata*, Römer sp.
,, *williamsoniana*, Jones.
,, ,, var. *stricta*, J. and H.
,, *chapmani*, J. and H.

Amongst the already described forms, nine are restricted to Gault and Chalk, viz. :—*Paracypris siliqua*, *Cythereis ornatissima*, and vars. *nuda*, *reticulata*, and *stricta*, *Cytheropteron concentricum*, *Cytherella muensteri*, *C. ovata*, and *C. williamsoniana*. Five are peculiarly Gault forms, viz. :—*Cythere harrisiana* var. *reticosa*, *C. lineatopunctata*, *Cythereis rudispinata*, *Cytherella williamsoniana* var. *stricta* and *C. chapmani*. One species only is restricted to the Chalk formation, viz. :—*Cythereis tuberosa*, whilst *Bairdia arquata* is a Chalk and Tertiary form. One species, *Cythereis quadrilatera*, ranges from the Neocomian to the Upper Cretaceous.

The balance of evidence from the Ostracoda is therefore clearly in favour of a correlation with the lower part of the Upper Cretaceous, that is, Albian. Another point worth especial notice is the similarity of at least two West Australian Jurassic species to our present *Cythere westraliensis*. The South African Cretaceous in the neighbourhood of the Buffalo River shows a striking faunal resemblance to that of the Australian.

THE OSTRACODA.

FAM. CYPRIDIDÆ.

GENUS PARACYPRIS, *G. O. Sars.*

Paracypris siliqua, *Jones* and *Hinde*.

(Plate XIII., fig. 1.)

Paracypris siliqua, Jones and Hinde, 1890, p. 2, pl. II., figs. 48, 49, 51 ; pl. III., figs. 33, 34. Chapman, 1893, p. 346. Idem, 1898, p. 332. Egger, 1899, p. 179, pl. XXVII., figs. 16, 17.

In Britain this species is found in the Gault of Folkestone, the Cambridge Greensand (derived from the Gault), and is well distributed in the Chalk. In the latter formation it has been recorded from counties Antrim and Londonderry, Ireland ; and from Horstead, Norfolk, England. Egger found this species in the Chalk-marl of the Bavarian Alps.

P. siliqua is represented in the present collection by several valves which agree very closely with those found in the northern hemisphere.

FAM. BAIRDIDÆ.

GENUS BAIRDIA, *McCoy*.

Bairdia arquata, *Munster sp.*

(Plate XIII., fig. 3.)

Cythere arquata, Münster, 1830, p. 63.

Bairdia arcuata, Egger, 1899, p. 178, pl. XXVII., figs. 1–3.

Von Münster named this species *arquata* from its locality, Castell' arquato, and the original spelling should therefore be adhered to.

This neat and slender *Bairdia* has not been recorded from the European Cretaceous excepting the Chalk-marl of Bavaria. It is a well known form in the Oligocene and Miocene of Germany. It is very rare at Gingin.

GENUS MACROCYPRIS, *Brady.*

Macrocypris simplex, var. africana, var. nov.

(Plate XIII., fig. 4.)

Macrocypris simplex, Chapman (pars), Chapman, 1904, p. 233, pl. XXIX., figs. 22, 22*a*, *b*.

This variety of the species originally described from the Cambridge Greensand was figured as an aberrant form of *M. simplex*; it was found amongst the Pondoland Cretaceous Ostracoda. It is distinct from *M. simplex* in the more strongly arched dorsum and the flexuous ventral border; whilst the anterior of the carapace is not so acuminate.

The occurrence of this variety in the present series is extremely interesting, since the age of the Pondoland Cretaceous as determined by its microzoa appears to be that of the lower part of the Upper Cretaceous.

One specimen from Gingin.

GENUS BYTHOCYPRIS, *Brady.*

Bythocypris howchiniana, sp. nov.*

(Plate XIII., figs. 2*a-c.*)

Description.—Carapace seen from the side, suboval, the anterior narrower than the posterior and evenly rounded; back strongly arched in the median line and obliquely rounded towards the hinder end where it meets the almost straight ventral border at an obtuse angle. Edge view of carapace long-elliptical with sharp extremities; left valve larger than right. End view sub-cordate and tumid.

Length, ·8mm.; height, ·4mm.; thickness of carapace, ·28mm.

This species comes nearest to *Bythocypris brownei*, Jones and Hinde,† in general form, but that the latter has a more evenly rounded carapace at both ends.

Two examples were found at Gingin.

FAM. CYTHERIDÆ.

GENUS CYTHERE, *Muller.*

Cythere harrisiana, *Jones*, var. reticosa, *Jones and Hinde.*

(Plate XIII., fig. 6.)

Cythere harrisiana, var. *reticosa*, Jones and Hinde, 1890, p. 18., pl. I., fig. 46.

This variety is usually smaller than the specific form, and is one of the smallest ostracod valves in the present collection.

C. harrisiana, var. *reticosa* is a restricted Gault fossil, and has only been recorded from two localities, in Kent and Surrey, England.

One specimen from the Gingin Chalk.

* Named after Mr. Walter Howchin, F.G.S., who previously investigated this fossil deposit.

† A Supplementary Monograph of the Cretaceous Entomostraca of England and Ireland. Pal. Soc. Mon. for 1889, p. 13. pl. III., Figs. 38, 39, 42, 43.

Cythere westraliensis, *sp. nov.*
(Plate XIII., figs. 7*a*, *b*, 8.)

Description.—Carapace seen from the side, elongate-ovate to pyriform. The specimens appear to fall into two series, that variety which is elongate having a subangulate dorsal margin, whilst the pyriform valves have a rounded back. The ventral border is slightly convex. The antero- and postero-ventral angles are sharp. Anterior border obliquely rounded towards the back ; posterior more gently rounded and narrower than the anterior. Both extremities are margined with a conspicuous flange. Edge view, long-ovate, more compressed at the anterior end. End view broadly ovate Surface ornamented with conspicuous pittings arranged in a quasi-concentric manner. The post-ventral angle generally bears a blunt spine.

Length of larger specimen, 1·08mm. ; height, ·73mm. ; thickness of carapace, ·5mm.

The subpyriform shape and concentric foveolate ornament of this species seems to point to an ancestral relationship with the living *Cythere demissa*, or a species of that type, several of which are now found living in the Southern Ocean. It is possible that the longer and more posteriorly tumid form represents the female of the species. At first sight one might be inclined to refer this species to the genus *Cytheridea*. The hinge-line, however, is in agreement with *Cythere*, and further, the carapace is more compressed than in typical Cytherideas. Closely related to this species is Rupert Jones' *Cythere drupacea*,* with an ovate and swollen carapace, recorded in strata from the Richmond Well boring at 1,205 feet, and probably on the Great Oolite horizon. *C. drupacea*, however, has a more pointed posterior end and a steeper ventral face, whilst the postero-ventral spine is absent. It is interesting to note that *C. drupacea* is recorded with some reservation from the Upper Cretaceous of East Pondoland, South Africa.† A variety of *Cythere drupacea* (var. *fortior*) was described by the writer from the Jurassic of the Greenough River District, W. Australia ‡ ; this form differs from *C. westraliensis* in the particulars enumerated for the English specimens of *C. drupacea*. Our figure 7 suggests a further relationship with *C. corrosa*, Jones and Sherborn, var. *grossepunctata*, Chapman, from the Jurassic of W. Australia,§ which is, however, a more tumid form, and having rounder extremities.

Common at Gingin.

Cythere lineatopunctata, *Chapman and Sherborn.*
(Plate XIV., fig. 9.)

Cythere lineatopunctata, Chapman and Sherborn, 1893, pp. 346, 348, pl. XIV. fig. 4 (marked 2 in error on plate).

A neat example of this English Gault species has occurred in the present sample. The anterior of the valve is not quite so

* Quart. Journ. Geol. Soc., Vol. XL. 1884, p. 772, pl. XXXIV., fig. 30.
† Chapman. Annals. S. African Museum, Vol. IV , part V. 1904, p. 234.
‡ Proc. R. Soc. Viet Vol. XVI. (N.S.) pt. II. 1904, p. 199, pl. XXIII., figs 3, 3*a*, *b*.
§ Ibid., p. 200, pl. XXIII., figs. 5, 5*a*, *b*.

widely expanded as in the Gault specimens, but in all other points it closely agrees with the species.

One specimen in the fine washings from Gingin.

GENUS CYTHEREIS, *Jones.*

Cythereis ornatissima, *Reuss sp.*

(Plate XIV., fig. 10.)

Cytherina ornatissima, Reuss, 1845–6, p. 104, pl. XXIV., figs. 12 and 18.

Cythereis ciliata, Jones, 1849, p. 19, pl. IV., figs. 11*a-h*.

Cypridina muricata, Reuss, 1851, p. 50, pl. V., figs. 12*a-c*.

Cythere ornatissima, Reuss, 1874, p. 146, pl. XXVII., figs. 5, 6*a-c*.

Cythere (*Cythereis*) *ornatissima*, Jones, 1875, pp. 79 and 81.

Cythereis ornatissima, Reuss sp., Jones and Hinde, 1890, p. 21, pl. II., figs. 1–7, 15, 16 ; pl. IV., figs. 7, 8. Egger, 1899, p. 182, pl. XXVII., fig. 35.

This is one of the commonest Upper Cretaceous ostracods. It was most abundant in zone X of the Gault at Folkestone. It also occurs in the Chalk-marl and Chalk of many localities both in England and on the continent (Bohemia, Bavaria, etc.).

Very common at Gingin.

Cythereis ornatissima, *Reuss sp.*, var. nuda, *Jones and Hinde.*

(Plate XIII., fig. 5 ; Plate XIV., fig. 11.)

Cythereis cornuta (non Roemer), Jones, 1849, p. 21 pl. V., figs. 13*ae*.

Cythereis ornatissima, Rss. sp., Jones and Hinde, 1890, p. 23, pl. I., fig. 76 ; pl. II., figs. 9, 12–14 ; pl. IV., fig. 14.

This nearly smooth variety is met with in abundance in the Gault of Folkestone. It has also occurred in the Chalk-marl and Chalk of England.

Very common at Gingin.

Cythereis ornatissima, *Reuss sp.*, var. reticulata, *Jones and Hinde.*

(Plate XIV., fig. 12.)

Cythereis ornatissima, Reuss sp., var. *reticulata*, Jones and Hinde, 1890, p. 24, pl. I., figs. 67, 68, 77 ; pl. IV., figs. 9–12.

The neatly reticulated surface and conspicuous sub-central boss distinguish this variety. It has been noted from the Gault of Folkestone, the Chalk-marl and Chalk of England, and the Chalk of Antrim, Ireland.

It is abundant at Gingin.

Cythereis ornatissima, *Reuss sp.*, var. stricta, *Jones and Hinde.*

(Plate XIV., fig. 13.)

Cythereis ornatissima, Rss. sp., var. *stricta*, Jones and Hinde, 1890, p. 25, pl. I., fig. 63.

This is a small variety with accentuated dorsal and ventral ridges and a finely reticulated surface.

It was found in the Folkestone Gault and the Chalk-marl of Didcot, England.

Rare at Gingin.

Cythereis quadrilatera, *Roemer sp.*
(Plate XIV., fig. 14.)

Cytherina quadrilatera, Roemer, 1840, p. 105, pl. XVI., fig. 19.
Cythereis quadrilatera, Roemer sp., Jones, 1849, p. 18, pl. III., figs. 10*a-f*; pl. IV., 10*g-j*.
Cythere (*Cythereis*) *quadrilatera,* Jones, 1884, pp. 766, 772, pl. XXXIV., figs. 39–41.
Cythereis quadrilatera, Roemer sp., Jones and Hinde, 1890, p. 20, pl. I., figs. 69–75.

The present is a young example of the species defined as such by the unbroken median ridge. Its history dates from the Neocomian (of the Richmond boring), occurring through the Gault and Chalk of England and the Chalk of North Germany, Saxony, and Bohemia. A similar form is noted from the Portlandian of Dorset by Rupert Jones.

One specimen from Gingin.

Cythereis rudispinata, *Chapman and Sherborn.*
(Plate XIV., fig. 15.)

Cythereis rudispinata, Chapman and Sherborn, 1893, pp. 347, 348, pl. XIV., fig. 67.

This species is characterised by having three parallel rows of boss-like spines on the valves. It was found well distributed in the Gault of Folkestone and has not since occurred in any other formation.

Not uncommon in the Gingin rock.

Cythereis tuberosa, *Jones and Hinde.*
(Plate XIV., fig. 16.)

Cythereis tuberosa, Jones and Hinde, 1890, p. 26, pl. III., figs. 2, 3.

This species originally came from the Upper Chalk of Horstead, Norfolk, and has not been recorded elsewhere.

One example from Gingin.

Genus Cytheropteron, *Sars.*

Cytheropteron concentricum, *Reuss sp.*
(Plate XIV., fig. 17.)

Cytherina concentrica, Reuss, 1846, pp. 104, 105, pl. XXIV., figs. 22*a-c*.
Cythere concentrica, Rss. sp., Kafka, 1887, p. 14, fig. 27.
Cytheropteron concentricum, Reuss sp., Jones and Hinde, 1890, p. 31, pl. I., figs. 5–10; pl. IV., fig. 19. Chapman and Sherborn, 1893, Table, p. 347. Egger, 1899, p. 185, pl. XXVII., fig. 51.

This species is confined to the Upper Cretaceous formations (Albian to Senonian). It was excessively common in zone X of the Folkestone Gault. The West Australian specimens are typical,

and show, by the absence of prickles between the pittings, that they are old or worn examples.

Common at Gingin.

Fam. CYTHERELLIDÆ.

Genus Cytherella, *Jones.*

Cytherella muensteri, *Roemer sp.*

(Plate XIV., fig. 18.)

Cytherina muensteri, Roemer, 1838, p. 516, pl. VI., fig. 13.

Cytherella muensteri, Roemer sp., Jones and Hinde, 1890, p. 46, pl. III., figs. 63–67. Egger, 1899, p. 187, pl. XXVII., figs. 48–50.

The Australian examples are in every way comparable with the Albian to Senonian fossils of Europe.

Abundant at Gingin.

Cytherella ovata, *Roemer sp.*

(Plate XIV., fig. 19.)

Cytherina ovata, Roemer 1840, p. 104, pl. XVI., fig. 21.

Cytherella ovata, Roemer, sp., Jones 1849, p. 28, pl. VII., figs. 24*a-i*. Jones and Hinde, 1890, p. 44, pl. III., figs. 48–54 ; pl. IV., fig. 39. Egger, 1899, p. 186, pl. XXVII., figs. 54–56.

This is a widely distributed Cretaceous species, being found in the Gault, Upper Greensand and Chalk of England and Ireland. It is also a well known fossil in the European Cretaceous, and has been doubtfully recorded from the Neocomian of France. Some of the present specimens closely approach *C. obovata*, Jones and Hinde, from the Chalk of Kent, in having unequally rounded ends.

Frequent at Gingin.

Cytherella williamsoniana, *Jones.*

(Plate XIV., fig. 20.)

Cytherella williamsoniana, Jones, 1849, p. 31, pl. VII., figs. 26*a-h*. Bosquet, 1854, p. 62, pl. V., figs. 2*a-d*. Reuss, 1874, p. 153, pl. XXVIII., figs. 9, 10*a*, *b*. Marsson, 1880, p. 31, pl. II., figs. 8*a-c*. Egger, 1899, p. 188, pl. XXVII., figs. 63–65.

The Australian specimens have the median lateral ornament of a curved ridge very pronounced. Previously recorded from the Gault of Kent and Surrey, the Upper Greensand of Ventnor (I. of Wight), and the Chalk of the South-east of England, Norfolk and Ireland. In Europe it occurs in the Chalk of Saxony and the I. of Rügen.

Common at Gingin.

Cytherella williamsoniana, *Jones*, var. stricta, *Jones* and *Hinde*.
(Plate XIV., fig. 21.)

Cytherella williamsoniana, var. *stricta*, Jones and Hinde, 1890, p. 48, pl. III., fig. 71.

Elsewhere this variety is confined to the Gault of Kent and Surrey.

Rare at Gingin.

Cytherella chapmani, *Jones* and *Hinde*.
(Plate XIV., fig. 22.)

Cytherella chapmani, Jones and Hinde, 1890, p. 49, pl. III., fig. 70.

In this species the median ridges form a compressed spiral. Hitherto known only from the Gault of Folkestone and Godstone, England.

One specimen at Gingin.

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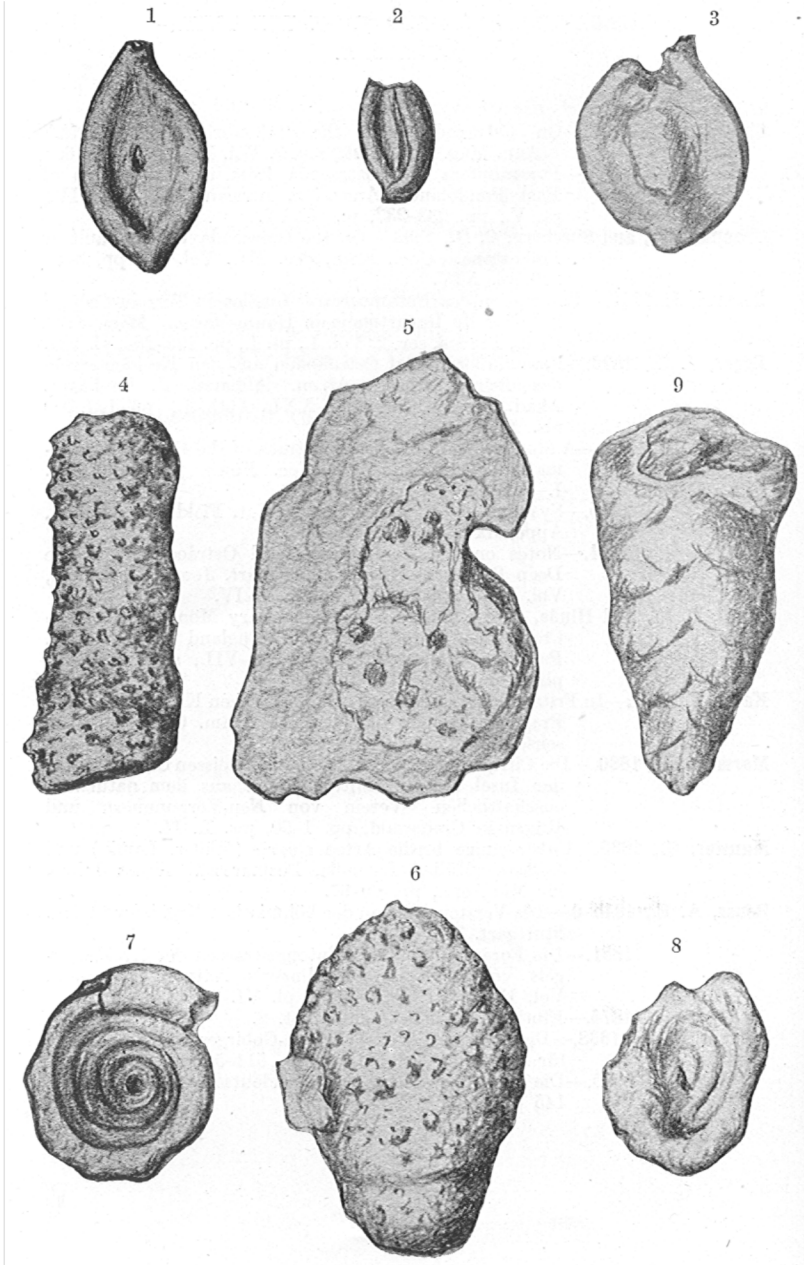
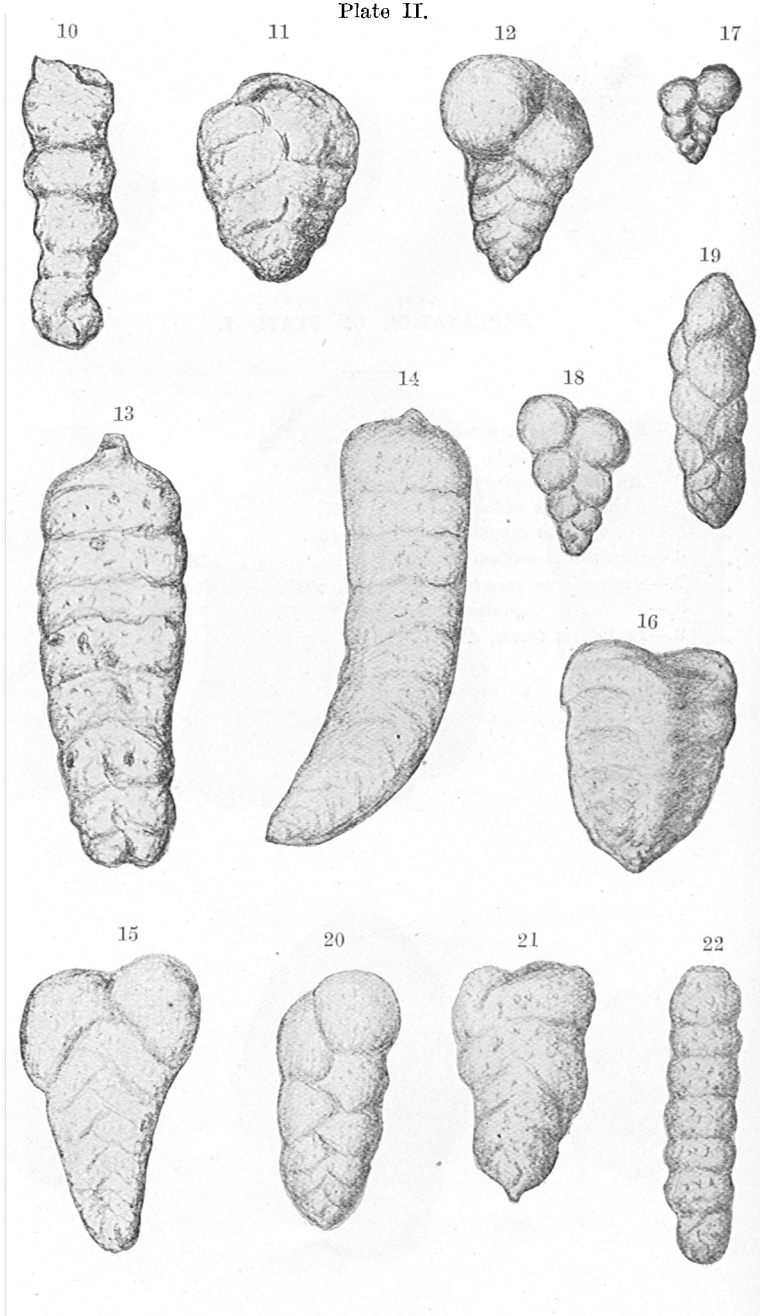
Plate I.



EXPLANATION OF PLATE I.

Fig. 1.—*Spiroloculina asperula*, Karrer sp., ×37.
„ 2.—*Miliolina venusta*, Karrer sp., ×37.
„ 3.—*Massilina ginginensis*, sp. nov., ×37.
„ 4.—*Rhizammina indivisa*, Brady, ×37.
„ 5.—*Placopsilina cenomana*, d'Orb., ×37.
„ 6.—*Haplostiche soldanii*, Jones and Parker sp., ×18.
„ 7.—*Ammodiscus incertus*, d'Orb. sp., ×37.
„ 8.— „ *gaultinus*, Berthelin, ×37.
„ 9.—*Textularia turris*, d'Orb., ×37.

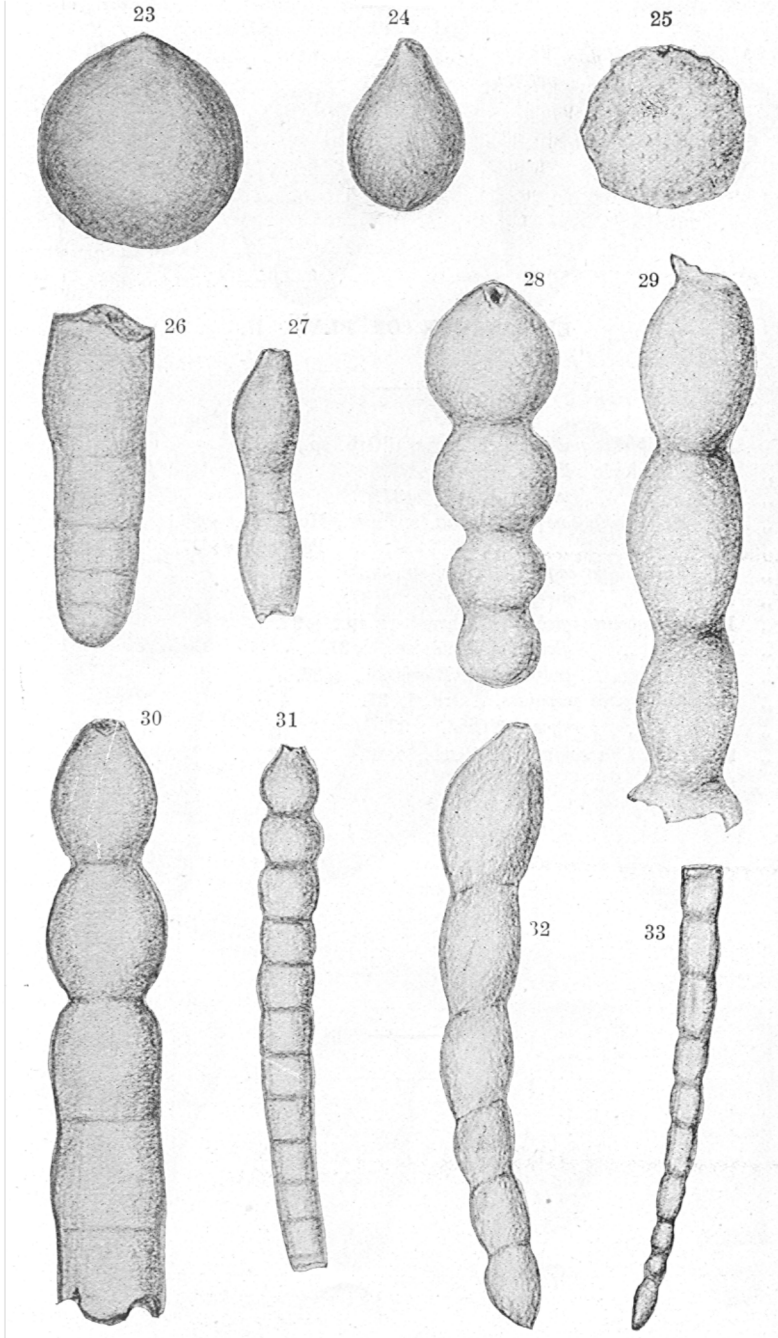
Plate II.



EXPLANATION OF PLATE II.

Fig. 10.—*Haplophragmium agglutinans*, d'Orb. sp., ×37.
„ 11.—*Textularia gibbosa*, d'Orb., ×37.
„ 12.— „ *gramen*, d'Orb., ×37.
„ 13.—*Bigenerina compressiuscula*, sp. nov., Holotype, ×37.
„ 14.— „ „ „ Paratype, ×37.
„ 15.—*Spiroplecta sagittula*, Defr. sp., ×37.
„ 16.— „ *anceps*, Reuss sp., ×37.
„ 17.—*Guembelina globulosa*, Ehrenberg sp., ×37.
„ 18.— „ *globifera*, Reuss sp., ×37.
„ 19.— „ *polystropha*, Reuss sp., ×37.
„ 20.—*Gaudryina pupoides*, d'Orb., ×37.
„ 21.— „ *rugosa*, d'Orb., ×37.
„ 22.—*Clavulina communis*, d'Orb., ×22.

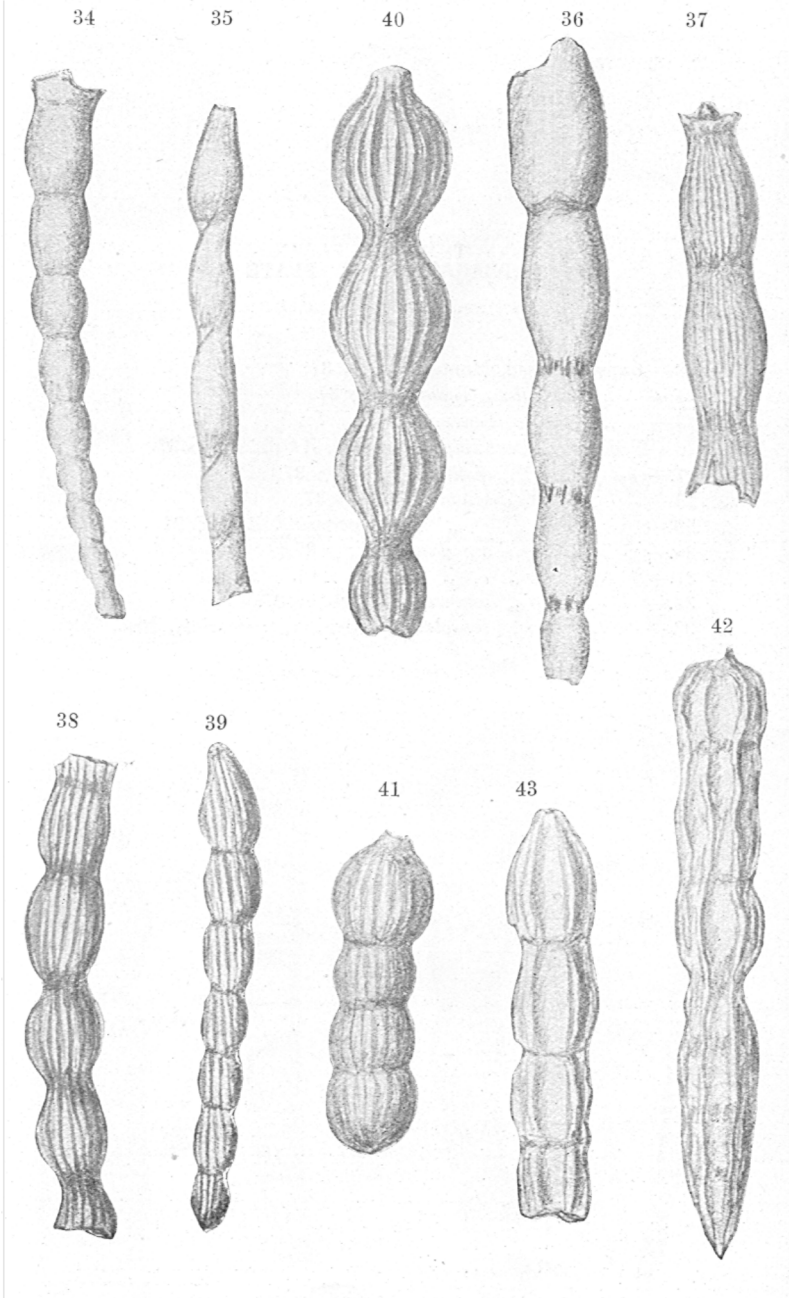
Plate III.



EXPLANATION OF PLATE III.

Fig. 23.—*Lagena globosa*, Montagu sp., ×37.
„ 24.— „ *apiculata*, Reuss sp., ×37.
„ 25.— „ *aspera*, Reuss, ×37.
„ 26.—*Nodosaria* (*Dentalina*) *pauperata*, d'Orb. sp., ×37.
„ 27.— „ (*D.*) *distincta*, Reuss, ×37.
„ 28.— „ „ *soluta*, Reuss, ×37.
„ 29.— „ „ „ *var. discrepans*, Rss., ×37.
„ 30.— „ „ *annulata*, Rss., ×37.
„ 31.— „ „ „ Rss., ×18.
„ 32.— „ „ *communis*, d'Orb., ×37.
„ 33.— „ „ *consobrina*, d'Orb., var. *emaciata*, Rss., ×37.

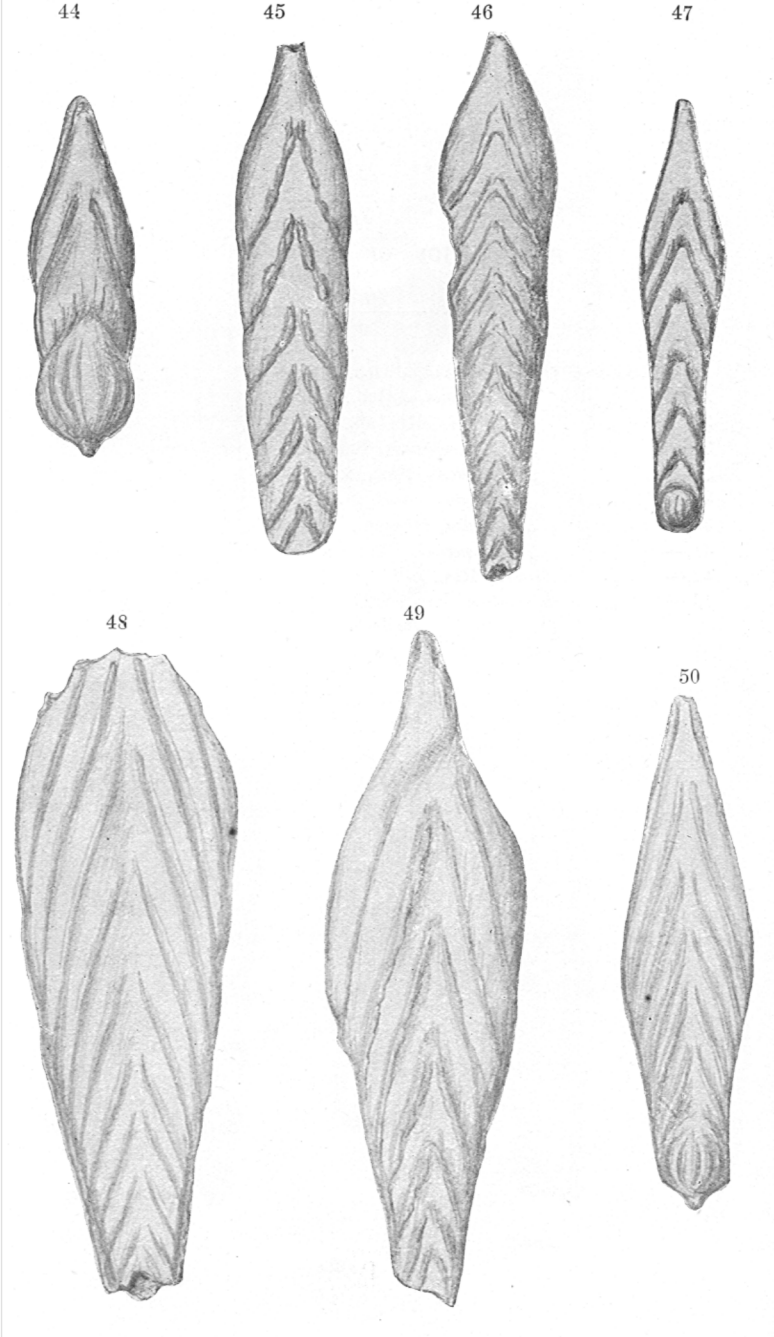
Plate IV.



EXPLANATION OF PLATE IV.

Fig. 34.—*Nodosaria* (*D.*) *lorneiana*, d'Orb., ×37.
„ 35.— „ „ *filiformis*, d'Orb., ×37.
„ 36.— „ „ *retrorsa*, Rss. sp., ×37.
„ 37.— „ „ *intercellularis*, Brady, ×37.
„ 38.— „ „ *costellata*, Rss., ×37.
„ 39.— „ „ *obliqua*, Linné sp., ×37.
„ 40.— „ „ *sulcata*, Nilsson., ×37.
„ 41.— „ „ *paupercula*, Rss., ×37.
„ 42.— „ *obscura*, Rss., ×37.
„ 43.— „ *prismatica*, Rss., ×37.

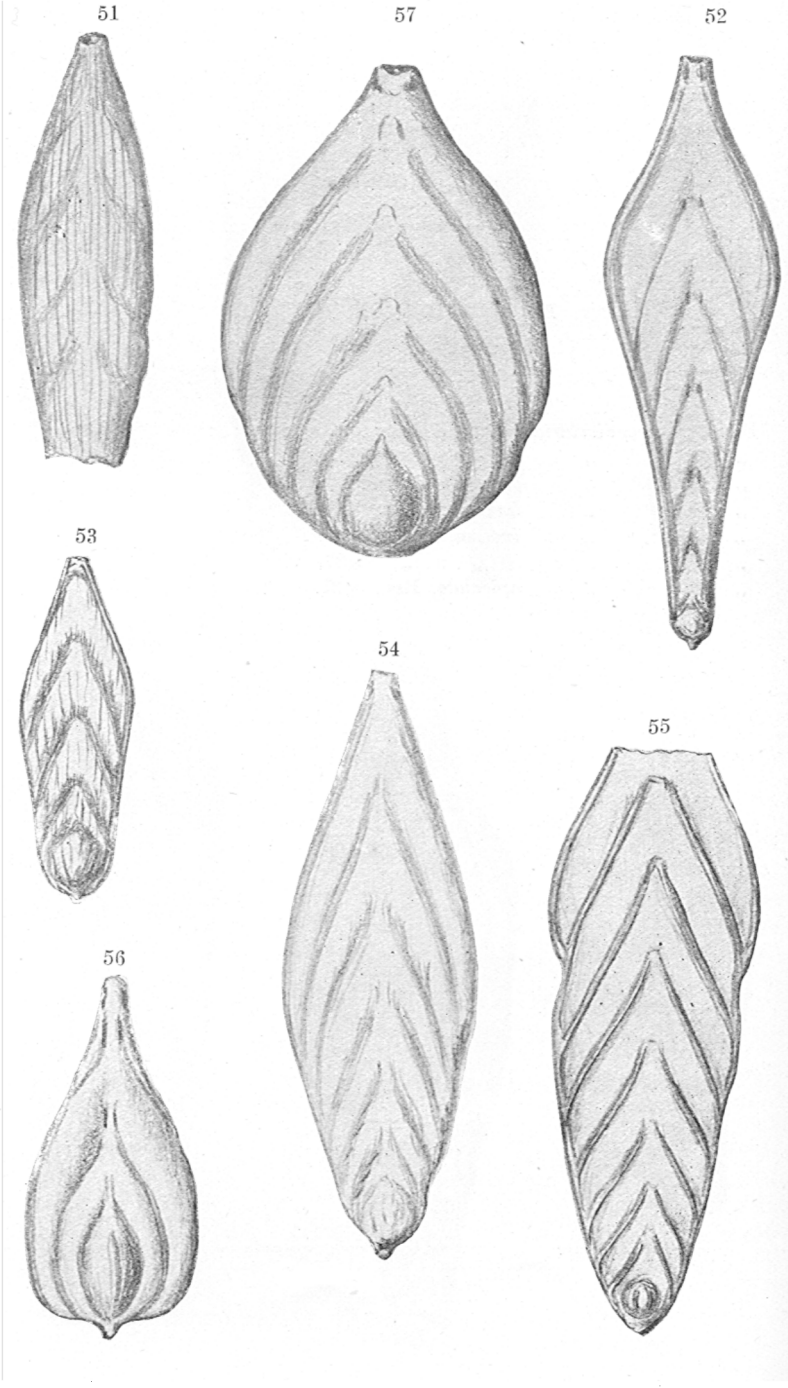
Plate V.



EXPLANATION OF PLATE V.

Fig. 44.—*Frondicularia ornata*, d'Orb., ×37.
„ 45.— „ *archiaciana*, d'Orb., ×37.
„ 46.— „ *chapmani*, Perner, ×18.
„ 47.— „ *lanceola*, Reuss, ×37.
„ 48.— „ *inversa*, Reuss, ×37.
„ 49.— „ „ „ ×37.
„ 50.— „ *apiculata*, Rss., ×37.

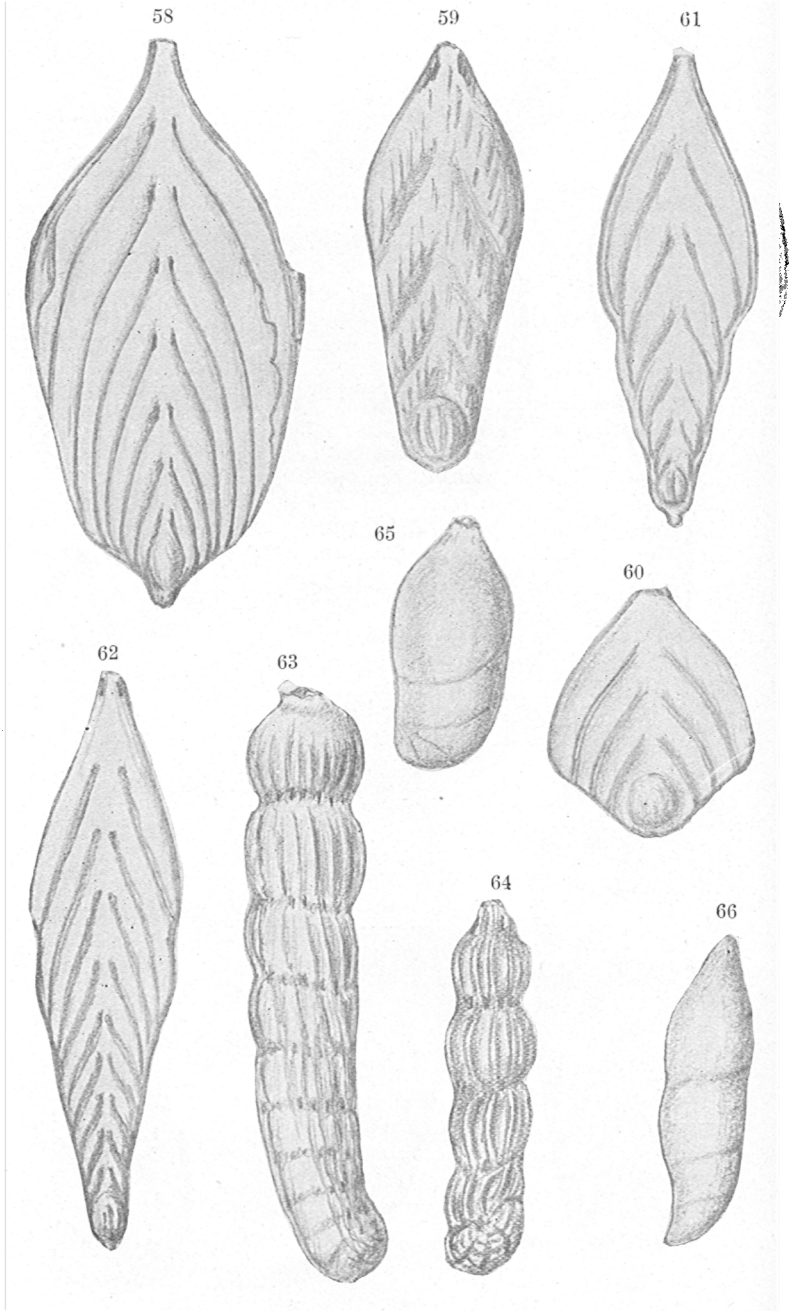
Plate VI.



EXPLANATION OF PLATE VI.

Fig. 51.—*Frondicularia sherborni*, Perner, ×37.
„ 52.— „ *marginata*, Rss., ×37.
„ 53.— „ *decheni*, Rss., ×37.
„ 54.— „ *gaultina*, Rss., ×37.
„ 55.— „ „ ×37.
„ 56.— „ *ungeri*, Rss., ×37.
„ 57.— „ *perovata*, Chapman, ×37.

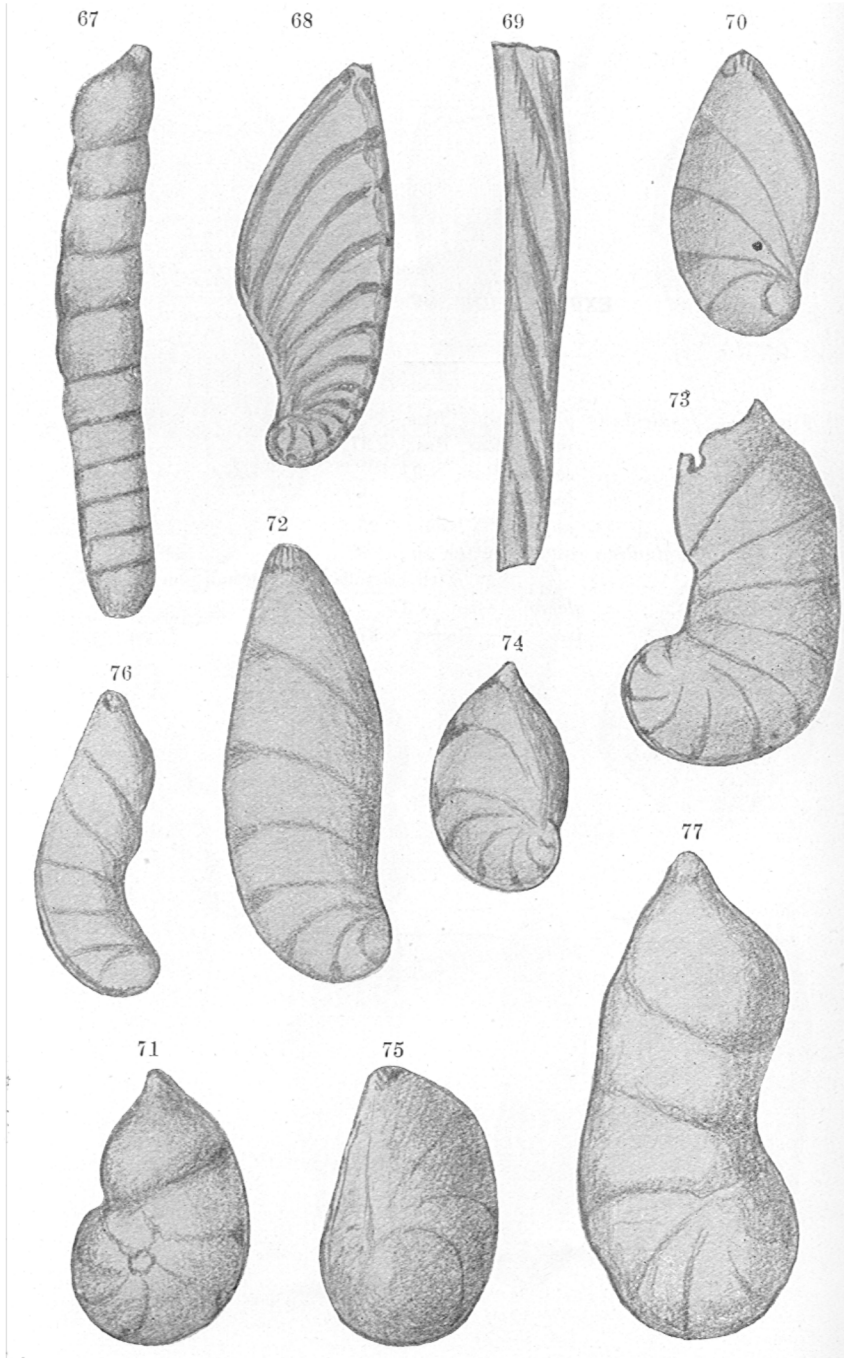
Plate VII.



EXPLANATION OF PLATE VII.

Fig. 58.—*Frondicularia guestphalica*, Rss., ×37.
„ 59.— „ *intermittens*, Rss., ×37.
„ 60.— „ *cordai*, Rss., ×37.
„ 61.— „ *lanceolata*, Perner, ×37.
„ 62.— „ *angusta*, Nilsson, ×25.
„ 63.—*Marginulina costata*, Batsch sp., ×37.
„ 64.— „ „ var. with cristellarian commencement, ×37.
„ 65.— „ *glabra*, d'Orb., ×37.
„ 66.— „ *inaequalis*, Reuss, ×37.

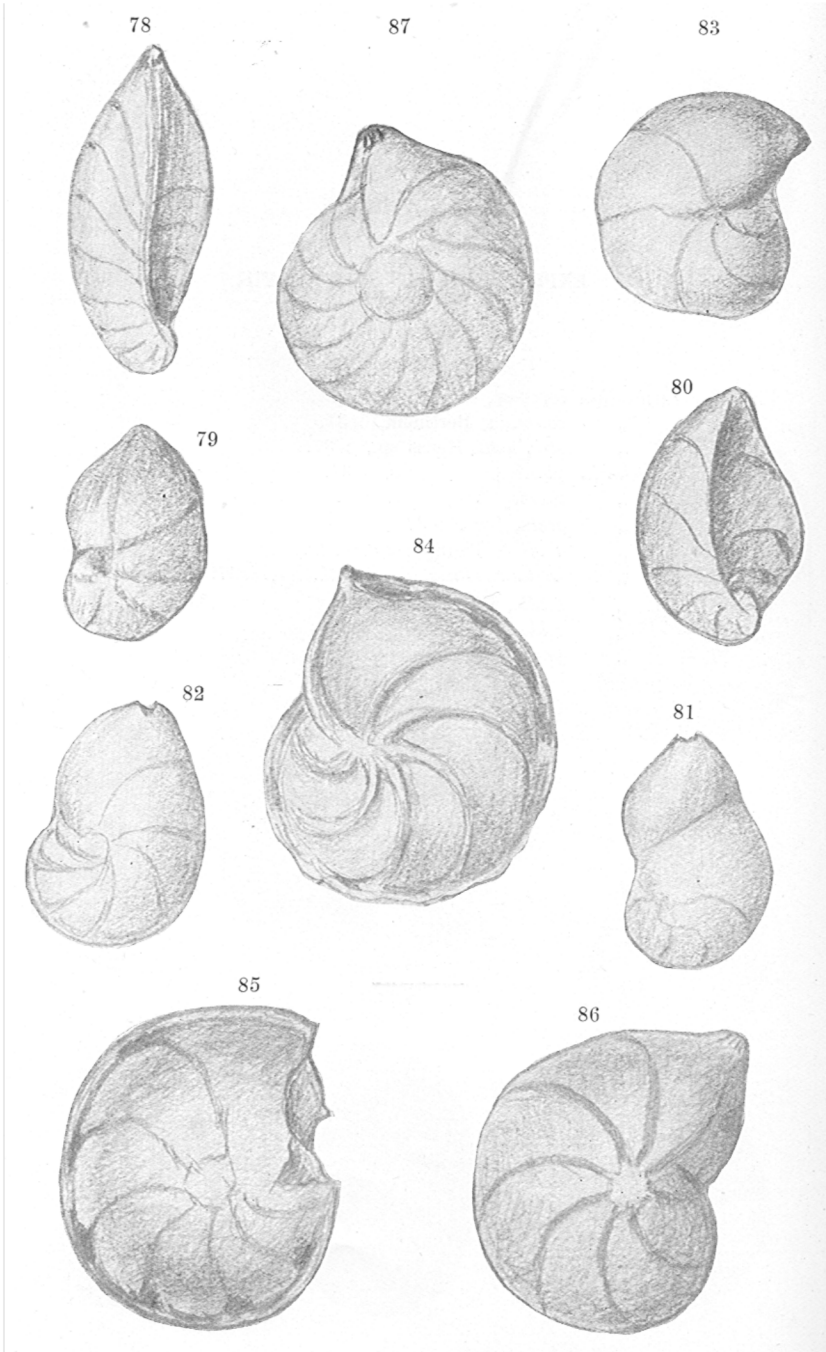
Plate VIII.



EXPLANATION OF PLATE VIII.

Fig. 67.—*Vaginulina* *legumen*, L. sp., ×24.
„ 68.— „ *comitina*, Berthelin, ×37.
„ 69.— „ *strigillata*, Reuss sp., ×37.
„ 70.—*Cristellaria* *planiuscula*, Reuss, ×37.
„ 71.— „ *lituola*, Rss., ×37.
„ 72.— „ *grata*, Rss., ×37.
„ 73.— „ *gladius*, Phillippi sp., ×37.
„ 74.— „ *acutauricularis*, F. and M. sp., ×37.
„ 75.— „ *ovalis*, Rss., ×37.
„ 76.— „ *schloenbachi*, Rss., ×37.
„ 77.— „ *bronni*, Roemer sp., ×37.

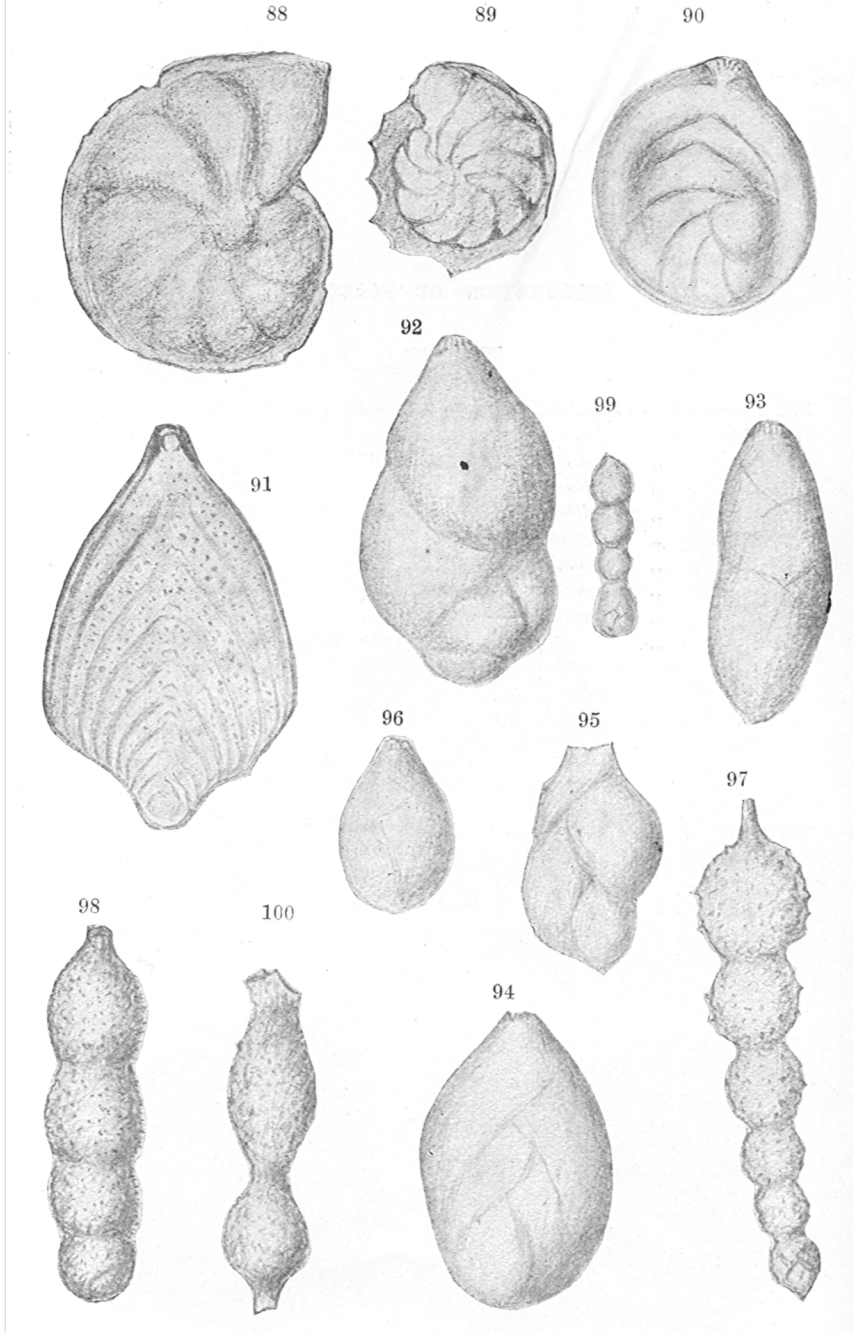
Plate IX.



EXPLANATION OF PLATE IX.

Fig. 78.—*Cristellaria italica*, Defrance sp., ×37.
„ 79.— „ *navicula*, d'Orb., ×37.
„ 80.— „ *triangularis*, d'Orb., ×37.
„ 81.— „ *oligostegia*, Rss., ×37.
„ 82.— „ *gibba*, d'Orb., +37.
„ 83.— „ *articulata*, Rss., ×37.
„ 84.— „ *subalata*, Rss., ×37.
„ 85.— „ *gaultina*, Rss., ×37.
„ 86.— „ *rotulata*, Lam. sp., ×37.
„ 87.— „ „ var. *macrodiscus*, Rss., ×37.

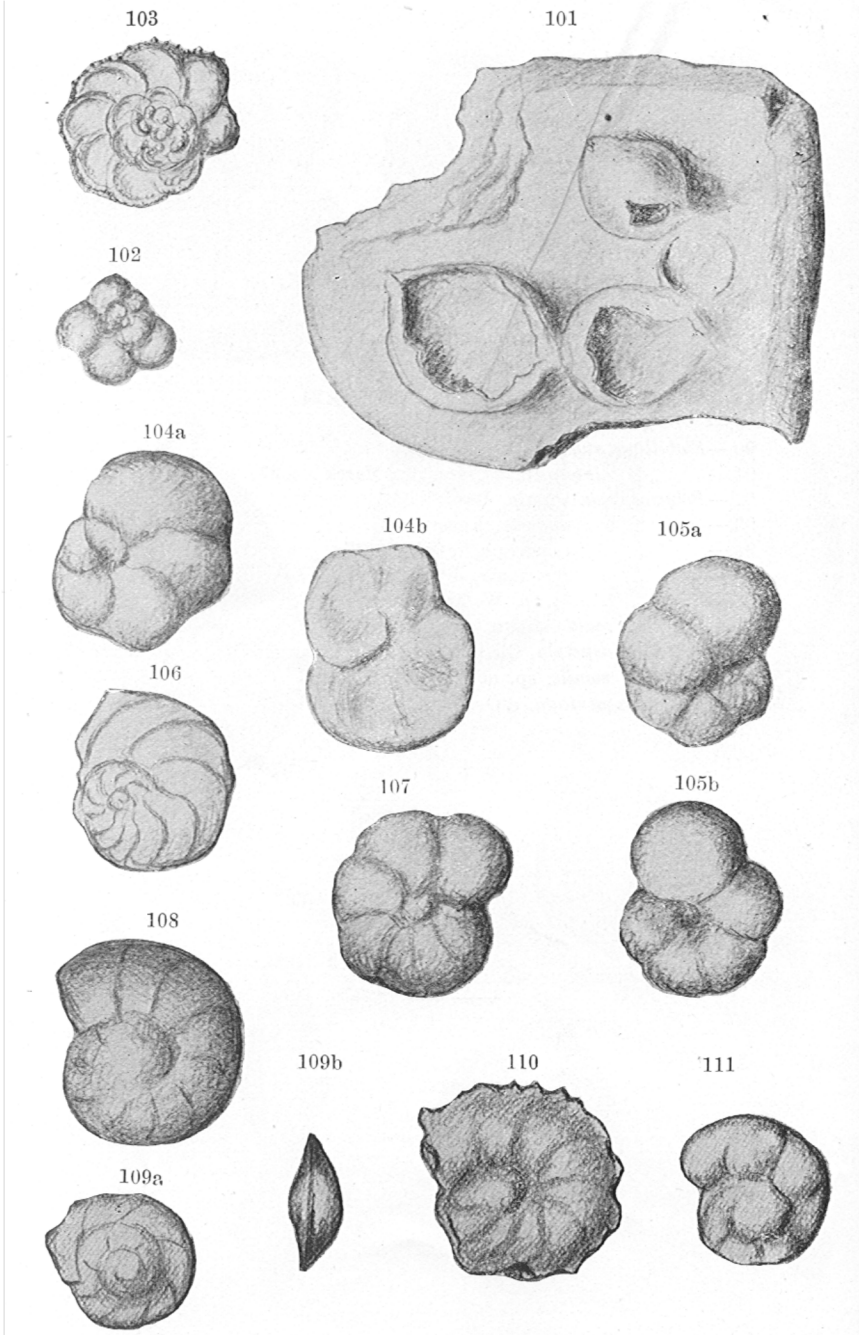
Plate X.



EXPLANATION OF PLATE X.

Fig. 88.—*Cristellaria circumcidanea*, Berthelin, ×24.
,, 89.— ,, *diademata*, Berth., ×37.
,, 90.—*Flabellina rugosa*, d'Orb., ×37.
,, 91.— ,, *interpunctata*, von der Marck., ×37.
,, 92.—*Polymorphina sororia*, Rss., ×37.
,, 93.— ,, *angusta*, Egger, ×37.
,, 94.— ,, *compressa*, d'Orb., ×37.
,, 95.— ,, *communis*, d'Orb., ×37.
,, 96.— ,, *lactea*, W. and J. sp., ×37.
,, 97.—*Sagraina maitlandiana*, sp. nov., ×37.
,, 98.— ,, *asperula*, Chapman, ×37.
,, 99.— ,, *monile*, sp. nov., ×37.
,, 100.—*Ramulina aculeata*, d'Orb., sp., ×37.

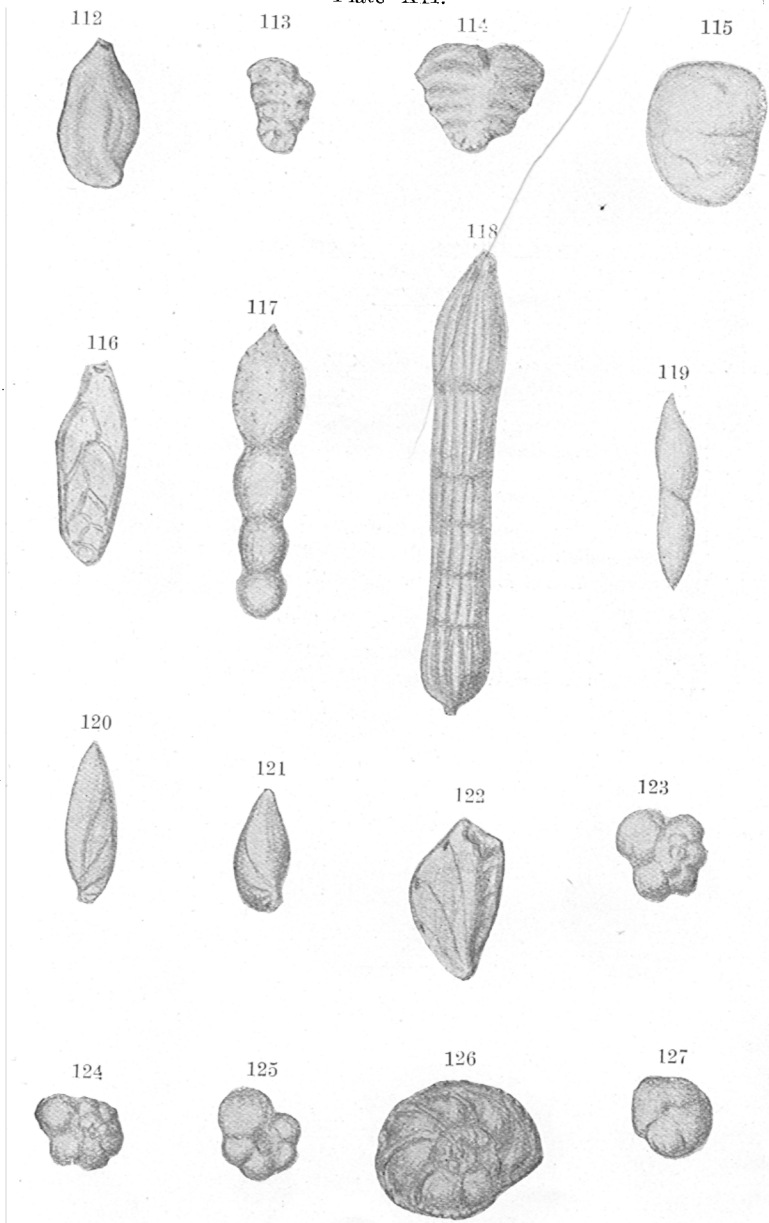
Plate IX.



EXPLANATION OF PLATE XI.

Fig. 101.—*Vitriwebbina laevis*, Sollas sp., ×37.
,, 102.—*Globigerina cretacea*, d'Orb., ×37.
,, 103.— ,, *linnaeana*, d'Orb., ×37.
,, 104*a*.— } *Truncatulina lobatula*, W. and J. sp., ×37.
,, 104*b*.— }
,, 105*a*.— }
,, 105*b*.— } ,, *convexa*, Reuss, ×37.
,, 106.— ,, *wuellerstorfi*, Schwager sp., ×37.
,, 107.—*Anomalina ammonoides*, Rss. sp., ×37.
,, 108.—*Pulvinulina elegans*, d'Orb. sp., ×37.
,, 109*a*.— }
,, 109*b*.— } ,, *cordieriana*, d'Orb., sp., ×37.
,, 110.— ,, *spinulifera*, Rss. sp., ×37.
,, 111.—*Rotalia soldani*, d'Orb., var. *nitida*, Rss., ×37.

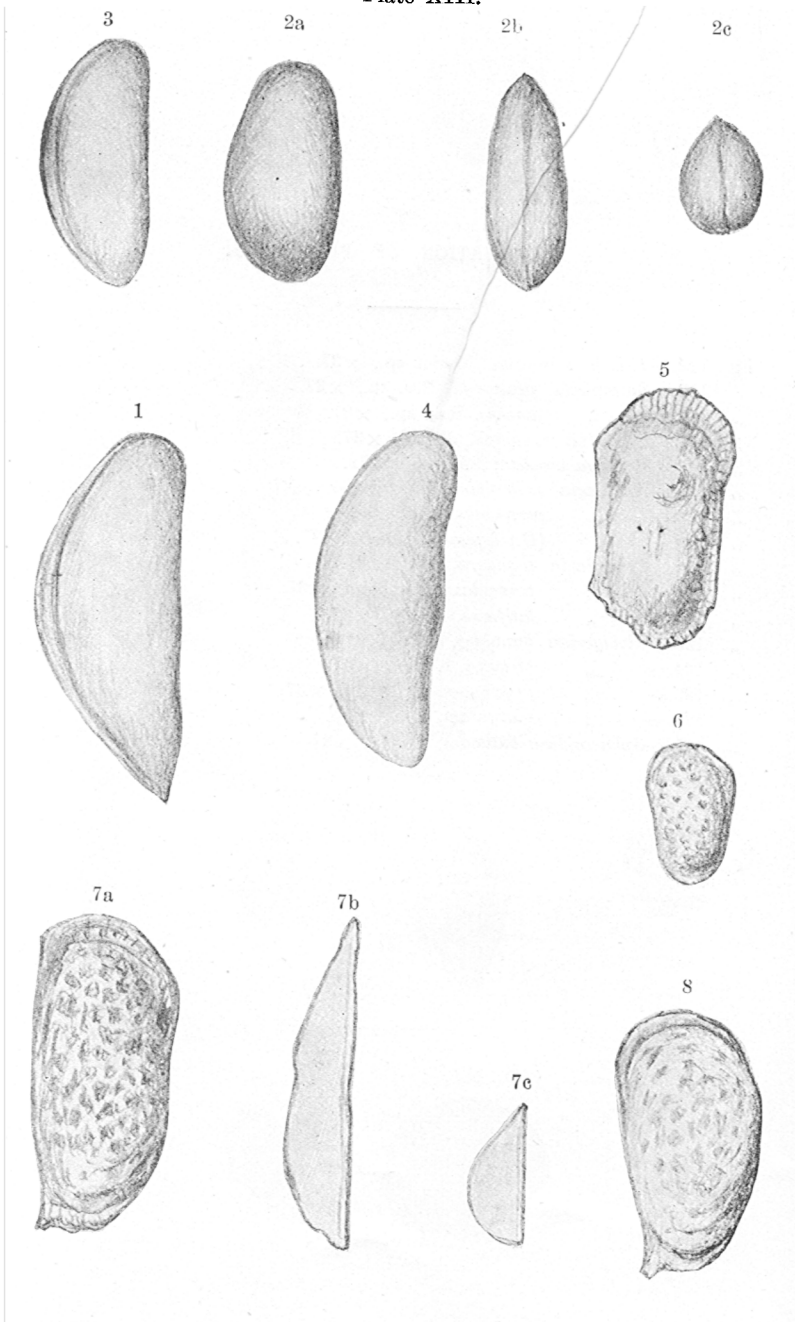
Plate XII.



EXPLANATION OF PLATE XII.

Fig. 112.—*Miliolina venusta*, Karrer sp., ×37.
„ 113.—*Spiroplecta praelonga*, Rss. sp., ×37.
„ 114.— „ *anceps*, Rss. sp., ×37.
„ 115.—*Bulimina variabilis*, d'Orb., ×37.
„ 116.—*Bolivina obsoleta*, Eley sp., ×74.
„ 117.—*Nodosaria subtertenuata*, Schwager, ×37.
„ 118.— „ *perpusilla*, Chapman, ×74.
„ 119.— „ *(D.) legumen*, Reuss, ×37.
„ 120.—*Cristellaria tripleura*, Rss., ×37.
„ 121.— „ *trunculata*, Berthelin, ×37.
„ 122.— „ *latifrons*, Brady, ×37.
„ 123.—*Globigerina bulloides*, d'Orb., ×37.
„ 124.— „ *cretacea*, d'Orb., ×37.
„ 125.— „ *aequilateralis*, Brady, ×37.
„ 126.— „ *marginata*, Rss., ×74.
„ 127.—*Sphaeroidina bulloides*, d'Orb., ×37.

Plate XIII.



EXPLANATION OF PLATE XIII.

Fig. 1.—*Paracypris siliqua*, Jones and Hinde. Carapace seen from the right, ×37.

„ 2a, 2b, 2c.—*Bythocypris howchiniana*, sp. nov. *a* Carapace seen from the right; *b* Edge view; *c* End view, ×37.

„ 3.—*Bairdia arquata*, Münster sp. Carapace seen from the right, ×37.

„ 4.—*Macrocypris simplex*, Chapman, var. *africana*, nov. Right valve, ×37.

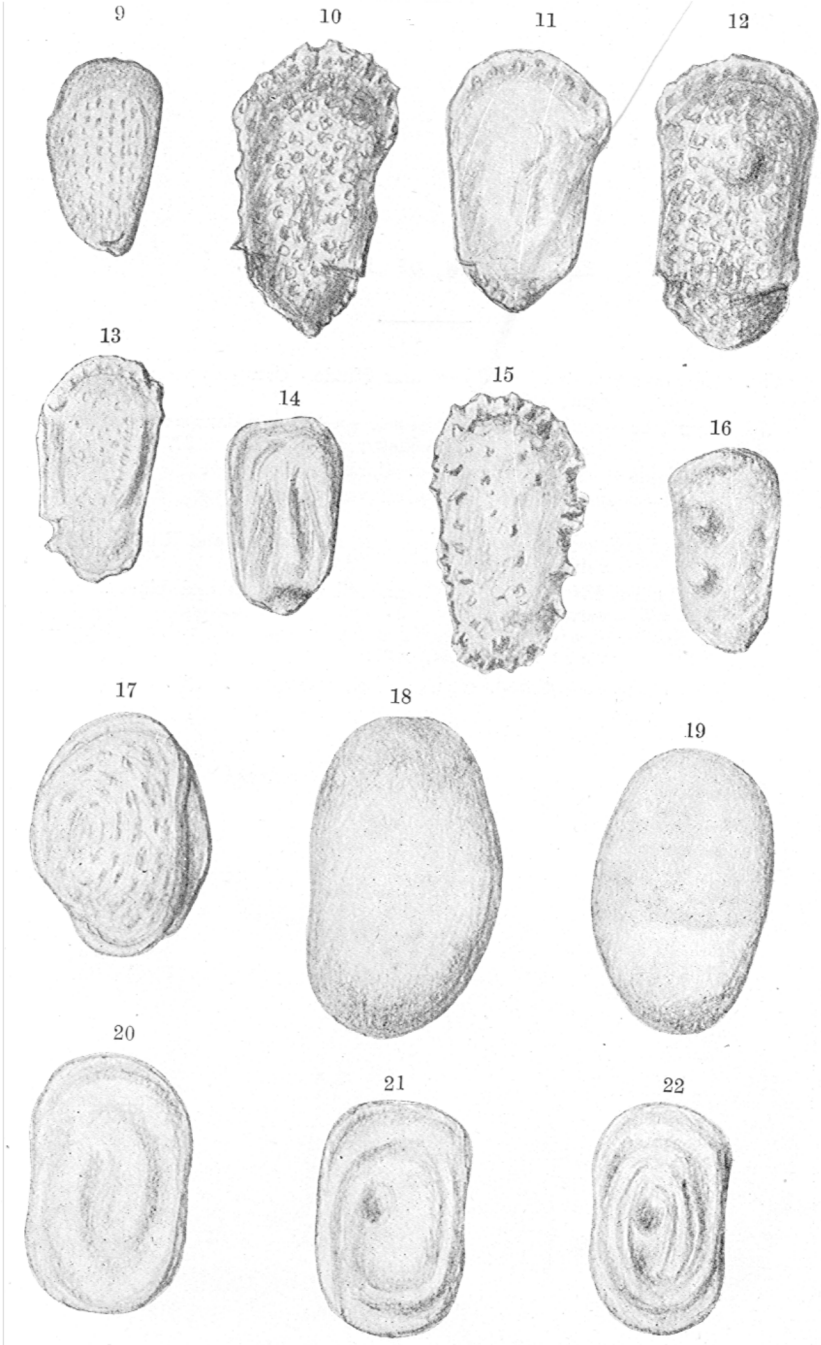
„ 5.—*Cythereis ornatissima*, Rss. sp., var. *nuda*, Jones and Hinde. Right valve, ×37.

„ 6.—*Cythere harrisiana*, Jones, var. *reticosa*, Jones and Hinde. Left valve, ×37.

„ 7a, 7b, 7c.—*Cythere westraliensis*, sp. nov. *a*, Left valve; *b* Edge view; *c* End view, ×37.

„ 8.—*Cythere westraliensis*, sp. nov. Left valve, ? ♂, ×37.

Plate XIV.



EXPLANATION OF PLATE XIV.

Fig. 9.—*Cythere lineatopunctata*, Chapman and Sherborn. Right valve, ×55.
„ 10.—*Cythereis ornatissima*, Rss. sp., Right valve, ×37.
„ 11.— „ „ var. *nuda*, Jones and Hinde. Left valve, ×37.
„ 12.— „ „ var. *reticulata*, J. and H. Right valve, ×37.
„ 13.— „ „ var. *stricta*, J. and H. Right valve, ×37.
„ 14.—*Cythereis quadrilatera*, Roemer sp. Left valve, ×55.
„ 15.—*Cythereis rudispinata*, Chapman and Sherborn. Left valve, ×37.
„ 16.—*Cythereis tuberosa*, J. and H. Right valve, ×74.
„ 17.—*Cytheropteron concentricum*, Reuss sp. Carapace seen from the right, ×37.
„ 18.—*Cytherella muensteri*, Roemer sp. Left valve, ×37.
„ 19.—*Cytherella ovata*, Roemer sp. Right valve, ×37.
„ 20.—*Cytherella williamsoniana*, Jones. Left valve, ×37.
„ 21.—*Cytherella williamsoniana*, var. *stricta*, J. and H. Left valve, ×37.
„ 22.—*Cytherella chapmani*, Jones and Hinde. Left valve, ×37.

Plate XV.

Girvanella, sp.
Transverse section of a pellet, exhibiting a central nucleus and the concentric laminae of tubes—× 6 diam.

XII.—Girvanella in The Cambrian Rocks OF *North-West Australia.*

BY

R. ETHERIDGE, Jr.,

Curator, The Australian Museum, Sydney.

WITH ONE PLATE—XV.

The obscure organism known as *Girvanella* has already been met with in the Cambrian of Victoria and South Australia, in certain Victorian Silurian limestones, and possibly also in the Carboniferous of New South Wales and Queensland.

For a full account of the affinities and distribution of *Girvanella* the reader is referred to Mr. F. Chapman's paper "On the Relationship of the Genus *Girvanella,* and its Occurrence in the Silurian limestones of Victoria." *

My attention was some time ago attracted by pellets, or small nodular masses, occurring in the Salterella Limestone of the Ord River, Kimberley. To the naked eye these appear either as oval or round masses of 20-25mm. approximately, and on closer inspection are found to be made up of concentric layers.

Thin slices prepared for the microscope at once revealed the nature of these masses—a peculiar arrangement of *Girvanella*-like tubes, layer upon layer, as in *Girvanella incrustans,* Bornemann,† occurring in the Cambrian of Sardinia. The tubes appear to form their own concentric layers, without the intervention of any layer-forming medium, and either repose on and intertwine with one another (so forming a lamina), or stand erect at right angles to the so-formed layer, or again indistinguishably entwined and twisted aggregations. But, no matter which of these three conditions exist, there is usually a free and unoccupied space between the top of one "lamina" and the base of that above. The edges of these spurious layers, cut in a section, are either in one plane or undulating. This degree of regularity does not exist throughout an entire pellet, but appears here and there, the remainder of its substance becoming a confused mass of tubes; still, on the whole this concentricity is certainly a marked feature of this Ord River form.

The pseudo-laminæ are produced in the first instance by a close agglomeration or intertwining of the tubes, but this close contact

* Chapman: Proc. Austr. Assoc. Adv. Sci. for 1907, XI., 1908, p. 377.
† Bornemann: Vers. Camb. Schich. Insel Sardinien, 1886, p. 18, pl. 2, figs. 1 and 2.

soon breaks up, and the tubes then become as stated in a preceding paragraph. The inter-laminar spaces consist of a semi-clear magma, not matrix infilling, with tubes loosely scattered through it. So far as my power of magnification enables me to judge the tubes are entire and non-segmented, neither moniliform, nor annulate, or furcate; the diameter on the average is .017 mm.

The principal section revealed the presence of a foreign body, apparently a low form of coral life, as a nucleus, around which the *Girvanella* had grown; to its other characters, therefore, may be added that of an encrusting or enveloping nature.

The *Girvanella* detected in association with Archæocyathinæ in the South Australian Cambrian was noted as closely resembling the before-mentioned *G.* (*Siphonema*) *incrustans,* Bornemann, from the Baltic Silurian.* In this enveloping habit, the present form resembles *G. sinensis,* Yabe,† from China, and probably of Carboniferous age; this appears to me to differ but little from *G. incrustans.* Both envelop foreign bodies, both are concentric in structure, and seem to differ only in the matter of diameter, that of the first being .01 mm., and that of the second .015 to .02. The Kimberley *Girvanella,* on the other hand, differs from both in its uniform and non-moniliform tubes, and in size is practically intermediate between them. In this uniformity of size we see a close approach to the generic type, *G. problematica,* Nich. & Eth. fil,‡ but here again size, 1.20-1.60 mm., steps in as an obstacle to identity. On the other hand, if the enveloping *Girvanella* of the Wenlock Limestone described by Mr. E. Wethered§ be *G. problematica,* the connection between this and the Ord River form is increased by the remarkable variation in the tube diameter, .02, .03, .05 mm., etc.

I cannot satisfactorily identify this *Girvanella* with any other, the descriptions of which I have access to, and simply content myself by calling attention to its occurrence in the Cambrian of North-West Australia, and associated with *Salterella hardmani,* Eth. fil.

---

* Etheridge: Trans. R. Soc. S. Austr., XIII., 1890, p. 19.
† Yabe: Sci. Reports Tohoku Imp. Univ., 2d. Series (Geology), I., heft 1, 1912, pt. I., fig. 1.
‡ Nicholson & Etheridge: Mon. Sil. Foss. Girvan, Fas. I., 1878, p. 23.
§ Wethered: Quart. Jour. Geol. Soc., XLIX., 1893, pl. VI.

PALÆONTOLOGICAL CONTRIBUTIONS

TO

THE GEOLOGY OF WESTERN AUSTRALIA.

SERIES I.—**BULLETIN 10, 1903.**

(i.) Descriptions of Carboniferous Fossils from the Gascoyne District, Western Australia.—R. Etheridge, jun.

SERIES II.—**BULLETIN 27, 1907.**

(i.) Plant Remains from the Collie Coalfield. — R. Etheridge, jun.

(ii.) Notes on Fossils from the Collie Coalfields, Western Australia, in the collection of the National Museum, Melbourne.—F. Chapman, F.L.S.

(iii.) Fossils from Minginew, Irwin River Coalfield, collected by E. S. Simpson.—R Etheridge, jun.

(iv.) Descriptions of Carboniferous Fossils from the Irwin River, collected by Mr. C. F. P. Jackson.—R. Etheridge, jun.

(v.) Foraminifera from a Calacreous Marlstone, Gingin. — W. Howchin, F.G.S.

SERIES III.—**BULLETIN 36, 1910.**

(i.) On the Fossil Sponge Spicules in a Rock from the Deep Lead (?) at Princess Royal Township, Norseman Township.—Dr. Geo. J. Hinde, F.R.S.

(ii.) Some Fossil Plants from Western Australia. — E. A. Newell Arber, M.A., F.G.S. F.L.S.

(iii.) Oolitic Fossils from the Greenough River District.—R. Etheridge, jun.

(iv.) Sthenurus Occidentalis.—Ludwig Glauert, F.G.S.

(v.) A list of Western Australian Fossils systematically arranged.—Ludwig Glauert, F.G.S.

(vi.) Fossil Flora of Western Australia.—Ludwig Glauert, F.G.S.

(vii.) New Fossils from the Barker Gorge, Napier Range, Kimberley.—Ludwig Glauert, F.G.S.

(viii.) The Geological Age and Organic Remains of the Gingin Chalk.—Ludwig Glauert F.G.S.

SERIES IV.—**BULLETIN 55, 1913.**

(ix.) The Cretaceous Fossils of the Gingin "Chalk."—R. Etheridge jun.

SERIES V.—**BULLETIN 58, 1914.**

(x.) Western Australian Carboniferous Fossils, chiefly from Mount Marmion, Lennard River, West Kimberley.—R. Etheridge, jun.

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INDEX

	Page
Anomalina aminonoides	46, 80
Ammodiscus gaultinus	18, 60
Ammodiscus incertus	17, 60
Bardia arquata	52, 84
Bigenerina compressuscula	19, 62
Bolivina obsoleta	22, 82
Bulimina variabilis	22, 82
Bythocypris howchiniana	53, 85
Clavulina communis	21
Cristellaria acutauricularis	35, 74
„ articulata	37, 76
„ bronin	36, 74
„ circumcidanca	39, 28
„ cultrata	39
„ diademata	39, 78
„ gaultina	38, 76
„ gibba	37, 76
„ gladius	35, 74
„ grata	35, 74
„ italica	36, 76
„ latifrons	37
„ lituola	35, 74
„ naricula	36, 76
„ obicularis	39
„ oligostegia	37, 76
„ ovalis	35, 74
„ planinsaila	34, 74
„ rotulata	38, 76
„ rotulata var. microdiscus	38, 76
„ schoenbachi	36, 74
„ subalata	38, 76
„ triangularis	36, 76
„ tripleura	24
„ trunculata	34, 83
Cytheropteron concentricium	56, 86
Cytherella chapmani	58, 86
„ muensteri	57, 86
„ ovata	57, 86
„ williamsoniana	57, 86
Cythere harrisiana var. reticosa	53, 84
„ lineatopunctata	54, 86
„ westraliensis	54, 84
Cythereis ornatissima	55, 84, 86
„ „ var nuda	55
„ „ var reticulata	55
„ „ var stricta	55
Cythereis quadrilatera	56, 86
„ rudispinata	56, 86
„ tuberosa	56, 86
Discorbina opercularis	45
Flabellina interpunctuata	40, 78
„ rugosa	39, 78
Frondicularia augusta	32, 72
„ apiculata	29, 68
„ archiaciana	28, 68
„ chapmani	29, 68
„ cordai	31, 72
„ decheni	30, 70
„ gaultina	30, 70
„ guesphalica	31, 72
„ inversa	29, 68
„ intermittens	31, 72
„ lanceola	29, 68
„ lanceolata	32, 72
„ marginata	30, 70
„ ornata	28, 68
„ perovata	31, 70
„ sherborni	30, 70
„ ungeri	31, 70
Gaudryina pupoides	21, 62
„ rugosa	21, 62
Girvanella	88, 89, 90
Globigerina aequilateralis	44, 82
„ bulloides	43, 82
„ cretacea	43, 80, 82
„ linnaeana	44
„ marginata	44, 82
Guembelina globifera	20, 62
„ globulosa	20, 62
„ polystropha	21, 62
Haplophragmium agglutinans	16, 63
Haplostiche soldanii	17, 60
Lagena apiculata	22, 64
„ aspera	23, 64
„ hispida	23
Macrocypris simplex var africana	53, 84
Marginula costata	32, 72
„ glabra	33, 72
„ inaequalis	33, 72
Massilina ginginensis	16, 60
Miliolina oblonga	15
„ venusta	15, 60, 82
Nodosaria annulata	24, 64
„ communis	24, 64

INDEX—*continued.*

	Page
Nodosaria consobrina var emaciata	24, 64
„ costellata	26, 66
„ dentalina destructa	23, 64
„ filiformis	25, 66
„ intercellularis	26, 66
„ legumen	25, 82
„ lornerana	25, 66
„ obliqua	26, 66
„ obscura	27, 66
„ pauperata	23, 64
„ paupercula	27, 66
„ perpusilla	28, 82
„ prismatica	28, 66
„ retrorsa	25, 66
„ soluta	23, 64
„ soluta var descrepans	24, 64
„ subtertenuata	27, 82
„ sulcata	26, 66
„ vertebralis	27
Nonionina asterizans	47
Placopsilina cenomana	17
„ vesicularis	16
Paracypris siliqua	52, 84
Polymorphina angusta	40 ,78
„ communis	41, 78
„ compressa	40, 78
„ lactea	41, 78
„ sororia	40, 78
Pulvinulina cordieriana	46, 80
„ elegans	46, 80
„ spinulifera	47, 80
Ramulina aculeata	42, 78
Rotalia beccarii	47
„ broeckiana	47
„ soldanii	47, 80
Rhezammina indivisa	16, 60
Sagraina asperuea	42, 78
„ maitlandiana	41, 78
„ monile	42, 78
Sphaeroidina bulloides	45, 82
Spiroplecta anceps	20, 62, 82
„ praelonga	20, 82
„ saggittula	19, 62
Spiroloculina asperula	15, 60
„ grata	15
Textularia gibbosa	18, 62
„ gramen	19, 62
„ trochus	18
„ turris	18, 60
Truncatulina convexa	45, 80
„ lobatula	45, 80
„ variabilis	46
„ wuellerstorfi	46, 80
Vaginulina comitina	33, 74
„ legumen	33, 74
„ strigillata	33, 74
Verneuilina spirulosa	19
Vitriwebbina laevis	43, 80

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