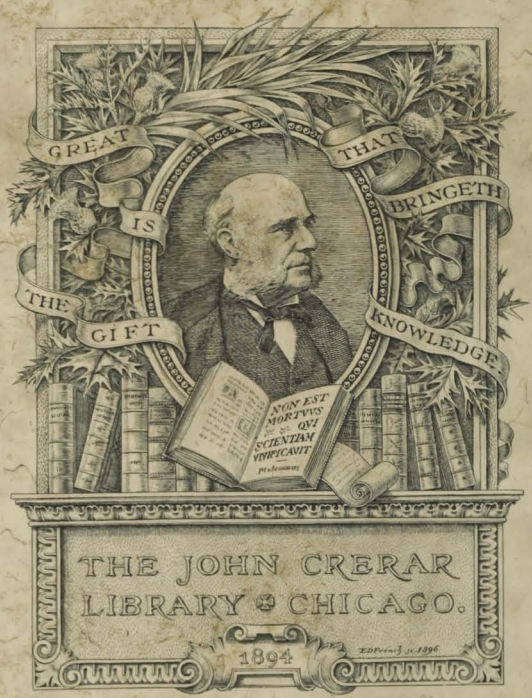
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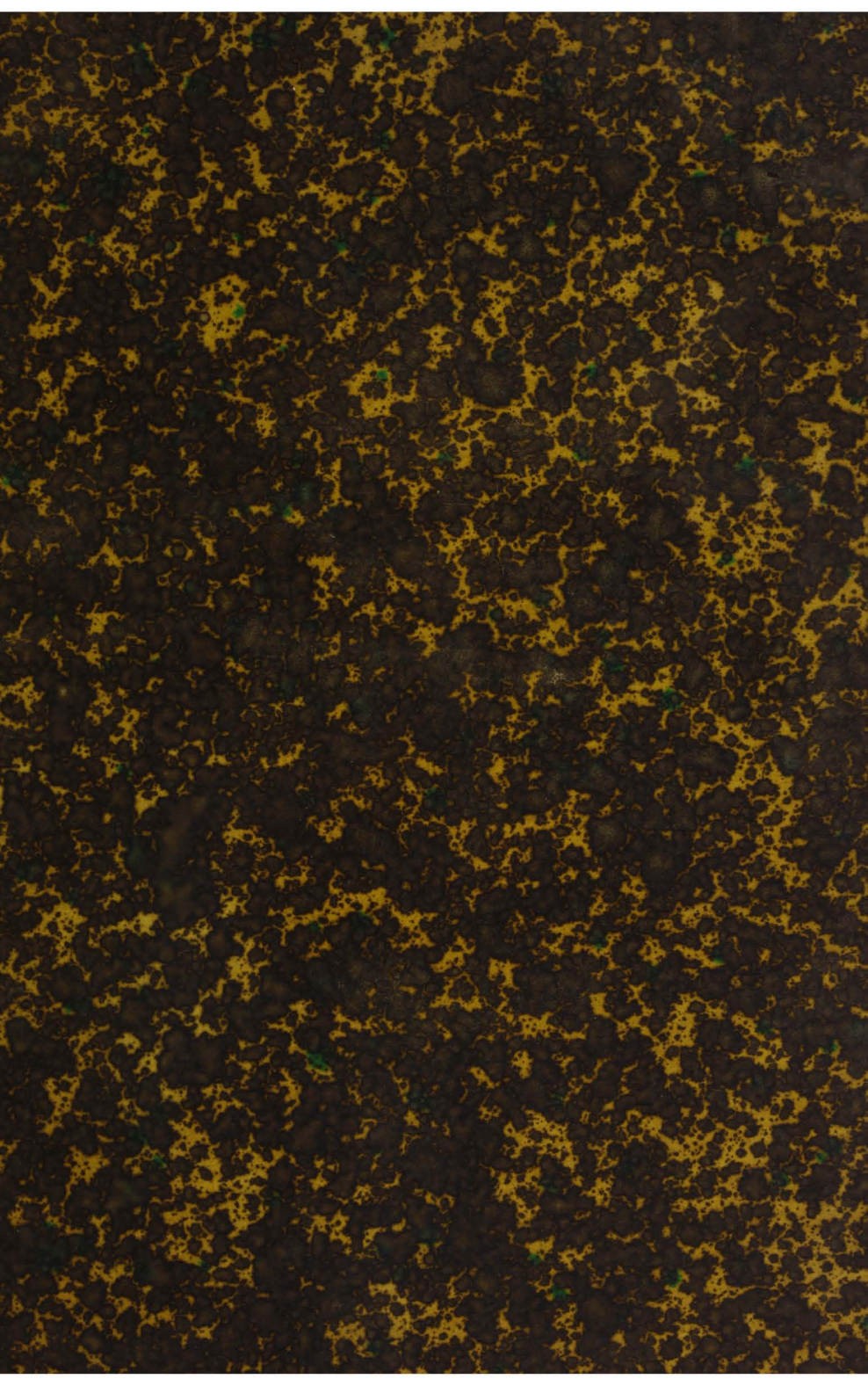

THE

NEOCOMIAN

SPONGES, BRYOZOA,

FORAMINIFERA

AND OTHER FOSSILS

OF THE

SPONGE-GRAVEL BEDS

AT

LITTLE COXWELL,

NEAR

FARINGDON,

BY

E. C. DAVEY,
Member of the Royal Numismatic Society, and Hon. Sec. Bath Literary Institution; F.G.S. from 1871 to 1882.

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PREFACE

AND

INTRODUCTION.

When residing near Faringdon between the years 1870 and 1880, I had frequent opportunities of going to the famous Sponge-gravel pits at Little Coxwell and gradually collected an almost perfect suite of its varied fossils,—subsequently acquired by the Geological Museum, Oxford. In 1874 I wrote a short illustrated " Paper " on the most characteristic Faringdon Sponges, intended for the 2nd vol. of the Transactions of the Newbury Field Club, but printed privately by Messrs. Pavier and Roberts, of Wantage. Copies of this essay were distributed among friends and the numerous persons whom I knew or believed to be interested in the subject, such as Professors Phillips, Prestwich, Rupert Jones and Page ; Rœmer of Breslau, Geinitz of Dresden, Fromentel of Gray, Bosquet of Maestricht ; Dr. Wright, Sir Wm. Guise, Revd. T. Wiltshire, R. Etheridge, W. Whitaker and A. J. Jukes Browne, from all of whom I received complimentary acknowledgments. In this way the entire issue was dispersed at home and abroad, so that no copy has been obtainable for more than 25 years, though copies may be seen at the libraries of the Geological Society, the Geologists' Association and the Royal Archæological Institute.

In 1883 appeared the great work of Dr. G. J. Hinde on Fossil Sponges, exhaustive and final ; and it may be asked, what need of any fresh descriptions or illustrations ? The answer is that Dr. Hinde's *opus magnum* treats of Sponges through the whole

range of geological strata and is therefore bulky and expensive, while I concern myself solely with Lower Greensand or Neocomian specialities. Again, Dr. Hinde goes very fully into the question of spicules—on which indeed he bases his classification—but I leave them out altogether because they are so difficult to discover, are in fact undiscoverable in most instances. My real object is to introduce a knowledge of the wonderful Faringdon fossils to those unacquainted with them and provide an easy and serviceable handbook for members of Field Clubs, like Bristol, Clifton, Bath, the Cotteswold, &c., as well as for ordinary visitors to the Coxwell pits.

In my 'Paper' of 1874, nothing was said about Bryozoa, but in a "Catalogue of Berkshire Cretaceous Fossils" issued on the occasion of a visit to Wantage by the Geologists' Association, May 7th, 1877, I gave a full list of the Faringdon Bryozoa and this list is now reproduced, with notes on the best types.

Neither the Paper of 1874 nor the Catalogue of 1877 contained any reference to Foraminifera or Entomostraca,—simply because I had never seen any nor guessed their presence in the rough gravelly and sandy matrix of the Coxwell beds. Up to the end of the year 1903 it was possible to say that no Foraminifera had been recorded from Faringdon and only two Entomostraca (Cythere Bairdiana and Harrisiana, *Palæont. Soc. for 1889, Vol. xliii*, 15, 17); but in the spring of 1904 a microscopical examination of some of the softer sands brought to light a most unexpected, as well as most varied and beautiful, series of both Foraminifera and Entomostraca. The credit of discovering and mounting several hundreds of these extremely minute organisms is due solely to the patience of Mr. F. Mockler, of the Holburne Museum, Bath; while the task of correctly identifying them was most kindly undertaken by the veteran Foraminiferist, Professor T. Rupert

Jones, F.R.S. &c., whose writings on the special subject have been carried on during more than 50 years, and by Mr. Joseph Wright, F.G.S., of Belfast, who has also devoted 25 years to the same exclusive study. Thanks are, at the same time, due to Mr. Walter Rossiter, Artist, of Bath for very accurate drawings of the best specimens, reproduced by photography so clearly that it is easy to recognise not only their shape and size, but also their peculiarities of ornamentation and variation.

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BATH.

THE NEOCOMIAN SPONGES

OF

FARINGDON.

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1. The famous Sponge-gravel beds of Berks, so unique in their assemblage of organic remains, so familiar by the writings of Mantell, Sharpe, Godwin-Austen, Davidson, Meyer and other zealous geologists, lie close to the town of Faringdon and the village of Little Coxwell, near the western confines of the county. A short branch of the Great Western railway runs from Uffington to Faringdon and renders these most attractive beds easy of access.

2. The whole Sponge-gravel deposit as exposed at intervals near Little Coxwell—partly also above Great Coxwell—is of very limited area, extending less than a mile in length and less than a quarter of a mile in breadth, with a vertical depth of 25 to 40 feet: but there is one outlier two miles to the north-west (Badbury hill), and another outlier one mile to the south (Fernham). The late Mr. C. Meyer was the first to demonstrate the existence of the Sponge-gravel beds on Badbury hill. They occur half way down its western slope, beneath sands and sandstone in which I have found such true Lower Greensand forms as Emarginula Neocomiensis and Rhynchonella Gibbsiana. In 1873 I had the further satisfaction of finding, at the spot indicated by Mr. Meyer, a specimen of Verticillites (Tremacystia) anastomosans, the most typical of all the Faringdon sponges. (*Geologist*, *vii*, 5—11).

The main mass forms a plateau between the eminences of Faringdon Clump, Badbury hill and Furze hills. It is based on Kimmeridge clay, overlapping the Coral Rag on its eastern limits and is capped in places by dark, barren iron sands. The beds, as described by Mantell and others, consist of a coarse, friable conglomerate of shells, sponges, sea-urchins, sand and pebbles consolidated by a ferruginous cement, with occasional calcareous bands. According to the observations of the eminent naturalist, D'Orbigny, these beds must have been accumulated in marine waters that were deep, clear and agitated by currents—say 40 fathoms deep as estimated by Godwin-Austen (*Q.J.G.S. vi*, 458)—but according to Prestwich and other English authorities, "the banks of shingle at Faringdon point to still and sheltered waters, probably of no great depth, and to adjacent dry land" (*Id. xxviii*, *Ann. Add.*; *Phillips*, *Geol. of Oxf.* 425; *Davidson*, *Cret. Brach.* 110, *n.*). Darwin's description of a living coral reef may be aptly applied to the ancient sand bank at Coxwell :—"the cemented mass is very hard and reddish from ferruginous matter. It consists of a sandstone composed entirely of shell, corals, spines of echini and other such organic remains" (*Coral Reefs*, 12).

3. There are three pits of fairly large dimensions and two other smaller openings. The largest of all the five pits, called Panting's by Mantell, Windmill by Meyer and Ballard's (Hickman's) by myself, covers at least two acres of ground. The material dug here is in great request for garden walks, roadside paths and park drives on account of its bright colour and its water-absorbing qualities. Another large pit, 300 yards east of Panting's, was long known as Boutcher's. Here the sands are darker, the mass more compact and fossils less abundant, with the exception of Nautili and Nucleolites which are entirely absent in the first named pit.

The Nautilus special to Boutcher's pit is named Faringdonensis by Sharpe, who states that "there is no other species for which it can be mistaken" (*Q.J.G.S.* x. 198). The Nucleolite is Trematopygus Far. or Davidsoni, fully described and figured by Dr. Wright (*Palæont. Soc.* xxix, 253—4), and is the only British Cretaceous species (*xxxvi*, 355). The genus to which this species belongs is found exclusively in the Middle Neocomian, "a fact of importance," remarks Dr. Wright, "helping to determine the age of the Sponge-gravel beds of Berks."

4. The Coxwell quarries are of considerable antiquity, for we have proof of their being worked more than 200 years ago. Edward Llhwyd who wrote a Latin treatise on fossils in 1698, tells us that he collected them from 'Coxal' for fifteen years and enumerates 75 specimens presented by him to the Ashmolean Museum, Oxford; but his descriptions are so obscure and his figures so faulty that it is often difficult, if not impossible, to decipher his meaning. I can however recognise Bryozoa, Bufonites, Asteracanthus, Serpulites, Echinoderms and certain bivalves; but as Sponges are almost unnoticed, I conclude that his researches were chiefly prosecuted in Boutcher's pit where these organisms are indifferently preserved. Llhwyd was very positive that the supply of fossils would prove inexhaustible: *non est dubitandum ea quæ hodie inveniuntur per omnia sæcula inveniri posse;* only I must add his warning to those who are too sanguine of success—*verum hic monendus evit ne unius diei spatio ea se inventurum speraret quæ nobis longè pluris constabant temporis* (*Litho. Brit.* 3).

Contemporary with Llhwyd was the well-known Dr. Woodward (1665—1728), the originator of the Woodwardian Museum, Cambridge, who describes several fossils from Faringdon, the most remarkable of which is the Vert. (Tremacystia) anastomosans. Dr. Woodward is careful to tell us that he found his

"first fossil shell" January 13th, 1689. From a passage in the 1695 edition of Camden's *Britannia*, I have no doubt that its learned editor, Dr. Gibson, Bishop of London, was familiar with Llhwyd's collections of Coxwell fossils.

So far as I am aware, no scientific writer mentions Coxwell for about one hundred years after the time of Llhwyd and Woodward. The first subsequent notice is to be found in the Transactions of the Linnean Society and consists of the following communication by Mr. Sowerby, dated November 7th, 1809:—"This pit is of a nature not yet described, being a rock composed of petrified animal remains which agree in structure much better with Alcyoniums than with anything else I can recollect. The rock exposes some hundreds of yards of strata and surface; and, being chiefly composed of heaps and heaps of these substances, is truly curious. It is cemented together by brown and reddish oxide of iron which often covers the animal remains in a peculiar manner with a fine crust of spiculæ, giving a velvety lustre to them when the light catches on their shining sides. Besides these Zoophytes there are remarkable Belemnites, mostly worn, and a stratum about an inch thick that presents little else than spines of Echini. There are also some Nautili and small pebbles of every description to be found in this rock" (*x*, 405—6).

Conybeare and Phillips are the next authorities. Their description is short, but accurate and interesting:—"the organic remains (of the L. Greensand) have yet received very little illustration. They appear to be very sparingly dispersed through it generally, although abundant in some particular spots. Of these, Faringdon is the most productive: we have collected from the pits near that town a large nautilus, fragments of ammonites, belemnites, ostreæ, terebratulæ and spines of an echinus cidaris; but the most abundant and interesting fossils of this

spot are the spongitæ of which many varieties occur, tubular, funnel-shaped and palmated: very beautiful minute corallines also occur" (*Outlines of the Geol. of Eng. & Wales* (1822), *p.* 140).

It is a matter of surprise and regret that Dr. Fitton was not attracted to these quarries in 1828. Although professedly engaged in recording all the lower Cretaceous beds in the southern half of England, he appears to have proceeded from Swindon to Oxford without visiting Coxwell, merely observing that "the hills round Faringdon seem especially deserving of notice" (*Trans. Geol. Soc., 2nd series, iv.* 271). Had a full account of the Sponge-gravel been included in Dr. Fitton's 'Memoir on the Strata between the Chalk and the Oxford Oolite,' the age of these singular beds would not have become the subject of so much controversy. § Several years after the appearance of this Memoir, Mantell gives us some valuable details in his "Wonders of Geology" (*i*, 226; *ii*, 637), and at greater length in his "Medals of Creation" (*i*, 278; *ii*, 673, 860). Following on the publication of these popular works, a number of able geologists were attracted to Coxwell pits and we have the results of their visits in finished essays by Godwin-Austen, Sharpe and Meyer; in catalogues by the Government Surveyors and Professor Phillips; in monographs by Davidson and Wright. §§

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§ Professsor Phillips esteemed this Memoir so highly that he considered it had "preserved the honour of England in regard to some part of the Secondary Rocks" *Geol. of Oxford*, 411).

§§ Godwin-Austen, Quart. Journ. Geol. Soc. vi, 454.
Sharpe, x. 176.
Meyer, Geologist, vii, 5—11.
Gov. Surveyors, Sheets 13 and 14.
Phillips, Geol. of Oxford.
Davidson, Palæont Soc. xxvii.
Wright, ,, ,, xxvi, xxxvi.

5. As intimated in the preceding paragraph, there was at one period much doubt and dispute concerning the stratigraphical age of the Coxwell 'gravels.' Mantell seems to have classified them with the Upper Greensand, an opinion formerly supported by Davidson, Woodward, &c., and unfortunately adopted by foreign Geologists, Geinitz (*Elbth.* 163), Desor (*Ech. foss.* 148) and others. In 1853 appeared the essay of Sharpe "On the age of the fossiliferous sands and gravels of Faringdon and its neighbourhood," admirable in all respects except in its conclusions which assigned the deposit to a period younger than our uppermost Chalk (*Q.J.G.S.* *x.* 176—198).

I think that Sharpe was led astray by the abundance of Bryozoa to unite the Faringdon beds with those of Maestricht. But though these graceful organisms are a marked feature in the two deposits, specific agreement is a rarity. I have consulted the standard work of von Hagenow (*Die Bryozoen der Maastr. Kreid.*), corresponded on the special subject with the late Dr. Bosquet of Maestricht and have myself paid a visit to the world-renowned quarries of St. Peter's Mountain, with the result that of the half hundred species found at Coxwell, I cannot recognise half a dozen as identical with those of Maestricht. The most prominent exception is the beautiful Stellipora Bosquetiana of von Hagenow (*Pl. v.* 8) or as D'Orbigny more correctly names it, Domopora Bosquetiana (*Pal. Fr.* *v.* 988). I have specimens both from Ballard's pit and from the summit of Badbury hill.

Sharpe also relied on identity of Sponges, but I question whether there is a single species common to the two formations. For example, the Manon peziza of Coxwell is a large spreading sponge, often two inches square; but the M. peziza of Maestricht is a diminutive production which would scarcely cover a shilling. Again, the Manon pulvinarium of

Coxwell is a round sponge, with oscula disposed singly and sparsely on its surface ; but the Manon pulvinarium of Maestricht has invariably groups or clusters of oscula. (See Goldfuss, xxix, 7 ; Geinitz, Elb. 28, and Rœmer, Spong. des nordd. Kr. xiv, 8).

6. It has long since been conceded that these fossiliferous gravels belong to the Lower Greensand of English authors, equivalent to the upper Neocomian and Aptian of French and Swiss Geologists. The grounds for this decision may be thus summarised :—

(*a*) Similarity with the undisputed sections at Seend in Wiltshire, Godalming in Surrey, Upware in Cambridgeshire and Potton in Bedfordshire, §§§ as well as those at the Sponge-bearing localities of Landéron and Neuveville near Neuchatel (the ancient Neocomium) and Mont Salève, near Geneva.

(*b*) Presence of typical Lower Greensand Brachiopoda (Terebratula oblonga, prælonga, tamarindus) and Echinodermata (Peltastes Wrightii, Goniopygus Delphinensis, Trematopygus Davidsoni, Cidaris Faringdonensis).*

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§§§ For Seend, see Cunnington, Q.J.G.S. vi, 453; Austen, vi, 459; Whitaker, Geologist, vii, 152. For Godalming, Meyer, Geol. Mag. 1 (part 2), 249. For Upware, Walker, Geol. Mag. iv, 309; Morris, 459. For Potton, Seeley, Ann. Nat. Hist., Aug., 1766; Morris, Geol. Mag. iv, 199.

* The Cidaris Far, whose spines occur in hundreds at Coxwell, is found also in the Aptian beds at La Presta, Val de Travers, Switzerland, along with Goniopygus Delph. M. de Loriol, with whom I had pleasant interviews at Geneva in May, 1904, thus records his discovery of Cidaris Faringdonensis : "C'est avec grand plaisir que je signale pour la première fois en Suisse cette espèce interessante que M. Wright a fait connâitre en Angleterre et qui est la seule espèce de Cidaris connue dans l'étage Aptien" (*Oursins foss. 2me. partie, 52*). The Cidaris F. is rare and almost always fragmentary. I hardly know of a perfect specimen. Peltastes Wrightii, the commonest of all the urchins, varies from the size of a pea to that of a walnut.

(*c*) Infraposition to the acknowledged Neocomian Ironsands of Furze hills which overspread and frequently penetrate the masses of Sponge-gravel to a depth of 20 feet.

(*d*) Utter dissimilarity with the true Upper Greensand which is fairly developed within ten miles of Faringdon and contains an abundance of characteristic fossils totally different from the Coxwell species.

7. The fossils are of two classes,—the remains of creatures that lived and died on the spot, and the remains of such as were derived from pre-existent Oolitic beds, in particular, Kimmeridge Clay and Coral Rag. The derivatives are, as a rule, easily distinguished by their colour and condition: they consist principally of Vertebrates—Fishes, Saurians and Turtles. Those natural to the spot include Sponges, Bryozoa, Echinoderms, Serpulites, Foraminifera and Bivalve Molluscs, being especially rich in varieties of Terebratula and Rhynchonella. The absence of Univalves is very remarkable. Austen's party found none. Sharpe and the Government Surveyors mention one only, the *Natica nodosa*. For myself, I can show none except strangers from the denuded Oolite. In this respect these beds contrast strongly with the Tourtia sands of Ciply in Belgium, which were at one time considered analogous and synchronous; for the Vicomte d'Archiac has recorded thence 47 Gasteropods (*Hist. des Progrès, &c. iv*, 188). We must conclude that the waters of the ancient Neocomian sea at Faringdon were deeper than suitable to univalves, for these creatures prefer for their habitat a zone of moderate depth:—"les trochoïdes," observes d'Archiac, "vivent non loin de la plage" (*Mém. Soc. Géol. de France, ii*, 296. Cf. *Phillips, Geol. of Oxford, x*, 129).

Of all the Coxwell or Faringdon fossils, the Sponges deserve foremost attention, because they

have given their name *par excellence* to the deposit, constitute an important part in the material of the 'gravel' and are themselves very beautiful objects. In 1840 Mantell wrote as follows :– "The richest locality in England for fossil sponges is near the little town of Faringdon in Berks" (*Med. i*, 226); and though since that date their remains have been found at Upware, besides the long established localities of Warminster,** Bridlington, &c., Faringdon still retains an undisputed pre-eminence. Considering the rough matrix in which the Sponges are embedded, their condition will excite surprise; for specimens of nearly every kind can be extracted in as perfect condition as when growing on their ancient sea-floor,—the meandering tissues unimpaired, the oscules and pores clear and distinct. And here I may state that after seeing and handling the specimens from Berklingen, Germigney, Landéron, Mont Salève and other Neocomian strata of Germany, France and Switzerland, exhibited in the classic museums of Neuchatel and Geneva, as well as in the private collections of Fromentel and de Loriol, I am satisfied that our Faringdon sponges are the most perfectly preserved in Europe.

Sharpe in 1854 enumerated sixteen species under the names of Manon, Scyphia, Jerea and Chenendopora; an obsolete nomenclature according to Dr. Hinde, replaced by Corynella, Synopella, Raphidonema, &c. Sharpe was so diligent and so successful in his researches at Faringdon that he scarcely left room for additions—the microzoa alone excepted—to his general catalogue as given in the

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** The best localities are not at Warminster, but 6 to 10 miles southwards, namely at Maiden Bradley, Rye Hill and Mere. Messrs. Jukes-Browne and Scanes have gathered a rich harvest of fossils from the Upper Greensands, including seventeen varieties of Sponges. See the very interesting report and catalogues in the Quart. Jour. Geol. Soc. for February, 1901.

Quarterly Journal of the Geological Society, vol. x. Hence we find that Hinde's list of Faringdon Sponges does not materially extend beyond Sharpe's and, similarly, the collections made in recent years by myself and my associate Mr. Mockler fairly correspond with both authors as to numbers, though differing occasionally in certain details.

In my Preface I stated that I have not been guided in the determination of genera and species by the microscopic examination of spicules, a knowledge of which is declared to be indispensable. When the advocates of the spicular system of classification begin to describe Sponge spicules, they tell us that they are "bacillar," "bihamate," "lithistid," "monactinellid" and "tetracladiate." But they also tell us that "crystallization has largely obliterated the spicular structure in the Sponges from the Lower Greensand of Faringdon" and that "to obtain the entire form of spicules can only be the result of accident extended over a long period of examination." Also, that "the defective state of preservation presents insuperable obstacles to a systematic employment of the forms of spicules in the fossil Calcispongiæ" and "In calcareous skeletons, distinctly preserved spicules are rarely observed" (*Zittel, in Ann. Nat. Hist. for* 1879 (2), *p.* 67. *See vol. for* 1882, *p.* 187; *for* 1883, *pp.* 22, 26 *and Hinde's Fossil Sponges in Brit. Museum*, 191, 192, 201).

E. de Fromentel, followed by M. de Loriol (*Salève*, 180—1), divides Sponges into the three families of TUBULATED, OSCULATED and POROUS.

The TUBULATED have deep circular tubes, singly or grouped, starting from the summit and descending to the base. Some exceptional species have oscules and pores as well as tubes.

The OSCULATED have superficial or penetrating oscules, plain or marginated.

The POROUS have pores only, covering the inner or outer surface with a multitude of very fine, needle-like punctures, best exemplified in the Manon peziza of Goldfuss, xxix, 8 ; the Cupulochonia sequana and tenuicala of Fromentel (Cat. Rais.) and the Raphidonema contortum of Hinde, xxxvii, 2.

There are, besides, some Sponges which appear to me to be altogether without tubes, oscules and pores ; but as they have a reticulate or vermiform tissue, nature has still supplied the means of absorbing and rejecting fluids. In doubtful cases the unseen pores may be concealed by an encrusting membrane or epidermis.

To the TUBULATED belong Siphoncœlias, Discœlias and Jereas,—otherwise Corynellas, Tremacystias and Elasmocœlias.

1. Corynella foraminosa, *Hinde xxxiv*, 9.
Scyphia foraminosa, *Goldf. xxxi*, 4.
„ „ *Mant. Med. l.* 70, *f.* 6.

Long, thick, single, open tubes.

Greatest height, $3\frac{1}{4}$ inches; diameter, $1\frac{1}{4}$.

The Siphonocœlia compressa of From., *Introd. iv*, 7.

Comparatively rare.

2. Corynella varians (not in Hinde).

A colony of thick, open tubes of different lengths, but all stunted or dwarfed in comparison with the preceding. Sometimes as many as seven spongites diverge from a common base. "On peut considérer ces spongitaires comme formés par la réunion de plusieurs Siphonocœlies." (Scyph. Coryn.) *From. Néoc. p.* 4.

Cf. Cnemidium astrophorum, *Mant. Med. l.* 70, *f.* 7. More or less rare according to the number of tubes in conjunction.

3. Peronella prolifera, *Hinde, xxx*, 8.

A colony of thick fistular spongites, shrub-like, branching and sub-branching.

Height, $2\frac{1}{2}$ inches; Breadth, $1\frac{1}{2}$. Rare.

Cf. Scyphia furcata, *Goldf. ii*, 6.

„ Discœlia flabellata, *De Lor. Land. iv*, 19—21.
„ „ ramosa, *From. Néoc. i*, 5.
„ „ dumosa, „ „ *i*, 6.
„ „ porosa, „ „ *ii*, 5.
„ „ strangulata, „ „ *ii*, 6.

4. Peronella unita (not in Hinde).

Thinner, shorter, reed-like spongites, so anastomosed (soudés intimement) that the separate pipes cannot be distinguished except by their terminating apertures.

Height and breadth, $\frac{1}{2}$ inch. Rare.

Cf. Discœlia subfurcata (Röm.), *Salève, xxi*, 4—5.

5. PERONELLA GILLIERIONI, *Hinde*, *xxxiii*, 10.

Small, short, clustering, fistular spongites, circular or spreading like a fan.

Height, 1 inch; breadth, 1½. Common.

Cf. Discœlia glomerata, *de Lor. Land. iv*, 15*a*.
„ „ Gillierioni, „ „ *iv*, 18.
„ „ glomerata, *From. Néoc. ii.*

6. TREMACYSTIA ANASTOMOSANS, *Hinde*, *xxxiv*, 4.
VERTICILLITES „ *Mant. Med. l.* 72.
VERTICILLOCŒLIA „ *Fromentel.*

This is the most complicated species of the Tubulated Sponges and, in Sharpe's estimation, "the most interesting of all the organic remains found at Faringdon." Its beautiful structure did not escape the observation of Conybeare and Phillips who, in 1822, described it as "a very singular ramose tubular fossil, divided like a chambered shell by transverse septa" (*Geol. of Engl.*, 140). It consists of a cluster of tubes, an inch or so in length, externally like the ordinary Peronella Gillierioni, but differing essentially in its internal composition; for, the tubes or pipes are not simple, hollow cylinders, but are fitted up with a series of equi-distant chambers, having a centre of communication.

Although of exceedingly common growth at Coxwell, especially in Ballard's (Hickman's) pit, it is difficult to extract specimens from the compact matrix in a condition fit for minute examination. The tubes are usually matted together with sand and shell débris; and attempts to clear the mass only result in the destruction of the tops of the tubes and their divisional chambers. But when a happy blow or an accidental fracture has removed one of the walls perpendicularly, the interior structure thereby disclosed is indeed marvellous and will well repay a careful microscopic study. The

central well is especially interesting. When divested of its surrounding chambers, it resembles a miniature lighthouse; for, at twelve or more successive stages, it is ornamented with as many fenestrules, or round and sometimes projecting eyelets.

Fromentel was loth to admit the Verticilites among Sponges under the impression that the tubes were closed at intervals by diaphragms. (On ne comprend pas comment un organe, destiné à la sortie des liquides, peut être obstrué par des diaphragmes. C'est donc sous toutes reserves que nous plaçons ce genre parmi les éponges fossiles. *Intr. p.* 31). But this is an entire misconception. The central axis or tower is hollow throughout and as there are, besides, numerous outlets into the accessional chambers, there is every facility for the absorption and rejection of water according to the requirement of all sponges in life and activity.***

When Sharpe published his essay, the Verticillites (Tremacystia) anastomosans had been found exclusively at Faringdon; but in subsequent years a Lower Greensand deposit at Upware in Cambridgeshire was brought to light, containing this and other sponges previously thought peculiar to the Berkshire Sponge gravels. † It is also found in the Aptian of La Presta (*Annals for* 1879 (2), p. 65) and there is a poor specimen from Boveresse in the Geneva museum of Natural History.

*** In the autumn of 1875 I had the pleasure of submitting to M. de Fromentel, at his country house near Gray, Haute Saône, some choice specimens of Verticillites showing to perfection their interior mechanism, with the result that he withdrew unreservedly his doubts as to their position among Spongitaria.

† Upware yields not only Sponges of species identical with those of Faringdon, but also the same abundant varieties of Rhynchonellæ and Terebratulæ and the same ichthyan and reptilian derivatives. There can be no question about the beds at Faringdon and Upware having formed parts of the same Upper Neocomian sea. See Palæont. for 1875, pp. 44—5.

7. TREMACYSTIA IRREGULARIS, *Hinde*, *xxxiv*, 5.

This is a larger species with same interior structure, but with this noticeable difference in the exterior of the tubes that they are marked by a series of "swellings and constrictions." It is rare to find many tubes joined together: they are usually single and seldom perfect.

An exceptionally fine specimen, showing plainly several ringed segments, is composed of five tubes.

Hinde has described a third species under the name of T. clavata (*xxxiv*, 6). I have not met with any specimens which exhibit features sufficiently distinctive to enable me to verify this addition to the Tremacystias.

(ELASMOCŒLIAS).

Dr. Hinde gives us three species, but with due deference to the learned Spongiologist, I consider we are justified in increasing their number to four, namely: two large types which may be classed as true Jereas (although not to be confounded with the Ierea Desnoyersii and pyriformis of Michelin (*Icon*, *xxix*, 1; *xxxvi*, 3) and two smaller kinds which answer to the Mantellian Tragos.

1. ELASMOCŒLIA MANTELLI, *Hinde*, *xxxiv*, 8.

Square, upright, massive Sponges, with feeble flexures but with large tubules, the orifices of which are lined with a membrane. The finest specimens are as much as 3 inches in height and 2 in diameter. A typical specimen in Mr. Mockler's collection measures $2\frac{1}{4}$ inches in height and 2 in breadth. Rare.

2. ELASMOCŒLIA ROTUNDATA, n.sp. (not in Hinde).

Smaller, rounded and more compact, with large tubules clustered together.

It seems to correspond with the nameless Sponge described by Carter in the Annals for 1879 (pt. 2), p. 433—"a thick, massive, circular, horizontal form, about $1\frac{1}{2}$ in. in diameter with square margin, presenting a plurality of deep holes like those of Corynella."

I think this rotundata has full claims to be recognised as distinct from the other large Elasmocœlia. It differs in size and shape; in its tubules which are aggregated without interspaces, and in the absence of flexures or grooves.

A perfect specimen before me measures $1\frac{5}{8}$ in height and breadth. Another one is $1\frac{1}{8}$ in height and 1 in breadth.

The E. rotundata is among the rarest of the Faringdon Sponges. I have not met with half-a-dozen examples in 35 years.

3. Elasmocoelia Faringdonensis, *Hinde xxxiv*, 7.

This Sponge, first noticed and described by Mantell as a "remarkably beautiful species," under the name of Tragos Faringd. (*Medals*, *i*, 229), may be easily distinguished from its associates by peculiar smooth flexures, grooves or furrows which are never wanting even on the smallest specimens and are shown so conspicuously in Mantell and on the accompanying photographic plate. Like the Verticillites, the E. Faringd. was once supposed to be a Faringdon speciality, but some typical Neocomian beds near Neuchatel and Geneva, as also at Germigney, have yielded closely resembling forms, in particular, the Elasmoierea sequana of Fromentel (*Intr. ii*, 3) and of de Loriol (*Salève*, *xxi*, 9; *Land. v*, 13). The Geneva specimens are said to have their tubules in single file (série unique), while at Neuchatel "there are double tubules in certain thick individuals" (*Land. p.* 69). Our fan-shaped variety agrees best with these latter.

The tubules are only half the size of the rounded perforations in E. Mant. and rotund.

General height and breadth an inch or less according to age.

Common and characteristic.

4. ELASMOCŒLIA CRASSA, *Hinde*, *xxxiii*, 11.

Dr. Hinde's figure so exactly agrees with the Elasmoierea tortuosa of De Loriol, that it is a pity the more appropriate epithet of the veteran Swiss Geologist was not accepted. De Loriol's description is as follows : "……se contournant et se bifurcant en divers sens, en formant une sorte de méandre très élégant " (*Land. p.* 68, *Pl. v*, 16—17).

Very common at Landéron; rare at Faringdon.

THE OSCULATED SPONGES.

OCULOSPONGIA, SYNOPELLA AND RAPHIDONEMA.

1. OCULOSPONGIA DILATATA, *Hinde*, *xxvi*, 3.

(OCULOSPONGIA PULVINARIA).

Small, rounded or sub-globular Sponges, about the size of a filbert, with detached, circular, slightly marginated oscules.

This is the description of a very common Sponge which I have known for 35 years as Manon pulvinarium. Unfortunately Dr. Hinde has given the name of Synopella pulvinaria to a rare sponge which has no connection with the true Pulvinarium. Hence I propose that the familiar M. pulv. should retain, as far as possible, its old designation, say Oculospongia pulvinaria and that the name of the distinctly mammillated Syn. pulv. should be changed to Synopella mammifera, a descriptive epithet approved by Fromentel when I submitted to him a solitary specimen from Faringdon.

2. SYNOPELLA PULVINARIA, *Hinde*, *xxxvi*, 1.
(TREMOSPONGIA MAMMIFERA, *Fromentel*, 1875).
(SYNOPELLA MAMMIFERA, *D.*, 1904).

A rounded or sub-oval Sponge, enlarging from a pedicle invested with a membrane: upper surface studded with mammillations, the centres of which are pierced by minute oscules.

The environs of Geneva have yielded a few badly preserved specimens of a Sponge (Actinofungia porosa), which seems, by De Loriol's description and figure, to be the Swiss representative of our English type :—Spongier en masse arrondie au sommet. Etoiles bien marquées, assez nombreuses, à cinq ou six rayons. Parenchyme vermicellé, fin, très poreux. (*Salève*, *xxii*, 8, *p.* 206).

The parent or predecessor of both Synopella mammifera and Actinofungia porosa may be perhaps seen in the Lymnorea mamillosa of Lamouroux and Zittel (*ap. Hinde, xxxv*, 1), which belongs to the Inferior Oolite of Cheltenham and Caen.

I am not acquainted with more than three specimens of Synopella mammifera, the only Faringdon sponge which is ornamented with distinct mammillations.

3. RAPHIDONEMA MACROPORA (*Hinde, xxxvii*, 4).
CATAGMA MACROPORUS, *Sollas, Ann.* 1878, *p.* 362.
ELASMOSTOMA ACUTIMARGO, *Römer, Spong., i*, 21.
,, FRONDESCENS, *From. Intr. iii*, 6 *a*.

Cup-shaped or expanded, the exterior often completely covered with bosses, or nodose excrescences: oscules larger than in any other species, flat, irregular in size and shape, with uneven edges (déchiquetés), but disposed in concentric lines.

The cup-shaped varieties are seldom quite round: they are more frequently bent and folded into forms that are sometimes curious, sometimes graceful.

4. RAPHIDONEMA PUSTULATUM, *Hinde, xxxiv*, 8 & 8*a*.
CF. TRAGOS PEZIZA, *Mant. Med. lign.* 72, *f* 1.
,, CHENENDOPORA MARGINATA, *Mich. Icon. xxviii.* 7
,, ELASMOSTOMA NORMANNIANUM, *Gein. Elb. vii*, [9—10.

Sponges with marginated oscules which in the best preserved types project like miniature tubes. These sponges never assume a cup shape with any depth. The general forms are like an ear, a shell, a leaf or a fan,—often very elegant.

RAPHIDONEMA.

1. RAPHIDONEMA CONTORTUM, *Hinde xxxvii*, 2.
   MANON PEZIZA, *Goldf. xxix*, 8.

Sponges of various forms, bent, folded and expanded, with one side covered with close-set, needle-like punctures or pores. In by far the great majority of cases, it is the inner or concave surface which shows the pores.

2. RAPHIDONEMA PORCATUM, *Hinde*, *xxxvii*, 3.
   MANON PORCATUM, *Sharpe*, *Pl. v.* 2.
   CATAGMA ,, *Sollas*, *Ann. for* 1878.

Cup shaped or expanded. Pores precisely as in R. contortum, but the exterior of the cups or other forms differs in being furrowed or wrinkled; "characterized," in the words of Hinde, "by its peculiar sinuous ridges."

3. RAPHIDONEMA FARINGDONENSE, *Hinde*, *xxxvii*, 5.
   MANON FARINGDONENSIS, *Sharpe*, *Pl. v*, 5 and 6.
   CHENENDOPORA FUNGIFORMIS, *Mantell.*
   CATAGMA FARINGD. *Sollas.*
   PHARETROSPONGIA FARINGD. *Zittel.*

Cup or funnel shaped Sponges with prominent bosses on the exterior, in regular order or promiscuously scattered. In young specimens, the pores of the interior are ranged in five or six concentric rings. In older specimens the concentric arrangement is no longer apparent on account of an investing membrane.

Mr. H. J. Carter maintained that funnel-shaped sponges "begin in the form of a fan and then curving round, the opposite borders unite to such an extent as finally to convert the fan into a vase-

shaped sponge" (*Annals for* 1879, *part* 2, *p.* 435). Mr. Carter is mistaken. Cup sponges take their form of cups from their earliest production, as can be shown in hundreds of examples: there is no intermediate stage of progression from imperfect to perfect cups. The same rule holds good for all kinds of fossil sponges. Whatever shape they start with, they retain through all subsequent growth.

4. RAPHIDONEMA PLANUM, *D.*
MANON PEZIZA, *Goldf. v*, 1.
SPONGIA PEZIZA, *Sharpe*, *Geol. J. x*, 194.
CUPULOSPONGIA SUBPEZIZA, *D'Orb. Prod. ii*, 288.

Dr. Hinde has not made any distinction between those cup sponges which have a "nodose character on the outer wall" and those which have perfectly smooth exteriors, both in their young and mature stages of growth. But from familiarity with hundreds of specimens I am quite confident that the smooth cups should be separated from those which have "nodose excrescences."

Sharpe enumerated 44 species, comprising 21 genera; and here, as with the Sponges, we have a fresh proof of his exhaustive researches in the fact that very few additions or alterations can be made to his list. It is not even certain that later investigations have brought to light some of the *rariora* which figure in his catalogue, such as *Ceriopora venosa*, *Multicavea lateralis* and *Nodelea semiluna*. Sharpe presented his collection to the Jermyn St. Museum, where examples of the 44 species were to be seen for a certain period after their deposit in 1854; but they had partially disappeared twenty years later, so that it became impossible to verify them in their entirety.

The following list was published in 1874 from actual specimens then in my possession, but subsequently transferred to the Oxford Geological Museum. The starred (*) numbers indicate recent acquisitions.

Berenicea papillosa, *d'Orbigny*.
„ papyracea, „
* „ megapora, „
Ceriocava sessilis, *Hagenow*, *v*, 7.
„ substellata, *Geinitz*, *Elb. xxx*, 9.
„ ramulosa, *d'Orb.*
„ truncata, *Michelin*, *li*, 7.
Clausa Sarthacensis, *d'Orb.*
Corymbosa Menardi, „
Cricopora elegans, *Blainville*, *lxvii*, 1.
Domopora Bosquetiana, *d'Orb.*
„ clavula, „
„ tuberculata, „
Entalaphora Meudonensis, „
„ ramosissima, „
„ Salevensis, *De Lor. Salève*, 129.
Heteropora Constantii, *d'Orb.*
„ cryptopora. See Multicrescis Mich.

Heteropora pyriformis, *d'Orb.*

„ reticulata, *Vine*, *Br. Assoc. Rep. for* [1883, *p.* 171.

„ tenera, *Vine*, *Br. Assoc. Rep. for* ,

Hornera tubulifera, *Hag. ii*, 1. [*p.* 172.

Idmonea fasciculata, *d'Orb.*

Lopholepis Hagenovii, *Sharpe*, *Q.J.G.S.*, *x*, *p.*

Multicrescis Michelini, *d'Orb.*

Nullipora racemosa, *Goldfuss*, *viii*, 2.

Peripora pseudo-spiralis, *d'Orb.*

Pustulopora pustulosa, „

Proboscina marginata, „

„ radiolitorum, „

„ ramosa, „

* Radiopora bulbosa, „

„ millepora, *Vine*, *ut supr. p.* 170.

„ pustulosa, *d'Orb.*

Reptomulticava collis, „

„ Gillierioni, „

„ mamilla, „

* „ micropora, Röm., *De Lor. Salève*, *xix*, 2

Reptomultisparsa Dutemp. *d'Orb.*

„ congesta, „

* „ Orbignyana, *Salève*, *xvii*, 6.

Reptotubigera elevata, *d'Orb.*

„ marginata, „

„ Neocomiensis, „

„ ramosa, „

Semicava variabilis, „

„ tuberosa, „

„ tuberculata, „

Stomatopora (Alecto) Calypso „

„ gracilis, „

„ granulata, „

„ incrassata, „

„ ramea, „

Unitubigera papyracea, „

The commonest descriptions are small, detached or adherent twigs, half an inch to an inch in length,

covered with pores which may be of uniform size or intercalated with more diminutive sets. The pores, ostioles or openings are diamond and lozenge shaped, triangular and five-sided. Most of the species may be ranged under the name of Entalophora which, according to Vine, embraces Spiropora, Cricopora, Peripora, Tubigera and Pustulopora. *Fourth Report on Fossil Polyzoa, British Assoc. for* 1883, *p.* 161. The two most elegant species are the Peripora which has its pores disposed in spiral rings and Pustulopora which has its pores prominent and marginated, like those in Hinde's Raphidonema pustulatum.

Almost equally abundant are the graceful varieties of Stomatopora (Alecto) and Proboscina, adherent on shells, sponges, &c., with cells either in single lines, like a string of oval pearls, or splitting up into lateral off-shoots.

Very common also is the encrusting Lopholepis Hagenovii, so named by Sharpe and described by him as follows:

"An incrusting coralline with long, narrow porous ridges, rising out of a smooth crust. The ridges are detached, but are usually arranged with some resemblance to branches on each side of a stem. The crust is cellular, but as few of these cells have openings, it is probable that the pores in its surface were gradually filled up. The ridges are formed of oblique tubular cells with small rounded openings, arranged in oblique lines, forming three or four rows on each side of the ridges, and these rows are continued beyond the ridges in the flat crust."

"This pretty Coralline probably belongs to Dr. Hagenow's genus Lopholepis, but it is larger and has the pores more regularly disposed than either of his species. It has much resemblance also to Reptomulticlausa Neocomiensis and R. obliqua of M. D'Orbigny. It is named after Dr. Hagenow, author of the 'Bryozoen der Maastrichter Kreidebildung'."

As a rule the Lopholepis is found on pebbles and not on sponges.

Sharpe reports its presence in the Upper Greensand of the Warminster district, but it does not appear in the catalogue of Messrs. A. J. Jukes-Browne and J. Scanes (*Q.J.G.S.*, *Feb.*, 1901, *p.* 118), nor do I think it has been discovered in any other locality.

Dr. J. W. Gregory pronounces the Faringdon Lopholepis to be an Idmonea (*Cretaceous Bry. p.p.* 36, 151).

The Domopora Bosquetiana, mentioned at page 10, is a beautiful little dome-like species with pores in perpendicular lines, flanked by thin parting series of much smaller pores, not unlike the ambulacral divisions in Echinites. Perfect specimens have domes of three tiers, diminishing in size. Occasionly an encrusting specimen may be met with, but they are generally free and upright.

The Bryozoans which cover parts of sponges and shells with a delicate moss-like film belong to Berenicea and Reptomultisparsa. When nestled in the crevices of a sponge, specimens may be seen with long, erect tubes in wonderful preservation.

The largest of the entire Faringdon series is Radiopora pustulosa which by its size, fabric and appearance seems rather to belong to the family of Sponges.

PELTASTES WRIGHTII.
,, STELLULATUS.
,, LARDYI.
GONIOPYGUS DELPHINENSIS.
PSEUDODIADEMA ROTULARE.
,, BOUEI.
,, BROGNIARTI.
TREMATOPYGUS DAVIDSONI.
CIDARIS FARINGDONENSIS.
(SALENIA LARDYI) *auct.*
(DIADEMA RHODANI *Phillips.*
(,, VARIOLARE *Geol. of Oxford*, 434.

This list is made out according to degree of rarity. The Peltastes Wrightii is exceedingly common. The Goniopygus is in the proportion of one to twenty-five. All the Pseudodiademas are rare. A collector might spend a whole day in the quarries without finding one. The Trematopygus is now very rare and hardly recognizable when found because always encrusted with oxide of iron. Dr. Wright in his great Monograph on British Fossil Echinodermata has honoured me by acknowledging his indebtedness "for several specimens more or less perfect to complete the description of the anatomy of the test of this very rare form." (*Pal. Soc. for* 1875, *p.* 254).

The Cidaris Faringdonensis must have swarmed in the Sponge Gravel sea, for its spines may be picked up in hundreds; yet no perfect specimen of the Urchin has ever been found: only broken portions are obtainable. Dr. Wright tells us plainly that the test is "known only by isolated plates." Concerning the spines he remarks that they "differ so much from all other forms that they cannot be mistaken for any other species, the long smooth lower portion of the stem forming such a conspicuous specific character." (*Pal. Soc. for* 1867, *p.* 68).

Peltastes Wrightii presents itself in every gradation of size from $\frac{5}{16}$ to $\frac{15}{16}$ of an inch in diameter.

The ambulacra have two rows of 15 granules each, while between the ambulacra are five or six prominent tubercles. The mouth opening is large, its lip or border (peristome) divided into U-shaped lobes.

The genus Peltastes, established by Agassiz in 1838, is special to the Cretaceous system, commencing with some remarkable forms in the Lower Greensand. The Faringdon species occurs in beds of approximately same age at Hythe in Kent and at Atherfield in the Isle of Wight. (*Pal. Soc. for* 1870, *p.* 150).

Peltastes stellulatus so nearly resembles the P. Wrightii that the differences are only perceptible when specimens are free from grit or other accretions and then only under microscopic examination. The main distinction appears to be the presence in P. stellulatus of a zigzag line of minute granulets (pin heads) between two rows of mammillated granules. In England the only other place where this species has been found is in the Red Chalk at Speeton, near Filey bay, Yorkshire; but it is common in French and Swiss Neocomian beds. (*Pal. Soc. p.* 154).

Peltastes Lardyi is so rare that Dr. Wright knew of only one specimen and that belongs to the British Museum. "In its form and general characters it approaches P. stellulatus: it is, however a larger Urchin with its upper surface more convex and inflated. The marginal rows of mammillated granules on the ambulacra are more numerous and separated from each other by a double series of microscopic granulets. Height four-tenths of an inch; tranverse diameter eight-tenths. (*Pal. Soc. p.* 155).

Goniopygus Delphinensis, Pal. Soc. for 1878, Plate lxvi, 1—2.

The ambulacra have two rows of granules containing seven in each row. They diverge obliquely from the apical plates so as to form a narrow V reversed and the tubercles between the ambulacra conform to the same direction. Dr. Wright has figured this species, but omitted any description. The above particulars may help collectors to recognize specimens.

Pseudodiadema differs from Diadema in having solid spines with a smooth surface whilst in the latter the spines are tubular. The sculpture of the Pseudodiadema consists of microscopic longitudinal lines. The Diadema has oblique annulations of scaly fringes.

Pseudodiadema rotulare is "a very rare Urchin," easily recognized by alternate rows of two and four close-set tubercles.

In England it has been found exclusively at Faringdon, but it is common abroad, being "one of the most characteristic fossils" of the middle Neocomian. (*Pal. Soc. for* 1867, *p.p.* 87—90).

Pseudodiadema variolare, Ib. Pl. xvii and xviii.

As this species has hitherto been reported from the Upper Greensand of Warminster, the Chloritic Marl of Chard and the Cenomanian of Calvados, I hesitate to claim its discovery in the Lower Greensand of Faringdon. But as Desor records specimens from the Hils conglomerate—a true Neocomian deposit—there is no improbability of its occurrence in our Sponge Gravels. Certainly I have before me a Pseudodiadema which has peculiarities ascribed exclusively to Ps. variolare, namely, bigeminal (*i.e.* two sets of twin) pores within septa which are shaped like a pear or a tennis bat, whereas in other species

the pores are enclosed in obtuse oval septa. Then the specimen under notice has two rows of tubercles separated by a single zigzag line of small granules. The tubercles have "narrow areolas, prominent bosses with sharply crenulated summits and deeply perforated mammillons." (*Ib. p.* 108).

Pseudodiadema Brongniarti, Pal. Soc. for 1867 Pl. xx and xxi, p. 111 and for 1869, p. 113.

This species, like the last described, belongs generally to strata *above* the Lower Greensand—to the French Albien or Gault and the English Chalk Marl of Maiden Bradley and Red Chalk of Hunstanton; but from specimens in the Oxford Museum and Mr. Mockler's collection, I think there can be no doubt of its occasional presence in our older Sponge Gravel.

The Ps. Brong. closely resembles Ps. variol., but there are differences in both tubercles and pores. The tubercles are alternately in double and triple rows with granulets in zigzag lines between them. The ambulacra are formed by twelve sets of twin pores in obtuse oval septa.

It is unnecessary to describe the Trematopygus Davidsoni (otherwise Faringdonensis) because it is the only Nucleolite ever found in the dark ferruginous beds of Boutcher's pit and cannot be mistaken for anything else. Suffice to say that in size and shape it is not unlike the common Micraster of the Chalk.

Rhynchonella depressa, *Sowerby.*
" antidichotoma, *Buvign.*
" Gibbsiana, *Sow.*
" latissima, "
" nuciformis, "
" truncata, "
Terebratula depressa, *Lam.*
" Lankesteri, *Walker.*
" oblonga, *Sow.*
" sella, "
" Moutoniana, var., *d'Orb.*
" Dallasii, *Davidson.*
Waldheimia Juddii, "
" Wanklyni, "
Terebratella oblonga, *Sow.*
" depressa, *Lam.*
Avicula lineata, *Röm.*
Arca Cottaldina, *d'Orb.*
Dianchora striata, *Sow.*
Lima Faringdonensis, *Sharpe.*
Mytilus Cuvieri, *De Loriol.*
Neithia quinquecostata, *Reuss.*
Pecten Rauliniatus, *d'Orb.*
Plicatula inæquidens, *Sharpe.*
Ostrea rectangularis, Röm., *De Loriol.*
" haliotoidea, Sow., *Goldfuss.*
" sigmoidea, *Reuss.*

Among very minute shells the following species have been recognised :

Argiope decemcostata, *Römer.*			R.
Crania	...	...	C.
Discina	...	...	R.
Thecidium Weth.		...	C.

A Foraminifer is "a little particle of jelly changing itself into a greater variety of forms than the fabled Proteus; laying hold of its food without members, swallowing it without a mouth, digesting it without a stomach, moving from place to place without muscles and feeling without nerves, but in many instances forming shelly coverings of a symmetry and complexity not surpassed by those of any testaceous animals."

"The size of the greater part of the Foraminifera is so small that many hundreds, thousands, or even tens of thousands of them, may be contained in a pill-box; yet usually not too minute to prevent the practised observer from distinguishing the most important peculiarities of each individual by a hand-magnifier alone."

"Scarcely any two individuals are alike."

Carpenter's Introd. to the study of Foraminifera, Ray. Society for 1862, *p.p.* 7—9.

"Foraminifera are 'Reticularian Rhizopoda,' having shells or tests. They are, in fact, minute masses of protoplasm, which secrete or excrete a stony cell-wall which is usually either perforated with minute holes (*foramina*) or has one or more larger apertures, through which the protoplasm in long filamentous threads (*pseudopodia*) protrudes itself. These threads unite whenever they meet or cross each other and thus form a living network. When any prey touches this net, it adheres: more protoplasm flows over and embeds it; the nutriment is absorbed and the refuse rejected. Thus nourishment goes on outside the shell."

Journal of Microscopy for 1884, *vol. iii, p.* 20.

NOTE.—The entire collection, consisting of several hundred specimens, has been re-examined and named by Mr. J. Wright while these pages were passing through the press (Feb. 3—5). Those names to which a star (*) is prefixed represent newly discovered species by him.

* Ammodiscus gordialis, *J. & P.*, very rare.
* Bolivina tegulata, *Reuss*, one specimen.
Bulimina affinis, *d'Orb* } very rare.
„ pupoides, „ }
Cornuspira cretacea, *Rss.* }
* Cristellaria acutauricularis, *F. & M.* }
Cristellaria crepidula, „ common.
„ ensis, *Reuss*, rare.
„ gibba, *d Orb*, common.
„ Italica, *Defr.*, very rare.
„ lata, *Cornuel*, one specimen.
* „ mammilligera, *Kar.*, frequent.
„ rotulata, *Montf.*, very common.
„ Schloenbachi, *Rss.*, very rare.
„ subalata, *Rss.*, rare.
„ sulcifera, „ one specimen.
Cyclammina cancellata, *Brady*, common.
Discina, *sp.*, two specimens.
Discorbina globularis, *d'Orb.*
„ rosacea.
„ turbo.
„ orbicularis, *Terg.*, common. Specimens intermediate between D. orbicularis and D. globularis.
Flabellina rugosa, *d'Orb.*, common: many of the specimens very fine.
Gaudryina oxycona, *Rss.*
G. pupoides, *d'Orb.*, very rare.
Haplostiche Soldani, *J. & P.*, very rare.
* Lagena globulosa, *Montf.*, „ „
Lingulina carinata, *d'Orb.* „ „
Variety with segments only slightly compressed.

Marginulina ensis, *Rss.*, rare.
„ Wetherelli, *Jones*, very rare.
Nodosaria (Glandulina) æqualis, *Rss.*, very rare.
„ calomorpha, *Rss.*, one specimen.
„ (Dentalina) pauperata, *d'Orb.*, very rare: specimens not typical.
„ (D.) consobrina, „ rare.
„ „ farcimen (*Sold.*), very rare.
„ „ communis, *d'Orb.*, rather rare.
„ „ Rœmeri, *Neug.*, very rare.
„ „ mucronata, „ „ „
* „ comata, *Batsch*, slender form, very rare.
„ raphanus, *Linn.*, very rare.
Patellina corrugata. *Will.*, common.
Placopsilina cenomana, *d'Orb.*, common.
Polymorphina communis, „ one specimen.
„ lanceolata, *Rss.*, rare: specimens in poor condition.
„ regina, *B., P. & J.*, one broken specimen
„ sororia, *Rss.*, one fistulose specimen.
Ramulina globulifera, *Br.*, frequent.
Reophax cylindracea, *Chapman*, two specimens.
Rhabdogonium tricarinatum, *d'Orb.*, one specimen.
Rotalia orbicularis, „ „ „
Spirillina margaritifera. *Will.*, very common.
Textularia trochus, *d'Orb.*, frequent.
„ turris, „ common.
*Thuramminopsis canaliculata, *Haeusler*, very rare.
Tritaxia triquetra, *Münster*, rare.
Vaginulina arguta, *Rss.*, rare.
„ gaultina, *d'Orb.*, rare.
„ harpa, *Roem.*, rather common.
„ legumen, *Linn.*, rather rare.
„ linearis, *Montague*, one specimen.
* „ marginuloides, *Rss.*, one specimen.
* „ recta, *Rss.*, very rare.
„ striata, *d'Orb.*, rare.
Vitrowebbina irregularis, *d'Orb.*, rare.

In this list of Foraminifera, only those species are included which have been positively determined.

There are, among the 400 specimens brought to light, very many others about which there is uncertainty, especially in species of Nodosariæ and Cristellariæ. Probably the larger proportion of the doubtful ones will be found eventually to correspond with those that have been so carefully sought in the Bargate beds of Surrey and so amply catalogued and described by Mr. F. Chapman in the 50th vol. of the Geological Society's Quarterly Journal. (*p.p.* 677—730).

The abbreviations refer to the following authors:

Br.—Brady.
Defr.—Defrance.
d'Orb.—A. d'Orbigny.
F. & M.—Fichtel & Moll.
Linn.—Linnæus.
Montf.—Montfort.
Neug.—Neugeboren.
P. & J.—Parker & Jones.
Rss.—Reuss.
Terg.—Terguem.
Will.—Williamson.

THE ENTOMOSTRACA.

Entomostraca or Ostracoda abound but do not exhibit many types. The chief species are :

	Bairdia subdeltoidea, *Münster.*		
	Cythereis auriculata, *Cornuel.* ...	...	C.
	,, ornatissima, *Reuss.* ...	...	R.
	,, quadrilatera, *Roëmer.*	...	R.
	Cytherella Münster, *Roëmer.* ...	...	C.
	,, ovata, ,,		
	,, Williamsoni, var. granulata, *Jones*		R.
	Cytheropticon concentricum, *Reuss.*	...	C.
	,, var. virginea, *Jones.*	...	C.
*	Macrocypris concinna, *Jones & Hinde.*	...	R.
	Paracypris siliqua, ,, ,,	...	R.

Older formations have contributed a great variety of derivatives. They seem to have mainly originated in Kimeridge clay, which at Little Coxwell is in direct contact with the Sponge Gravels. Other Oolitic beds are represented by rolled specimens from the Coral rag, Portland stone and Oxford clay, while the pebbles of quartz, lydian, slate, &c., may probably be traced to Devonian rocks. Of fish and saurian remains we have about 20 kinds, as per following list :—

Gyrodus, Hybodus, Pycnodus, Sphœrodus, Strophodus, Lepidotus, Saurocephalus, Edaphodon, Asteracanthus, Lamna, Ichthyosaurus, Plesiosaurus, Dakosaurus, Teleosaurus, Goniopholis, Polyptychodon, Iguanodon ; Chelonia. All of these were identified by the late W. Davies of the British Museum.

Other derivatives are Ammonites, Belemnites, Cardium dissimile, Cidaris florigemma, Chemnitzia, Exogyra, Isastræa, Ostrea deltoidea, Panopæa, Pentacrinus, Perna, Pholadomya, Thetis, Thracia depressa and Trigonia clavellata.

To amateurs the most attractive of these derivatives will probably be the teeth and vertebræ of fishes and saurians. The teeth of fishes, belonging to the Lamna and Otodus families, are pointed and thorn-like : those of the Gyrodus are in size and shape much like coffee berries: those of the Spœrodus are round (intended for crushing oysters, &c.) and resemble acorn cups, as noted by Llhwyd in the 17th century,....." instar capsulæ glandis quercinæ." They were supposed to be the eyes of petrified toads and hence called Toadstones, Bufonites and Crapaudines. Great numbers have been found in the phosphatic diggings near Potton, Bedfordshire, but they are not equal in beauty to the Faringdon specimens which are coated with a

brilliant natural enamel. Conybeare and Phillips, writing in 1822, inform us that "these little fossil productions were, a century since, in common use with the ladies as ornaments." (*Geol. of Eng. & Wales*, 208, *n.*). The teeth of Strophodus, very common in the Great Oolite and Forest Marble, occur sparingly at Faringdon. The quarrymen call them "fossil leeches" and the name is quite appropriate.

Explanation of Plates.

PLATE I.

1. RAPHIDONEMA FARINGDONENSE, *Hinde, xxxvii*, 5.
   Specimen on left from Faringdon; on right from Germigney.
2. TREMACYSTIA ANASTOMOSANS, *Hinde, xxxiv*, 4.
3. PERONELLA GILLIERIONI, *Hinde, xxxiii*, 10.

PLATE II.

1. INTERIOR OF TREMACYSTIA ANASTOMOSANS.
2. ELASMOCŒLIA FARINGDONENSIS, *Hinde xxxiv*, 7.
3. (left) ELASMOCŒLIA MANTELLI, *Hinde, xxxiv*, 8.
   (right) ELASMOCŒLIA ROTUNDATA, D.

PLATE III.

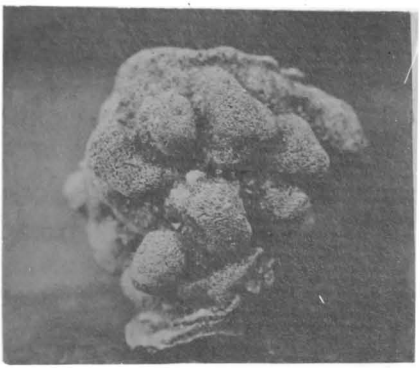
1. RAPHIDONEMA PUSTULATUM, *Hinde, xxxiv*, 8.
2. RAPHIDONEMA MACROPORA, *Hinde xxxvii*, 4.

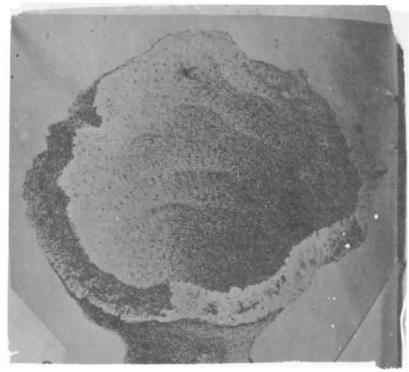
PLATE IV.

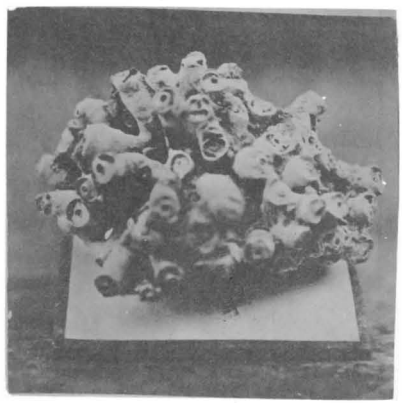
1. Four specimens of OCULOSPONGIA DILATATA, *Hinde, xxxvi*, 3. (O. PULVINARIA, D).
2. PELTASTES WRIGHTII.
3. TREMATOPYGUS DAVIDSONI.
4. GONIOPYGUS DELPHINENSIS.
   (*Handwriting of Dr. Thos. Wright reproduced*).

PLATE V. 24 specimens of FORAMINIFERA, &c. belonging to species of CRISTELLARIA (Nautiloids), NODOSARIA, VAGINULINA (straight lines) and CYTHEROPTICON.

PLATE I







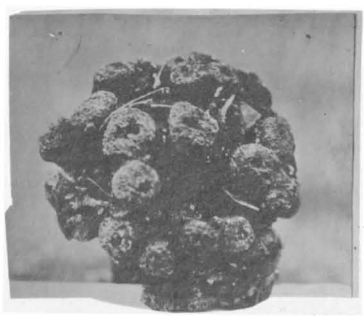
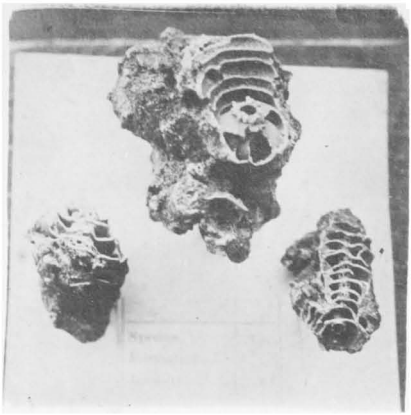
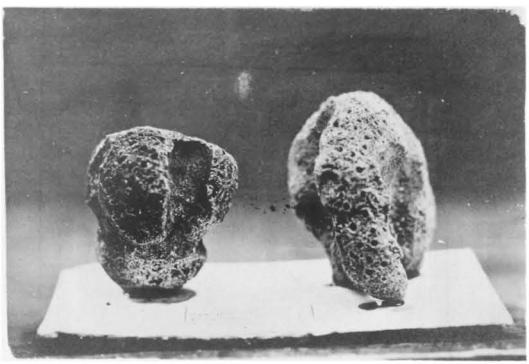
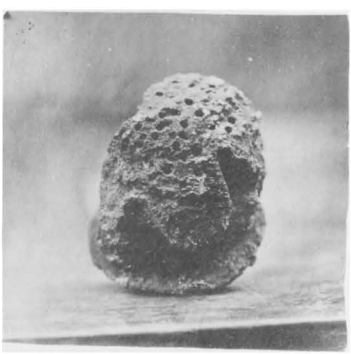


PLATE II.







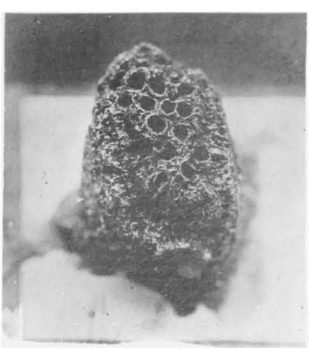


PLATE III.

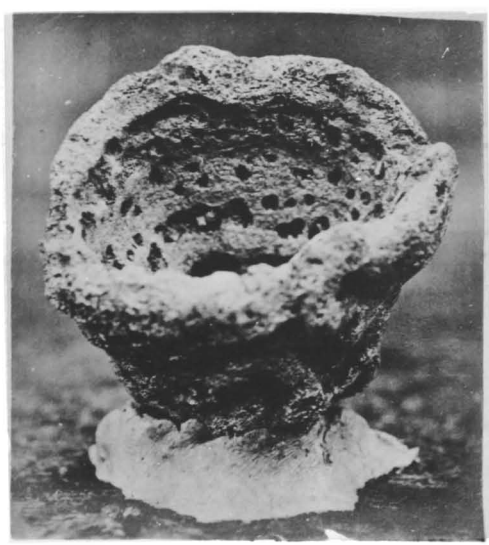


PLATE IV

PLATE V