On: 25 April 2015, At: 18:17
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Annals and Magazine of Natural History: Series 5

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tnah11

XIV.—Studies on fossil sponges.—V. Calcispongiæ

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Published online: 29 Jan 2010.

To cite this article: Karl Alfred Zittel (1879) XIV.—Studies on fossil sponges.—V. Calcispongiæ , Annals and Magazine of Natural History: Series 5, 4:20, 120-135, DOI: 10.1080/00222937908679802

To link to this article: http://dx.doi.org/10.1080/00222937908679802

less closely and less strongly punctured than in the preceding species.

Antipha Bennetti, Hope.

Galeruca Bennetti, Gray, Zool. Misc. 1831, p. 29.

A. late ovata, postice ampliata, convexa, picco-fulva, nitida; elytris metallico violaceo micantibus, fortiter crebre punctatis.
Long. 4½ lin.

Hab. Nepal. Type in Brit. Mus., also in my own collection.

Front impressed with a deep fovea; encarpæ transverse, separated (their extreme apices excepted) by the clypeus; third joint of antennæ twice the length of the second. Thorax nearly three times as broad at the base as long; sides converging from base to apex, the anterior angles produced, their apices obtuse. Elytra broader than the thorax, dilated posteriorly, very convex, not depressed below the basilar space, strongly and coarsely punctured, the interspaces thickened, rugulose.

[To be continued.]

XIV.—*Studies on Fossil Sponges.*—V. *Calcispongiæ.*

By Karl Alfred Zittel.

[Continued from p. 73.]

Corynella, Zittel.

Scyphia auctt.
Cnemidium p. p., *Myrmecium* p. p., Münst., Klipst.
Eudea p. p., *Hippalimus* p. p., *Lymnorea* p. p., D'Orb.
Eudea, Diseudea, Polycnemiseudea, Siphonocœlia p. p., *Polycœlia* (*Discœlia*) p. p., *Monotheles, Distheles, Epitheles* p. p., From.
Monotheles p. p., *Distheles, Endostoma, Polyendostoma*, Röm.
Copanon, Distheles, Dycopanon, Cnemicopanon, Hallisidia, Pachytœcia, Holosphecion, Pom.

Sponge simple, more rarely compound. Individual persons clavate, cylindrical, top-shaped or pyriform, thick-walled. Vertex truncate or convex. Stomachal cavity funnel-shaped, more or less impressed, rarely reaching to the base, usually divided at its lower end into a bundle of vertical tubes. Osculum of the central cavity often radiated by open radial furrows. Into the stomachal cavity open radial canals, usually curved outwards and downwards, which gradually become finer as they depart from the stomachal cavity. Surface furnished with the ostia of fine incurrent canals, which usually open obliquely inwards and downwards, and run into the radial canals of the stomachal cavity. Base sometimes with a dense dermal layer.

Skeletal fibres rather coarse, chiefly consisting of simple bacillar spicules, among which, however, there are some scattered large triradiates.

The development of the canal-system forms the essential character of this genus, and distinguishes it very definitely from *Peronella*, with which it most nearly agrees externally. The coarse radial canals of the stomachal cavity are always present; but, on the contrary, the incurrent tubules may sometimes become very fine, or, under circumstances, entirely disappear. In the latter case, of course, the ostia of the surface are absent. The constitution of these afferent canals varies extraordinarily according to the species; in general they are most strongly developed in the Triassic and Middle-Jurassic species.

The stomachal cavity is also very variable. Sometimes it becomes nearly tubular, as in *Peronella*, and reaches almost to the base, but then always shows large canal-ostia; sometimes it forms only a shallow funnel, from which issues a bundle of vertical and curvilinearly diverging coarse canals.

In spite of these differences, which strike even the passing observer, with respect to the constitution of the stomachal cavity and canal-system, the transition between the two extremes may be so completely demonstrated, that I have been unable to determine to divide this series of forms into several generic groups.

Fromentel, partly upon unimportant characters (occurrence as single persons or in composite stocks, presence or absence of an epitheca), and partly upon erroneous observations, has established a whole series of genera, which, in my opinion, are untenable.

The canal-system of *Eudea*, *Discudea*, and *Polycnemiscudea*, From., is decidedly incorrectly described, inasmuch as the canals never pierce the wall. In *Monotheles* and *Distheles* the stomachal cavity is not, as described by Fromentel, shallow and superficial, but even in *Monotheles stellata* itself considerably impressed, funnel-shaped, and divided into vertical tubes at its lower extremity. A weak epitheca occurs at the base of several species; others, however, are quite naked.

The genus *Corynella* is distributed from the Trias up to the uppermost Cretaceous. As typical species may be mentioned:—

a. *From the Trias.*

1. *Myrmecium gracile*, Münst. Beitr. iv. Taf. i. figs. 26, 27.
2. *Cnemidium pyriforme*, Klipst. Beitr. Taf. xx. fig. 5.

3. *Eudea rosa*, Laube, Fauna von St. Cass. Taf. i. fig. 4.
4. *Cnemidium astroites*, Münst. Beitr. iv. Taf. i. fig. 24.
5. *Scyphia capitata*, Münst. ib. Taf. i. fig. 12.
6. *Stellispongia clavosa*, Laube, *l. c.* Taf. ii. fig. 3.

b. *From the Jura.*

1. *Spongia lagenaria*, Lamx. Exp. pl. lxxxiv. fig. 4; Mich. Ic. pl. lviii. fig. 5.
   Discudea lagenaria, From. Intr. pl. i. fig. 5.
2. *Hallirhoa lycoperdioides*, Lamx. Exp. pl. lxxviii. fig. 2; Mich. Ic. pl. lviii. fig. 6.
3. *Alcyonites costata*, Stahl. Correspondenzbl. württ. landw. Ver. 1824, p. 84, fig. 29.
   Spongites astrophorus alatus, Quenst. Petr. Taf. cxxiv. figs. 54-57.
4. *Corynella Quenstedti*, Zitt.
   Spongites astrophorus caloporus and *cornucopiæ*, Quenst. Petr. Taf. cxxiv. figs. 58-64.
5. *Corynella stolata*, Zitt.
   Spongites astrophorus stolatus and *parabolis*, Quenst. Petr. Taf. cxxiv. figs. 65-69.
6. *Parendea cornuta*, Etal. Leth. Bruntr. pl. lviii. fig. 31.
7. *Cnemidium astrophorum* p. p., Goldf. Taf. xxxv. fig. 8, *a*, *c*.
8. *Crispispongia solitaria*, Quenst. Petr. cxxiv. figs. 51–53.
9. *Parendea prismatica*, Etal. ib. pl. lix. fig. 1.
10. *Cnemidium parvum*, Etal. ib. pl. lix. fig. 2.
11. *Cnemidium capitatum*, Münst. Goldf. Taf. xxxv. fig. 9.
12. *Siphonocœlia globosa*, From. Pol. Cor. de Gray, pl. xv. fig. 3.
13. *Siphonocœlia stellifera*, From. ib. pl. xv. fig. 4.
14. *Siphonocœlia pyriformis*, From. ib. pl. xv. fig. 5.
15. *Siphonocœlia aspera*, From. ib. pl. xv. fig. 6.
16. *Discœlia champlittensis*, From. ib. pl. xv. fig. 7.
17. *Madrespongia madreporata*, Quenst. Petr. Taf. cxxiv. figs. 70–72.
   Cnemidium astrophorum, Goldf. Taf. xxxv. fig. 83.
18. *Polycnemiseudea corallina*, From. Introd. pl. i. fig. 6.

c. *From the Cretaceous.*

1. *Scyphia excavata*, Röm. Nordd. Ool.
   Siphonocœlia truncata, From. Cat. Rais. pl. i. fig. 3.
2. *Siphonocœlia neocomiensis*, From. Cat. Rais. pl. i. fig. 2.
   ? *Polyendostoma pyriforme*, Röm. Spongit. Tab. i. fig. 3.
3. *Distheles excavata*, Röm. Spongit. Taf. i. fig. 19.

4. *Eudea globosa*, Röm. ib. Taf. i. fig. 1.
5. *Monotheles punctata*, Röm. ib. Taf. i. fig. 17.
6. *Monotheles stellata*, From. Introd. pl. ii. fig. 6.
7. *Distheles depressa*, From. Introd. pl. ii. fig. 7.
8. *Distheles inflata*, From. Cat. Rais. pl. ii. fig. 5.
9. *Distheles pediculata*, From. ib. pl. iii. fig. 1.
10. *Scyphia foraminosa*, Goldf. Taf. xxxi. fig. 4.
Endostoma foraminosum, Röm. Spongit. Taf. xiv. fig. 6.
11. *Scyphia tetragona*, Goldf. tab. ii. fig. 2.
Endostoma tetragonum, Röm. Spongit. Taf. xiv. fig. 7.
Polyendostoma sociale, Röm. ib. Taf. xiv. fig. 4.

Myrmecium, Goldf.

(Petr. Germ. p. 18.)

Cnemidium p. p., Goldf.
Epitheles p. p., From.
Myrmecium, ? *Gymnomyrmecium*, Pom.

Sponge small, hemispherical, spherical, or cylindrical, narrowed below, shortly pedunculate, at the base with a smooth or concentrically wrinkled dermal layer, which sometimes also coats the whole of the sides. Vertex convex, with a round osculum in the middle, serving as an opening to a narrow tubular stomachal cavity, which traverses the whole sponge-body vertically. There are also numerous small poriform ostia distributed on the surface wherever it is not clothed with the covering layer.

In the central cavity terminate rather stout radial canals, which follow a curved course from without and below, and are furcate in the vicinity of the surface. Their ostia are generally placed in longitudinal series in the wall of the central tube. Other straight canals penetrate into the sponge-body obliquely inwards and downwards from the superficial ostia.

The skeleton consists of a narrow-meshed tissue of rather thin anastomosing fibres, usually composed of calcite, rarely of silica. I have been unable to recognize spicules with perfect certainty; but certain parts of the calcite fibres appear to me to contain three- or four-rayed stars.

This genus is distinguished from *Corynella* chiefly by the fine skeletal fibres, the narrow central cavity, and the greatly developed covering layer, which is always present and frequently envelops the sponge-body up to the vertex. It is for the present not very sharply defined; but the Upper-Jurassic species belonging to it bear so peculiar a stamp that I could not resolve to unite them with *Corynella*.

1. *Myrmecium hemisphæricum*, Goldf. Taf. vi. fig. 12.

Cnemidium rotula, Goldf. Taf. vi. fig. 6.
Spongites rotula, Quenst. Petr. Taf. cxxvi. figs. 1–41.

a. var. *biretiformis*, Quenst. *l. c.* figs. 2–4, 6, 7.
b. var. *foliata*, Quenst. *l. c.* fig. 5.
c. var. *cylindrata*, Quenst. *l. c.* figs. 8–10.
d. var. *coniformis*, Quenst. *l. c.* figs. 11–13.
e. var. *pedunculata*, Quenst. *l. c.* figs. 14–18, 30, 31.
f. var. *longiceps*, Quenst. *l. c.* figs. 21–26.

2. *Spongites indutus*, Quenst. Petr. Taf. cxxvi. figs. 42–46.

3. *Spongites circumseptus*, Quenst. ib. Taf. cxxvi. figs. 55–57.

? Hippalimus, Lamx.

Hippalimeudea, From. (non *Hippalimus*, D'Orb., Röm. &c.).

Sponge mushroom- or umbrella-shaped, pedunculate; vertex with a wide funnel-shaped central cavity. The sloping sides of the conical umbrella set with oscula. Lower surface of the umbrella, stem, and wall of the central cavity smooth, without oscula.

I know this genus only from figures, and am consequently uncertain about its systematic position. Possibly it belongs to the order Lithistidæ.

The single species, *H. lobatus*, Lamx., Exp. Méth. pl. lxxix. fig. 1, is from the Cenomanian of Villers in Calvados.

Lymnorea, Lamx.

Mamillipora, Bronn.
Lymnoreotheles, From.
Lymnorea, *Placorea*, Pom.

Sponge nodular, consisting of verruciform, mamilliform, or globular individuals, which are grown together and covered by a common, thick, and wrinkled basal epidermis. At the vertex of each individual there is a simple, sometimes radiate, and not very deep osculum.

Of the typical species of this genus I possess only insufficient material, which gives me no certain information as to the nature of the oscula and the depth of the stomachal cavity. In a specimen from Ranville I have made sections of several of the round heads: the shallow oscula, into which a number of radial canals opened, then soon disappeared; but there remained, instead of them, upon the cut surface, some scattered round sections of fine vertical canals; and that these traversed the whole sponge-body appears from the fact that on cutting through the base of the common peduncle a bundle of fine canal-sections was visible in the centre. The oscula conse-

quently appear to be continued downwards into simple fine tubes.

The only species which certainly belongs here occurs in the Middle Jura :—

Lymnorea mamillaris, Lamx. Exp. Méth. pl. lxxix. figs. 2–4; Mich. Ic. pl. lvii. fig. 10.

Stellispongia, D'Orb.

Manon, Achilleum, Cnemidium auctt.
Stellispongia, D'Orb.
Stellispongia, Enaulofungia, Diasterofungia, From.
Stellispongia, Limnoretheles p. p., Laube.
Stellispongia, Asterospongia, Desmospongia, Didesmospongia, Cerio-spongia, Etal.
Ateloracia, Cnemiracia, Holoracia, Trachysphecion, Pom.

Sponge simple or, more frequently, composite. Individuals globular, semiglobular, clavate, or cylindrical; stock often nodular, clothed, almost always at the base, and sometimes also on the sides, with a thick, wrinkled, dermal layer. Vertex convex, with a shallow radiate osculum, into which open a larger or smaller number of efferent canals. The round ostia of the latter are situated partly at the bottom, partly on the sides of the osculum; the former are connected with vertical, the latter with radial canals. The uppermost radial canals are frequently open, and then form more or less impressed radial furrows. Over all the rest of the surface of the sponge-body, so far as it is not covered with epitheca, there are smaller ostia, connected with vertical or oblique incurrent canals.

The anastomosing skeletal fibres are generally of considerable thickness.

I have limited D'Orbigny's name *Stellispongia* to those calcareous sponges which are characterized by radiate oscula into which vertical and radial canals open, and by numerous smaller ostia on the surface. The round orifices at the bottom of the oscula have previously often been overlooked, but they are wanting in no true *Stellispongia*.

Fromentel's genus *Enaulofungia* is founded upon an erroneous observation; for upon the typical species (*E. corallina*) itself the ostia on the surface are very distinctly developed.

The species belonging to this genus are from the Trias Jura, and Cretaceous.

a. *From the Trias.*

1. *Cnemidium rotulare*, Münst. Beitr. iv. Taf. i. fig. 20.
Cnemidium Manon, Münst. ib. Taf. i. fig. 20?
Cnemidium astroites, Münst. ib. Taf. i. fig. 24.

2. *Cnemidium variabile*, Münst. ib. Taf. i. figs. 21–23.
   Cnemidium turbinatum, Münst. ib. Taf. i. fig. 19.
   Cnemidium stellare, Klipst. Oest. Alp. Taf. xx. fig. 6.
   Cnemidium concinnum, Klipst. ib. Taf. xx. fig. 7.
3. *Tragos hybridum*, Münst. Beitr. iv. Taf. i. fig. 16.

b. *From the Jura.*

1. *Spongia stellata*, Lamx. Exp. Méth. pl. lxxxiv. fig. 13.
   Spongia umbellata, Mich. Ic. pl. lviii. fig. 1.
2. *Enaulofungia corallina*, From. Introd. pl. iii. fig. 11.
   Enaulofungia globosa, From. ib. pl. iv. fig. 1.
   Cnemidium pisiforme and *rotula*, Mich. Ic. pl. xxvi. figs. 6, 7.
   Asterospongia corallina, Etal. Leth. Taf. lix. figs. 8, 9.
3. *Spongites glomeratus*, Quenst. Jura, Taf. lxxxiv. figs. 10, 11.
   Didesmospongia Thurmanni, Etal. Leth. pl. lix. fig. 3.
   Stellispongia pertusa, *aperta*, *hybrida*, and *glomerata*, Etal. Leth. pl. lix. figs. 4–7.
   Cnemidium stellatum, Mich. Ic. pl. xxvi. fig. 8.
   ?*Asterospongia rugosa*, Etal. Leth. pl. lix. fig. 10.
4. *Ceriospongia mundus-stellatus*, Etal. Leth. pl. lix. fig. 11.
   Diasterofungia mundistellata, From. Coll. de Lem. pl. xii. fig. 13.
5. *Ceriospongia bernensis*, Etal. Leth. pl. lix. fig. 12.
6. *Spongites semicinctus*, Quenst. Petr. Taf. cxxv. figs. 2–9.

c. *From the Cretaceous.*

1. *Stellispongia sequana*, From. Cat. Rais. pl. iii. fig. 2.
2. ? *Stellispongia subglobosa*, Röm. Spongit. Taf. i. fig. 20.

Sestrostomella, Zittel.

Tremospongia p. p., D'Orb.
Sparsispongia p. p., *Tremospongia* p. p., From.
Sparsispongia p. p., *Diestosphecion* p. p., Pom.
Spongites p. p., *Nudispongia*, Quenst.
Palæojerea, Laube.

Sponge simple, or more frequently compound, tufted or composed of verruciform individuals standing on a common base. Individuals distinctly separated, cylindrico-clavate or semiglobular; vertex with a shallow, sometimes radiate osculum, into which a great number of round ostia of vertical tubular efferent canals open. Surface porous, naked, or the base and sometimes also a part of the sides clothed with a dermal layer.

The calcareous sponges belonging to this genus have hitherto been described under the names of *Sparsispongia*, *Tremospongia*, or *Palæojerea*. Under the name of *Sparsi-*

spongia, D'Orbigny understood chiefly certain *Stromatoporæ* furnished with pores, as well as some calcareous sponges from the Upper Cretaceous, which were placed by Fromentel under *Tremospongia*. Of all the species of *Sparsispongia* mentioned in the "Prodrome," not a single one belongs to the present genus, whilst our diagnosis of *Sestrostomella* embraces most of the *Sparsispongiæ* and a part of the *Tremospongiæ* of Fromentel. Fromentel distinguishes these two genera principally according to the absence or presence of an epitheca. But that so unessential and inconstant a character cannot be employed for the discrimination of genera among the sponges any more than among corals, is most clearly seen in the fossil Calcispongiæ, among which, on account of this difference, we should have to place in different genera forms which agree perfectly in all other essential characters.

As Fromentel has applied D'Orbigny's names *Tremospongia* and *Sparsispongia* quite arbitrarily, and D'Orbigny himself characterizes them by very indefinite and, in part, erroneous diagnoses, I regard it as advisable to drop both names.

The genus *Sestrostomella* occurs from the Trias up to the Cretaceous.

a. *From the Trias.*

1. *Palæojerea gracilis*, Laube, St. Cass. Taf. i. fig. 4.
2. *Sestrostomella robusta*, Zitt.

Epeudea sp., Loretz, Zeitschr. deutsch. geol. Gesellsch. 1875, p. 832.

b. *From the Jura.*

1. *Jerea biceps*, Reuss, Denkschr. Akad. Wiss. Wien, xxvii. Sep. Abz. Taf. ii. fig. 9.
2. *Spongites* (*Nudispongia*) *cribratus*, Quenst. Petr. Taf. cxxv. figs. 14–18.

c. *From the Cretaceous.*

1. *Sparsispongia flabellata*, From. Cat. Rais. pl. iii. fig. 6.
2. *Sparsispongia varians*, From. ib. pl. iii. fig. 8.
3. *Tremospongia bullata*, From. Introd. pl. iv. fig. 10.
4. *Sparsispongia sulcata*, Loriol, Et. Val. Arz. pl. ix. fig. 4.
5. *Sparsispongia gemmata*, Lor. ib. pl. ix. figs. 5–7.
6. *Tremospongia valanginiensis*, Lor. ib. pl. ix. fig. 1.
7. *Tremospongia divaricata*, Lor. ib. pl. ix. fig. 2.
8. *Sparsispongia brevicauda*, Lor. Urg. Land. pl. v. figs. 19–21, pl. vi. fig. 8.
9. *Sparsispongia abnormis*, Lor. ib. pl. vi. figs. 3–6.
10. *Sparsispongia expansa*, Lor. ib. pl. vi. fig. 7.

Blastinia, Zittel.

Achilleum p. p., Goldf.
Actinospongia p. p., *Pterosmila* p. p., Pom.
Astrospongia p. p., Etal.
Tetrasmila p. p., From.

Sponge bud-like or clavate, simple, gradually narrowed below into a peduncle. Vertex with radially converging, more or less deep constrictions, which are continued over half or more of the height of the sponge. The lower half is coated with a wrinkled dermal layer; the upper half naked, rough, and porous. Skeleton consisting of vermiform interwoven fibres. Central cavity, ostia, and canals wanting.

This genus in many respects resembles *Stellispongia*, but is easily distinguished by the want of an orifice furnished with tubes in the vertex, and of a canal-system.

Pomel refers the typical species (*Achilleum costatum*, Goldf.) to *Actinospongia*, D'Orb.; but in *A. ornata*, upon which D'Orbigny had founded his genus, he remarks the presence of "perforant proctides" both in the furrows and on the costæ of the vertex. According to these characters, *Actinospongia*, D'Orb., should be identical with *Stellispongia*.

I believe also that *Spongites alatus*, Quenst., must be referred here, as the structure of several specimens from the Blauthal exactly agrees with that of *Achilleum costatum*. But whether *Ceriopora alata*, Goldf. (Taf. xi. fig. 8), is identical therewith, I regard as doubtful, notwithstanding the external resemblance. The state of preservation of the silicified specimens from Franconia permits no examination of the microstructure; and from the general habit I should regard the small-winged bodies which Fromentel refers to the genus *Tetrasmila*, and Pomel to *Pterosmila*, rather as Hydractiniæ or Bryozoa. Now that M. Steinmann* has demonstrated that *Thalamospongia* at least belongs to the Hydractiniæ, the whole family Porosmilinæ of Pomel, with the genera *Thalamospongia*, D'Orb., *Porosmila*, From., *Heterosmila*, Pom., *Cœlosmila*, Pom., *Pterosmila*, Pom., and *Cladosmila*, Pom., ought also probably to be removed to the same group.

All the species are from the Upper Jura.

1. *Achilleum costatum*, Goldf. Taf. xxxiv. fig. 7.
   Spongites costatus, Quenst. Petr. cxxv. figs. 19–23.
2. ? *Actinospongia subcostata*, Etal. Class. p. 150.
3. *Spongites alatus*, Quenst. Petr. Taf. cxxv. figs. 24, 25.

* Palæontographica, xxv.

Synopella, Zittel.

Tremospongia p. p., *Sparsispongia* p. p., D'Orb.; From.
Tremospongia, Orosphecion, Aplosphecion, Pom.

Sponge composite, rarely simple, hemispherical or nodular. Upper surface plain, convex, or warty, with irregularly scattered oscula, which are formed by the separated openings of two or more large excurrent canals. Besides these oscula, the surface is furnished with small ostia of fine incurrent tubules. Base, and frequently also the sides, coated with a thick wrinkled dermal layer. Skeletal fibres coarse.

This genus is difficult to define sharply from *Stellispongia* and *Sestrostomella*, although the typical species bear a peculiar stamp. If the oscula are radiated by radial canals, as now and then occurs, the distinction from *Stellispongia* is difficult; if, on the other hand, the roundish heads project more definitely from the mass, transitions towards *Sestrostomella* are produced. To the present genus I refer only nodular forms in which the individuals are not sharply defined, but amalgamated with each other.

The species are distributed through the different horizons of the Cretaceous formation.

1. *Lymnorea sphærica*, Mich. Ic. pl. lii. fig. 16.
2. *Tremospongia plana*, From. Introd. pl. iv. fig. 10.
3. *Manon pulvinarium*, Goldf. Tab. xxix. fig. 7.

Oculospongia, Fromentel.

Manon, Goldf.
Oculispongia p. p., *Tremospongia* p. p., Röm.
Oculospongia, Sphecidion, Pom.

Sponge nodular or clavate, massive; vertex with but slightly scattered, circular oscula, from which tubular canals penetrate into the skeletal mass. Outer surface with or without a wrinkled dermal layer. Skeleton consisting of coarse anastomosing fibres.

This genus is distinguished from *Synopella* merely by its simple circular oscula, which are not composed of several apertures. Jurassic and Cretaceous.

? 1. *Spongites sella* and *binoculatus*, Quenst. Petr. cxxvi. figs. 58, 59.
2. *Oculospongia neocomiensis*, From. Introd. pl. ii. fig. 8.
3. *Tremospongia dilatata*, Röm. Spongit. Taf. i. fig. 24.
? 4. *Limnorea mamillaris*, Röm. Spongit. Taf. i. fig. 14.
5. *Oculospongia flabellata*, From. Cat. Rais. pl. iii. fig. 4.
6. *Oculospongia irregularis*, Loriol, Land. pl. v. fig. 18.

7. *Manon capitatum*, Goldf. Taf. i. fig. 4.
8. *Manon tubuliferum*, Goldf. Taf. i. fig. 5.

Crispispongia, Quenstedt.

Manon p. p., Goldf.
Conispongia, Etal., Pom.
Crispispongia p. p. Quenst.
Verrucospongia p. p., Laube.

Sponge nodular, polymorphic, sometimes consisting of thick, contorted, and amalgamated leaves, usually adherent by a broad base to foreign bodies. Whole surface, or only the vertex, coated with a dense, smooth dermal layer, in which there are rather large, round or distorted, frequently margined oscula; these are either quite shallow or sunk into the sponge-mass in the form of a funnel, often furnished with canal-ostia at the bottom. The skeleton consists of coarse anastomosing fibres. Canal-system indistinctly developed.

Goldfuss admirably figured two species of the present genus under the name of *Manon peziza*, on Taf. xxxiv. fig. 8, *a*, *b*. Etallon (Classif. Spong. du Haut-Jura, p. 149) subsequently established the genus *Conispongia* for a conical species from the Coral Rag of Valfin; but as this name is quite inapplicable to all the other species, I have adopted the designation *Crispispongia* proposed by Quenstedt, but confine this name to the forms indicated below.

I am acquainted with a still undescribed species from the Trias of St. Cassian (like *Verrucospongia crassa*, Laube, Taf. i. fig. 13); all the rest occur in the Upper Jura.

1. *Crispispongia pezizoides*, Zitt.

Manon peziza p. p., Goldf. Taf. xxiv. fig. 8, *a*.

2. *Crispispongia expansa*, Quenst. Petr. Taf. cxxiv. figs. 38–47.

3. *Conispongia Thurmanni*, Etal. Actes Soc. Jur. d'Emul. 1860, p. 149, fig. 16.

Elasmostoma, Fromentel.

Tragos p. p., *Manon* p. p., *Spongia* p. p., auctt.
Elasmostoma, *Porostoma* p. p., *Chenendroscyphia* p. p., From.
Tragos p. p., *Chenendopora* p. p., *Elasmostoma*, *Cupulospongia* p. p., Röm.
Elasmostoma, *Trachypenia*, *Coniatopenia*, Pom.

Sponge usually consisting of a rather thin, curved leaf, but sometimes funnel-shaped or cup-shaped. One surface with a smooth dermal layer, in which are very shallow oscula of a roundish or irregular form. Opposite surface naked, porous. Canal-system wanting.

Skeletal fibres coarse, apparently formed principally of uniaxial, frequently curved bacillar spicules and scattered triradiates.

All the species occur in the Cretaceous.

1. *Tragos acutimargo*, Röm. Nordd. Ool. Taf. xvii. fig. 26; Spongit. Taf. i. fig. 21.

   Elasmostoma frondescens, From. Introd. pl. iii. fig. 6.

2. *Elasmostoma neocomiense*, Loriol, Descr. anim. invert. foss. Néoc. du Mont-Salève, pl. xxii. figs. 1, 2.
3. *Chenendroscyphia crassa*, From. Cat. Rais. pl. iv. fig. 2.
4. *Porostoma porosa*, From. ib. pl. iii. fig. 3.
5. *Chenendroscyphia mamillata*, From. ib. pl. iii. fig. 4.
6. ? *Elasmostoma cupula*, Röm. Spongit. Taf. i. fig. 22.
7. *Oculospongia polymorpha*, Röm. ib. Taf. i. fig. 16.
8. *Manon macropora*, Sharpe, Q. J. G. S. x. pl. v. figs. 3, 4.
9. *Cupulospongia Normanniana*, D'Orb. Prodr. ii. p. 188.

   Manon peziza, Mich. Ic. pl. xxxvi. fig. 5.

10. *Manon peziza* p. p., Goldf. Taf. xxix. fig. 8.
11. *Cupulospongia consobrina*, D'Orb. Prodr. ii. fig. 188.

    Manon peziza p. p., Goldf. Taf. i. figs. 7, 8.
    Manon stellatum, Goldf. Taf. i. fig. 9.

12. *Spongia Trigeri*, Mich. Ic. pl. liii. fig. 2.

Diplostoma, Fromentel (non Röm.).

Forospongia p. p., D'Orb.

Like *Elasmostoma*, but both surfaces furnished with smooth epidermis and shallow oscula. Cretaceous.

1. *Diplostoma neocomiensis*, From. Introd. pl. iii. fig. 3.

Pharetrospongia, Sollas.

Manon p. p., *Chenendopora* p. p., auctt.
Cupulispongia p. p., D'Orb.
Cupulochonia p. p., From.
Cupulospongia, *Phlyctia*, *Trachyphlyctia*, ? *Heterophlyctia*, ? *Heteropenia*, Pom.
Pharetrospongia, Sollas.

Sponge cup-, funnel-, or leaf-shaped; in the last case the thick-walled leaf always bent or folded. Upper surface (=inner surface) usually smooth, with very small oscula or only simple pores. Outer surface rough, porous. Canal-system deficient, or consisting of fine tubes, which penetrate from both surfaces into the wall. Skeleton consisting of anastomosing vermiform fibres, which are entirely composed of simple bacillar spicules.

As Mr. Sollas has so admirably described (Quart. Journ.

Geol. Soc. 1877, p. 242) the microstructure and characters of the organization of *Pharetrospongia Strahani*, I extend this name to a number of calcareous sponges of similar structure and form which have hitherto generally been referred to *Cupulospongia*, D'Orb., or *Cupulochonia*, From. Under these names, however, the most different Hexactinellidæ, Lithistidæ, and Calcispongiæ have been thrown together; so that it does not seem advisable to maintain either of them.

I have somewhat altered Sollas's diagnosis, and associated with the typical species (*P. Strahani*), which consists of a folded leaf, a series of cup-shaped sponges which agree in their other essential characters. The genus has thus certainly attained a wide extent and a somewhat vague limitation; but some unsuccessful attempts to break it up into several genera have led me constantly back to the union of all the forms cited below. Very frequently the state of preservation causes notable differences which did not originally exist. Thus, probably, all the species in which both surfaces are of a rough and porous texture must have lost the smooth thin epidermis, which is so beautifully preserved in certain specimens from Farringdon, Essen, and Maestricht.

The development or the absence of canals depends, on the one hand, upon the size of the oscula and ostia, and, on the other, upon the coarser or finer meshes of the skeletal network. In *Cupulospongia farringdonensis*, for example, there is a double system of efferent and incurrent canals, whilst other species are entirely destitute of canals.

If we give the genus *Pharetrospongia* the increased extension proposed by me, it contains species from the Trias up to the uppermost Cretaceous.

a. *From the Trias.*

1. *Achilleum patellare*, Münst. Beitr. iv. Taf. i. fig. 6.

b. *From the Jura.*

1. *Spongia helvelloides*, Lamx. Exp. Méth. pl. lxxxiv. figs. 1–3.

c. *From the Cretaceous.*

1. *Cupulochonia cupuliformis*, From. Introd. pl. iii. fig. 5.
2. *Cupulospongia tenuipora*, Röm. Spongit. Taf. ii. fig. 7.
3. *Chenendopora multiformis*, Röm. ib. Taf. i. fig. 13, and ii. fig. 2.
4. *Cupulochonia sequana*, From. Cat. Rais. pl. iv. fig. 1.
5. *Cupulochonia tenuicula*, From. ib. pl. iv. fig. 3.
6. *Cupulochonia profunda*, From. ib. pl. iv. fig. 4.

? 7. *Cupulochonia spissa*, From. ib. pl. iv. fig. 5.

8. *Cupulochonia exquisita*, Loriol, Arzier. pl. ix. figs. 9, 10.

9. *Cupulochonia insueta*, Loriol, ib. pl. ix. fig. 11.

10. *Cupulochonia Couloni*, Loriol, Urg. Land. pl. vi. fig. 17, and vii. figs. 1, 2.

11. *Cupulochonia sabaudiana*, Loriol, ib. pl. vii. figs. 7–9.

12. *Cupulochonia Hiselyi*, Loriol, ib. pl. vii. figs. 11, 12.

13. *Manon farringdonensis*, Sharpe, Q. J. G. S. x. pl. v. figs. 5, 6.

Chenendopora fungiformis, Mant. (non Mich.) Medals, i. p. 228.

14. *Cupulospongia subpeziza*, D'Orb. Prodr. Et. 22, no. 1521.

Manon peziza, Goldf. Taf. v. fig. 1.

? 15. *Spongia boletiformis*, Mich. Ic. pl. i. fig. 1.

? 16. *Epitheles multiformis*, Röm. Spongit. Taf. xiv. fig. 2.

Pachytilodia, Zittel.

Scyphia p. p., Goldf.
Hippalimus p. p., Röm.

Sponge funnel-shaped or pyriform, large, very thick-walled, with a broad depression in the vertex. Base furnished with a smooth covering layer. Rest of the surface naked, without special oscula or canal-openings. Skeleton consisting of a coarse-meshed net of very thick, curved, anastomosing calcareous fibres, which sometimes coalesce to form regular lamellæ and vesicles, and among which the circulation of water took place without any special canal-system.

This genus is distinguished from *Pharetrospongia* by its thick skeletal fibres, the complete absence of a canal-system, and its very thick wall.

The typical species, *Scyphia infundibuliformis*, Goldf., Taf. v. fig. 2 (Quenst. Petr. Taf. cxxxii. figs. 1–3), occurs frequently in the Tourtia of Essen.

Leiospongia, D'Orbigny*.

Achilleum p. p., Münst.
Leiofungia, From.
Leiospongia, Aulacopagia, Lænopagia, ? Elasmopagia, Pom.

Sponge nodular or branched, on the sides with a smooth or

The position of this genus among the Pharetrones cannot be regarded as perfectly certain until spicules have been detected in the skeletal fibres. Possibly *Leiospongia*, like most species of the genera *Actinofungia*, From., *Actinospongia*, D'Orb., and *Amorphospongia*, D'Orb., in which the skeleton consists of anastomosing calcareous fibres, is nearly allied to certain calcareous Hydrozoa (*Millepora*).

concentrically wrinkled surface; vertex consisting of a curled, rather coarse tissue of anastomosing calcareous fibres, which also composes the interior of the sponge-body. The circulation of water could only take place in the interstices of the skeleton.

In this genus I have been unable to detect spicules in the calcareous fibres. All the thin sections which I have prepared of specimens from St. Cassian or from the Seeland Alp exhibit a crystalline-radiate structure.

By Laube several true Bryozoa were united with *Leiofungia*, *Cribroscyphia*, and *Actinofungia*; and Pomel also refers a true Bryozoan (*Catenipora spongiosa*, Klipst.) to *Aulacopagia*. All these forms may easily be distinguished from the fibrous sponges by their tubular structure.

I am acquainted with the genus *Leiospongia* only from the Alpine Trias.

1. *Achilleum milleporatum*, Münst. Beitr. iv. Taf. i. fig. 5.
2. *Achilleum radiciforme*, Münst. ib. Taf. ii. fig. 20.
3. *Achilleum verrucosum*, Münst. ib. Taf. i. fig. 1.
4. *Achilleum subcariosum*, Münst. ib. Taf. i. fig. 2.
5. *Achilleum reticulare*, Münst. ib. Taf. iv. fig. 4.
   Non *Leiofungia reticularis*, Laube, St. Cass. Taf. ii. fig. 8.
6. *Achilleum rugosum*, Münst. ib. Taf. i. fig. 3.

Family 4. Sycones, Häckel.

Wall regularly composed of straight unbranched canals or tubes, directed radially towards the axis of the stomach (radial canals, radial tubes). Skeletal spicules regularly radially arranged; dermal and gastral skeletons separated from the parenchyma-skeleton.

Protosycon, Zittel.

Scyphia p. p., Goldf.
Siphonocœlia p. p., From.

Sponge simple, cylindrical or clavate, narrowed below, with a wide tubular central cavity extending to the base. The wall consists of hollow radial cones, placed in layers one above the other, with their bases towards the central cavity and their apices directed outwards. These hollow cones, opening inwards, produce, on the wall of the central cavity, numerous ostia, arranged in longitudinal rows, and leading into the hollow cones. As the latter are narrowed outwards and terminate in a truncated head, conical interspaces, but pointed inwards, are formed between; and if both the hollow cones and interspaces are filled with rock matter, it appears

as if the wall were furnished with two kinds of radial canals, one set opening into the central cavity, while the others commence about the middle of the wall and widen outwards.

The skeleton appears to be composed chiefly of tri- and quadriradiate spicules; I have, however, never succeeded in distinctly displaying their form in thin sections.

I have no hesitation in referring this elegant genus to the Sycones. The whole external form of the cylindrical sponge-body, its construction of radial tubes, the numerous serially arranged ostia on the wall of the central cavity, and, finally, the mesh-like interspaces on the outer surface agree in a remarkable manner with certain living Sycones. It is, however, impossible to assign it precisely to a place among the recent genera, on account of the imperfect preservation of the skeletal spicules.

The typical species has been well figured by Goldfuss (Taf. iii. fig. 10) as *Scyphia punctata*. It occurs, not very abundantly, in the middle sponge-limestone of the White Jura. The skeleton almost always consists of calcite, and shows indistinct spicular structure. Rarely also specimens with a silicified skeleton occur; and one of these must have been taken by O. Schmidt for his figure (Atlant. Spong. Taf. i. fig. 21). The fragment probably shows the surface of the wall of the stomachal cavity with the ostia of the radial tubes, which stand in regular rows, and thus somewhat remind us of the Hexactinellidæ. That O. Schmidt indicates canals in the skeletal fibres is due to an illusion, at least if the figure in question belongs to *Scyphia punctata*.

In Quenstedt's 'Petrefactenkunde Deutschlands' there are good figures of *Scyphia punctata* (Taf. cxxxi. figs. 24–27).

XV.—*Description of a new Species of* Vesperugo *from Bermuda*. By G. E. Dobson, M.A., M.B., &c.

Vesperugo vagans, n. sp.

Ears short, triangular, like those of *V. pipistrellus*; the tragus reaches its greatest width in the upper third, its inner margin is slightly concave above, the outer margin straight in the lower two thirds, with a small rounded lobe at the base, not succeeded by an emargination, upper margin broadly rounded off, in general outline, on the whole, like that of *V. maurus*.

Postcalcaneal lobe well developed; the last rudimentary caudal vertebra alone free.

Fur, above, dark reddish brown; beneath similar, but paler