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FRESH-WATER SPONGES FROM AUSTRALIA AND NEW ZEALAND.

By

N. GIST GEE,

The Rockefeller Foundation, Peiping, China.

I. HISTORICAL NOTES.

Mr. L. P. Capewell, as far as we can discover from available literature, was the first person to collect a fresh-water sponge in Australia. This sponge was collected in Lake Hindmarsh, Victoria. Dr. J. S. Bowerbank in 1863 described¹ this sponge as a new species and illustrated it with a good drawing. The sponge being a new one was named for the finder and was called *Spongilla capewelli*; now that the nomenclature has changed somewhat, this species becomes known as (1) *Ephydatia capewelli* (Bowerbank). Mr. H. J. Carter, writing in 1881,² improved the original description somewhat. Later writers have also mentioned this form, but have added very little to the splendid descriptive notes made by Bowerbank and Carter.

Dr. W. A. Haswell, writing on "Australian Fresh Water Sponges" in 1883,³ describes three new species and thus brings the total number of described species up to four at that date. It is very unfortunate that Dr. Haswell did not follow Dr. Bowerbank's example and leave us good drawings of the forms described. (2) *Spongilla sceptroides* Haswell, and (3) *Spongilla botryoides* Haswell, were both found in a pond near Brisbane, growing on submerged branches and twigs. Dr. Traxler illustrates the gemmule spicules of *S. sceptroides* in his paper⁴ on the subfossil sponges of Australia, and Annandale gives a full description and illustrations of a specimen of this species from Queensland in a later paper.⁵

Mr. E. P. Ramsay had collected in Bell River at Wellington, New South Wales, another sponge which Haswell described and named (4) *Meyenia ramsayi*. This now becomes *Ephydatia ramsayi* (Haswell). Dr. Lendenfeld⁶ has restudied *E. ramsayi* and gives us a fuller description than the original one and also provided illustrations of the form he examined.

Dr. Morris provided a few spicules of another species of *Ephydatia* from the Botany Reservoirs, near Sydney. These were quite different from both *E. capewelli* and *E. ramsayi*, but as Dr. Haswell does not describe this form we shall have to designate it for the present as (5) *Ephydatia* ?.

¹ Bowerbank.—Proceedings Zoological Society of London, November 24, 1863, p. 447, pl. xxxviii.

² Carter.—Annals and Magazine of Natural History, (5), vii, 1881, p. 93.

³ Haswell.—Proceedings Linnean Society of N.S.W., vii, 1883, pp. 208-210.

⁴ Traxler.—Földtani Közlöny, xxvi, 1896, pp. 95-97, pl. iii.

⁵ Annandale.—Proceedings U.S. National Museum, xxxvi, 1909, pp. 627-632.

⁶ Lendenfeld.—Zool. Jahrb., ii, 1887, p. 91, pl. vi.

Dr. R. von Lendenfeld in the paper cited lists (1), (2), (3) and (4) of the above-named species and in addition adds (6) *Spongilla lacustris* var. *sphærica* found in the neighbourhood of the copper works of Cobar, New South Wales, and (7) *Tubella nigra* found in a swamp near Sydney, New South Wales, as new records for this region. This last form is illustrated with several drawings. He also suggests that (4) *Ephydatia ramsayi* (Haswell) is not entitled to more than varietal distinction, and that it should be called (*Spongilla*) *Ephydatia fluviatilis* var. *ramsayi*.

Mr. D. Vernon reports⁷ the finding of fragments of spicules of fresh-water sponges in 1887 in the diatomaceous earth from the Tertiary beds of Warrumbungle Mountain, near Coonamble, New South Wales. He was not able to place the spicules as belonging to any one species and simply records it as a *Spongilla*.

Mr. Whitelegge, writing in 1889, records⁸ finding a fresh-water sponge in Woolli Creek, Cook's River, Botany Bay, New South Wales, which Weltner places among the unidentified forms in his "Spongillidenstudien III".

Dr. Weltner in 1895⁹ questions the new variety *S. lacustris* var. *sphærica* of Dr. Lendenfeld and states (p. 119) that, after the examination of some of the original specimens in which no gemmules are found, that he is not even certain whether this form really belongs to the genus *Spongilla*. It would then seem best either to delete this name from the list for the present or leave it with a question mark and thus record the fact that an unknown sponge has been found in that locality and make an effort to secure, if possible, from that place additional material bearing gemmules.

In this same paper Dr. Weltner disagrees with Dr. Lendenfeld's change of status of (4) *E. ramsayi* from a distinct species to a variety of *E. fluviatilis*, and remarks (p. 127) that he considers that the characteristics of both the skeleton spicules and the gemmule spicules of this sponge are so different from those of *E. fluviatilis* that *E. ramsayi* should stand as a species. Thus Dr. Lendenfeld, in the paper above referred to, makes only one addition which is entitled to recognition to the fresh-water sponge fauna of Australia, viz., (7) *Tubella nigra* Lendenfeld. We now propose to call this *Ephydatia nigra*.

Dr. Weltner, however, added in this same article the description of another new species which he called (8) *Tubella multidentata*, but which now becomes *Ephydatia multidentata* (Weltner). This sponge was collected by Mr. R. Semon in the Burnett River, Queensland.

Dr. Traxler, in 1896,¹⁰ gives us the result of his investigation of a sponge which was collected by Mr. Chilton in the Kakahu River, Canterbury, South Island, New Zealand, and concerning which Mr. Chilton published a note¹¹ entitled "A New Zealand Fresh-water Sponge" in 1883. Dr. Traxler describes and illustrates this form fully and gives it the name (9) *Ephydatia kakahuensis*. Dr. Kirkpatrick, writing in 1921,¹² records this same species as collected by Mr. H. Hill from

⁷ Vernon.—Department of Mines, N.S.W., Annual Report, 1887 (1888), pp. 165-166.

⁸ Whitelegge.—Journ. and Proc. Roy. Soc. N.S.W., xxiii, 1889, p. 306.

⁹ Weltner.—Archiv für Naturgeschichte, i, 1895, p. 119.

¹⁰ Traxler.—Termez. Fuzetek, xix, 1, 1896, pp. 30-33.

¹¹ Chilton.—New Zealand Journal of Science, i, 1883, pp. 383-384.

¹² Kirkpatrick.—Ann. Mag. Nat. Hist., (9), viii, 1921, pp. 400-401.

Lake Taupo in the centre of North Island, New Zealand. Dr. Lendenfeld also observed this form, but called it "*Ephydatia fluviatilis*".

Dr. Weltner in 1900¹³ records (10) *Spongilla fragilis* as occurring in the Murray River, Australia.

Mr. F. W. Hutton records¹⁴ in 1904 (11) *Spongilla lacustris* as occurring in New Zealand.

Dr. Traxler also records, in another article¹⁵ in 1896, that he has found in the alluvial diatomaceous earth of Geelong, Victoria, spicules of the following subfossil species: (2) *Spongilla sceptroides*, (12) *Ephydatia fluviatilis*, and a new species which he dedicates to Dr. Lendenfeld as (13) *Ephydatia lendenfeldi*.

Dr. W. Weltner writing in 1910 describes¹⁶ in detail (14) *Ephydatia multi-formis*, a new species from Herdsman's Lake, near Subiaco, Western Australia.

In order to make this record as complete as possible we will add references to three additional works in which mention is made of fossil or subfossil spicules of fresh-water sponges. Mr. F. Barnard¹⁷ records the occurrence of unidentified sponge spicules; Mr. Etheridge¹⁸ records the presence of spicules of *Ephydatia* and *Spongilla* in a deposit of pre-Pleistocene diatomaceous earth in the Warrumbungle Mountains, New South Wales; and Mr. F. Chapman in 1922¹⁹ describes the finding of certain fresh-water sponge spicules in opal nodules from Tintenbar, Richmond River, New South Wales. These spicules were identified as probably belonging to *Ephydatia capewelli*, *Ephydatia ramsayi*, and some others to the genus *Spongilla*.

To summarize, the following fresh-water sponges are recorded from Australia and New Zealand:

1. (*Spongilla*) *Ephydatia capewelli* (Bowerbank).
Victoria: Lake Hindmarsh. New South Wales: ? Tintenbar, Richmond River.
2. *Spongilla sceptroides* Haswell.
Queensland: Near Brisbane; Lillesmere Lagoon, Lower Burdekin River.
New South Wales: Bunnerong Road, Sydney. Victoria: Geelong (subfossil).
3. *Spongilla botryoides* Haswell.
Queensland: Near Brisbane. North Australia: Ten Mile Station, Port Darwin.
4. (*Myenia*) *Ephydatia ramsayi* (Haswell).
New South Wales: Bell River, Wellington; in Macquarie River, near Dubbo; ? Tintenbar, Richmond River. Also in Argentine, in Paraguay and in New Guinea.

¹³ Weltner.—In Semon's Zool. Forschungsr. in Australien, v, 5, 1900 (Denkschr. Medic. Naturw. Ges. Jena, viii), pp. 517-524.

¹⁴ Hutton.—Index Faunæ Novæ Zealandiæ, London, 1904, p. 323.

¹⁵ Traxler.—Földtani Közlöny, xxvi, 1896, pp. 95-97, pl. iii.

¹⁶ Weltner.—In Michaelsen and Hartmeyer, Die Fauna Südwest Australiens, iii, 1910, pp. 137-144.

¹⁷ Barnard.—Quart. Journ. Micro. Soc., Victoria, i, 1879, pp. 14-15, pl. i.

¹⁸ Etheridge.—Ann. Rept. Dept. Mines, N. S. Wales, 1887 (1888).

¹⁹ Chapman.—Proc. Roy. Soc. Victoria, xxxiv, 1922, pp. 167-171.

- ? 5. (*Myenia*) *Ephydatia* ?.
New South Wales: Botany Reservoirs, near Sydney.
- ? 6. Unknown Sponge (*Spongilla lacustris* var. *sphærica* Lendenfeld).
New South Wales: Near copper works, Cobar.
7. (*Tabella*) *Ephydatia nigra* (Lendenfeld).
New South Wales: Swamp near Sydney; Moore Park, near Sydney, in pond now filled up; Wooli Creek, Cook's River. Also a pond in Victoria.
8. (*Tabella*) *Ephydatia multidentata* (Weltner).
Queensland: Burnett River. South Australia: Cooper's Creek, 1924.
9. *Spongilla fragilis* Leidy.
Murray River in southern Australia.
10. *Spongilla lacustris* (L.).
New Zealand.
11. *Ephydatia kakahuensis* Traxler.
New Zealand: Kakahu River, Canterbury, South Island; Lake Taupo, North Island; Lake Takapuna, Auckland, North Island; creek near Invercargill, South Island.
12. *Ephydatia fluviatilis* auct. (subfossil).
Victoria: Geelong (*E. haswelli* Lendenfeld, no locality given). New South Wales: ? Woronora River.
13. *Ephydatia lendenfeldi* Traxler (subfossil).
Victoria: Geelong; New South Wales: Cambewarra Mountains; Ungarie. Western Australia: Waneroo Lake, near Perth.
14. *Ephydatia multififormis* Weltner.
Western Australia: Herdman's Lake, near Subiaco; Two People Bay pumping station, near Albany. New South Wales: Toronto, Lake Macquarie.

II. DESCRIPTIVE NOTES.

Some months ago the authorities of the Australian Museum kindly sent for examination the small collection of Australian fresh-water sponges in their possession. This collection, together with some small bits of sponges from Australia, from the Berlin Zoological Museum, the Indian Museum and the British Museum (Natural History), and also some small bits from Professor G. E. Nichols and from Mr. E. W. Bennett, M.Sc., has enabled us to prepare the following descriptions which will serve as a summary of our present knowledge and a basis for further study of this very interesting group from that part of the world.

Mr. S. W. Ling, of Yenching University, Peiping, China, has kindly made the excellent drawings which accompany the descriptions. We wish, here, to express to Dr. W. Arndt our thanks for his many kindnesses in furnishing from his splendid collection in the Berlin Zoological Museum, slides and specimens, and also for reading over the manuscript before its publication.

We would like also to call attention to the fact that the *Ephydatias* from Australia have, in a great many cases, the rotules unequal. This characteristic is

unique for that region and it is doubtless deserving of some special recognition in the nomenclature of the several species. For the present, however, we prefer to use simply the generic names already assigned to them. We believe that before much longer a careful study and revision of the nomenclature of the group should be made, and when this is done it will be time enough to rearrange the terminology. Our present object is to furnish the necessary facts for a further study of this interesting group of animals by those who are interested in them and we trust that this paper may stimulate more extensive collections for such a study in the near future. The writer would be very grateful for gemmule-bearing specimens of fresh-water sponges bearing gemmules from all parts of Australasia.

Spongilla botryoides Haswell, 1883.

(Figure 1).

Historical Statement.—This sponge was first collected by Haswell from a pond near Brisbane and was described by him²⁰ in 1883. Lendenfeld in 1887 repeated²¹ the original description, but adds nothing to our knowledge and states that he has not seen the sponge.

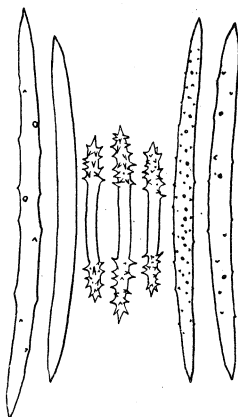


FIGURE 1.
Spongilla botryoides.
Skeleton and gemmule spicules.

Through the kindness of the Australian Museum we have recently received a specimen which we take to be this species. This specimen (No. 54769) was collected by A. A. Livingstone of the Australian Museum in July, 1929, the dry season for that part of Australia, from a small lake at Ten Mile Station, Port Darwin, North Australia.

Habitat.—The sponge was collected on the dead stalks of grass around a small lake. It was, in the majority of cases, dry when collected, but had, of course, grown on the grass while it was still covered during the high water season. The original specimens were found growing in a pond on submerged branches and twigs. They formed flat crusts on their supports.

²⁰ Haswell.—Proc. Linn. Soc. N.S.W., vii, 1883, p. 209.

²¹ Lendenfeld.—Zool. Jahrb., ii, 1887, p. 89.

General Characteristics.—Unfortunately the specimens recently submitted to me for examination by the Australian Museum were badly broken when received. Two pieces, both growing around small grass stems and with a total diameter of about 2 cm. and a length of about $4\frac{1}{2}$ cm., give us some idea, however, of how the sponge grew. It is largest in the centre and gradually becomes smaller toward its ends. The outer surface is smooth. There are no conspicuous oscula. The inner portion of the sponge is loosely constructed, being full of canals.

Colour.—In the larger pieces it has a light brown colour in alcohol; the smaller bits when free from sediment are quite clear and transparent.

Structure.—The skeleton is rather fragile. The main skeletal fibres, which radiate in lines about perpendicular to the small grass stalk on which the sponge was growing, are very thin, being composed of from two to five or six spicules, but can be clearly distinguished. We can detect no regular, continuous, transverse fibres, though the main ones are bound together by irregular meshes of about the length of the skeleton spicule. These meshes are very thin, the sides often being composed of only one or two spicules. The amount of spongin is small.

Skeleton Spicules.—These are gently curved, spindle-shaped, and usually gradually and sharply pointed at their ends; some few are more abruptly pointed. The surfaces of the spicules vary from being covered by exceedingly fine granulations, not spines, visible under only high powers of the microscope, to bearing a few scattered, readily seen, sharp spines.

Length: 280–315 μ . Thickness: 12–19 μ .

Haswell thus described those examined by him: "curved, fusiform, acute, usually with scattered, extremely minute projecting points".

Flesh Spicules.—There are no flesh spicules present.

Gemmules.—The gemmules are abundant, dark brown in colour, spherical in shape and are scattered singly throughout the body of the sponge. They are held in position by the meshes of the skeleton and are readily dislodged when the sponge is handled. The granular coat surrounding the gemmule is very thickly packed with the very characteristic spicules, which are lying embedded in it chiefly at an angle to the surface. Only a few in a tangential position were observed. They are woven into a very thick mass over the entire surface of the gemmule and form an effective covering. Usually the pore tube does not extend beyond the granular coat which covers the gemmule, but two or three gemmules have been observed with pore tubes projecting beyond the surface, and these tubes were also covered by a granular coat, in which numerous gemmule spicules were embedded.

Diameter: 307–383 μ .

Gemmule Spicules.—The gemmule spicules are mostly straight, though some are gently curved. In the centre the spicules are smooth, only rarely bearing one or more spines; but for about one-fourth or more of the length of the spicule, at each end, there are comparatively large perpendicular spines covering it; these spines are largest toward the middle of the spicule and become smaller and more numerous nearer the tips. The spicules always end in a sharp spine or point. In some of the spicules the spines appear to be blunted.

Length: 66–70 μ . Thickness: 3–4 μ .

Haswell thus describes the gemmule spicules of his specimen: "short, strongly curved spicules which are provided at each end with a head composed of numerous short, blunt or subacute spines producing a somewhat botryoidal appearance; the intermediate curved shaft is free from spines".

Type.—The location of the type of this species is not known. The specimen under examination is being deposited in the Australian Museum at Sydney. A small specimen is being retained in my collection.

Distribution.—Up to the present this sponge is known only from the type locality, Brisbane, and from Ten Mile Station, near Port Darwin. Doubtless it will be found in other places in northern Australia.

Remarks.—Unfortunately we do not have a type specimen or drawings of the original *S. botryoides* for comparison with this sponge. Haswell's description of that species is so inadequate that it does not give us a very clear idea of what that sponge is like. His indefinite description calls attention, however, to two or three points which correspond to the sponge in hand.

1. Its habit of growth—on twigs.
2. The description of skeleton spicules might apply to those of the Port Darwin specimen.
3. An active imagination and a poor microscope might help one to see the ends of these spicules as resembling a bunch of grapes. They do not suggest this to the writer.

Haswell speaks of the gemmule spicules as being "strongly curved"; in this sponge they are prevailingly straight or very slightly curved.

We call this sponge *S. botryoides* tentatively until collections can be again made in Brisbane.

Spongilla fragilis Leidy.

(Figure 2.)

Historical Statement.—This species was first described by Leidy in 1851.²² Since then it has been redescribed many times.

Weltner²³ states that the Berlin Museum possesses several fragments of this species with gemmules which originated from Murray River in southern Australia. Annandale²⁴ also records this species as occurring in Australia. Neither of them calls attention to any variations from the typical form, so we give a description of the common forms of this species found in many places over the world. We have not seen the material from Australia representing this species. Our illustration is from an American specimen.

Habitat.—*S. fragilis* grows in both running and standing and even in stagnant waters, though it seems to thrive best in still waters. It grows on stone surfaces, on timbers or similar supports, and sometimes covers comparatively large areas.

²² Leidy.—Proc. Acad. Nat. Sci., Philadelphia, 1851, p. 278.

²³ Weltner.—In Semon's Zool. Forschungsr. in Australien, v, 5, 1900 (Denkschr. Medic. Naturw. Ges. Jena, viii), p. 523.

²⁴ Annandale.—Fauna of British India—Freshwater Sponges, Hydroids and Polyzoa, 1911, p. 96.

General Characteristics.—*Spongilla fragilis* forms flat, lichenoid patches, never of very great thickness, on almost any kind of support. Cases are recorded where these patches covered as much as two or three square feet, but were not more than an inch in thickness at the centre and shaded down to very thin filmy edges. Most of the specimens we have examined are smaller and thinner than the thickest portion of the one mentioned above. We have specimens forming small patches two or three centimetres in diameter and less than a centimetre in thickness.

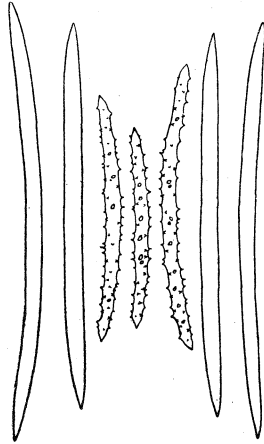


FIGURE 2.
Spongilla fragilis.
Skeleton and gemmule spicules.

The surface of the sponge is generally smooth or slightly tuberculated. The oscula are numerous and clearly visible and the confluent radiating canals often give them a star-like appearance.

Colour.—This sponge may be almost white in very clean water, or at times it is quite black as in some of our specimens. The prevailing colours are probably greyish or brownish. Some green sponges have been recorded, but those of that colour are not so abundant as is the case in *S. lacustris*.

Structure.—Vertical main skeletal fibres and horizontal transverse ones are well defined and they form a dense firm network. The amount of spongin is small and for this reason the structure can be readily crumbled.

Skeleton Spicules.—The skeleton spicules are straight or only slightly curved, rather thin, spindle-shaped, smooth and gradually and sharply pointed. They range from about 180 to 255 μ in length and from 5 to 16 μ in thickness.

Flesh Spicules.—None are present.

Gemmules.—The gemmules are abundant, arranged as a rule in a pavement layer or layers at the base of the sponge; each gemmule is enclosed in a thick cellular covering several layers thick, and they are also bound together in free groups of two, three, or more, by a common cellular covering. The foraminiferal

tubule is a simple, usually curved, tube which always projects outward through the surrounding individual gemmule coat; at times more than one tubule may be borne by a single gemmule. The gemmule spicules lie embedded in these air cell layers. The gemmules are as a rule spherical, but often under pressure their shape may become somewhat polygonal. They are small, measuring in diameter usually from 250 to 350 μ , but at times there are those which measure as much as 500 μ . The diameter varies a good deal due to the varying thickness of the air bubble cell layer.

Gemmule Spicules.—The gemmule spicules are usually straight, or slightly curved, cylindrical, or slightly tapering, blunt or abruptly pointed or often ending in a single terminal spine. They are covered all over with erect spines of varying size and these are often largest near the ends of the spicules. They range between 68 and 125 μ in length and from 3 or 4 to 8 to 10 μ in thickness.

Type.—Potts states that the type is preserved in the Academy of Natural Science, Philadelphia, U.S.A.

Distribution.—This is another cosmopolitan species. Both Weltner and Annandale record the typical form of this species from Australia, the former from Murray River and the latter from no special locality.

Remarks.—This sponge can be easily distinguished from all other species found in Australia to date by the peculiarities of the arrangement of its gemmules in small groups surrounded by a common cellular coat, and by the long, usually curved, foraminal tubes projecting through its coat to the outside.

Spongilla lacustris Linnæus.

(Figure 3.)

Historical Statement.—*Spongilla lacustris* is one of the earliest species of fresh-water sponges recorded and was included by Linnæus in his *Systema Naturæ*, Ed. 10, Vol. 2, p. 1348, in 1759.

Our authority for placing this sponge in the list of sponges from the fresh waters of Australasia is its record in Hutton's "Index Faunæ Novæ Zealandiæ", London, 1904, p. 323. He gives as his basis for this record Chilton in "New Zealand Journal of Science", Vol. I, 1883, pp. 383 and 572. We have access to the first reference, which, according to Traxler, is to *Ephydatia kakahuensis*; the one on page 572 we have not seen.²⁵ Our description is a general one and will help one in identifying this sponge if he happens to find it in Australia.

Habitat.—*S. lacustris* may grow in swiftly running streams or in quiet stagnant waters and its form is adjusted to its place of growth.

General Characteristics.—It is a very variable species and we can only give a few of its outstanding characters. "As found in infinite numbers of situations

²⁵ The complete reference on page 572 is reprinted herewith:

"A New Zealand Fresh Water Sponge.—The sponges preserved in the Canterbury Museum have lately been examined by Dr. v. Lendenfeld. Among them was a specimen of the fresh water sponge, found by me in the Kakahu River (see page 383 of this Journal). Dr. Lendenfeld finds that this is *Spongilla fluviatilis*, the fresh water sponge found in running streams in England.—C[HARLES] C[HILTON]."

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and variety of forms in North America, this sponge is green, when growing, as it does by preference, in the light: from a sessile base freely and repeatedly branching; branches cylindrical or more or less tapering; bristling with points of radiating spicules; ends of the branches pointed or rounded" (Potts).²⁶ Some specimens in our collection from Lake Kizaki, Japan, suggest a very much

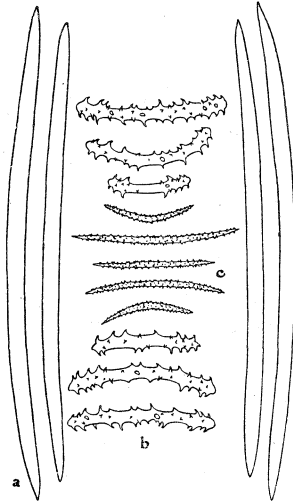


FIGURE 3.

Spongilla lacustris.

a, Skeleton spicules. b, Gemmule spicules. c, Flesh spicules.

branched deer antler in appearance. Other specimens are simple masses or clumps of small size: these are usually taken from swiftly moving waters: even these often bear short finger-like projections. Oscula are surrounded by well developed collars, moderate in size and made conspicuous by furrows which radiate from them.

Colour.—Often this sponge is green in the light; sponges growing in the shade may be greyish, yellowish or varying shades of brown.

Structure.—"Texture loose; the branching process made up of thick longitudinal lines of fasciculated spicules, united by single spicules or more slender fascicles, in a radiating manner."²⁷ These longitudinal fibres extend throughout the branches in branched specimen. The spongin is usually well developed.

Skeleton Spicules.—The skeleton spicules are slightly curved, rarely straight, smooth, thin, gradually and sharply pointed. They vary from about 200 to 330 μ in length and 6 to 15 μ in thickness.

Flesh Spicules.—The flesh spicules are small, 70 to 130 μ by 2 to 8 μ , usually slightly curved, sometimes crescent-shaped, rarely straight, more or less thickly covered with small spines. Usually they are gradually and sharply pointed,

²⁶ Potts.—Proc. Acad. Nat. Sci., Philadelphia, 1887, p. 187.

²⁷ Potts.—*Loc. cit.*, p. 187.

though sometimes those with bluntly rounded ends may be present. The number of these spicules in the parenchyma is very variable, often they are very numerous.

Gemmules.—The gemmules are spherical in shape and variable in size, from 500 to 800 μ in diameter; most of those we have measured are between 500 and 600 μ in diameter, but were without the granular coat. They are scattered throughout the entire skeleton and lie freely in its reticulations. They are usually covered with a thick granular coat in which the spicules are placed more or less tangentially; this coat varies much in thickness and at times may be altogether lacking. There is no projecting pore-tube, but its place may be taken by "an open, bowl-shaped chitinous structure the base of which is in continuity with the inner chitinous coat of the gemmule".

Gemmule Spicules.—"Gemmule-spicules resembling the flesh-spicules but are shorter, and as a rule more strongly curved, sometimes bent so as to form semicircular figures, usually pointed somewhat abruptly; their spines are relatively longer than those of the flesh-spicules, often curved backwards, especially near the ends of the spicules, at which points they are often longer than elsewhere."²⁸ They vary from 80 to 130 μ in length and from 3 to 10 μ in thickness.

Type.—No recognized type of this species is in existence. It has been described many times by many authors and in many languages.

Distribution.—In range it is practically cosmopolitan and is one of the commonest species. Its occurrence in Australasia needs confirmation, since it is not at all certain that it has been found there.

? *Spongilla lacustris* var. *sphærica* Lendenfeld, 1887.

(Figure 4.)

Historical Statement.—In 1887 Lendenfeld described²⁹ a sponge from near Cobar copper works in New South Wales as a new variety of *S. lacustris* and designated it as variety *sphærica*.

He found no gemmules and his identification of the variety has been called into question. In order to make our record as complete as possible and to make available to future students of Australia's fresh-water sponges all previous records, we will give what is known of this sponge.

The following description is based upon Lendenfeld's original description and upon our observations upon three of Weltner's slides, marked as this variety, from the University Zoological Museum of Berlin.

Habitat.—Lendenfeld states that he found this sponge among large quantities of smaller specimens, on a *Chara* plant in a pool of slightly brackish water, rich in magnesia, which at times became altogether dry. After years of drought it was filled after a heavy rainfall and remained with water in it for a period

²⁸ Annandale.—Fauna of British India.—Freshwater Sponges, Hydroids and Polyzoa, 1911, p. 70.

²⁹ Lendenfeld.—Zool. Jahrb., ii, 1887, p. 90.

of about six months to a year. The region where these pools were found was not a part of the river bed. Within this flat area the centre of each pool is its deepest part. This sponge was found a month after a heavy rainfall, which occurred after an absolute drought of three years.

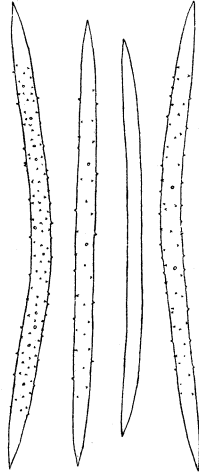


FIGURE 4.
Spongilla lacustris var. *sphaerica*.
Skeleton spicules.

General Characteristics.—The sponges are round or oval and are without prolongations. The largest specimens are oval and are from 15 to 20 mm. in diameter.

Structure.—The skeleton is composed of the usual spicule bundles or single spicules.

Skeleton Spicules.—Lendenfeld states that the skeleton spicules are spindle-shaped, slightly spined, gradually pointed and about 180 μ in length; their thickness in the centre is 8.6 μ . The spines have a much wider base than is usual on the spicules and are not very sharply pointed; they reach a length which is equal to about one-fourth of the thickness of the spicule.

Through the kindness of Dr. Arndt I have been able to examine three of Weltner's slides labelled *Spongilla lacustris* var. *sphaerica*. These slides contain only the skeleton spicules, a very careful search not revealing even one flesh spicule characteristic of *S. lacustris*. Weltner also failed to find them. The skeleton spicules on these slides are slightly curved and usually thickly covered with small spines except near their sharpened tips. The type of point at the ends of the spicules varies; some taper gradually from the centre to very sharp points at their ends, others are more cylindrical, tapering only slightly, but near the ends abruptly become sharp-pointed. These spicules also measure much larger in every way than those recorded by Lendenfeld, for they vary from 239 to 323 μ in length and 8 to 14 μ in thickness, averaging around 280 to 290 μ in length and 9 to 11 μ in diameter. With these larger spicules are found

numerous small, slender, smooth, very sharply pointed spicules which we consider the young skeleton spicules.

These spicules closely resemble those of other Australian sponges.

Flesh Spicules.—Lendenfeld describes the flesh spicules of a typical *S. lacustris* as being slender, spindle-shaped, spiny throughout and gradually pointed. He adds concerning these spicules of his variety *sphaerica* that flesh spicules of varying dimensions were observed, but that they were rare. I could find none in the three of Weltner's slides examined.

Gemmules.—No gemmules were found, consequently the final determination of the variety is doubtful.

Type.—The Berlin Museum contains some of the original material, but not the type. We can find no reference to the location of the type, and it would be most helpful to have further collections of sponges bearing gemmules from the type locality in order to settle the question of this sponge's claim to stand as a variety.

Distribution.—Up to date it is reported only from the original locality in a temporary pond in the neighbourhood of the Cobar copper works in the interior of New South Wales.

Remarks.—The identity of this sponge remains very doubtful. Weltner³⁰ states that the identification is very uncertain so long as no gemmules have been found. He also says that he has studied three of the specimens of the original material and failed to find any flesh spicules. He even questions whether this is a *Spongilla* at all. We have also been unable to find any flesh spicules and question the determination made by Lendenfeld. We think it quite likely that these spicules may belong to an entirely distinct sponge, even of another genus.

Spongilla sceptroides Haswell, 1882.

(Figures 5-6.)

Historical Statement.—About 1880 Haswell first found a fresh-water sponge in a pond near Brisbane and sent a note describing this to the Linnean Society of New South Wales, but, hoping to secure additional material, he later withdrew his note from publication, and it was not until 1882³¹ that he published his description of the above-named species.

Lendenfeld again described³² this species, but adds little to the original description. Whitelegge³³ records it in 1889 from a new locality, Port Jackson. Traxler³⁴ records finding the spicules of this species in the diatomaceous earth deposits of Geelong, Victoria. Annandale³⁵ redescribed a sponge from the U.S. National Museum collection, which he considered to be this species.

³⁰ Weltner.—Archiv für Naturg., i, 1895, p. 119.

³¹ Haswell.—Proc. Linn. Soc. N.S.W., vii, 1882, p. 209.

³² Lendenfeld.—Zool. Jahrb., ii, 1887, p. 89.

³³ Whitelegge.—Journ. and Proc. Roy. Soc. N.S.W., xxiii, 1889, p. 306.

³⁴ Traxler.—Földtani Közlöny, xxxvi, 1896, p. 97.

³⁵ Annandale.—U.S. National Museum, Proceedings, xxxvi, 1909, pp. 627-629.

Through the kindness of the Australian Museum we have been privileged to examine the type of this species, but it bears no gemmules, so we have only been able to study the skeleton spicules. The U.S. National Museum has kindly given us a small bit of the material (No. 53930) described by Annandale from its collection as *S. sceptroides*. Our illustrations are from this specimen. In our description which follows we give our conclusions from these studies.

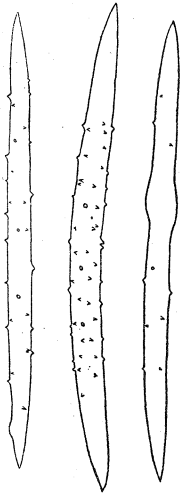


FIGURE 5.
Spongilla sceptroides.
Skeleton spicules.

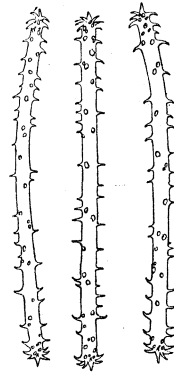


FIGURE 6.
Spongilla sceptroides.
Gemmule spicules.

Habitat.—The type is a very small bit which was growing on a water plant. Haswell records that he found this sponge growing on submerged branches and twigs in a pond. Annandale says that the specimen he examined formed a mass coating a piece of stick. A second specimen from the Australian Museum marked as belonging to this species was similar to the type in that it formed very small, thin growths on a similar water plant; it was also, unfortunately, without gemmules.

General Characteristics.—"Encrusting, smooth, moderately elastic, not crumbling."³⁶ The sponge examined by Annandale was an "irregular mass, some 10.5 cm. long and 2 cm. thick. . . . The surface so far as it remains, is smooth, with fairly large oscula (about 3 mm. in diameter), which are not raised on eminences".

Colour.—Haswell and Whitelegge record their specimens as being green in colour. The dry specimen in the U.S. National Museum is a pale grey in colour. The alcoholic specimens from the Australian Museum are almost colourless, being only slightly tinged with a very pale brown.

Structure.—The type is too small a bit to show much definite structure, but both it and the other Australian Museum specimen seem to be made up of an

³⁶ Haswell.—*Loc. cit.*

irregular mass of meshes loosely woven together; no long or continuous rays are apparent. The specimen examined by Annandale he describes as follows: "The substance of the sponge is compact, the primary radiating fibers, but not the secondary transverse ones, being visible in vertical section to the naked eye as slender white threads."

Skeleton Spicules.—"Skeleton spicules very slightly curved, fusiform, acute at both ends, ornamented with scattered minute projecting points which only become visible under a fairly high power" (Haswell). Lendenfeld concludes from this that the skeleton spicules are cylindrical and suddenly pointed. They measure $250\ \mu$ long by $10\ \mu$ thick.

Annandale says: "The largest skeleton spicules measure $350\ \mu$ by $21\ \mu$. They are straight or feebly curved and are covered with extremely minute projections in the central part of their length, the ends, which are sharply and cleanly pointed, being smooth. The projections are so minute that it is often difficult to see them. They are conical in outline, somewhat broad at the base in comparison with their length, and are rarely sufficiently numerous to give the spicule a roughened look under a low power of the microscope."

We find that the skeleton spicules from the type specimen are usually fusiform, tapering gradually from the centre to sharp-pointed ends; some of them are more uniform in thickness until near the ends, and become more abruptly sharp pointed. Sometimes they have a bulb-like enlargement in the centre. They are covered with very fine spines except near the sharpened ends, where they are invariably smooth. The number of spines varies considerably, some spicules bearing many more than others. A number of smaller spicules, which we consider to be immature, are found in our preparations. These slides contain two sizes of spicules, the larger ones measuring from 271 to $315\ \mu$ long and have a thickness of from 9 to $16\ \mu$. The smaller ones range from 194 to $216\ \mu$ in length and are around 8 to $10\ \mu$ in thickness. The spicules of the type and of the other Australian Museum specimen are very similar.

The skeleton spicules of the U.S. National Museum specimen as compared with the type are considerably thicker, measuring from 18 to $24\ \mu$, and have fewer but larger spines. They are also less curved and are often straight. They measure from about 264 to over $300\ \mu$ in length.

Flesh Spicules.—No flesh spicules were observed in this sponge.

Gemmules.—The gemmules are spherical. Annandale states that the gemmules in the specimen examined by him were practically colourless and numerous throughout the sponge. "In general structure they closely resemble those of *Spongilla lacustris*. They are spherical and measure on an average $520\ \mu$ in diameter. There is a thick granular coat, in which the spicules are arranged close together and tangentially, while an outer layer of horizontal spicules can be detected on the surfaces of some gemmules. The aperture of the gemmule, which is single, is provided with a stout foraminal tubule, which is generally more or less curved and projects through the granular coat."

Our examination of the gemmules in the specimen from the U.S. National Museum gives us the following results. They are dark brown in colour, spherical in shape, varying from $484\ \mu$ to $582\ \mu$ in diameter, the larger number measuring

around 540 μ . There is no very regular arrangement of the gemmule spicules in the granular layer around the gemmule; in addition to the positions described by Annandale we find numbers of them standing either perpendicular to the surface of the gemmule or inclined at an angle to it. In one gemmule we find the straight pore-tube projecting slightly beyond the surface of the granular coat, but this gemmule seems to have the granular portion somewhat worn away by handling.

Gemmule Spicules.—The gemmule spicules, according to Haswell, are long, slender, straight and cylindrical. They are armed with numerous acute spicules, chiefly aggregated round the extremities, where they form distinct heads, the intermediate shaft having but two or three very small spinules.

“The gemmule spicules”, of the U.S. National Museum specimen, “measure from 126 μ to 147 μ in length. They are slender in proportion (transverse diameter about 4.2 μ) and straight or feebly curved. The spines which cover them with fair uniformity are about half as long as the spicule is thick; those in the middle are straight, those at either end curved and directed backward. As a rule the spicule terminates at either end in a single straight spine.” Those illustrated by Traxler and assigned to this species lack the terminal spine, and the two are somewhat differently spined.

Our observations of the skeleton spicules agree in most details with those by Annandale. We find them to vary between 118 and 134 μ in length and 3.5 to 5 μ in thickness. In most of them, however, the spines are more thickly crowded near the ends, though the central portion of the spicule is never entirely free of spines.

Type.—The gemmuleless “type” of the species is preserved in the Australian Museum in Sydney, Australia. This specimen is labelled as coming from the Lillesmere Lagoon, Lower Burdekin River, whereas the type should be Haswell’s specimen from Brisbane.

Distribution.—If we consider all the forms referred to above as belonging to this species, then it has been found in the following localities. Queensland: in a pond near Brisbane (Haswell); U.S. National Museum also possesses a specimen from this State. New South Wales: water reserve off Bunnerong Road (near Sydney). Victoria: Geelong (Traxler).

The “type” is marked “Lillesmere Lagoon, Lower Burdekin River, Queensland”.

Remarks.—Annandale states that it is a close ally of *S. lacustris*, but that it can be distinguished from that sponge by the absence of flesh spicules and by the “armature of the aperture of the gemmule”. It can be distinguished from *S. proliferens* by its “more compact and massive structure” and by its lack of flesh spicules.

We follow Annandale in assigning this sponge to the species *S. sceptroides* until further sponges are available from that region. We confess, however, that we do so with grave doubts, and that we cannot reconcile Haswell’s statement that there are only two or three very fine spines in the middle of the shaft. In our specimens the spines are numerous in that portion of the shaft.

Ephydatia capewelli (Bowerbank), 1863.
(*Spongilla capewelli* Bowerbank, 1863.)

(Figures 7-8.)

Historical Statement.—This sponge was first described and illustrated by Bowerbank³⁷ as *Spongilla capewelli* from specimens collected from Lake Hindmarsh, Victoria, by E. P. Capewell. Carter described³⁸ it again, and Lendenfeld³⁹ further recorded it.

Habitat.—The specimen from which the original description was made was: "7½ inches long and 3 inches in greatest diameter, surrounding in a very irregular manner a small twig of wood not a quarter of an inch in diameter, and from which it projects in large tuberiform masses". It was collected upon the shores of the lake. Mr. Capewell writes: "In the winter season, about June, the weather being very tempestuous, the lake becomes greatly agitated, and the roll and swell is so great that at times a small boat can scarcely live upon the surface. It is

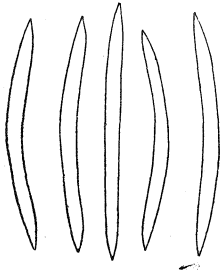


FIGURE 7.
Skeleton spicules.
Ephydatia capewelli.

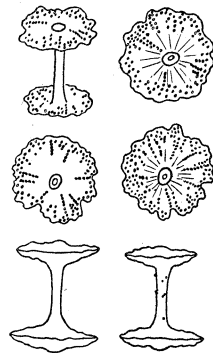


FIGURE 8.
Ephydatia capewelli.
Gemmule spicules.

after one of these storms that, by searching along the shores, one may obtain specimens. I have searched well for it among the reeds and upon the branches of the trees pendant in the water, but did not succeed in finding them in those situations, and my impression has always been that it coated dead branches of trees that had fallen some depth in the water."

General Characteristics.—"Sponge massive, sessile; surface uneven, often lobular, smooth. Oscula simple, minute, dispersed. Pores inconspicuous. Dermal membrane pellucid, aspiculous." I have not seen a large enough specimen of this sponge to form any idea as to its general form.

Colour.—"Colour dull green with a tint of yellow." A small dry bit of a cotype of this sponge kindly given me by Dr. Arndt of the Berlin Zoological Museum is a dirty light-brown in colour.

³⁷ Bowerbank.—Proceedings Zoological Society, London, 1863, pp. 447-448.

³⁸ Carter.—Ann. Mag. Nat. Hist., (5), viii, 1881, pp. 93-94.

³⁹ Lendenfeld.—Zoolog. Jahrb., ii, 1887, p. 93.

Structure.—"Soft and crumbly." Our small specimen shows an irregular network made up in the main of thin meshes bounded by one, two or three spicules, but with here and there thicker vertical fibres consisting of from four to six spicules. The amount of spongin is small.

Skeleton Spicules.—The skeleton spicules are usually curved, smooth, of almost a uniform diameter until near their ends, where they become abruptly and bluntly pointed. They vary a good deal in length and in diameter. Rare ones are slightly enlarged in the centre. They measure from about 272 to 323 μ in length, averaging around 285 μ . The thinner ones are as little as 12 μ in diameter, while the thickest may measure 20 μ . The average is around 16 to 18 μ .

Flesh Spicules.—No flesh spicules are present in this species.

Gemmules.—The gemmules are somewhat yellowish in colour when dry and are crowded together in the basal portion of the sponge; they are spherical in shape, but when dry often somewhat flattened. The surface is regular and smooth. The pore tube is simple and has a circular opening even with the surface of the outer protective layer of the gemmule. The gemmule is covered with a single layer of densely crowded birotulates and large numbers of the skeleton spicules are closely attached to this thick, outer, granular layer of the gemmule. We measured three gemmules and found them to be 619 μ , 697 μ and 731 μ respectively, in diameter.

Gemmule Spicules.—The birotulate spicules have a straight, usually smooth shaft, which is sometimes slightly inflated in the centre, forming a small bulb. The disks are at times about equal in diameter, though most of them have the outer disk very slightly smaller than the inner one. The margins of the rotules are "irregularly crenulo-denticulate", the indentations being as a rule only shallow ones, though sometimes deeper ones are present. Over the surface of the rotule are small granulations thickly scattered, especially around the outer edges of the disk, frequently forming radial rows extending toward the centre of the disk.

Bowerbank says that the shaft is "incipiently spinous"; our preparations from a cotype have smooth shafts with only very rarely any roughness at all upon them. The length of the birotulates varies from about 22 to 34 μ , with an average length of around 28 μ . The rotules vary from 20 to 28 μ in diameter, with the outer one often 2 to 4 μ smaller than the other.

Type.—The type of the species is preserved in the British Museum (Natural History). We have a small cotype in our collection.

Distribution.—This sponge is known from its original locality, Lake Hindmarsh, lat. 35° 30' S., long. 141° 40' E., Victoria, and is also reported by Chapman in 1922 from Tintenbar, Richmond River, N.S.W., as having been found in opal nodules. Doubtless a thorough exploration of the country would reveal its presence in other localities. Only very little work has as yet been done upon this very interesting group of animals from Australia.

Ephydatia fluviatilis auct.

(Figures 9–11.)

Historical Statement.—It is somewhat uncertain who is the author of this species, but it is probable that Linnæus first gave it its name *fluviatilis* in 1759 as

Spongilla fluviatilis.⁴⁰ Many good descriptions and illustrations of this common species are now available in more recent literature.

Chilton informed Traxler that his sponge from Kakahu River, New Zealand, had been identified by Lendenfeld as identical with *E. fluviatilis*, but Traxler found it so different from that species that he gave it a new name, *E. kakahuensis*.

Our record of the occurrence of this species in Australia is due to Traxler,⁴¹ who found spicules of it in the diatomaceous earth at Geelong, Victoria.

In addition to the record of the Australia findings by Traxler we have been able to examine a specimen from the Australian Museum marked as the "type of *E. haswelli*, Lendenfeld". This last is clearly *E. fluviatilis*. We can find no reference anywhere in the available literature to a description of any such sponge as *E. haswelli* Lendenfeld! It must, therefore, be simply an error in the naming of the specimen. We also add tentatively the specimen from Woronora River to this species.

Our description is a general one for the species.

Habitat.—This sponge grows under very different conditions; it may be found in stagnant or in flowing water and in a few cases it has even been found in brackish water. It is one of the most common and most conspicuous forms.

General Characteristics.—The conditions under which this sponge grows have a very decided influence upon its general form and appearance. In rapidly flowing water the colonies become crust-like, while in still or slowly flowing waters larger and thicker masses are formed. In China we have seen masses 10 or 12 cm. at the base and as high as 15 cm. growing attached to a stone in a stagnant pond. In one slowly flowing stream it formed masses with a diameter of 30 to 40 cm. and a thickness in the centre of 8 to 10 cm., gradually becoming thinner toward the outer edges of the colony. At other times we have found it forming small, soft masses of irregular shape growing on water weeds. The surface is rarely smooth, it more often has irregular elevations and depressions and may at times bear lumps or rounded projections. It rarely forms long branches.

Colour.—The colour is as variable as the structure. When living in the light it may be green, due to the presence of a green alga; when it grows in shaded or dark places it is usually yellow to brown, white or a dirty-white in colour. The Australian specimen is a light brown in colour.

Structure.—In our Soochow, China, forms there are distinct radiating fibres which often send off smaller fan-shaped fibres in the upper portion of the sponge. The transverse fibres are also present, but are not so well defined. The whole mass is quite firm, but is fragile and readily crumbles to a powder under pressure, since the amount of spongin present is comparatively small. Bladder cells are lacking in the parenchyma of this sponge.

In the Australian specimen the radiating fibres are strong and clearly defined, and are knit together at intervals by the transverse connections, which do not seem to be regular enough to be defined as fibres. The entire structure

⁴⁰ Linnæus.—Systema Naturæ, edit. x, ii, 1759, p. 1348.

⁴¹ Traxler.—Földtani Közlöny, xxvi, 1896, pp. 96-97.

is held together by only small amounts of spongin and the thin section under the microscope is quite transparent.

Skeleton Spicules.—The common skeleton spicules are generally slightly curved, rarely straight, smooth, slender, gradually and sharply pointed, rarely abruptly pointed. These spicules vary a great deal, however, and short, thick, smooth spicules, or even at times slightly roughened or spined spicules may be present. Arndt states that they range from 180 to 550 μ in length and from 3 to 20 μ in thickness, but that they generally average between 250 to 370 μ in length and around 15 μ in maximum diameter.

The Australian Museum specimen, marked as the type of *E. haswelli*, has gently curved, smooth, spindle-shaped spicules, which are often comparatively thick in the centre. They are always sharp pointed, but sometimes rather abruptly sharpened. They vary in length from 238 to 331 μ and average around 300 μ long. In thickness they range from 14 to 22 μ and average around 16 or 17 μ .

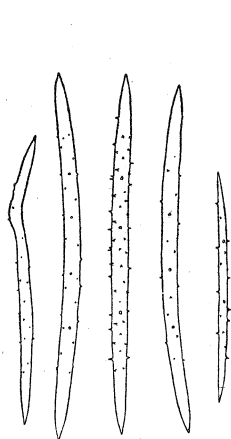


FIGURE 9.
Ephydatia fluviatilis.
Skeleton spicules.

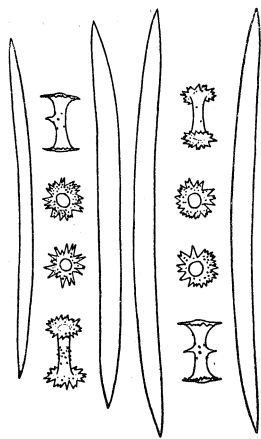


FIGURE 10.
Ephydatia fluviatilis.
Skeleton and gemmule spicules.

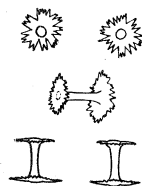


FIGURE 11.
Ephydatia fluviatilis.
Gemmule spicules.

Flesh Spicules.—There are no flesh spicules present in this species.

Gemmules.—In some cases the gemmules are scattered throughout the entire sponge, at other times they are crowded in large numbers at the base of the sponge, and in a few cases we have found small masses of them crowded together in a very small area up inside near the centre of the sponge. The gemmules are spherical in shape, have a simple pore tube opening on the upper surface of the bubble cell layer which covers it, and are, when mature, covered by an outer cuticle. They are usually covered by a single layer of perpendicularly arranged birotulates.

In the Australian Museum specimen the gemmules are very abundant, scattered throughout the sponge, are yellowish-brown in colour, and are covered by a single layer of crowded birotulates. They vary from 340 to 442 μ in diameter. They are quite irregular in shape, for, while the prevailing shape is spherical, there

are many flattened gemmules and in a few instances they are so elongated that they become ellipsoidal.

Gemmule Spicules.—The rotules are flat, incised at their borders, either forming small, sharp teeth of nearly equal size, or they may be cut by deeper incisions into larger sectors, which in turn bear upon them smaller and shallower serrations; both of these forms may be found in the same sponge. The teeth are rarely less than twenty in number. In some sponges the rotules are much more deeply incised and form fewer and larger teeth. The rotules vary from 10 to 20 μ in diameter. The shaft is usually smooth, but frequently those with large spines are found. The length of the shaft varies considerably, from 20 to 27 μ , and may, in some sponges, be as much as twice as long as the diameter of the rotule. The shaft is also very variable in thickness, being sometimes very thin, at other times much thicker.

The shaft of the Australian Museum specimen is usually slightly constricted in the centre and becomes larger at each end where it joins the rotule. In most cases the shaft is roughened in the middle area by very minute spines and sometimes it may bear one or more large spines, which at times become almost equal in length to the radius of the rotule. The spicules are of about the same length, varying from 20 to 22 μ . The rotules are shallowly incised, forming sharp teeth.

The rotule varies from 14 to 16 μ in diameter.

Type.—The type is unknown.

Distribution.—This is a very widely distributed species, and has been found in most places over the globe where fresh-water sponges have been studied. No definite location is given for the "*E. haswelli*" from the Australian Museum; it is numbered 333 and marked "Australia" and bears the initials "R.V.L.". Traxler's sponge spicules were found at Geelong, Victoria.

We have a small bit of a sponge (No. 53727) from the Australian Museum with the following notes: "From the side of a boulder in a fresh-water stream at the headquarters of the Woronora River (a tributary of the George's River flowing into Botany Bay), N.S. Wales. Colour in life dark green. The specimens were scraped from a colony of about two square feet. The branching portions of the colony arose from an adhesive flat layer of sponge which entirely covered one portion of the rock anchorage." This sponge was collected by A. A. Livingstone on December 20, 1925.

Unfortunately this specimen contained no gemmules and we were inclined to place it with *E. nigra* on account of the close resemblance in every respect of the skeletal spicules, but after searching carefully through several slides we found a few gemmule spicules, which we illustrate herewith, and these cause us to place this specimen with *E. fluviatilis* for the present. It may, of course, have happened that the few gemmule spicules were introduced from some other source and that this specimen belongs to another species. We hope Mr. Livingstone will collect additional specimens at the same locality when the sponge is bearing gemmules.

E. fluviatilis is a very variable species, as is well shown by the two illustrations given herewith.

Ephydatia kakahuensis Traxler, 1896.

(Figures 12-14.)

Historical Statement.—This sponge was first found by Charles Chilton⁴² in Kakahu River, about six miles west of Temuku, New Zealand. It was described and fully illustrated by Traxler⁴³ in 1896. The same species was also later collected by H. Hill in Lake Taupo, New Zealand, and this find was recorded by Kirkpatrick.⁴⁴

We have two specimens kindly sent us by the Australian Museum of Sydney and marked "*Spongilla*" and one marked "*Ephydatia fluviatilis*" which we believe to be this species, though there are no gemmules present in any of them, and this fact makes positive identification impossible. Two of these were collected by Thos. Steel in Lake Takapuna, Auckland, New Zealand, and the third from a creek near Invercargill, New Zealand. Dr. Arndt has kindly loaned us a slide from the cotype of this species. Our description is based upon Traxler's original one, checked with the materials we have in hand.

Habitat.—The original specimens were collected adhering to sticks or stones in a shallow running stream; one of our bits was taken from a creek, while the others were all taken in lakes. This form seems to grow in either running or still water. Kirkpatrick states that the specimens sent him from Lake Taupo were thoroughly permeated with fine sand.

General Characteristics.—Traxler states that, while we have very little information concerning the form of this sponge, yet it seems to form a crust upon its support and that it has a rather smooth surface, disturbed here and there by the projection of prominent bundles of skeleton spicules.

Kirkpatrick says concerning the specimens sent him: "The specimens had been stranded after a gale. They are about an inch in area and an inch high. Some specimens form thin flat crusts without visible oscules, others are conical, with one large oscule, and others, again, are irregular and meandrine." Chilton stated that: "On stones they formed irregular circular incrustations of a distinct green colour, with the surface tolerably smooth. On the sticks, which were all small, they formed similar masses, sometimes circling right round the sticks."

The small bits in our collection have smooth, irregular surfaces and one piece bears a large osculum opening at the top of a chimney-like structure extending fully one centimetre above the surface of the sponge.

Colour.—The colour is "yellowish-brown in alcohol". Our Lake Takapuna specimens are a very light brown and were evidently taken in very clean water. The bit from the creek is a darker, dirtier brown and contains more sediment than the lake specimen.

Structure.—The texture of the sponge is firm, and even in small bits it can be seen that the entire structure contains numerous comparatively large canals. No very definite main or transverse fibres can be distinguished, since the sponge

⁴² Chilton.—New Zealand Journ. Sci., i, 8, 1883, pp. 383-384. (See also footnote 25, page 33.—Editor, RECORDS OF THE AUSTRALIAN MUSEUM.)

⁴³ Traxler.—Termesztudományi Füzetek, xix, 1, 1896, pp. 102-104.

⁴⁴ Kirkpatrick.—Ann. Mag. Nat. Hist., (9), viii, 1921, pp. 400-401.

is made up of irregular meshes with very thin connections. The amount of spongin is very small.

Skeleton Spicules.—The skeleton spicules are gently curved, rarely straight, cylindrical and of almost uniform diameter until near the ends, where they become abruptly but sharply pointed. They are thickly covered, except on the pointed ends, with small spines rather evenly distributed over the entire surface.

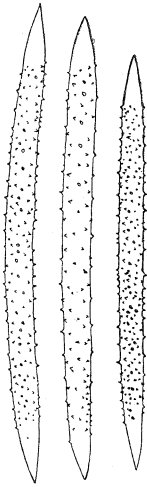


FIGURE 12.
Ephedatia kakahuensis.
Skeleton spicules.

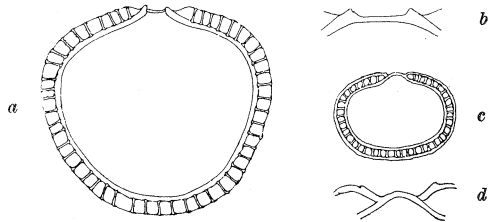


FIGURE 13.
Ephedatia kakahuensis.
a-b, cross-sections through spicule; *c-d*, cross-sections through gemmule of *E. fluviatilis* (after Traxler).

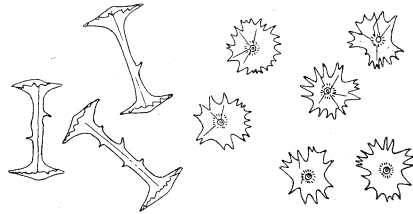


FIGURE 14.
Ephedatia kakahuensis.
Gemmule spicules (after Traxler).

Traxler found them to vary in length from 203-244 μ and in thickness from 8-12 μ . Our measurements of the specimens examined give the following results:

Cotype.	Long.	Thick.	
No. 53711 ..	204 - 255 μ ..	12 - 16 μ ..	Invercargill, New Zealand
No. 53730 ..	153 - 187 μ ..	9 - 14 μ ..	Lake Takapuna, New Zealand
No. 53731 ..	170 - 188 μ ..	8 - 12 μ ..	Lake Takapuna, New Zealand
No. 54599 ..	170 - 194 μ ..	8 - 13 μ ..	(Indian Mus.) New Zealand

Flesh Spicules.—No flesh spicules are present in this sponge.

Gemmules.—As we have not had access to the gemmules of this sponge we give the substance of Traxler's description of them and the amphidisks.

The gemmules are scattered throughout the meshes of the sponge. They are approximately spherical and have a diameter of 600 μ . The very small air cell layer is 30 to 40 μ in thickness and has no chitinous membrane covering it. The funnel-shaped rim of the pore-tube is smaller than is generally the case in most fresh-water sponges. The air cell layer contains a single layer of amphidisks arranged radially with their proximal disks embedded in the inner chitinous membrane.

Gemmule Spicules.—The disks of the birotulate gemmule spicules are scalloped, the indentations between the scalloped spaces being often equal to half the radius of the disk. The number of pointed projections (teeth) is from 15 to 22. The diameter of the disks varies from 16 to 24 μ , with an average of about 20 μ . The shaft is usually smooth, thick, and often has a bulb-shaped thickening in the middle. Now and then the shaft is supplied with large spines. The length of the amphidisk is from 28 to 45 μ and the thickness of the shaft is 2 to 3 μ .

Type.—We do not know the location of the type of this species, but the Berlin Zoological Museum has a cotype slide which was kindly loaned to us for examination.

Distribution.—Chilton's specimens were taken from Kakahu River, Canterbury, South Island, New Zealand.

Hill's specimens were collected on the north shore of Lake Taupo, North Island, New Zealand. Lake Taupo "is 1,210 feet above sea-level, has an area of 140 square miles and a depth of 300 to 530 feet".

Steel's specimens were collected in Lake Takapuna, near Auckland, New Zealand. Another small bit from a creek near Invercargill, N.Z. (the collector's name is not recorded) is doubtless this same species.

Remarks.—Traxler differentiates *E. kakahuensis* from *E. fluviatilis* by the following characters:

1. The amphidisks of *E. fluviatilis* are more closely crowded around the gemmule.
 2. The disks of *E. fluviatilis* seldom reach 25 μ in diameter.
 3. The skeleton spicules of *E. fluviatilis* are 200–400 μ long, usually smooth, and, even when spines are present, the general appearance of the spicule is different from that of *E. kakahuensis*.
 4. The diameter of the gemmule of *E. fluviatilis* is from 300 to 350 μ .
- describe the material which we have in hand at present, and which we consider
5. The pore-tubes of the two species are also different.

He also calls attention to the following points in comparing *E. kakahuensis* with *E. ramsayi*.

1. The skeleton spicules of the two are almost identical.
2. The shafts of the amphidisks of *E. ramsayi* are shorter and thicker than those of *E. kakahuensis*.
3. The gemmules of *E. ramsayi* are of a stronger build and have a smaller diameter than those of *E. kakahuensis*.

Ephydatia lendenfeldi Traxler.

(Figures 15–16.)

Historical Statement.—While examining the alluvial diatomaceous earth of Geelong, Victoria, Traxler found among other sponge spicules thirty large amphidisks which he holds to be those of a new sponge for this region, and which he names *Ephydatia lendenfeldi*.⁴⁵

⁴⁵ Traxler.—Földtani Közlöny, xxvi, 1896, pp. 95–97, pl. iii.

Through the kindness of the Australian Museum we have a small bit of a sponge from the Nowra Reservoir, Cambewarra Mountains, New South Wales, which we consider to be the existing form of Traxler's subfossil *E. lendenfeldi*. Since Traxler's description was based upon such limited material we will fully describe the material which we have in hand at present, and which we consider to represent this species.

Habitat.—Our small specimen was found "growing amongst stems of *Plumatella*" in the Nowra Reservoir.

General Characteristics.—The specimen we have is too small to give us any definite idea of the habit of growth of the sponge. The small bits give no indication whatever of the size or extent of the sponge and the note accompanying it simply gives the locality from which it was collected.

Colour.—The specimen is light brown in colour.

Structure.—The sponge seems to be made up of irregular meshes without any very definite radial or transverse rays. These meshes have sides of about the length of the skeleton spicules.

Skeleton Spicules.—The skeleton spicules are generally slightly curved, rarely straight, covered, except near their ends, with small spines. The spines vary a great deal in number; at times spicules may be found which are almost free of

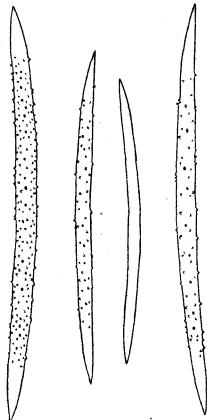


FIGURE 15.
Ephydatia lendenfeldi.
Skeleton spicules.

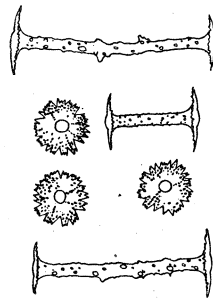


FIGURE 16.
Ephydatia lendenfeldi.
Gemmule spicules.

them, while others may be very thickly covered with them. Some of the spicules are typically spindle-shaped, being thickest in the centre and gradually tapering from that point to very fine points at the ends; in spicules of this kind the spines are more crowded at the centre and often the ends are entirely smooth. The other skeleton spicules, which are much more numerous, are also thickest at the centre, but taper very gradually to near the ends, where they abruptly become sharp-pointed; some of the smaller ones are more cylindrical, becoming abruptly pointed. These spicules vary a good deal in length, from about 287 μ to 382 μ , the

average being around 340 to 360 μ . They are from 10 to 19 μ in thickness, the average being around 13 to 15 μ .

Gemmules.—The gemmules are light brown in colour, spherical in shape, flattened a bit when dry, are not bound together as in *S. fragilis*, though they are crowded into groups, not in layers, in the basal portion of the sponge. They seem to be very numerous, as our small specimen bears a comparatively large number of them. They are covered by a single layer of gemmule spicules of varying lengths, arranged perpendicularly to the surface of the gemmule, and embedded in a granular coat covering the whole structure. The pore-tube is simple and has a circular opening just below the outer surface of the granular layer. The gemmules vary somewhat in diameter, from around 493 μ to 561 μ .

Gemmule Spicules.—The gemmule spicules are also very variable in length; some of them are quite short, measuring only about 30 μ in length, while the longest ones are as much as 80 μ long. Lendenfeld's measurements ranged from 35 to 73 μ in length, so our form corresponds very closely in this respect with the one studied by him.

The cylindrical shaft of the spicules is roughened by granules or very fine spines; only an occasional shaft bears one or two long spines. While the shaft is straight in the larger number of cases, yet very often, especially in the longer forms, it is slightly curved.

We find that in most cases the outer and inner rotules differ a little in diameter; this is especially true in the shorter, straight-shafted spicules. The longer shafted ones seem to bear more nearly equal rotules, but here, too, are sometimes found inequalities in size.

The rotules are flat and bear numerous very fine, shallow indentations with very sharp teeth; at times there may be larger lobes made by larger shallow incisions and these lobes bear the fine teeth. The surface of the rotules is covered, especially near the outer edges, with very fine granulations, and these often extend in radial lines from the base of the shaft to the outer edges of the rotule. We find the smaller rotules to vary from 17 to 22 μ in diameter, while the larger ones are from 20 to 24 μ across.

Type.—Lendenfeld does not record the location of the type.

Distribution.—This species was originally described as subfossil from the diatomaceous earth of Geelong, Victoria. Our specimen was collected by Dr. F. A. Rodway in the Nowra Reservoir in the Cambewarra Mountains, New South Wales. If we are correct in our determination of this form it is still to be found as a living form, and it is so similar in all respects to the one described by Lendenfeld that we do not feel justified, without examining his type, in even making it a variety of his species.

Remarks.—There are two other sponges which we would place in this species for the present. One is a very small specimen from Waneroo Lake, near Perth, Western Australia, kindly sent to us by Professor G. E. Nicholls. The specimen was collected on April 7, 1923.

The other is a small specimen, torn into small bits, collected by Mr. D. N. Johns from a water pipe connected with a pump at Ungarie, New South Wales. This specimen was sent to the Australian Museum by Mr. E. Cheel, of the Botanic Gardens, Sydney, with a letter dated April 15, 1928.

Ephydatia multidentata (Weltner), 1895.

(Figures 17–18.)

Historical Statement.—Weltner first described this species in his “Spongillidenstudien III.”⁴⁶ The sponge had been collected by Semon in the Burnett River in Queensland, Australia, and was first placed in the genus *Tubella* by Weltner, but, writing later,⁴⁷ he redescribes this species in much detail and gives as his reason for changing its generic classification from *Tubella* to *Ephydatia* that there is so little difference in the size of the rotules. We follow Weltner’s very full description.

Habitat.—From the appearance of the under portion of the sponge Weltner judged that it had been taken from the surface of a piece of wood which was covered by the water of the river.

General Characteristics.—Weltner had only two small pieces of the sponge which measured about five and a half centimetres long and about one-half centimetre thick. He says that the upper surface of his specimens was uneven and contained a number of small and larger holes. The larger ones were considered to be excurrent oscula, while the smaller ones were thought to be the canals through which the water entered the sponge. The bubble cells so characteristic of *E. mulleri* are also common in this sponge.

The small bit of this sponge kindly given us by the Australian Museum contains one large osculum opening on an apparently smooth surface.

Colour.—The specimens examined by Weltner were described as “yellowish and dark grey” in colour. Our small specimen, a cotype secured from the Berlin Museum through the kindness of Dr. Arndt, is of a dark brown colour. The other small specimen from the Australian Museum is a light yellowish-brown or straw colour.

Structure.—The lower part of the sponge skeleton is made up of an irregular network of skeleton fibres, but a more definite arrangement into perpendicular and transverse fibres is found in its upper portion. The number of spicules in the fibres is very variable and Weltner counted as many as twelve making up most of them. The main and the transverse fibres are of about equal size, and where more or less regular meshes are formed they measure from 175 to 350 μ across.

Skeleton Spicules.—There is very great variation in the skeleton spicules of this sponge. The larger number of spicules are slightly curved, spindle-shaped, with rather abruptly but sharply pointed ends, and bear a varying number of very fine spines. There are a few exceptions to all of these characters; straight spicules may be found, at times one or both ends of the spicules may be rounded, and it is not unusual to find now and then a perfectly smooth skeleton spicule in our preparations. The spines vary from a very few to very large numbers, but, as a rule, are not found near the ends of the spicules. The axial channel is frequently clearly visible in these spicules. Weltner gives the following dimensions of the spicules:

Length	270 to 390 μ	Average around ..	340 μ
Thickness	15 to 20 μ	Average around ..	18 μ

⁴⁶ Weltner.—Archiv für Naturg., i, 1895, pp. 142-143.

⁴⁷ Weltner.—In Semon’s Zoologisch. Forschungs., v, 5 (Denkschr. Medic. Naturw. Ges., Jena, viii), 1900, pp. 519-523.

Our measurements of the length of these spicules of our cotype correspond to these in the main, but possibly even a little wider range would be necessary to cover the great variations; we find the thicker ones to measure as much as $24\ \mu$ in diameter.

Flesh Spicules.—No flesh spicules have been observed. Small, slender, mostly smooth spicules are found throughout the preparations; these should not be confused with flesh spicules as they are young skeleton spicules.



FIGURE 17.
Ephydatia multidentata.
Gemmule spicules.

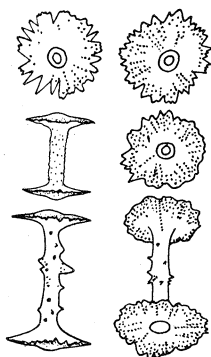


FIGURE 18.
Ephydatia multidentata.
Skeleton spicules.

Gemmules.—The gemmules are numerous and are at the base of the sponge in one or more layers. They are from 500 to $650\ \mu$ and average around $560\ \mu$ in diameter, spherical or oval shaped and a light brown in colour. The pore-tube is simple and does not project beyond the layer of protective material which covers the gemmule. The air cell layer covering the gemmule is of very variable thickness; in places it may be just thick enough to barely cover the single layer of gemmule spicules or amphidisks; at other places even on the same gemmule the development of the bubble cells may make this layer three or four times as thick as the thinner area. For this reason these gemmules generally present a very uneven surface.

Weltner calls attention to the fact that these air cells often develop to the extent of uniting several gemmules together, but that they do not form characteristic gemmule groups as is the case with *Spongilla fragilis*. He also observed that, while as a rule there was only a single layer of gemmule spicules around the gemmule, yet in many cases he found single amphidisks of a second lying embedded in the bubble cells. The air cell layer varies from 30 to $120\ \mu$ in thickness.

Gemmule Spicules.—The length of the amphidisks varies greatly, the longest ones being at least twice the length of the shortest ones. The shaft is of a uniform diameter throughout its length and is covered with small spines and granulations; now and then a few large bluntly pointed spines or cones are also present. The disks, or rotules, are also covered by the fine spines and small tubercles which

are often arranged in rows radiating from the centre. The disks are biconvex and their edges are very finely and irregularly incised. The disks are of nearly the same size, though the outer ones average a bit smaller.

Weltner gives an interesting lot of illustrations showing how these spicules develop. He gives the following measurements:

Length of shaft	28 to 56 μ
Thickness of shaft	4 μ
Diameter of inner disk	22 to 26 μ
Diameter of outer disk	20 to 22 μ

Our measurements of these spicules confirm the figures given by Weltner.

Type.—The type of this sponge is preserved in the Berlin Museum. We have a minute cotype in our collection.

Distribution.—So far this sponge has been found in the original locality, Burnett River, Queensland, where it was collected by R. Semon, and a small specimen collected in Cooper's Creek, in south Central Australia. This latter specimen is a small bit of a sponge kindly sent us some time ago by the Australian Museum.

Remarks.—For a very full discussion of the canal system and the histology of this sponge the reader is referred to Weltner's paper of 1900 mentioned in the first paragraph of this description.

We have a small bit of sponge from Cooper's Creek, sent us some time ago by the Australian Museum, which we assign to this species. It is lighter brown and more yellowish than the tiny specimen given us by the Berlin Zoological Museum. The skeleton spicules are shorter and thinner than those in Weltner's specimen; our measurements are: length 221 to 316 μ , and thickness 14 to 17 μ . Otherwise they correspond to those of the ones described by Weltner. Our measurement of the rotules of the gemmule spicules of the Cooper Creek specimen are exactly the same as Weltner's, but we find the length of the shaft to vary less—from 26 to 42 μ .

Ephydatia multiformis Weltner, 1910.

(Figures 19–23.)

Historical Statement.—The Michaelsen and Hartmeyer expedition to study the fauna of south-west Australia collected one fresh-water sponge in Herdsman's Lake, near Subiaco, in 1905. Weltner described and illustrated this as a new species, *E. multiformis*.⁴⁸ Since we have not seen a large piece of this sponge, our brief description is condensed from a translation of Weltner's very full one given in the reference above and checked by our observations upon the spicules.

Through the kindness of Dr. Arndt, of the University Zoological Museum, Berlin, we have a tiny bit of this sponge and have a slide prepared from this. We also have a small bit of sponge representing this species which was furnished us by the Indian Museum. It is recorded as an exchange from the Australian Museum and was collected at Toronto, Lake Macquarie, New South Wales.

⁴⁸ Weltner.—In Michaelsen und Hartmeyer, Die Fauna Südwest-Australiens, 1910, pp. 137-144.

Habitat.—The sponge was found forming thin crusts on bark and pieces of wood in the lake.

General Characteristics.—It was small and thin, the crusts being about 3 cm. long and above 3 mm. thick and of delicate consistency. The upper surface is smooth; branches and projections are lacking, but it is not determined as yet whether or not these are present in larger specimens of the sponge. Through the epidermis the large openings of the incurrent canals can be readily recognized even with the naked eyes.

Colour.—In alcohol the colour is grey. According to the collector's notes the pieces of the sponge were pale yellowish-grey when they were fresh.

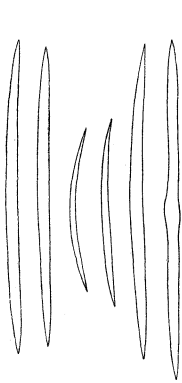


FIGURE 19.
Ephydatia multiformis.
Skeleton spicules.

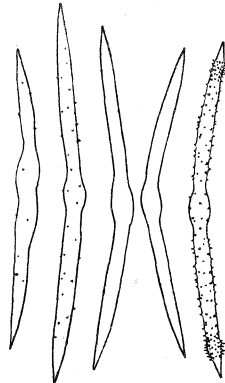


FIGURE 20.
? Ephydatia multiformis.
Skeleton spicules bearing bulbs.

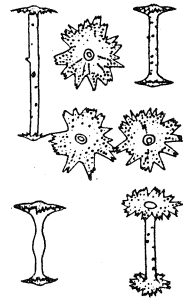


FIGURE 21.
Ephydatia multiformis.
Skeleton spicules.

Structure.—The solid skeleton consists of slender longitudinal fibres which stand perpendicularly to the stratum. These fibres are separated from each other at intervals of about the length of a spicule and are united together by transverse spicule-bridges. The longitudinal fibres are composed of single spicules lying one behind the other, or of bundles of from two to four spicules lying closely against one another; both of these arrangements may appear in the same fibre. The transverse fibres are usually thin and consist of one to two spicules. Between the two kinds of fibres there are many other irregularly scattered spicules which resemble those of the solid skeleton. In many cases even the entire skeleton is composed of only the irregularly entangled spicules.

The amount of spongin is small and in an unstained specimen can be distinctly seen only at the points of contact between the spicules.

Skeleton Spicules.—The skeleton spicules are of only one type; they are slender, smooth, usually slightly curved, gradually sharp pointed axials, which show various sizes. The larger ones range from 344 to 425 μ in length and from 13 to 20 μ in thickness, averaging around 374 μ long and 16.6 μ thick. The variations in thickness do not always correspond with the length, for often a short spicule may be as thick as the longest ones.

Weltner found a very great variation in the size of the spicules, some being as small as $104\ \mu$ long and $3\ \mu$ thick, and from that size all the way up to the greatest length, $425\ \mu$.

Flesh Spicules.—Now and again in the slides of the spicules which we have examined, we find among the smaller spicules those around $200\ \mu$ in length, which are covered with small spines. They are 7 or $8\ \mu$ in thickness and doubtless are the parenchyma spicules to which Weltner calls attention in his description of this species in 1910. These are very similar to the smaller spicules illustrated herewith, except that they bear spines.

Gemmules.—The gemmules lie loosely in the meshes of the skeleton in the basal portion of the sponge without being surrounded by a common air-chamber-layer; they may be easily separated from the sponge or its substratum.

They are yellowish in colour, round or oval-shaped and of different sizes.

In most of the gemmules examined by Weltner the contents had already been discharged and he concluded that the sponge examined was the product of the empty gemmules.

The pore-tube represents a short elongation of the inner cuticle covering the gemmule and it does not extend beyond the upper surface of the layer surrounding the gemmule, but is somewhat sunken in like a navel. There are 9 to 11 birotulates surrounding the pore-tube. The gemmule is surrounded by a single layer of radially arranged gemmule spicules which lie in the air cell layer. The gemmules were found to vary from 500 to $750\ \mu$ in diameter.

Gemmule Spicules.—The birotulates have unequal disks and vary considerably in length. Weltner's descriptions of the differences of the structure of the disks is limited to the basal disk. He describes several types as follows:

1. The disks are mostly star-like in which the disk is divided into teeth and lobes formed by deep incisions; often the depth of these deep incisions is up to one-half or more of the radius of the disk. The lobed areas themselves are unindented. The teeth are quite similar in size and are seldom blunt at the ends. The number of teeth and lobes varies from 10 to 30 . The diameter of the disk varies from 12 to $20\ \mu$. The shaft is smooth. The figures from Weltner show two varieties of this group of disks, one with shallow and the other with deeper incisions.

2. Sometimes from the same gemmule one will find birotulates with the disks irregularly and coarsely lobed; the single lobes are usually separated by shallow notches and the lobes are unindented or appear as if they had been gnawed or very finely toothed.

3. Other disks show a large number of smaller finely toothed lobes.

4. Others show a combination of finely toothed lobes and larger pointed teeth.

5. Still other disks show unindented or toothed lobes between which are larger teeth, but the lobes, the teeth and the surface of the disks are made rough or granular by very fine spines. The shaft of these amphidisks is smooth, or finely roughened or granular, or with single larger spines.

The longest amphidisks were $44\ \mu$ long and others as short as $24\ \mu$. The basal disks varied from 14 to $24\ \mu$ and the distal ones from 14 to $18\ \mu$. The diameter of the shaft was as great in the shorter amphidisks as in the larger ones, varying from 2 to $4\ \mu$.

Type.—The type of the sponge is in the Berlin Zoological Museum.

Distribution.—It has, up to the present, been reported from only one place, the type locality, Station 111, Herdsman's Lake, near Subiaco, south Western Australia, Sept. 3, 1905.

Remarks.—Professor G. E. Nicholls sent me another small sponge (No. 53695) collected at Two People Bay Pumping Station, near Albany, Western Australia, which is unique in that both the skeleton and the gemmule spicules invariably have the central portion of their shafts enlarged into bulbs.

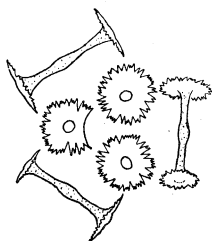


FIGURE 22.
? *Ephydatia multiformis*.
Gemmule spicules with bulbs.

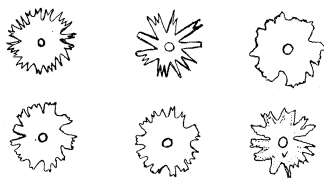


FIGURE 23.
Ephydatia multiformis.
Ends of rotules (after Weltner).

The skeleton spicules vary from common altogether smooth ones characteristic of *E. multiformis* to those rare ones spined as shown in our illustration. These spicules range from 245 – $302\ \mu$ in length, and from about 10 – $16\ \mu$ in thickness.

The gemmule spicules average somewhat longer than those of the specimen from Herdsman's Lake and are less variable. Most of them are from 41 – $48\ \mu$ in length and the outer rotules are from 16 – $21\ \mu$ in diameter, while the inner ones are slightly larger, being usually about $22\ \mu$ in diameter. The difference in diameter of the rotules is at times quite marked, while in other cases the two rotules may be about equal.

We place this sponge in this species tentatively. It may be that we have just an abnormal specimen, but the very fact that it is rare that we find even one spicule free from the bulb would seem to entitle it to at least a varietal name which should be *bulbosa*. We will await further material from that locality before creating a new variety.

Our illustration shows the characteristics described above.

Ephydatia nigra (Lendenfeld).
Tubella nigra Lendenfeld, 1887.

(Figures 24–26.)

Historical Statement.—This sponge was first found in the neighbourhood of Sydney and later also in Victoria (no definite locality was named by Lendenfeld).

The author of the species described it as a new species and illustrated it.⁴⁹ Weber,⁵⁰ in enumerating the sponges from the Dutch East Indies, mentions *T. nigra* as having been found in Borneo, but we take this to be an error, as he was doubtless referring to *T. vesparium*.

Through the courtesy of the Australian Museum we have been allowed to examine the type of this species which was collected in Moore Park, Sydney. Our description is based upon the original one of Lendenfeld checked by our observation of preparations from the type. The drawings are made from the type.

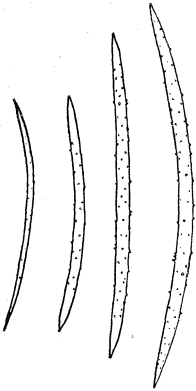


FIGURE 24.
Ephydatia nigra.
Skeleton spicules.

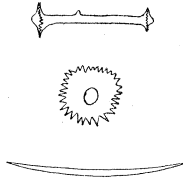


FIGURE 25.
Ephydatia nigra.
Spicules (after Lendenfeld).

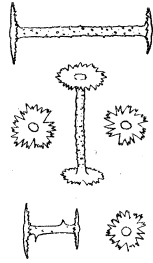


FIGURE 26.
Ephydatia nigra.
Gemmule spicules.

Habitat.—Of the two localities from which the sponge was collected, one was a swamp and the other was a pond. In both cases the sponge was doubtless found in standing water.

General Characteristics.—*E. nigra* forms thin crusts from 2 to 5 mm. thick upon its support and has a smooth velvet-like surface. The sponge often spreads out horizontally over an area of as much as 70 mm. long by 50 mm. wide and has an uneven, irregularly lobed margin. There are several small bits in the type specimen, no pieces so large as the one mentioned above. Some of the sponge in the type material is growing with a bryozoan, probably *Plumatella*, the two being thoroughly interwoven with each other.

Colour.—The crusts are blackish in colour. Whitelegge states⁵¹ that "this species is not naturally black as the name would imply; the specimen described was stained with black mud, the true colour being a dirty yellow."

Structure.—The sponge is very soft and the canals are small and inconspicuous. The spicule bundles which form the skeleton fibres are very slender and fragile and are often made up of a line of single spicules.

⁴⁹ Lendenfeld.—Zool. Jahrb., ii, 1887, p. 91.

⁵⁰ Weber.—Zoolog. Ergebn. Niederl. Ost-Indien, 1890, p. 46.

⁵¹ Whitelegge.—Journ. and Proc., Roy. Soc. N.S.W., xxiii, 1889, p. 306.

Skeleton Spicules.—Lendenfeld describes the skeleton spicules as being decidedly spindle-shaped, gradually and sharply pointed, slightly curved and absolutely smooth. He gives their length as being 220μ and their diameter as 7.4μ in the centre of the spicules.

Our observation of preparations from the type do not altogether agree with the above. We find the skeleton spicules to be generally decidedly curved, but with a few rare straight ones. Instead of being smooth they are covered with very fine spines except at their sharpened tips; the degree of spininess varies considerably, but none of the spicules are smooth. The prevailing kind of spicule is cylindrical, of about uniform diameter, with rather abruptly sharpened ends. Our measurements correspond fairly well with Lendenfeld's, the spicules varying from 212 to 248μ in length and from 6 to 9μ in thickness. It is possible that Lendenfeld examined the spicules with only a low power lens and overlooked the fine spines.

Flesh Spicules.—We find no flesh spicules in this species.

Gemmules.—Lendenfeld observed that the gemmules formed a continuous layer at the base of the sponge; that they were irregular, spherical, and covered with a single layer of birotulates; that they measured about 300μ in diameter.

We find the gemmules very numerous and crowded throughout the entire thin crust of the sponge, but without a distinct clearly arranged single layer at the base of the sponge as illustrated by Lendenfeld. They are irregularly spherical, often somewhat flattened, have a simple pore-tube opening on the surface of the protective layer of the gemmule, which is composed of a single layer of birotulates embedded in a granular layer. The diameter of the gemmules varies a good deal, from 382 to 450μ in those measured by us.

Gemmule Spicules.—Lendenfeld describes these spicules as follows: They are amphidisks, 33μ in length; the slender shaft, 1.5μ in diameter, bears a few sharp slender spines, which in the centre of the shaft at times reach a length equal to the diameter of the smaller rotule. The disks or rotules are regularly incised like a spur wheel with many teeth of equal size. The outer ends of the shaft project slightly beyond the rotules at each end. The diameter of the larger rotule is 12.5μ and that of the smaller one is 8μ , otherwise the rotules at both ends are altogether similar.

In the type specimen from the Australian Museum there are certain decided differences from the form described above by Lendenfeld. We find (slide No. 54524) very marked variations in the length of the shaft of the spicules, from 30 to 68μ in length. The rotules are also variable; in some cases the two of the same birotulate spicule are very nearly of equal diameter; in others their difference in size is as much as $5-7 \mu$. We also found the rotules to be considerably larger than those recorded by Lendenfeld. Our measurements of three typical birotulates gave the following results:

Smaller disks	16μ	17μ	14μ
Larger disks	18μ	20μ	20μ

The shafts are usually granular or provided with very minute spines, they are rarely altogether smooth; now and then a single long thin spine, rarely

equal to the radius of the smaller rotule, is found near the central portion of the shaft. The shorter birotulates as a rule have straight shafts, but the longer ones are frequently slightly curved. The disks vary a good deal, some are provided with numerous small, sharp teeth, the incisions often being equal to nearly half the radius of the disk; the teeth frequently have very fine granulations near their outer tips. Others have shallower incisions, finer teeth, or may even be divided into lobes with small teeth. The shaft forms only a low, rounded projection on the outside of the disk.

Type.—The type is preserved in the Australian Museum, Sydney.

Distribution.—The following are the records of the occurrence of this sponge to date: by Lendenfeld in 1887—(1) from a swamp near Sydney, (2) from a pond, with no definite locality given, in Victoria; by Whitelegge in 1889—(3) from a pond in Moore Park, Sydney (this pond was already filled in at the date given), (4) from Wooli Creek, Cook's River, Sydney. Weber in 1890 records it from Borneo, but I take this to be intended for *T. vesparium*.

Remarks.—The difference between the sponge described by Lendenfeld as *Tubella nigra* and the specimen marked as the *type* of this species in the collection of the Australian Museum raise the question whether or not these are two separate and distinct sponges. It might help to solve the difficulty if fresh gemmule-bearing material could be secured from as many of the localities given as now have sponges growing in them.

We would also give the sponge from the Australian Museum marked as the *type* of this species the generic name of *Ephydatia* instead of *Tubella*, since the rotules are often of about the same size and are both characteristically *Ephydatia*-like, though at times they differ a good deal in size.

For the sake of comparison we also reproduce Lendenfeld's drawings of his *T. nigra*.

***Ephydatia ramsayi* Haswell, 1883.**
(Figures 27–28.)

E. fluviatilis var. *ramsayi* Haswell-Lendenfeld, 1887.

Historical Statement.—*Meyenia ramsayi* was first found by E. P. Ramsay in the Bell River at Wellington and described as a new species by Haswell⁵² in 1883. This sponge was later found again by Lendenfeld in 1887 and 1888 in Macquarie River, near Dubbo, in New South Wales, and described by him.⁵³ Through the kindness of the authorities of the Australian Museum I have been allowed to examine the type of this species, and the following description is based upon the combined result of these references and my own observations.

Habitat.—Haswell states that it is a "rather deep growing species" and that it was found "growing in considerable masses attached to submerged timber".

Lendenfeld states that it was found growing on submerged branches which it completely covered.

⁵² Haswell.—Proc. Linn. Soc. N.S.W., vii, 1883, p. 210.

⁵³ Lendenfeld.—Zool. Jahrb., ii, 1887, pp. 92–93.

General Characteristics.—Haswell says: "Sponge massive, tubercular, or with finger-like projections." Lendenfeld states that "the sponge is massive with irregular ripply surface; it covers its support for 50 mm., and reaches a thickness of 30 mm.; it is sometimes more massive on one side of the support and covers only one side of the supporting branch. Single oscules are visible on the surface of the sponge."

The type consists of two small pieces, presents a smooth surface, and is permeated by numerous small canals. It shows the effect of having been pressed in the packing. One piece begins as a thin film surrounding a small stick and reaches a thickness of about one centimetre at the other end, where it appears that the stick upon which it was growing was broken off with a portion of the sponge. The other piece is on a stick of about the same size, possibly a part of the same stick; it is about 6 cm. long, the sponge forming a mere film on one side and reaching a maximum thickness of two and one-half centimetres on the other side of the support.

Colour.—The type in alcohol is a dirty brown in colour and contains a large amount of sediment in it. Colour of the fresh sponge is "grass green to greyish-yellow", according to Haswell. Lendenfeld says that when alive this sponge is light brown or dirty yellow in colour.

Structure.—Lendenfeld states that the consistency of the sponge is massive and hard: the skeleton is composed of the usual skeleton bundles: the canals are noticeably wide and thereby impart to the sponge a very lacunar character.

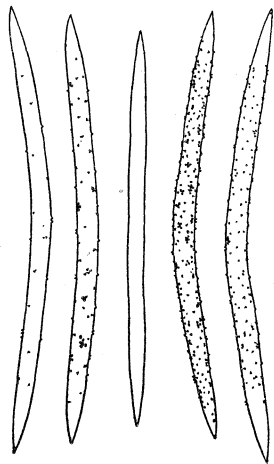


FIGURE 27.
Ephydatia ramsayi.
Skeleton spicules.

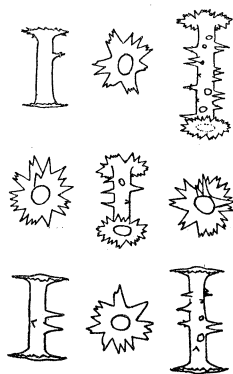


FIGURE 28.
Ephydatia ramsayi.
Gemmule spicules.

We find it difficult to detect any definite main or transverse fibres in the type specimen, the sponge being made up of a mass of irregularly arranged meshes bounded by thin walls composed of only very few spicules.

Skeleton Spicules.—Haswell thus recorded his observations: "Skeleton spicules curved, fusiform, rather abruptly acute, perfectly smooth." Lendenfeld says that they are not so definitely spindle-shaped as are those of some forms of *Ephydatia*

fluviatilis, but are more cylindrical and suddenly pointed. He finds the surface slightly spiny. He measured them as being 220 μ long and 10 μ thick.

Our observations based upon preparations from the type are as follows. The spicules are slightly curved, while some few of them are smooth, yet most of them are covered, except at their ends, with very fine spines which Haswell must have overlooked. Our drawings show these spines a little too heavy. The spicules are varied in shape, some of them being cylindrical with abruptly formed sharp points; others are largest near the centre, some few even being bulbous there, and gradually taper to very fine points at their tips. We find them to average considerably larger than Lendenfeld's measurements; the spicules range from 246 to 340 μ in length and from 10 to 16 μ in thickness. It is rare that one finds one as short as 220 μ in length.

Flesh Spicules.—No flesh spicules are present in this species.

Gemmules.—Most of the gemmules in the type are located in the basal portion of the sponge, though a few are scattered singly through the mass and now and then occur near the surface of the sponge. They are numerous, and, while they are usually crowded close together, there is no regularity in their arrangement. They are spherical in shape and are covered by a single layer of regularly arranged birotulates. We find them to vary in diameter from 357 to 450 μ . The average is somewhat larger than that given by Lendenfeld as 350 μ .

Gemmule Spicules.—Haswell states that the birotulate spicules "consist of a stout cylindrical shaft armed with 1 to 10 acute and prominent spines, and terminal rotulæ the edges of which are deeply dentate or spinous, the teeth—to the number of between 12 and 20—being irregular in size and acute".

Lendenfeld finds the number of teeth to vary between 12 and 16 and our count gives between 16 and 22. The number is very variable and has, we think, no specific significance. Lendenfeld finds the length of the gemmule spicule to be 29 μ and the shaft to have a diameter of 4.8 μ , while the diameter of the rotule is 20 μ .

Here again our measurements of the type birotulates show a somewhat larger structure with the following dimensions: length, 32 to 42 μ ; diameter of rotule, 20 to 22 μ , and diameter of shaft 5 to 6 μ . The spines on the shaft of the spicule vary from very short ones to almost as long as the radius of the rotule itself. We found the number of spines to range from 0 in a very few cases to as many as 14 in others.

Type.—The type is preserved in the Australian Museum.

Distribution.—This species has been found in Bell River at Wellington and in Macquarie River, near Dubbo, New South Wales. Chapman, in 1922, also reports it from Tintenbar, Richmond River, New South Wales, as found in opal nodules. Weltner (1900) states that two local forms of this sponge are known in South America also, one in Argentine and another in Paraguay. Annandale describes⁵⁴ a specimen sent to him by Professor Max Weber as this species. It was collected growing upon the shells of living snails in a small stream at Sekanto, near Humboldt Bay, by the Dutch New Guinea Expedition, on May 30, 1903.

⁵⁴ Annandale.—Nova Guinea, v, 3, 1909, p. 421.

Remarks.—There has been a good deal of difference in opinion as to whether this sponge is entitled to specific rank. Lendenfeld and later Annandale have made it simply a variety of *E. fluviatilis*. Haswell gave it specific rank, and Weltner has contended strongly and persistently that the characters of both the skeleton and the gemmule spicules were distinct enough to entitle the sponge to specific rank. We hold with Weltner, for, while such forms as *E. meyeri* are separated as species from *E. fluviatilis*, *E. ramsayi* is much more entitled to be so separated.

Since Lendenfeld's measurements differ so much from our measurements of the type specimen of this sponge, we wonder if he had specimens of the same sponge for examination.

THREE SPONGES WITHOUT GEMMULES.

In addition to the foregoing sponges which we have described, we also have small specimens of the following three sponges:

(1) One received from Mr. E. W. Bennett, M.Sc., which was collected at Tandakot, Western Australia. This was labelled: “? *Ephydatia*”.

(2) Another sent us by the Australian Museum which was collected at Legges' Camp, Myall Lakes, near Port Stephens, New South Wales.

(3) A third from Lake Sarah, Cass, New Zealand, marked: “*Spongilla fluviatilis*”.

We can find no gemmules or gemmule spicules in any of these, and therefore hesitate to place them in any classification. Possibly the collectors of these specimens may be able to collect gemmule-bearing specimens at a later date, and then definite determinations can be made.

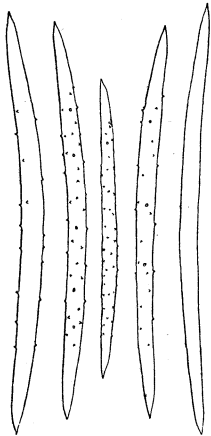


FIGURE 29.
Skeleton spicules of sponge
from Tandakot, Western
Australia.

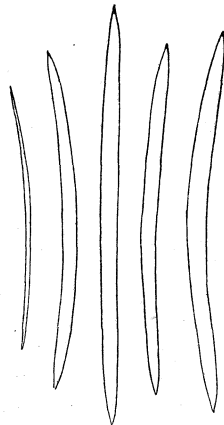


FIGURE 30.
Skeleton spicules of sponge
from Legges' Camp, near
Port Stephens, New South
Wales.

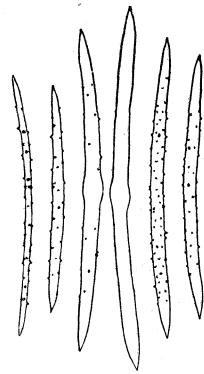


FIGURE 31.
Skeleton spicules of sponge
from Lake Sarah, Cass,
New Zealand.