Sponges

The sponges are aquatic, dominantly marine invertebrates, which are ranked next above protozoans in classification, because they are composed of many cells having specialized functions but lacking organization into definite tissue. Attainment of a cellular grade of construction distinguishes them from the protozoans, and absence of a tissue grade, found in coelenterates and all higher invertebrates, separates them from these. Sponges now are assigned to a phylum of their own, called Porifera (pore-bearing).

General Characters:

The form and size of sponges vary exceedingly. Many grow as solitary individuals which have globular, cylindrical, conical, or irregular shape. Their dimensions range from those of a pinhead to a height or width of more than (1) inch. Colonial sponges are common; they are mostly irregular branching forms which may attain a diameter of (2) m. Some sponges, both solitary and colonial, comprise thin incrustations on foreign objects such as rock or shell.

A few kinds of modern sponges are illustrated in Fig. (1), the sponges have no internal organs, nervous tissue, or circulatory and digestive systems, such as occur in higher invertebrates. There is neither mouth nor anus. Food particles and oxygen are brought to cells of the body interior by water which is introduced through myriads of external apertures, termed **dermal pores**. Outlet of this water is by way of larger openings, called **oscula**. The interior of the sponge consists simply of an open space, the **cloaca** or spongocoel (sponge hollow), or it comprises a branching system of canals. Nearly all sponges possess an internal skeleton of separate or joined elements, which are calcareous, siliceous, or composed of a horny organic substance, called spongin. The individual skeletal elements, termed **spicules.**

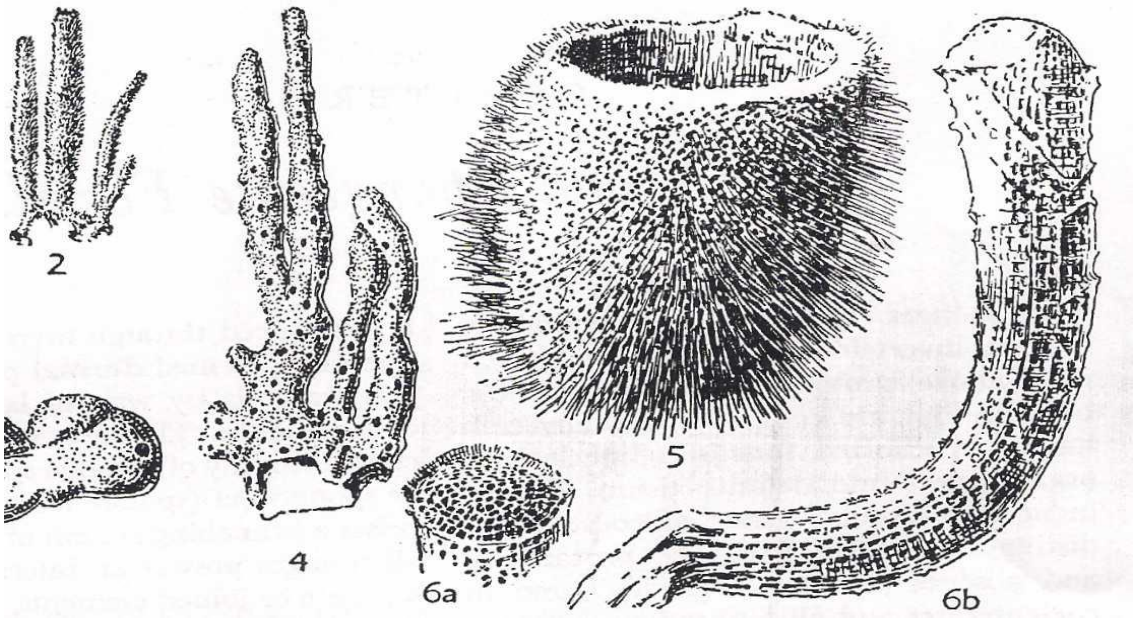

Figure (1) Modern sponges belonging to classes represented by fossils. The sponges grow as solitary individuals or in colonies, some having porous, nearly smooth exterior surfaces and some bearing many projecting spicules, which produce a bristly to hairy appearance. Except for one rather minor family, sponges are exclusively marine. *(After Hyman and Dendy, not to scale.)*

Fossil Record:

The sponges have a paleontological record which is not exceeded in length by any other animals. Several kinds of siliceous sponges occur in Cambrian rocks, including the Lower Cambrian, and spicules are recorded from Pre-Cambrian formations of northwestern France. The siliceous sponges are numerous in many Paleozoic and younger deposits, but calcareous forms are recorded only from Devonian to Recent. They are most abundant in some Jurassic, Cretaceous, and early Tertiary rocks.

STRUCTURAL FEATURES:

Soft Parts:

Two main categories of cells in the body of sponges can be discriminated. One of these comprises so-called choanocytes or collar cells, which bear a mobile, whiplike flagellum, guarded by a cylindrical wall (the collar). These cells are identical in nature to some protozoans. In sponges, they serve the dual functions of producing water currents by motion of their flagella and of withdrawing food particles from the water for digestion. The other category of cells lacks digestive functions. It includes especially those which form the outer portions of the body wall, a sort of

epiderm. Some of these are specialized for the secretion of skeletal spicules, and a few serve other purposes, such as reproduction. This entire second group of cells is dependent on the collar cells for sustenance.

Three general types of body structure are recognized. The **ascon type**, represented by the living calcareous sponge, *Leucosolenia,* constitutes the simplest known sort (Fig. 2, 7). It has a saclike form, with collar cells lining the central cavity and epiderm cells forming the exterior. Spicules of calcite strengthen the body wall, which is perforated in many places by pores.

More complex than ascon sponges are those of the **sycon type**, represented in simplest form by the genus *Sycetta* (Fig. 2, 2) and in more advanced stage by *Sycon* (Fig. 2, 3). In both, convolution of the walls gives origin to chambers lined with collar cells, and in these chambers a more concentrated flow of water can be affected.

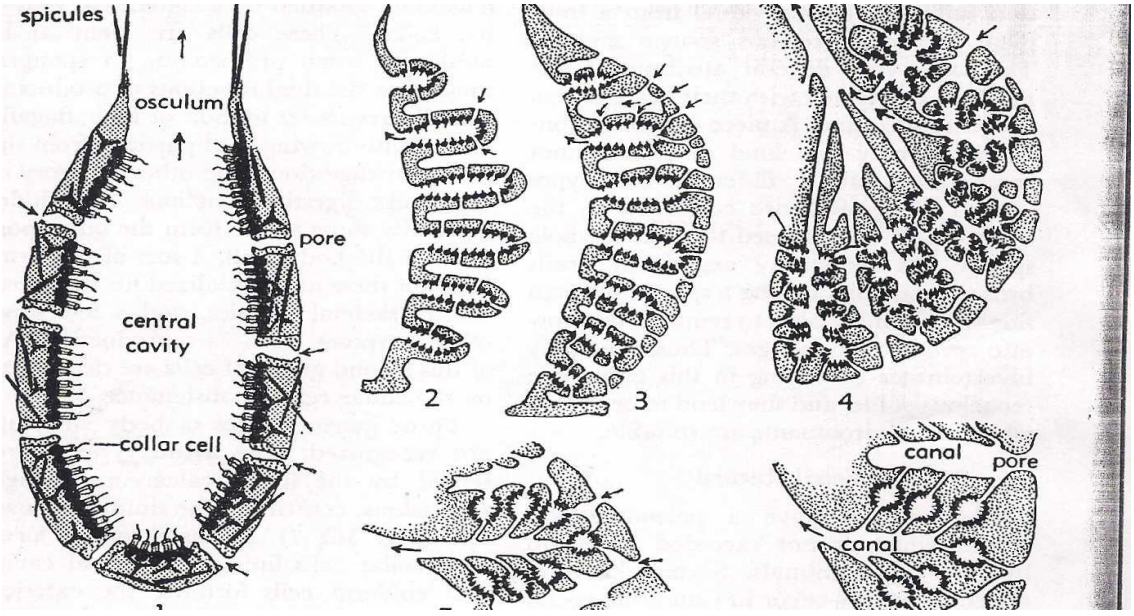

Figure (2) Types of sponge structures. Diagrammatic sections show placement of the digestive collar cells (black), which control water movement by means of their whiplike flagella; direction of water currents is indicated by arrows.

A third sort of sponge, the **leucon type,** is represented by *Leuconia* and other genera in which the collar-cell chambers become subdivided (Fig. 2, 4-6) and the path- ways of water movement more circuitous.

Skeleton:

Only calcareous and siliceous hard parts of sponges have paleontological importance, and so attention may be confined to them. Sponges having skeletons of these kinds are very numerous, but no sponge has an internal support consisting of both calcareous and siliceous spicules. It has either one sort or the other. Moreover, the nature of the hard parts is a chief feature in classifying sponges**.**

Spicules of sponges, whether composed of calcite or silica, are of two general sorts: relatively larger ones (megascleres), which constitute the main skeletal framework; and minor ones (microscleres), which are irregularly distributed as accessory skeletal elements in the body. Both types are classified in groups according to the number of their axes, and within each group are many varieties. Examples are illustrated in Fig. (3).

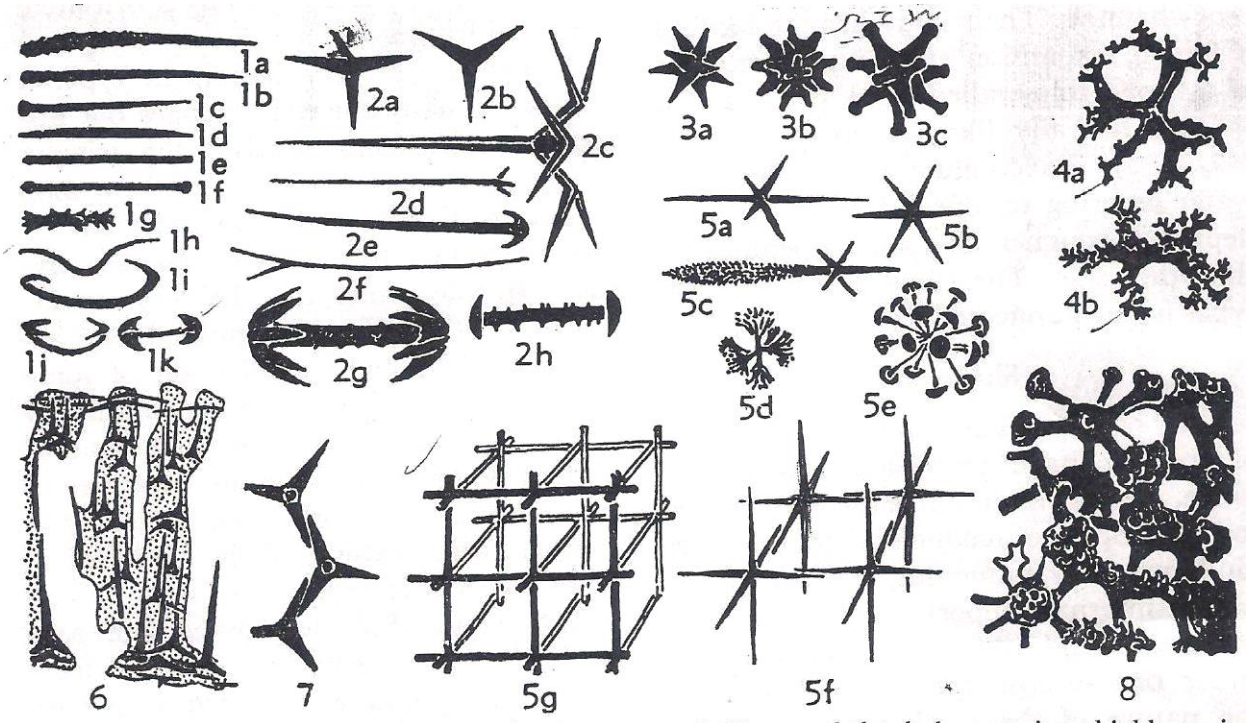

FIG. 3. **Sponge spicules.** The form of calcareous and siliceous skeletal elements is so highly varie that classification is difficult; yet the scores of named kinds can be assembled in a few groups. Example of each are illustrated (not to scale).

Monaxons. Calcareous or siliceous spicules which grow in one or both directions along a single axis are termed monaxons. (1a-g).

Triaxons. A very important type of spicule in many siliceous sponges but absent in calcareous forms is the triaxon (5a-g). It consists essentially of three axes which cross one another at right angles.

Tetraxons. Spicules having four axes not in the same plane, which diverge from a common point, is termed tetraxons. They occur both in calcareous and siliceous sponges. The rays may be more or less equal (2a), but generally one ray is considerably elongated and others are reduced (2c - e).

Polyaxons. Siliceous spicules which have several equal rays diverging from a point are known as polyaxons (3a - c).

Desmas. A special kind of siliceous characterized by seeming lawlessness spicules of structural plan, is termed desma (4a, b) Divergent main members of the spicule commonly bear spiny or warty excrescences growing in all directions.

CLASSIFICATION

1- Calcispongea *(class),* skeleton composed of discrete or united calcareous spicules, Devonian - Recent.

2- Hyalospongea *(class),* skeleton composed of discrete or united siliceous spicules of triaxon type; the glass sponges, Cambrian - Recent.

3- Demospongea *(class),* skeleton of siliceous or horny spicules, or both; no triaxons, Precambrian - Recent.