

Sponges: an historical survey of their knowledge in Greek antiquity

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A detailed account of sponge knowledge in Greek antiquity is given on the basis of their records in the written documents of the historical periods it comprises. The analysis of the examined material revealed interesting information on various aspects of sponge biology, more or less consistent with their present scientific knowledge. The value of sponges for man at that time was evident in many of his activities, such as household, personal hygiene, pain relief, disease treatment, art and war enterprises. The significant role of sponges in medical practice is illustrated by the high number of their records in the medical works of the studied historical period. Furthermore, sponges appeared in legends, as well as in similes and metaphors that attributed their special qualities to human behaviour, various body parts or objects.

*Ah state of mortal man! in time of wealth,
A line, a shadow! and if ill fate falls,
One wet sponge-sweep wipes all our traces away'*

Aeschylus, *Agamemnon*
(E. Morshead's translation, modified)

INTRODUCTION

More than twenty-five centuries have passed since the foundations for modern western philosophy and science were laid by the early Greek thinkers who, pursuing knowledge, searched for the underlying principles of nature. Much has since changed with science having been separated from philosophy and having reached a high level of specialization at our times. The cost of the continually growing specialization in science, in spite of its epistemic benefits, is that the expertise of individual scientists narrows. As new specialties are created, barriers are built and these can sometimes be an impediment to the development of science (Brad Wray, 2005). Finding the roots of their science and tracing back to the historical and cultural background of their inquiry may help modern scientists to broaden their conceptual horizon, and probably redefine their research.

The study of animals in antiquity has been a subject of research mostly for philosophers and historians of zoology (Bodson, 1998, 2001). However, recently, scientists have been challenged to go back to the roots of their science in the early societies. Under this scope, some of them have studied ancient sources such as texts or paintings, and extracted knowledge relevant to their expertise (Juvén & Desmots, 2000; Bazopoulou-Kyrkanidou, 2001; Tipton, 2006).

Sponges are among the most ancient multicellular animals alive on the planet today, being ecologically and economically among the most highly successful life forms that have ever existed (Hooper & van Soest, 2002). Obviously, they have attracted human attention very early, due to their spongy

nature and their use in various human activities. Some of the early zoologists who studied sponges sometimes mention sponge records in the classical texts (Arndt, 1937), while other researchers commented on the methods of their collection in antiquity (Frost, 1968). A short account of sponge knowledge in classical literature has been given by Thompson (1947). Recently an analysis of sponge terminology and nomenclature showing their classical Greek origin has been presented by Voultziadou & Gkelis (2005).

A recent attempt of the author to study and evaluate zoological information from classical texts, such as those by Homer (Voultziadou & Tatolas, 2005) and Aristotle (Voultziadou & Vafidis, 2007), revealed interesting records on sponges and suggested that a thorough research for sponge knowledge in the classical Greek literature might be very fruitful. In order to pursue human knowledge on sponges in classical antiquity, the present work focuses on a detailed account of the early evidence on sponges appearing in the classical Greek literature by examining all the available sources.

MATERIALS AND METHODS

This research was based on a detailed investigation of records concerning sponges in all the written documents of Greek antiquity and more specifically all texts written in classical Greek from the 8th Century BC to the end of the 1st Century BC. This was achieved using the search engine of the Thesaurus Linguae Graecae digital library (TLG E, Edition 2006), in which the University of California offers a

comprehensive library of the Greek literature. References to the classical works in the text are in accordance with their TLG versions.

All records on sponges taken into account were analysed with the help of modern Greek and English translations. The most commonly used were the translations provided in the publications of the Loeb Classical Library, Harvard University. Some translations available on-line, such as those at the 'Perseus digital library' and the 'Internet classics archive', were also consulted. Various dictionaries, such as *The Greek-English Lexicon* by Liddell & Scott were consulted in cases where no translation to modern Greek or English was available.

RESULTS AND DISCUSSION

The review of the literature that appeared during the geometric, archaic, classical and Hellenistic period of Greek history revealed 211 records of words including the root *spong-*. All these records were not evenly scattered in the literature of the eight centuries BC scanned during the present work (Table 1). The most prolific, both generally and in terms of sponge records, was the 5th Century BC followed by the 4th due to the supreme works of Hippocrates on medicine and Aristotle on zoology.

The sponge was mentioned in the studied texts either as *spongus*, or less often, as *spongia*. *Spongia* has been used among others by Aristophanes (*Frogs* 482, 487) who gave the earliest record of this name for a sponge, by Aristotle (*History of animals* 616a24) and by Hippocrates (*On diseases* 2.14.16). Probably, the first sponge genus erected by Linnaeus in 1759, the genus *Spongia*, should be attributed to his inspiration by one of the above authors. The name *spongion* was used sometimes to indicate a small-sized sponge (Aristophanes, *Acharnenses* 463).

An analysis of all the collected information showed that the records relevant to sponges could be classified into three categories (Figure 1): first, records commenting on aspects of sponge biology (19 records); second, those describing sponge value for man (118 records); and third, records in which sponges occurred in similes or the root *spong-* was used metaphorically in the formation of either relevant verbs and adverbs, or of similes (74 records).

Ancient knowledge of sponge biology

Most of the biological information on sponges was given by Aristotle in his zoological works. However, other classical authors seem to have had a good perception of the form and the physical properties of sponges, since they used them in a variety of comparisons, similes and metaphors.

Diversity

As Voultziadou & Vafidis (2007) have pointed out, the sponge in antiquity was definitely a member of the order Dictyoceratida. Commercial sponge species have attracted human interest very early, and thus every description or comment on the nature of sponges concerns this kind. An exception is *Aphysias* (*a*=not, *phyno*=wash, clean) the sponge that 'can not be cleaned' and used by man, which corresponds to the black *Ircinia Sarcotragus muscarum* Schmidt, 1864, a species very common all over the coasts of the Aegean

Table 1. Works mentioning or providing information on sponges in Greek antiquity.

Author	Type of work	Number of sponge records
8th Century BC		
Homer	Heroic epic	5
7th Century BC		
–		
6th Century BC		
Aesop	Fables	4
Aeschylus	Tragedy	1
5th Century BC		
Aristophanes	Comedy	9
Antiphon	Oration	1
Plato	Philosophy	2
Crates	Comedy	2
Pherecrates	Comedy	2
Theopompus	Comedy	2
Hippocrates	Medicine	100
Alcmaeon	Philosophy	1
Diogenes	Philosophy	1
4th Century BC		
Demosthenes	Oration	1
Aeschines	Oration	1
Lycurgus	Oration	2
Aeneas	Military	2
Aristoteles	Zoology	30
Theophrastus	Botany	5
Eubulus	Comedy	2
Calisthenes	History	3
Callimachus	Philosophy	1
Clearchus	Philosophy	1
Eudemus	Philosophy	1
Timaeus	History	1
3rd Century BC		
Antigonus	History	2
Aristophanes	Zoology	3
Erasistratus	Medicine	2
Chryssipus	Philosophy	6
Heraclides	Travelling	1
Philo	Mechanics	3
Straton	Philosophy	1
2nd Century BC		
Agatharchides	History	1
Posidonius	Philosophy	3
1st Century BC		
Diodorus Sicul.	History	2
Dionysius Hal.	History	1
Strabo	Geography	2
Arius Didymus	Physics	2
Philoxenus	Grammar	2

(Voultziadou, 2005). When alive, this species resembles very much the common commercial sponge *Hippospongia communis* (Lamarck, 1813) and probably the early sponge fishermen were collecting it by mistake to find out very soon that it had none of the useful properties of the latter. A detailed justification of the identification of this and the four

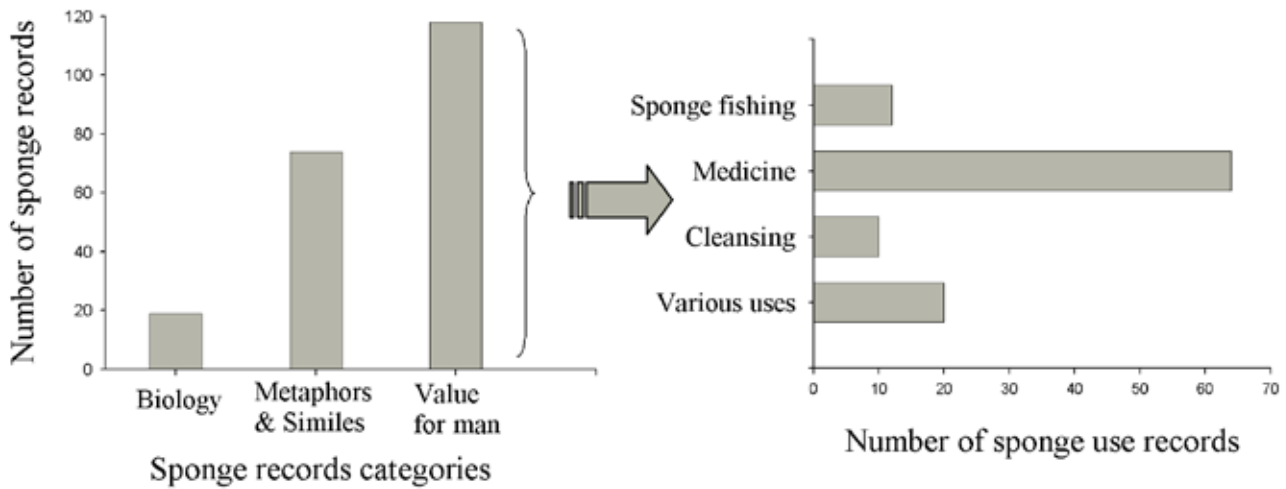


Figure 1. Classification diagram of sponge records in the written documents of Greek antiquity.

‘true’ sponge species, on the basis of Aristotle’s descriptions, has been presented by Voultziadou & Vafidis (2007). Very briefly, the four commercial species recognized by Aristotle (*History of animals* 548b) are the above mentioned honey-comb called *manos* (=loose-textured), the Greek bathing sponge *Spongia officinalis* called *pycnos* (=dense, close-textured), the elephant ear *Spongia agaricina* Pallas, 1766 called *Achilleios*, and the leather sponge *Spongia zimocca* Schmidt, 1862 called *tragos* (=goat). *Aphysias* is differentiated from other sponges by Theophrastus as well (*Enquiry into plants* 4.6.10.17). The names *S. agaricina* and *S. zimocca* are used here in the sense of Mediterranean authors, e.g. Vacelet (1959).

Sponge nature

By including sponges in his zoological works, Aristotle actually classifies them among animals. However, he uses them as an example of organisms exhibiting both plant and animal characteristics. He says that nature proceeds from the inanimate to animals by such small steps that, because of the continuity, we fail to see to which side the boundary and the middle between them belongs. The change from plants to animals, he says, is continuous. Some organisms in the sea might raise the question whether they are animals or plants since they grow attached on one hand, but they exhibit a kind of sensation on the other. Sponges belong to this category (*History of animals* 588b21; *Parts of animals* 681a11, a15). The fact that sponges share with plants the state of standing in one place and being attached, but they have the sense of touch like animals was observed by other authors as well (Posidonius, *Fragmenta* 309a42). The ability of sponges to respond to stimuli was indicated by the fact that ‘it is very difficult to detach a sponge unless the effort to do so is made surreptitiously. If the sponge becomes aware that someone is intending to pull it off, it contracts itself and is then difficult to detach’. It does the same when there is high wind or a rough sea, to prevent itself from being torn away (Aristotle, *History of animals* 487b9, 548b11; Antigonus *Historium mirabilium collection* 83.1.1).

Sponges were not unique among animals for living in close adhesion to an external object; many kinds of bivalves did the same (Aristotle, *History of animals* 487b9, 548b11;

Aristophanes Gramm., *Animal histories* 1.45.4). ‘They grow attached on rocks or on beaches and they get their nourishment in the mud. This is shown by the fact that when they are gathered they are full of mud. The same holds for other sessile organisms that derive their nourishment from their adherence to some surface’ (Aristotle, *History of animals* 548b6).

Regeneration in sponges was observed and reported by Aristotle: ‘when the sponge is broken off, a new one grows up again from the remaining portion and takes the place of the old one’ (*History of animals* 548b18).

External morphology

A description of sponge morphology given by Aristotle is presumably a good description of the commercial species *Hippospongia communis*: ‘when they are alive, before they have been washed and cleaned, they are black in appearance. Their base of attachment is wide, not confined to one point, not extending over the whole under side. Their attachment is spread over numerous places leaving cavities in between. On top of the sponge, most of the cavities and canals are covered [author’s comment: by the pinacoderm] and only a few openings [author’s comment: large oscula] are visible. Some people say they receive their food through these ones’ (*History of animals* 548b30).

It is worth mentioning that the sponge pinacoderm was described as a spider web spread over the sponge cavities. ‘Its contraction permits the opening and closing of surface openings and the entry of small fishes’ which were thought to be food for the sponge (Aristotle, *History of animals* 548a29).

Symbiotic relationships

Symbiosis of other animals with sponges was observed: ‘several animal species are known to live and feed inside the sponges. When the sponge is detached they get out and are devoured by small rock-fishes; so do the remnants of the sponge on the rock’ (Aristotle, *History of animals* 548b16). Specifically, it was known that small crustaceans, called ‘pinna-guards’ were living in the canals of sponges (Aristotle, *History of animals* 548a28, Aristophanes Gramm., *Animal histories* 1.45.5; Chrysippus, *Fragmenta logica et physica* 729b5).

According to Voultziadou & Vafidis (2007) the sponge pinna-guards are the shrimps of the family Alpheidae, common species of which (*Synalpheus gambarelloides*, *Alpheus dentipes*, *Typton spongicola*) live inside Aegean sponges. Aristotle's comment on sponges capturing small fish (see the previous paragraph) probably refers to the symbiotic relationship among the two groups.

Characteristic attributes

Aristotle, describing materials, defines sponges as compressible and squeezable but not tactile (*Meteorologica* 386a29, 386b5, b17). Their ability to obtain again their original size after compression was stressed by Straton (*Fragmenta* 56.19). Their characteristic to keep great quantities of water in their canals (Aristotle, *Meteorologica* 386b5; *Problems* 868b31) and expel it when compressed (Aristotle, *Problems* 938b20; Posidonius, *Fragmenta* 291.74) was illustrated in similes comparing certain body parts with sponges. For example, Diogenes Apolloniates (*Testimonia* 22.3) compares the human tongue with a sponge because it receives juices from food and sends them via blood vessels to the senses. Furthermore, Alcmaeon postulated a 'sponge' theory of prenatal nourishment, thus indicating the absorptiveness of sponges (*Testimonia* 17.2).

Sponges were included among things that 'have no sound', in contrast to bronze which is smooth and solid (Aristotle, *On the soul* 419b6). This quality made them useful to assist in noise absorption.

Habitat, distribution and sponge quality

Observations were made on the habitat preference by sponges and the consequences of the environmental conditions on their quality: 'the sponges growing in deep calm waters are softest, because the effect of winds and storms is to harden them and inhibit their growth'. Differences in softness were observed among areas with different wind action. Furthermore, 'they prefer to live in shadowy places, avoiding the heat of the sun which destroys them. Thus, the best of them grow at a good depth on rocky coasts, where they find the best conditions' (Aristotle, *History of animals* 548b21). According to Theophrastus (*Enquiry into plants* 4.6.5.6) they thrived in areas oriented or exposed to the north.

Some information on the geographical distribution of sponges was given by Aristotle. It is well known that the area of his research on marine animals was the Aegean Sea and more specifically the north-western coasts of Asia Minor and the coasts of Lesbos Island (Thompson, 1913; Lee, 1948). Thus, it is not surprising that two of the areas recorded for their sponges are Lycia, where 'the loose-textured sponges reach the largest size and are more plentiful' and Hellespont known for its 'rough and close-textured sponges' due to 'the effect of winds and storms' prevailing there (Aristotle, *History of animals* 548b20-25). The two sides of Cape Maleas, in South Peloponnese are compared for the quality of the growing sponges, which differ in softness.

The value of sponges for man in antiquity

Sponges were mostly known in antiquity for their utility in everyday life. So, not surprisingly, the vast majority of records

examined in the texts (Figure 1) commented on their various uses in different human activities. An overview of sponge collection and usages in Greek antiquity is presented below.

Sponge fishing and commerce

Sponge gathering was a common activity in ancient coastal Greek communities. Some local economies were based mainly on fishing and collecting different kinds of edible invertebrates. Heraclides (*Descriptio Graeciae* 1.24.2) describing everyday life in the small town Antheon, located on the coasts of the Gulf of Euboea (central Greece), says that its inhabitants were making their living by fishing and collecting purple shellfish and sponges.

The sponge fisherman was initially called sponge-hunter (*spongotheras*), sponge-swimmer (*spongokolymetes*) (Lycurgus, *Fragmenta* Oration 14.11.1) or simply *spongeus* (Aristotle, *Problemata* 960b21; Theophrastus, *Enquiry into plants* 4.6.4.13). Later in Roman Greece, the name sponge-cutter (*spongolomos*) was also used (Oppianus, *Halieutica* 5.612). Oppianus gives a detailed description of the diving and sponge collecting procedure, which is going to be presented in detail in a future work on Roman antiquity since it is out of the date range of the present research.

Sponge divers fixed sponges in their ears to prevent water from entering violently and damaging the eardrums, while sometimes they deliberately punctured their eardrums and nostrils in order to facilitate their diving by avoiding the need to equalize pressure (Aristotle, *Problemata* 960b15, 21). Strabo (*Geography* 15.1.67.2) reports that people in India have been taught to use and collect sponges by the Macedonians.

Most divers in antiquity were engaged primarily in sponge collecting but diving had other applications, such as salvage and war operations. Frost (1968), in an interesting overview of diving in antiquity, discusses methods, dangers, devices and products exploited.

Sponge fishing became a subject of legends and stories told in antiquity. So, Eudemus (*Fragmenta* 131.2) narrates a story about a seal fallen in love with the ugliest among a group of sponge fishermen, whom she thought as the most handsome man she had ever met! Furthermore, we find an indication on sponge commerce in two of the Aesop's fables: there is a merchant who buys a large number of sponges, and piles them on the back of his ass. When the ass falls down in a stream, his burden is doubled because the sponges become swollen with water (*Fables* 191.1.3 and 6; 266.15 and 18).

Cleansing and bathing

Sponges were widely used for cleansing and bathing. Very early, in the first written documents of western civilization, Homer puts sponges in the hands of Hephaestus. He is in his house waiting for Thetis, '...and with a sponge he wiped his face and his two hands ...' (*Iliad*, 18.414). In *Odyssey*, the servants make use of 'porous sponges' to clean the tables and chairs in the court of Odysseus in Ithaca (1.111, 20.151, 22.439, 22.453). Relevant records are given by Aristophanes (*Fragmenta* 55.1, 55a1, 19.1) and Crates (*Fragmenta* 2.7, 15.7). The uses of sponges in cleansing and bathing are further analysed and discussed in the following section on their medical use.

Medicine and pharmacology

The first time a sponge is used for a medical purpose is recorded by Aristophanes (*Frogs* 482 and 487) where sponges squeezed in the water are put on the heart to bring somebody who had fainted into his senses. Sponges seem to have played a principal role in the medical practice in antiquity. The first works on medicine are those by Hippocrates, considered as the father of Medicine, in which sponges appear as a basic tool in the treatment of various health problems and diseases. A detailed overview of sponge usage in medicine, as recorded in his works, is presented below:

Healing baths. – The bath was of help in the treatment of many diseases and in such cases sponges should be used instead of brushes (Hippocrates, *On regimen in acute diseases* 18.16–18). Sponges were also useful when a small quantity of water was needed (Hippocrates, *Use of liquids* 1.5).

Head diseases. – In various head diseases or diseases with symptoms in this part of the body, soft large sponges squeezed out of hot water should be applied on parts of the head to stop the pain: the ears, the eyes, the neck, the tongue (*On diseases i–iii* 2.14.8 and 25, 2.22.4, 2.26.18, 2.27.5, 6.22, *Of places in man* 12.14, *Of the epidemics* 2.6.22.4). Small sponges soaked in honey were put inside the ear for the treatment of otorrhoea (*On diseases i–iii*, 2.14.16). A sponge was put inside the mouth to cure inflammations and swellings of the tongue and the palate (*On diseases i–iii* 2.31.3, 2.32.7). Sponges were used to remove nose polypus. For this purpose, a special device was constructed using a sponge. A small sponge was twisted to have a spiral shape and wound with a linen thread to get hard. This device was driven inside the nostril and was pulled with the help of a needle from the mouth, in order to uproot the polyp (*On diseases i–iii* 2.33.5,7).

Clyster therapy. – Enemas were applied for medical reasons. After introducing the proper liquid into the rectum, the anus was plugged with a small sponge to help keep the liquid inside the colon. The patient was sitting in hot water until cleaning of the large intestine was completed (*On diseases i–iii* 3.14.22).

Wound and sore healing. – Sponges were used for cleansing and drying the sores before applying the proper medicine. Before applying a bandage on a wound, the sore should be dried by frequently cleansing it with a sponge. (*Of ulcers* 4.2, 3). In case a swelling arose around the sore, one waited for the inflammation to cease and then sponges were applied tight, beginning from the sound parts and gradually advancing to the sore, to absorb the fluids and bring the parts, which were separated, together (*Of ulcers* 10.11 and 13). For the sores formed when the flesh had been wounded or cut by a sharp instrument, especially those situated in the leg, in a toe or finger, it was first recommended to let the blood flow. So the sores became dryer and reduced in size. After the flow of the blood, it was expedient to bind a sponge on the sore. It was recommended that the sponge was dense and soft (indicating the species *Spongia officinalis*) rather dry than wet (*Of ulcers* 2.12, 15.12; *On the physician* 2.18). Sponges soaked in oil were used to sear (cauterize) sores or scars during performing an operation (*On sight* 3.6,8,14).

Diseases of the digestive system. – The treatment of haemorrhoids included burning and then the application of a cataplasm made of lentils and tares for six days. On the

seventh, a very soft sponge was cut into very slender pieces 15 cm long. A thin smooth piece of cloth of the same size with the sponge was smeared with honey and applied on the sponge. The sponge was pushed as deep as possible into the anus and a piece of wool was placed upon the sponge, so that it remained there (*On Haemorrhoids* 2.18, 19, 20, 21, 22, 23). Alternatively, after the application of a complicated medicine, oiled compresses were put on the anus and a sponge was bound on them (*On Haemorrhoids* 3.7). Anal or anorectal fistulae were treated using sponges. A soft, slender piece of sponge with honey was forced into the anus in exactly the same way as described above in the operation of the haemorrhoids. The bandage was removed the next day and the fistula was cleaned with a sponge and hot water. This was to be done for seven days. Bandage with the sponge should be preserved afterwards until the cure was completed (*Of fistulae* 4.17, 19, 20, 22, 27). In rectal procidentia, the anus was washed with a soft sponge moistened with hot water in which the shavings of lotus had been boiled. Then the sponge was squeezed and placed to push the anus with a shawl which was brought below between the legs and fastened at the navel (*Of fistulae* 9.1, 5 and 7).

Gynaecological diseases and conditions. – Sponges were used in infections and pains of the uterus (in simple or more complicated cases, such as when a woman carried a dead foetus) as well as to restrain intense blood flow. A sponge was squeezed in oil or hot water, in which occasionally olive leaves, roses, etc. were boiled, and placed over the area hurt to stop the pain. For the same reason, sponges were used to clean the genitals and vagina squeezed either in hot water or in wine (*On the diseases of women i–iii* 64.10, 14, 16, 113.13, 137.11, 166.8, 171.11, 193.20; *On the excision of the foetus* 5.6). Dry sponges were heated and used to keep a woman's belly warm (*On the nature of the women*, 105.17). Sponges fastened at the navel were useful in the treatment of uterine prolapse (*On the nature of the women* 5.9; *On the diseases of women i–iii* 144.11, 248.8).

Pain relief. – Sponges squeezed in hot water were used for relief from pains and tiredness. Sponges were put on the back, hips or legs and were tied with leather or wool (*Of the epidemics* 5.1.58.3, 7.1.76.5). Soft big sponges were put between the body and a hot application, a bottle or a bladder with hot water, to prevent pain. This application was covered up above so that the heat remained longer, and at the same time the vapour was prevented from being carried up to the patient's breath (*On regimen in acute diseases* 7.7). Pain due to swollen feet was relieved with sponges bound as cataplasms on them (*Of ulcers* 24.3).

Drug production. – There are only two cases, in which sponges are mentioned for their therapeutic properties and their use in the construction of drugs. Both concern the healing of gynaecological diseases. In one case, sponge is ground together with a kind of seaweed and seal rennet, and then all these are mixed with seal fat. This mixture is used to fumigate the genitals (*On the nature of the women* 34.27; *On the diseases of women i–iii* 203.29). Another drug is made of toasted and then ground sponge tissue, mixed with wine. This is recommended as a drink for intense and prolonged blood flow in women (*On the nature of the women* 90.7; *On the diseases of women i–iii* 192.34). Ancient Chinese also used burnt sponge

and seaweed, as sources of iodine, in reducing the size of goitre or causing its disappearance (Rosenfeld, 2000).

Various uses of sponges

Sponges were included among the common household objects, along with pots, knives, tripods, bowls, oil vessels, lamp stands, etc. (Clearchus, *Fragmenta* 87.5). Moreover they were used in various human activities described briefly below:

Shoes were polished using a sponge and a black varnish (Aristophanes, *Vespae* 600).

When sawing a piece of wood, sponges were tied both on the wood and the saw to assist noise absorption (Aeneas, *Polioretica* 19.1.2).

Sponges were tied on wooden sticks to obtain water from a spring (Theophrastus, *Fragmenta* 160.1.4; Callimachus *Fragmenta grammatica* 407.113; Antigonus, *Historiarum mirabilium collection* 158.1.4).

To prevent heat-stroke, it was recommended to put a large, dense and hollow sponge (indicating *Spongia agaricina*) on the head before exposure to the sun. The sponge should be first saturated with water and then squeezed of as much water as possible (Erasistratus, *Testimonia et fragmenta* 190.2).

Oiled sponges were used to separate water from wine when the latter (*oinos*) had been watered (*kekramenos*). This was accomplished by wetting a sponge in oil and then putting it into the wine. The water if any, was absorbed by the sponge and separated from the wine (Chrysippus, *Fragmenta logica et physica* 471. 28, 30, 472.10,11; Arius Didymus, *Physica* 28.23, 25).

A sponge was used to stop up a hole or a leak in a vessel (Strabo, *Geography*, 8.8.4.25; Aristophanes, *Acharnenses* 463).

In military enterprises, wet sponges soaked in water or vinegar were put, along with algae kept in fishing nets and sheepskins, on the various war machines to protect them from catching fire (Philo, *Parasceustica et polioretica* 99.25). Moreover, the 'closely textured, strongest and rarest among sponge species', the *Achilleios* identified as *Spongia agaricina* (cf. Voultziadou & Vafidis, 2007), was used for 'lining helmets and greaves for protection, deadening the noise of blows on them' (Aristoteles, *History of animals* 548b1).

Sponges squeezed in water were applied on letters written with invisible ink to make them visible again. The special ink used in time of war for security purposes, was made of a solidified liquid secreted by oak trees, which was diluted in water. When the ink became dry, it was invisible (Philo, *Parasceustica et polioretica* 102.35).

Gold was mined and purified in Egypt with a complicated method involving the use of sponges. After the rock blocks of gold were pounded to small pieces with stone hammers, the rock fragments and powder were sifted carefully in running water on a sloping stone table to segregate the denser, gold-bearing fragments, which were swept up in sponges (Agatharchides, *De mari Erythraeo* 27.13; Diodorus Siculus, *Library of History* 3.14.2).

Besides all the above uses of sponges recorded in the classical texts, we should notice their significant role in the art of the Late Minoan Age presented by Evans (1928, 1930) in his treatise describing the excavations of Minos' Palace at Knossos. Sponges played an important role in the

development of the 'marine style' which was the last purely Minoan style of artistic decoration. Besides being depicted on wall-paintings and vases, sponges were used as painting tools: the repeated use of a single small sponge on the end of a stick, dipped from time to time in paint, produced a decorative scheme called 'sponge pattern'.

Sponges in metaphors and similes

In 74 of the total records found, the sponge was used in various similes, and the root *spong-* in the formation of relevant verbs and adverbs metaphorically stating the sponging activity or sponge quality. All verbs (*spongizo* and the like), found in 38 records, had the meaning of cleaning, wiping or rubbing but not necessarily with a sponge; the sponging activity could be done using a woolen cloth as well (Hippocrates, *On the nature of the women* 32.64). In several cases, the authors indicated that sponging was made with a sponge (Hippocrates, *On ulcers* 4.2-3), in others this is not clarified (Demosthenes, *De corona* 258.7; Callisthenes, *Fragmenta* 5.17, 18, 19).

The adverbs (*spongodes* or *spongoides* = spongy) and the similes (like a sponge, having the form of a sponge) had the meaning of resembling a sponge in texture, porosity, elasticity or compressibility and were used mainly to characterize some parts of the human body (Hippocrates, *On ancient medicine* 2.28, 27; Aristoteles, *Problems* 857b22). Hippocrates, supports that 'some of the conformations in the human body are spongy and of loose texture, such as the lungs, spleen and breasts' (*On ancient medicine* 22.8.27). Lungs, according to Plato, 'are soft containing within perforated cavities like those of a sponge so that, when they receive the breath and the drink, they might have a cooling effect and furnish relief and comfort to the passionate heart' (*Timaeus* 70c6). The palatine tonsils were called 'sponges' (Hippocrates, *Of the epidemics* 4.1.7.18).

Sponge maximum size, is used as a standard for comparisons (Aristotle, *History of animals* 616a24; Diodorus Siculus, *Library of history* 5.13.2.1).

The verb 'to sponge' was used metaphorically to show that someone was drinking and eating very much (Aeschines, *On the false embassy* 112.3). Plato argues that the art of sponging (=drinking) is equally interesting for a philosopher as is any other art (*Sophist* 227a8).

Sponges sometimes occurred in similes used to describe human behaviour. Moral degradation or decadence was compared with a sponge torn and thrown away (Chrysippus, *Fragmenta moralia* 487.44), while bad fate could 'sponge one's life out' (Aeschylus, *Agamemnon* 1329).

Concluding remarks

Human knowledge of sponges in Greek antiquity, as illustrated in the written documents from their first appearance in western civilization until the beginnings of the Roman Empire, seems to be interestingly rich. Ancient Greeks knew how to gather, clean, and use sponges in household, personal hygiene, pain relief, disease treatment, art and a series of other purposes. The significant role of sponges in medical practice is illustrated by the high number of their records in the medical works of the studied historical period. Concerning the study of their biology, sponges are

extensively mentioned in the fundamental zoological works by Aristotle, which include information on their structure, function, diversity, ecology and distribution. The biological information on sponges encountered in the studied texts seems to be more or less consistent with present scientific knowledge.

However, the ancient history of these ancient animals does not seem to end here. It has to be further investigated in order to cover the succeeding very important period of the Roman civilization which gave a rich literature, both in Greek and Latin, on natural history (Pliny the Elder), zoology (Oppianus, Aelianus), and medicine (Galen).

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