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ENDEMIC FEATURES OF THE UPPER JURASSIC SPONGES IN THE WESTERN CENTRAL DOBROGEA (ATARNATI-CECHIRGEA PERIMETER)

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Abstract. In the Upper Oxfordian, central Dobrogea hosted the far eastern end of the Upper Jurassic Sponge "Megafacies". Its' closest relations are the occurrences in Poland and those in the Swabian Alb (Germany). However, in Dobrogea, the foundation of the faunal association was a slight slope, unlikely the rest of the European occurrences. As the closest Upper Jurassic sponge communities were quite far, their weak influence allowed the development of some different sponge populations in the specific conditions of life here. The differences are mostly related to shape and size, and this study tries to present some of them. Several genera are considered: *Laocoetis*, *Cribrospongia*, *Trochobolus*, *Cnemidiastrum* and *Melonella*. Specimens of *Tremadyction phylloideum* (Antonescu) are particularly analyzed and it is suggested that species is only a variety of *Cribrospongia reticulata* (Goldfuss), and not a separate one. It is, also, particularly analyzed the *Trochobolus dentatus* (Kolb) species identified in that area. Unhappily, diagenetic conditions did not allow the conservation of the skeleton structure. That is why all taxonomical identifications of fossil sponges in Dobrogea, both previous and present ones are based entirely on the macroscopic morphologic descriptions.

Keywords: Sponges, Jurassic, Romania, taxonomy, Dobrogea, Oxfordian.

INTRODUCTION

The studied perimeter is located in the western part of Central Dobrogea, southwest of the town of Hârsova (fig. 1). The main outcrops are on Cechirgea Valley, Veriga Valley and on the right bank of the Danube, south of Ghindaresti and north of Atârnati Island.

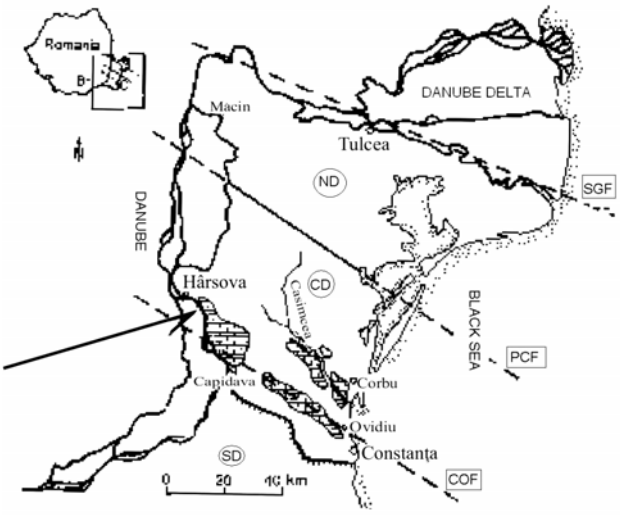

Fig. 1 - Perimeter location in Dobrogea. CD – Central Dobrogea, SD – Southern Dobrogea, ND – Northern Dobrogea, SGF – Sfântu Gheorghe Fault, PCF – Peceneaga – Camena Fault, COF – Capidava – Ovidiu Fault (after Hermann, 1996).

A great community of sponges has developed, in that area, in the Upper Oxfordian. Its remains are now enclosed in stromatolitic limestone of microbialithic origin.

Even though the fossil richness of the rocks in the Danube right bank is well known from the end of the XIX-th century, but there is no paleoecology and taxonomic study of the sponges written yet. In time, several authors have paid attention to those deposits. Just to mention some of them: Simionescu (1909), Antonescu (1928), Barbulescu (1967, 1972, 1974), Draganescu (1976), Andrasanu et al. (1982), Herrmann (1996), Dragastan et al. (1998). Without their previous works, our present study would not have been possible.

Sponge deposits in Dobrogea are part of the great european belt of spongolithic reef limestones that laid, 160 million years ago, on the northern coast of Tethys Ocean, from Portugal, in west, through Spain, France, Switzerland, Southern Germany, Poland, to Romania, at east. That belt was recently named "Upper Jurassic Sponge Megafacies" (UJSM)] (Matyja, 1976, fide Pisera, 1997) (fig. 2).

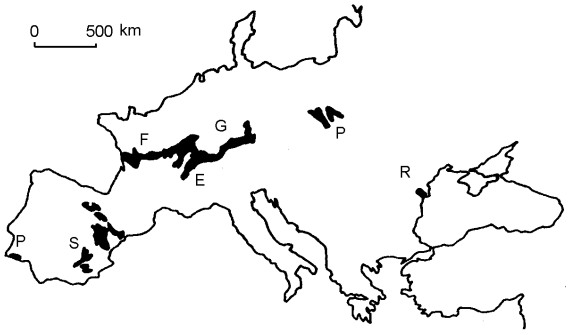

Fig. 2. Jurassic sponges facies occurrence as remains of European Tethys. P – Portugal (Algarve), S – Spain, F – France (Poitou), E – Switzerland, G – Germany (Swabia and Franconia), P – Poland, R – Romania (Central Dobrogea) (after Herrmann, 1996).

Recent researches suggest similar facies outside European borders: in Georgia, Western India and Nepal (Mehl & Fürsich, 1997). As Pisera (1997) has

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already noticed, there might be an event of global extent. Obviously, there are serious differences in faunistic associations in different areas, and even in their stratigraphic age.

In Portugal and Spain, the Jurassic Hexactinellid presence was been recorded starting with the Bajocian. However, in Spain they developed in different locations of different ages. In the Upper Jurassic, siliceous sponges have been dated in Middle Oxfordian to Upper Kimmeridgian. The environment was a low-angle flat sea floor, far from the land. In the southern Portugal, it was a steepened ramp (Pisera, 1991; Leinfelder et al., 1994; Krautter, 1995).

In France, the sponge deposits are Upper Oxfordian (Gaillard, 1972).

In Germany, the spongolithic facies has been dated from Middle Oxfordian to Upper Kimmeridgian (Leinfelder et al., 1994; Pisera, 1997).

In Switzerland, the sponge megafacies occurs in the Middle Oxfordian and in Poland, in the Lower Oxfordian, on a slightly inclined slope (Trammer, 1982).

The spongolithic facies in Georgia seems to be the oldest one, dated in Middle Jurassic (Nutsubidze, 1964, fide Pisera, 1997).

In Romania, the sponge facies has been dated starting with the Lower Oxfordian, in the Eastern Central Dobrogea. A low-angled slope inclined towards west has upholded it. The sponge facies has had the moment of maximum extent in Upper Oxfordian; then started, also, the regression that ended at the Oxfordian-Kimmerdgian boundary, together with the sponge megafacies existence.

Comparing the Upper Jurassic Hexactinellid fauna in France, Germany, India and Romania, for example, one can notice that in France, from 22 described species, 6 are in Romania too; in Germany, from 112 species, 19 were found in Romania, too and only 4 of the Romanian species are among the 11 species described by Mehl & Fürsich (1987) from India. So far, there are 22 sponge genera with 41 species recorded in Dobrogea. Nevertheless, we could collect and identify specimens of only 18 genera and 25 species; the species we could not find belong both to the 4 missing genera and other found genera.

Statistically and paleontologically, the Romanian fauna has the strongest similarities with the associations in Swabian Alb (Germany) and Poland and shows important differences compared to that one in Spain or Portugal, for example.

Central Dobrogea is the easternmost area of occurrence of the sponge megafacies and the particular conditions here supported the development of specific features. In Central Eastern Dobrogea (Cheia area) are the only atolls of sponge origin in the world. Ring-shaped bioherms built entirely by sponge skeletons have no corresponding fossil or actual bio-construction.

The sponges here have been the dominant macrofaunal representatives in the facies. They have been the main part of the eco-system and there had to be a strong relationship between the conditions that allowed their flourishing as association and their life. That is why the specific environment must have influenced the organisms own physical development, as well.

We will try to describe briefly some of the particular features of the sponges here. Because of their extent in the fauna in the study area, we consider them as endemic. The changes of the specific features were mostly noticed at 4 genera and 5 species.

The modern determination methods, based on the spicule network could not be applied. Therefore, the determinations below are entirely based on details related to their appearance and shape.

Phylum Porifera LINNE, 1758
Class Hexactinellida SCHMIDT, 1870
Subclass Hexasterophora SCHULTZE, 1887
Order Hexactinosa SCHRAMMEN, 1903
Family Craticulariidae RAUFF, 1893
emendata REID 1964, emendata MEHL 1992
Genus *Laocoetis* POMEL, 1872
Laocoetis parallela (GOLDFUSS), 1826
Pl. I, fig. 1, 4-6, 8

1826. *Scyphia parallela nobis* n. sp. ; Goldfuss (p. 8; tab. III, fig. 3)
1862. *Scyphia parallela nobis* Goldfuss; Goldfuss (p. 8; tab. III, fig. 3)
1928. *Craticularia paralella* Goldfuss; Antonescu (p. 487/7)
1973. *Craticularia parallela* Goldfuss; Fibich (p. 50, tab. VIII, fig. 3, 4)
1992. *Laocaetis parallela* Goldfuss; Mehl (p. 73; tab. 14, fig. 3)
1997. *Laocoetis parallela* Golldfuss; Pisera (p. 38-40; pl. 7, fig. 1-3; pl. 8, fig. 4,8; pl. 34, fig. 5,6; fig. 10)
1998. *Laocaetis paralella* Goldfuss; Barbulescu in Dragastan et al. (p. 133)

Material: 3 fully preserved specimens, 8 fragments.

Dimensions: Fully preserved specimens height: 4-10 cm. Osculum diameter: 1,2 cm, wall thickness: 3 mm, no. of pores on cm^2: 42-45. Pore diameter: 0,3-0,9 mm, bandwidth between the pore rows: 0,8 mm.

Description: Typical features: prolonged conical shape, rounded upper limit, pores in rectangular pattern. The specimens have reduced morphological variability. Their conical shape may be slightly curved towards the fixing point.

Remarks: Number of pores/cm^2 is higher with 40-80% than the figure in the description of the species (25-30) (Pisera, 1997); we assume this difference is probably related to the particular life conditions. Even it is a very important feature, we

consider it an endemic one. The reason is that we could notice the same deviation in comparison with the species description concerning also others species of the genus we could determine in the collection. Furthermore, that property is systematically repeated on every specimen. We present below the drawing of Goldfuss (1862) in his work supporting species definition (fig. 3), for comparison with our images.

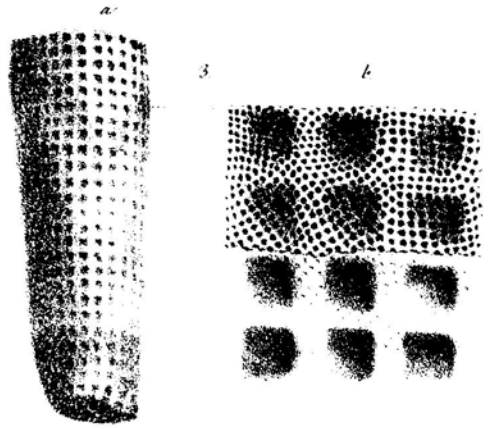

Fig. 3. The original drawing of *Laocoetis parallela*; a – natural size; b – magnified (after Goldfuss, 1862)

Occurence: Cechirgea Valley, Veriga Valley; Upper Oxfordian. The species has been, also, located in Germany (Plettenberg, Barenthal, Tieringen, Erkenbrechtsweiler, Hettingen, Blaubeuren, Genkingen, and Blaustein) (Pisera, 1997) in Oxfordian and Kimmeridgian.

Laocoetis procumbens GOLDFUSS, 1826
Pl. I, fig. 2, 3, 7, 10

1826. *Scyphia procumbens nobis* n. sp. ; Goldfuss (p. 11; tab. IV, fig. 3)
1862. *Scyphia procumbens nobis* Goldfuss; Goldfuss (p. 11; tab. IV, fig. 3)
1928. *Craticularia procumbens* Goldfuss; Antonescu (p. 487/7-488/8)
1982. *Paracraticularia procumbens* Goldfuss; Andrasanu et al. (p. 84, pl. II, fig. 4; p. 85, pl. I, fig. 1)
1997. *Laocoetis procumbens* Goldfuss; Pisera (p. 40, pl. 6, fig. 4; pl. 8, fig. 7; fig. 11)

Material: 22 fragments.

Dimensions: in the range of 1,5 to 18,5 cm; no. of pores/cm^2: 50-100, accordingly with the age of the individual, thin wall (2-3 mm)

Description: Colonial sponge with general appearance resembling *L. parallela* species. References have not precisely differentiated that species and the previous one. Some authors (e. g. Pisera, 1997) suggest that the two species are a single group which requires a common analysis. Distinct features: pores no., generally cylinder-shaped, often winding shaped, commonly associated in colonies, pores rectangular pattern; particularly the larger number of pores/cm^2 and the generally tubular shape may separate it from *L. parallela* species.

Remarks: It is noticeable again that the species in Dobrogea has a higher pore density than the standard (36), with about 40-170%. That is an endemic feature for Western Central Dobrogea area, as all our specimens present it. As in the case of *L. parallela*, it is not enough for defining a new species and we cannot explain yet the necessity determining that adaptation.

Occurence: Cechirgea Valley, Veriga Valley, Atârnati-Ghindaresti; Upper Oxfordian. The species occurs, also, in Germany (Barenthal, Erkenbrechtsweiler, Genkingen and Hochwang) (Pisera, 1997) in Kimmeridgian.

Family Cribrospongiidae ROEMER, 1864
Genus *Cribrospongia* D'ORBIGNY, 1849
Cribrospongia reticulata var. *piriformis* (GOLDFUSS), 1862
Pl. I, Fig. 11; Pl. II, Fig. 1, 4, 5

1862. *Scyphia reticulata nobis* var. *piriformis* n. sp. ; Goldfuss (pag. 10; tab. IV, fig. 1b)
1928. *Tremadictyon philloideum* n. sp.; Antonescu (pag. 486/6, fig. 1)
1943. *Tremadictyon phylloideum* Antonescu; Simionescu & Barbu (pag. 18, pl. II, fig. 12)
1962. *Tremadictyon phylloideum* Antonescu; Barbu (pag. 127, pl. XXIV, fig. 268)
1974. *Tremadictyon phylloideum* Antonescu; Barbulescu (pl. XVI, fig. 1)
1982. *Tremadictyon phylloideum* Antonescu; Andrasanu et al. (pag. 86, pl. II, fig. 4-6)
1998. *Tremadictyon phylloideum* Antonescu; Barbulescu in Dragastan et al. (pag. 133; pl. II, fig. 1-4, 8)

Material: 1 full specimen and 4 fragments.

Dimensions: The full specimen is 17 cm high, 8,5 cm wide in middle part of maximum width and 3 cm thick. The osculum is 2,5 cm in length and 1,5 cm wide across the center. The observations made have revealed that the wall thickness is of 8 mm, the pores are over 1 mm wide and over 2 mm high and their density is of 12/cm^2.

Description: The specific features are palette-shaped, flat profile, large pores, almost polygonal, with a typical pattern for the genus; where the internal side arrangement is visible, the pores seem to be alternating as on the external side and their size is similar. The pores are deep and wide along their entire depth. Sponge body may present girdles but, generally, it does not show the same morphologic variability as the previous species.

Remarks: *Cribrospongia reticulata* var. *piriformis* is considered endemic for Dobrogea, as no other scientist has described such a shape elsewhere.

Fig. 4. The original drawing of *Tremadyction phylloideum* (after Antonescu, 1928)

However, a similar specimen has been mentioned and drawn by Goldfuss (1862) as *Scyphia reticulata nobis* var. *piriformis* (p. 10-11, Tab. IV, fig. 1b), collected in Germany (Streitberg). Both descriptions (Goldfuss' and Antonescu's) seem to present the same animal. Furthermore, the Goldfuss' drawing obviously resembles the image in Antonescu's work (fig. 5). The only difference is that Antonescu presents a flat bodied sponge and Goldfuss a round bodied one. We assume is the same thing as the round very shape in his plates could not be resembled with anything in the available reference. But the piriform profile is identical with the outline of *T. phylloideum*. None of the authors did make any skeletal studies on the sponge. Their remarks, as well as ours, are entirely based on macroscopically morphologic features.

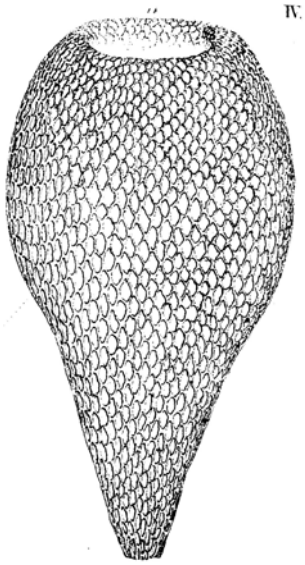

Fig. 5. The original drawing of *Scyphia reticulata nobis* var. *piriformis*, x 0,6 (after Goldfuss, 1862)

Later, Goldfuss' species was synonymized with *Cribrospongia reticulata* (GOLDFUSS, 1826). The pore arrangement, their shape, depth and size, on both sides of the wall, the wall thickness, are similar on *T. phylloideum* and C. *reticulata*. Except for the body shape, nothing is different between the two species. Or, the shape variability is one of the most common features of the sponges especially of *C. reticulata* and that only property is not enough for defining a species. To put it differently, we got no reasons, either microscopic, structural, or macroscopic, morphological, to consider *T. phylloideum* a separate species. Goldfuss himself has described a similar pore pattern for *S. reticulata nobis* var. *piriformis* as in the case of other varieties of *S. reticulata,* including all varieties in a single species (fig. 6).

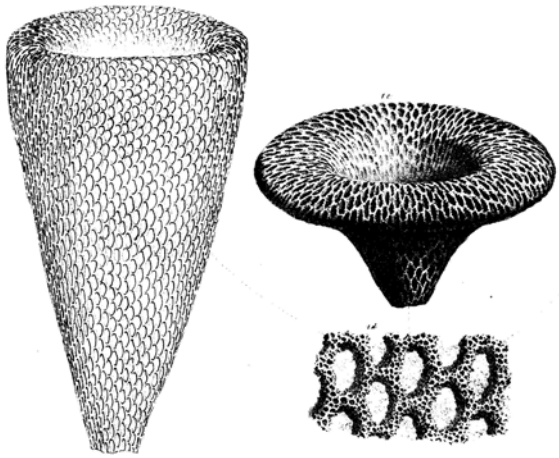

Fig. 6. Other varieties of *Scyphia reticulata nobis* and the pore arrangement, x 0,4 (after Goldfuss, 1862).

Generally, these are the reasons we consider *T.. phylloideum* only a variety of *C. reticulata.* A spicular analysis would clear the situation but sponges in Dobrogea are completely calcitized and the skeleton structure is not preserved. Until that analysis will be possible, on a better-preserved specimen, we propose that, according to the first description of Goldfuss, it be named *Cribrospongia reticulata* var. *piriforma*.

Nevertheless, that variety is not common elsewhere except Dobrogea and we could not find it in the available references except for the Romanian ones. Almost all authors dealing with the fossil fauna in Western Central Dobrogea have mentioned it in their collection. That is a reason for considering it as endemic.

As a supplementary reason for our opinion and for comparison with the figures above, we present illustrations of *Tremadyction phylloideum* in Romanian authors' works (fig. 7-9).

Occurrence: Cechirgea Valley, Veriga Valley; Upper Oxfordian.

Fig. 7. *Tremadyction phylloideum*, x 0,3 (after Barbulescu, 1974)

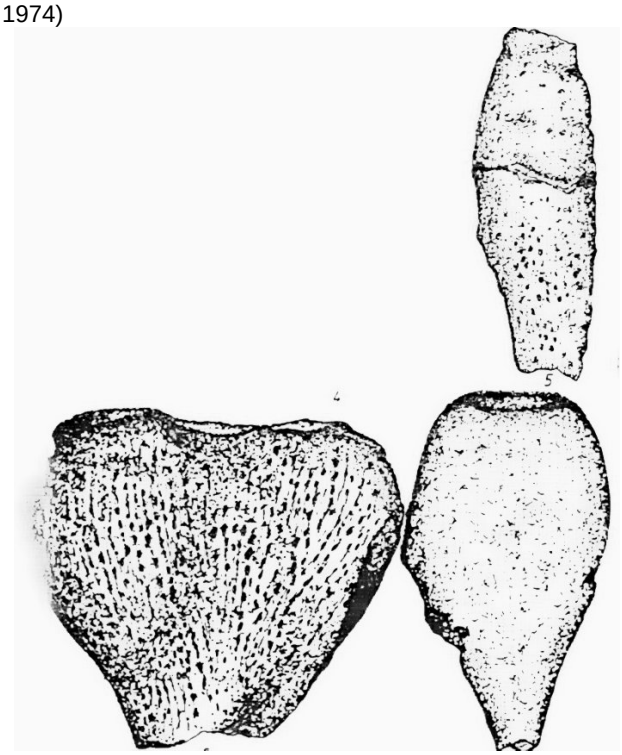

Fig. 8. *Tremadyction phylloideum*, x 0,3 (after Andrasanu et al., 1982)

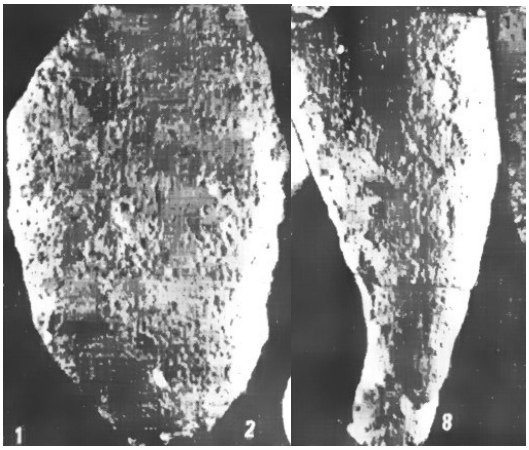

Fig. 9. *Tremadyction phylloideum*, x 0,4 (after Barbulescu et al. 1998)

Order Lychniscosa
SCHRAMMEN, 1903
Family Diapleuridae IJIMA, 1927
Genus *Trochobolus* ZITTEL, 1877
Trochobolus cf. *dentatus* KOLB, 1910
Pl. I, Fig. 9, 12; Pl. II, Fig. 2, 3

1910. *Trochobulus dentatus* n. sp.; Kolb (p. 202; pl. XX, fig. 3, 4)
1972. *Trochobolus dentatus* Kolb; Gaillard (p. 129; pl. III, fig. 6,7)
1973. *Trochobolus dentatus* Kolb; Fibich (p. 46; tab. VI, fig. 1a, b; tab. X, fig. 2)
1997. *Trochobolus dentatus* Kolb; Pisera (p. 73; pl. 39, fig. 9; fig. 29)

Material: 4 entirely preserved specimens.

Dimensions: 8-14 cm high, body diameter: 6,5-9 cm. Osculum average diameter is in the range of 2-3,5 cm. Wall average thickness is of 1,2 cm. The pores are large (2 mm).

Description: Medium sized, oval or piriform shaped, rarely conical sponge. Spongocoel is deep and the osculum is oval. The walls are thick. The pores can be hardly observed and only when they are enlarged by natural corrosion. Generally, they are rare, almost round and are labyrintically branching inside the wall. Rarely, there are slight constrictions on the body. Typical macroscopic features are the shape and the tooth-like tubercles, irregularly arranged on the body.

Remarks: In comparison with the descriptions in references (Pisera, 1997), the specimens in Dobrogea are quite larger; consequently the tubercles are smaller to the sponge scale, as they are not related to the sponge size.

For comparison with our specimens, we present below the individuals described by Pisera from the Kimmeridgian marls in Germany (fig. 10). Their average size is 2-4 times smaller in height and over 2 times smaller in width than the average size of the specimens collected by us. That is another endemic element confirming the particular features of the

fossil sponges in Dobrogea.

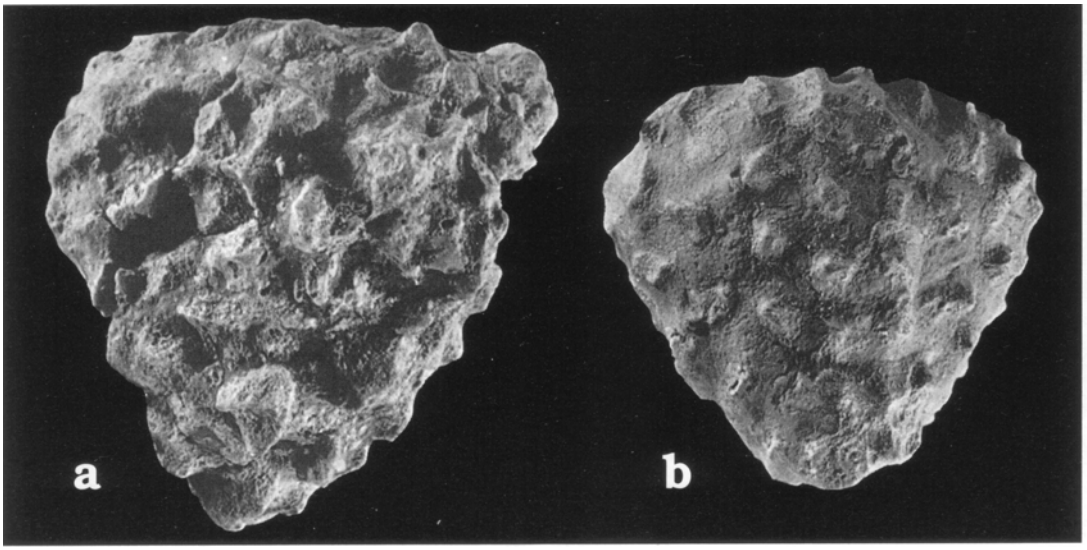

Fig. 10. *Trochobolus dentatus* from Kimmeridgian marls, x 1,5 (after Pisera, 1997).

Occurence: Cechirgea Valley, Veriga Valley; Upper Oxfordian. The species has been also located in Germany (Barenthal and Hochwang) in Kimmeridgian and in France, in Upper Oxfordian.

Class Demospongea SOLLAS, 1875
"Lithistida"
Suborder Didymmorina ZITTEL, 1878
Genus *Melonella* Zittel, 1878
Melonella radiata QUENSTEDT, 1878

1858. *Sphonia radiata* n. sp.*;* Quenstedt
1928. *Melonella radiata* Quenstedt; Antonescu (p. 483/3)
1943. *Melonella radiata* Quenstedt; Simionescu & Barbu (p. 16, fig. 3)
1957. *Melonella radiata* Quenstedt; Pauca (p. 239, fig. 32)
1962. *Melonella radiata* Quenstedt; Barbu (p. 127, pl. XXIV, fig. 272)
1974. *Melonella radiata* Quenstedt; Barbulescu (pl. XVII, fig. 1)
1981. *Melonella radiata* Quenstedt; Manoliu & Orbocea (p. 174, fig. 65)
1982. *Melonella radiata* Quenstedt; Andrasanu et al. (p. 83, pl. I, fig. 1; p. 85, pl. I, fig. 9)
1997. *Melonella radiata* Quenstedt; Mehl, Fursich (p. 22, fig. 4g; p. 24, fig. 5d; p. 26)
1997. *Melonella radiata* Quenstedt; Pisera (p. 91-92; pl. 32, fig. 6)

Material: 3 fully preserved specimens and 1 fragment.

Dimensions: 4,8-7,5 cm in diameter, 4-7 cm high, osculum diameter of 1,5-2,8 cm.

Description: Ball-like shapes, almost spherical. The pores are not visible because the material is strongly diagenised and the outer surface is covered with associated fauna (serpulids). Here and there oscula are visible.

Remarks: Even though the observed specimens have not outstanding size, the references (Antonescu, 1928) have mention unusual large-sized specimens collected in the Western Central Dobrogea Oxfordian they do not fit the species descriptions as "small-sized sponges" (Mehl & Fursich, 1997).

Indian specimens have sizes of 2-3 cm in diameter, and up to 2 cm in height, according to Mehl & Fursich (1997) description and image (fig. 11). Pisera (1997) has measured his largest specimen of 6 cm in diameter and 5 cm high, with about 1 cm in diameter at the osculum (fig. 12).

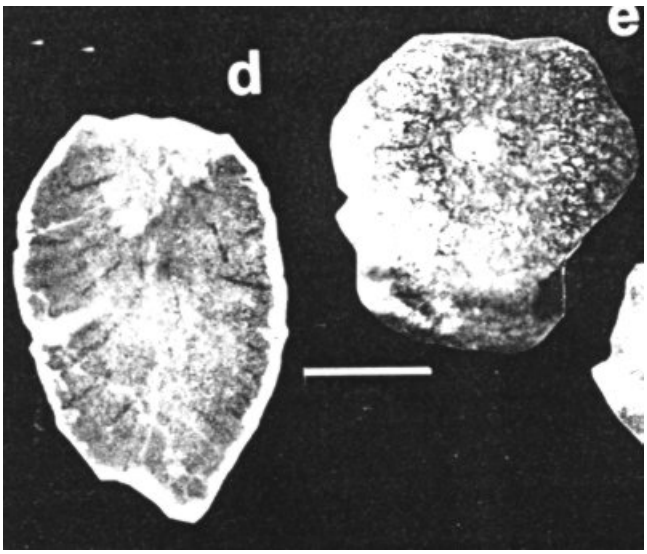

Fig. 11. *Melonella radiata*, after Mehl & Fursich (1997); scale bar: 1 cm

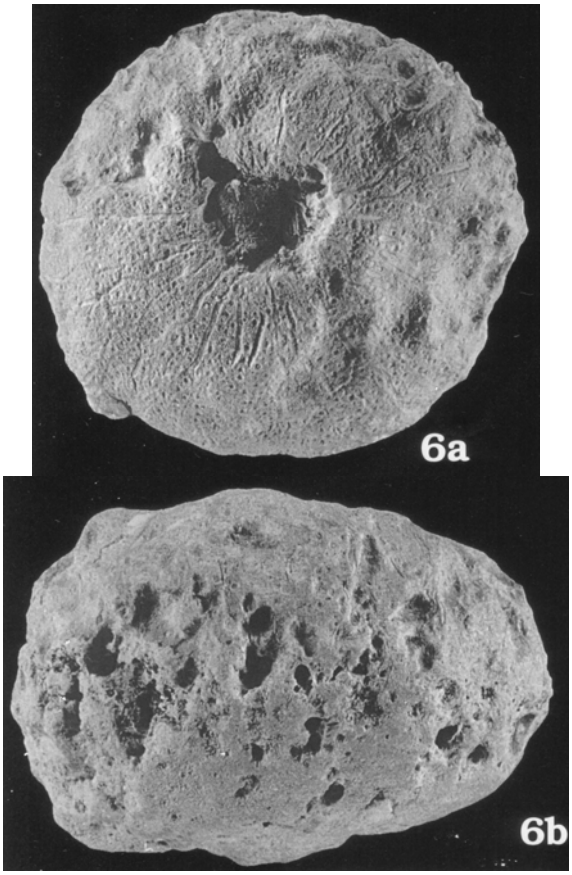

Fig. 12. *Melonella radiata*, x 1 (after Pisera, 1997)

On the other hand, the descriptions and images of Romanian specimens have shown maximum sizes of 19 cm in diameter and 16 cm in height (Barbulescu, 1974) (fig. 13).

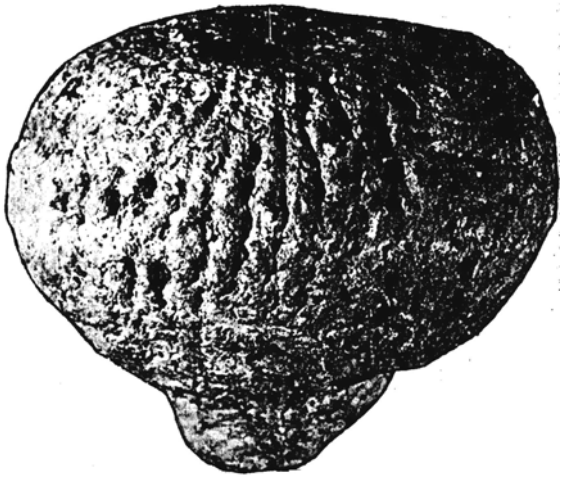

Fig. 13. *Melonella radiata*, after Barbulescu (1974); the real size is 19 cm in diameter and 16 cm in height.

The largest sizes we could measure were of 7,5 cm in diameter, 7 cm high and 2,8 cm osculum diameter. The average sizes of Romanian described or pictured specimens are about 9 cm in diameter and 9 cm in height. That is about 50% more than the descriptions in foreign references.

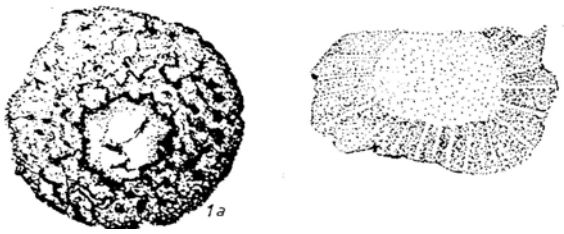

Fig. 14. *Melonella radiata*, x 0,5 (after Andrasanu et al., 1982)

If one compares the largest individuals, the Romanian one is over three times larger than that in Germany. We may conclude, Western Central Dobrogea environment in Upper Oxfordian has had certain conditions difficult to estimate that determined the development of that species and that is the reason here the average specimens sizes are obviously larger than elsewhere; that supports the endemic features of the fauna in that area.

Occurence: Cechirgea Valley, Veriga Valley; Upper Oxfordian. The species was also located in Germany (Wilmadingen, Hettingen and Hochwang) in Kimmeridgian and in India (Kachchh), in Middle Jurassic.

As a conclusion, the typical features of the environment conditions in Western Central Dobrogea have determined some morphologic, dimensional features of sponges, as well. Along our study we tried to point out those specific features and we tried to prove they are endemic. The present study is to call attention to an event of wide extent in Upper Jurassic and the particularities of its traces in our country.

Acknowledgements

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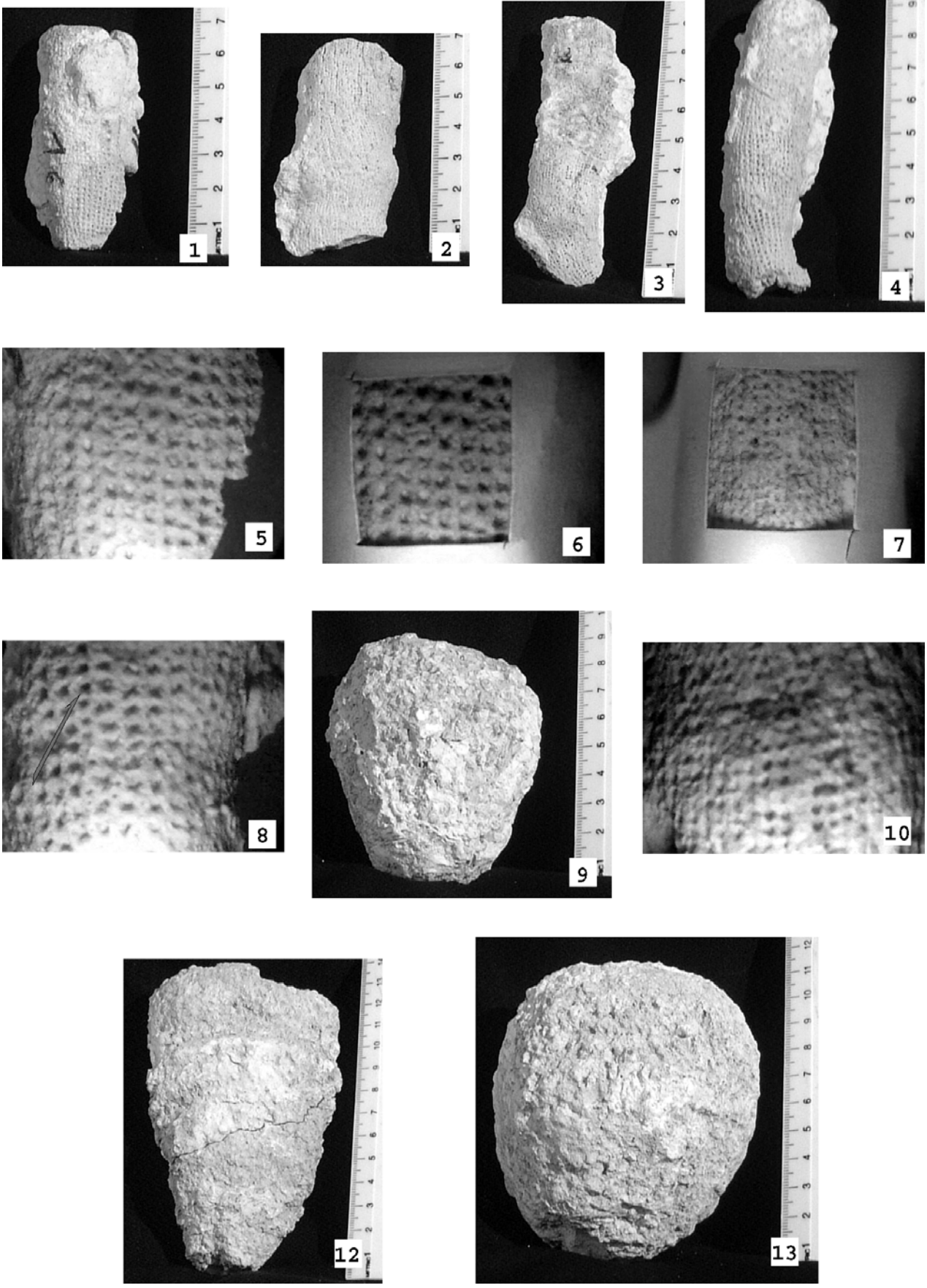
PLATES

PLATE I

Fig. 1, 4 – *Laocoetis parallela* Goldfuss – Cechirgea Valley – Upper Oxfordian
Fig. 2 – *Laocoetis procumbens* Goldfuss – Veriga Valley – Upper Oxfordian
Fig. 3 - *Laocoetis procumbens* Goldfuss – Cechirgea Valley – Upper Oxfordian
Fig. 5 – Specimen in fig. 1, detail x 4
Fig. 6 – Specimen in fig. 4, detail x 4 – pore counting on a square cm.
Fig. 7 – Specimen in fig. 3, detail x 4 – pore counting on a square cm.
Fig. 8 – Specimen in fig. 4, detail x 4; the red arrow points to a branching point of pore vertical rows.
Fig. 9, 12 – *Trochobolus* cf. *dentatus* Kolb – Veriga Valley – Upper Oxfordian
Fig. 10 – Specimen in fig. 3, detail x 4
Fig. 11 - *Cribrospongia reticulata* var. *piriformis* Goldfuss – Cechirgea Valley – Upper Oxfordian

PLATE II

Fig. 1 – *Cribrospongia reticulata* var. *piriformis* Goldfuss – confluence of Cechirgea and Veriga Valleys – Upper Oxfordian
Fig. 2, 3 - *Trochobolus* cf. *dentatus* Kolb – Cechirgea Valley – Upper Oxfordian
Fig. 4 - *Cribrospongia reticulata* var. *piriformis* Goldfuss – Cechirgea Valley – Upper Oxfordian
Fig. 5 – Specimen in fig. 4; oscular view (top of sponge).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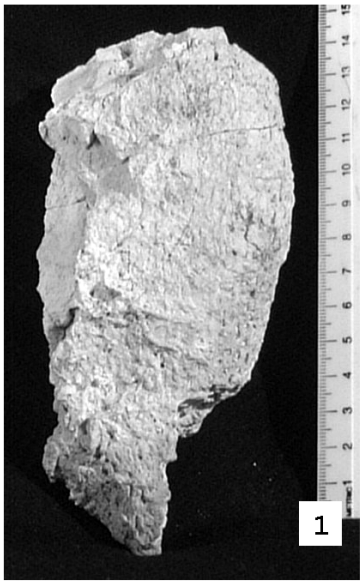
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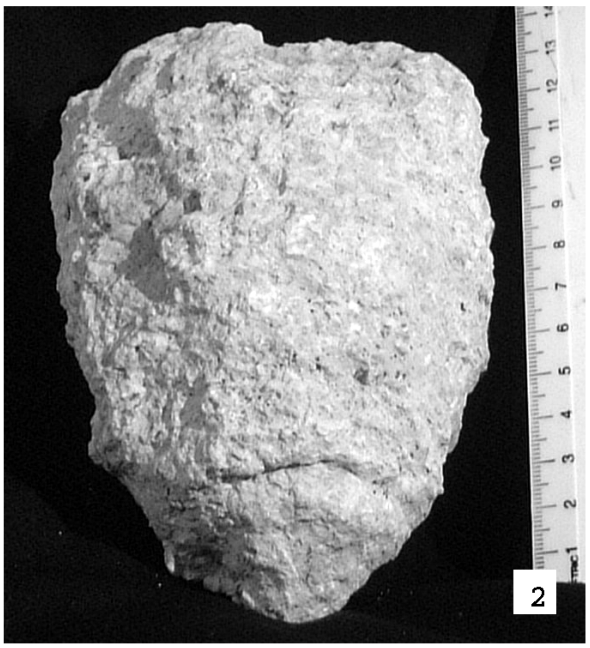
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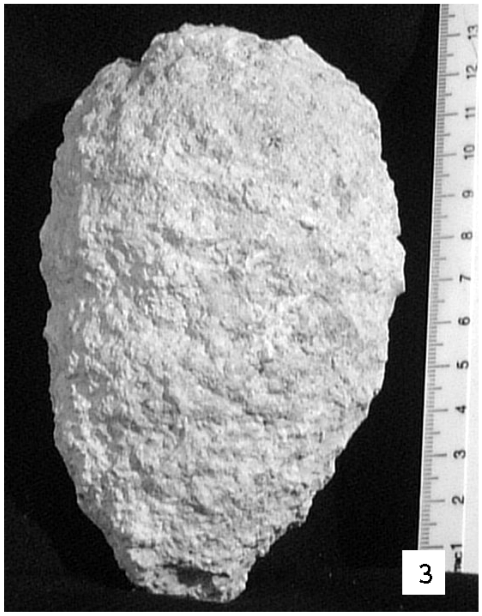
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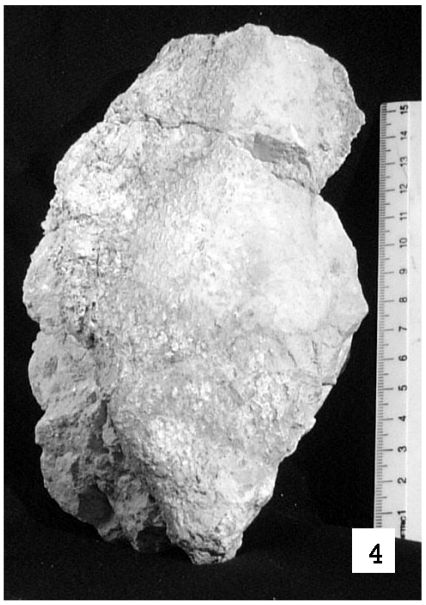
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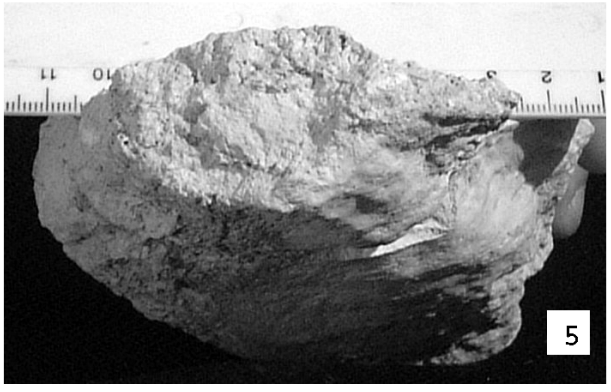
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