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Szymon OSTROWSKI[1]

CALCIFICATION OF SKELETONS OF SILICEOUS SPONGES – AN EARLY DIAGENETIC PHENOMENON

INTRODUCTION

Calcification of skeletons of siliceous sponges is supposed to be an early diagenetic process. However it is more difficult to determine the exact moment of diagenetic history in which the calcification of sponge skeleton takes place.

The paper shows new evidence showing that the process of calcification should be located i very early diagenesis on the border of the depositional processes.

GEOLOGICAL SETTING

Upper Jurassic carbonate sponge megafacies (Matyja, Pisera 1991) was developing on the northern shelf of the Tethys Ocean, and is widespread in the western and central Europe. It is well known from the territory of Poland (Matyja Wierzbowski 1995). Outcrops of this megafacies can be observed in the Kraków – Wieluń Upland, Mesozoic margin of the Holly Cross Mountains and in the Kujawy Region. Sponge megafacies is characterised by occurrence of biohermal carbonate buildups. Siliceous sponges contributed apparently to the formation of this bioherms.

RESULTS

Sponges soft tissue is preserved as an outline of the body composed of darker micrite (so called "sponge mummy"). Skeletons of sponges are originally composed of opal (Pisera 1997) but in most cases it is diagenetically replaced by calcite. Original silica can be found sporadically.

In rocks surrounding bioherms, early diagenetic flints are abundant. The sponge skeletons, dissolved in bioherms, are the main source of silica for flints (Świerczewska 1990). In spite of common high porosity of rocks, pores do not occur in place of skeleton.

Recent researches in the Bielawy quarry in Kujawy region (Ostrowski 2001) brought new data supporting early diagenetic calcification. Bioherms typically are surrounded by platy limestones. Bioherm outcropping in the quarry are surrounded by quartz mudstones of the Łyna Formation (Matyja et al. 1985). Sponges occur in the mudstones also, but are not subjected to calcification so intensely and many of their skeletons are preserved as original silica skeletons. Fragments of sediment

[1] *The Warsaw University, Faculty of Geology, Institute of Geology, ul Żwirki i Wigury 93, 02-089 Warszawa, Poland; Szymon.Ostrowski@uw.edu.pl*

and skeletal debris are found in mudstones. Some particles are incorporated into the sponge body and overgrown by the skeleton (Fig. 2).

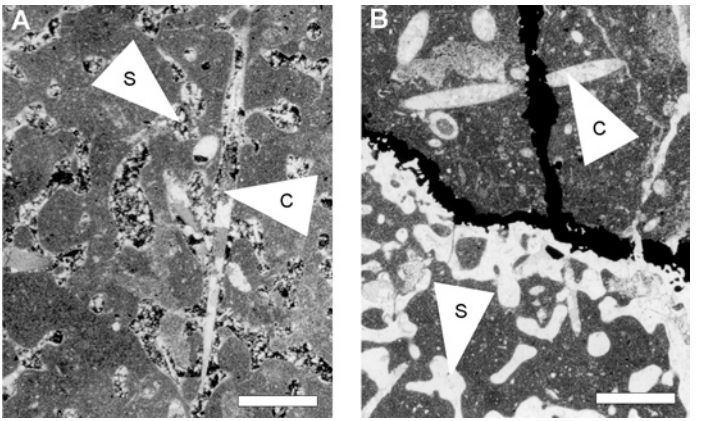

Fig. 2. A – calcified spicule (C) incorporated into silica sponge skeleton (S), B – lithoclast with calcified spicules (C) overgrown by silica sponge skeleton (S). Scale bar is 1 mm

Incorporated fragments of carbonate sediments with already calcified fragments of sponge skeletons and single calcified spicules (fragments of skeleton) are found within diagenetically unaltered, silica skeletons of other sponges. This clearly proves very early calcification of siliceous sponge skeletons.

DISCUSSION

Sedimentological observations shows that lithification of soft parts of sponges is a very early diagenetic process (e. g. Gwinner 1976, Matyja 1977, Matyszkiewicz 1994). Existence of flints in facies surrounding bioherms also points to rather early diagenetic mobilisation of silica from sponge skeletons and probably early calcification.

Process of calcification is probably related to the activity of symbiotic bacteria taking control over chemical reactions within host cells after death (Schumann-Kindel et al. 1997). Bacterial decay of soft tissue of sponges cause slight decrease of pH value followed by increase of pH and increase of carbonate alkalinity. These changes lead to precipitation of calcium carbonate within and around dead cells (op. cit.). It can be suggested that the same process was responsible for calcification of sponge skeleton.

Evidences from the Bielawy quarry show that the calcification took place in a bioherm simultaneously with deposition and growth of sponges in the vicinity. Bioherms formed prominent elevations on the sea bottom (Matyja, Wierzbowski 1996). Fragments of sediments with already calcified spicules were redeposited from bioherm into surrounding facies. Some fragments deposited on the surface of living sponges were overgrown and incorporated into skeletons. The last mentioned skeletons reminded unaltered by calcification. This resulted in preservation of sponges previously described.

CONCLUSIONS

Process of calcification of siliceous sponge skeletons took place in very early stage of diagenesis on the border of depositional processes. Calcification of skeletons was probably simultaneous with calcification of soft bodies of sponges. Changes of chemical environment, caused by bacterial decay of sponge, is suggested to be crucial for the process of calcification.

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