Silica Replacement of Rudist Shells

Najat I. Al Fudhaili[1], Matthias López Correa[2, 3], Axel Munnecke[2], Claudio Mazzoli[4], Jaroslaw Stolarski[5]

[1]Industrial Innovation Academy
[2]Erlangen University
[3]Istituto di Scienze Marine
[4]University of Padova
[5]Polish Academy of Sciences

Abstract

Rudists bivalves has been known as potential reservoirs during the Campanian time. Assessing their shell preservation (Macgillavryia sp., Vaccinites sp., Torreites sanchezi) by investigating their microstructure and mineral composition, allows tackling the development of silica replacement as a crucial diagenetic feature prior to sclerochronological and geochemical analyses. Understanding the silicification spatial distribution allows those shell parts to be avoided during stable isotope sampling. Shell microstructure, mineralogy and silica distribution were investigated by SEM, EDX elemental mapping and Raman spectroscopy. Silicification occurred either as large crystal filling in primary pores or as partial replacement of the calcitic layer. This fine replacement often occurs together with preservation of the primary microstructure and delicate meshwork structures. Resulted from the differences in origin of mineral composition, microstructure, and crystal orientation of each part. There are two potential sources of silica, either siliceous organisms like sponges, or silica-rich diagenetic fluids percolating through the rocks. The first source would argue for an early, the second one for a late diagenetic silicification. The organic matrix in the shell played a role in the distribution and replacement of silica within the rudist shells arguing for an early diagenetic silicification. The organic matter decay locally changed the pH in pore water fluid by releasing CO2, and this is considered as catalyst to dissolve the metastable minerals and create voids, which then act as a preferential zone for the replacement by silica. The fine substitution with synchronous preservation of initial shell microstructure implies a reaction front within the shell, without going through a "void" stage from dissolution.