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Isotopic fingerprints of bacterial chemosymbiosis in the bivalve Loripes lacteus

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Metazoans with chemosynthetic bacterial endosymbionts are widespread in marine habitats and respective endosymbioses are known from seven recent animal phyla. However, little is known about endosymbioses in fossil settings and, hence, ecological significance in earth history. In the presented project, we investigate the ancient and recent bivalve fauna living at marine sedimentary oxic/anoxic interfaces. Two bivalve species collected from the same benthic environment - a Mediterranean lagoon - were studied in detail. The diet of Loripes lacteus is based on thiotrophic gill symbionts whereas Venerupis aureus is a filter feeding bivalve without symbionts. The presence of three key enzymes from sulfur oxidation (APS-reductase), carbon fixation (RubisCO) and assimilation of nitrogen (glutamine synthetase [GS]) were detected by immunofluorescence in symbionts of Loripes and/or by activity tests in living specimens.
In search of biosignatures associated with thiotrophic chemosymbionts that might be suitable for detection of chemosymbiotic diets in recent and fossil bivalve shells, we analyzed the isotopic composition of shell lipids (δ13C) and the bulk organic matrix of the shell (δ13C, δ15N, δ34S). We could show that the combined δ15N and δ13C values from shell extracts are stable in subfossil (Pleistocene) bivalve specimens, as long as the isotopic data is "calibrated" with respective signatures from a filter feeding bivalve sampled from the same site or lithostratigraphic bed.