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Paleoenvironmental and sclerochronological reconstruction of Crassostrea gryphoides Miocene biostromes from Crete island (Greece)

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The mangrove oyster Crassostrea gasar (Adanson, 1757) is a keystone species mainly along the African Atlantic coasts. It forms biostromes on muddy coasts and typically associated with river mouths in the intertidal zone in depths of 0.60 up to 1 m1. Similarly, many biostrome structures of the fossilized Crassostrea gryphoides are found within Cenozoic deposits of Greece2. Since Crassostrea gasar is the phyllogenetically corresponding species of Crassostrea gryphoides, it is investigated whether the fossil biostromes formed under environmental conditions similar to those favored by modern Crassostrea gasar and if growth rate and longevity are comparable.
A biostrome from the Tortonian of Heraklion district, Crete island (southern Greece) was studied to investigate the paleoenvironmental conditions and the life history of these oysters. The shells are big, ranging up to 40 cm in length, thick and positioned mainly horizontally. The biostrome is approximately 2 m in thickness and a few meters in length. Individual oysters, associated fauna and lithologic samples were collected. Paleoenvironmental interpretation was based on the analysis of the oyster taphonomy, the associated fauna and the sclerochronology/stable isotopic geochemistry of the oyster shells. The biostrome is observed in sandy marl which laterally contains Veneridae, Melongena, Terebralia bidentata and oligospecific microfossils, mainly Ammonia beccarii and Miliolids. Borings by many ichnotaxa occur on the external and internal surface of the oyster shells during the pre and /or post-mortem.
Using a micromill, successive samples were taken along the hinge/ligament region of an oyster for isotopic analyses. The δ18O values ranged from -2.9 to 0.1. The wide range of values supports the interpretation of changing environmental conditions. The δ13C values ranged from -2.6 to -0.1. A correlation between δ18O and δ13C was observed. The profiles exhibit cyclicity with respect to isotopic and Sr/Ca ratios which correlates with major shell growth increments, though with a variability suggesting annual growth patterns and seasonal fluctuations in environmental conditions. Additonal analysis on shell geochemistry is needed to lead to information about the rate of growth and the age of the shells. The fauna in whole, the taphonomical features and the geochemical evidence support a shallow marine environment with riverine influxes for this Miocene biostrome.

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