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Bivalve shells as high resolution biomineral archives of early Pleistocene seasonality

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Bivalves are among the best tools for palaeoclimatic and palaeoenvironmental reconstructions because they are known to precipitate their shells in isotopic equilibrium with the seawater in which they live. Also, the analysis of their shell microstructure shows that these organisms modify their shell fabric in response to environmental variations forming growth lines. However, diagenetic processes may alter fossil bivalve shell microstructure and shell isotopic composition; for this reason it is important to perform screening tests to check if the shell is pristine and thus confidently identify biogenic calcium carbonate as a reliable proxy of primary seawater chemistry. Here, we performed a detailed study of the microstructure of ten aragonite bivalves shells belonging to *Glycymeris insubrica, Glycymeris inflata* and *Arctica islandica*, collected from the lower Pleistocene Arda River marine succession (northern Italy), to check their preservation for subsequent sclerochemical stable isotope analyses (δ^{18}O, δ^{13}C). To assess shell preservation 4 different screening techniques were used: Scanning Electron Microscopy (SEM), Catholuminescence (CL), X-Ray Powder Diffraction (XRD) and Feigl's solution.

Shells of species of *Glycymeris*, under SEM, show an outer crossed lamellar layer, an inner irregular and cone complex crossed lamellar layer and an irregular simple prismatic pallial myostracum; all the layers are penetrated by cylindrical tubules. *Arctica islandica* has an outer homogenous/crossed lamellar/crossed acicular layer, an inner fine complex crossed lamellar layer and an irregular simple prismatic pallial myostracum. The comparative analysis with recent fabrics shows a consistent pattern for species of both *Glycymeris* and *Arctica* genera, the recent and fossils shell microstructures being almost identical. Analyses at CL, XRD and Feigl's solution support that these fossil species have a non luminescent shells composed of pure aragonite.

The excellent preservation and the distinct growth lines of the Arda taxa makes them a powerful archive to study, through sclerochemistry, the change in seasonality during the early Pleistocene, a time interval characterized by several climatic oscillations linked to glacial/interglacial cycles, in the Mediterranean area.