Geophysical Research Abstracts
Vol. 18, EGU2016-7380, 2016
EGU General Assembly 2016

Changes in the northern Adriatic molluscan community from the Holocene transgression up to the present

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The northern Adriatic Sea is one of the few modern, epicontinental seas comparable to typical Palaeozoic shelf environments. It has a shallow average water depth (<50 m) and was formed at the end of the last glaciation when the sea level rose. Since historical times this part of the Adriatic has been strongly influenced by human activities through multiple direct or indirect impacts (e.g. fishing, coastal building development, pollution, eutrophication, increased sedimentation), making it one of the most degraded marine ecosystems worldwide. Our study was designed to reconstruct major environmental changes here since the onset of the Holocene transgression using down-core changes in death assemblages of molluscs as indicators for ecological shifts. The sediment cores were taken at three different stations (Brijuni Islands, Croatia, off Piran, Slovenia, and off Venice, Italy), each representative of specific sediment and nutrient conditions and degrees of habitat exploitation. The cores were 1.5 m long and had diameters of 90 or 160 mm. For the molluscan shell analyses, sediment subsamples were examined for species composition, abundance, taxonomic similarity and ecological interactions (e.g. frequencies of drilling predation). In total, 98,700 valves and shells were investigated and 113 bivalve and 178 gastropod species recorded. Sedimentation rates derived from ^{210}Pb dating are very low, between 0.15 cm/yr at Brijuni and 0.25 cm/yr at Piran. The dating of *Lucinella divaricata*, *Timoclea ovata* and *Gouldia minima* shells with ^{14}C calibrated amino-acid racemisation (AAR) revealed that the cores at all three stations cover at least 6000 to 8000 years, i.e. the whole Holocene transgression period. Time averaging is high, especially in the lower core layers of Piran station, probably due to strong bioturbation. Surface mixed-layer assemblages tend to show right-skewed postmortem age-frequency distributions, whereas subsurface assemblages show unimodal or uniform shapes. Molluscan assemblages show significant interregional differences that correlate with sedimentation rate, grain size, and the occurrence of organic pollutants and heavy metals. Down-core changes in molluscan communities are also conspicuous in all cores. They partly reflect long-term changes in water depth, vegetation cover or grain size distribution caused by natural fluctuations of environmental conditions over the past millennia. In the uppermost core layers, however, these changes can be interpreted as indicators of anthropogenic impacts.