Geophysical Research Abstracts
Vol. 19, EGU2017-19362-1, 2017
EGU General Assembly 2017


# Testing the best method to prepare recent and fossil brachiopod shells for SEM analysis

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The analysis of shell microstructures by Scanning Electron Microscope (SEM) is a method easily available to most palaeontologists and geochemists. This kind of analysis is a fundamental step in the study of the mineralised parts of marine and terrestrial organisms, and it provides invaluable information in different fields of palaeontology, from the comprehension of evolutionary taxonomy and biomineralisation processes to the screening of shell diagenetic alteration. In precipitating their low-magnesium calcite shells in isotopic equilibrium with ambient seawater, brachiopods are excellent archives of past seawater temperature and ocean chemistry. However, diagenetic processes may alter the original fabric and the original geochemical composition of the shells; the SEM analysis of the microstructure represents one of the most common method used to test fossil shell preservation and eventually exclude diagenetic alteration. Notwithstanding the importance of this analysis, only few and scattered data have been published about the preparation and cleaning of brachiopod shells for SEM analyses Here, we describe several tests performed on recent and fossil brachiopod shells, experimenting new and old methodologies in order to identify a general protocol to better highlight and analyze the shell fabric. Recent taxa include Liothyrella uva and Liothyrella neozelanica, respectively collected from Antarctica and New Zealand; fossil shells are those of Terebratula scillae collected from the lower Pleistocene Stirone River sedimentary succession in Northern Italy.
We carried out several tests to check the response of the shell fabric to the resin used to embed the valves before cutting and to different times of exposure to hydrochloric acid; furthermore, as the presence of the organic matrix in recent shells represents the main obstacle to obtaining high quality SEM images, we used bleach and hydrogen peroxide with different concentrations and times of exposure to remove it. We conclude that bleach and hydrogen peroxide at the highest time of exposure followed by hydrochloric acid for 3 seconds is the best method to use when preparing recent brachiopods, whereas fossil shells should undergo higher exposure time to hydrochloric acid (15 seconds).