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Calcareous foraminifera are able to agglutinate sedimentary particles within their test

Chiara Borrelli (1) and Giuliana Panieri (2)

(1) Department of Earth and Environmental Sciences, University of Rochester, Rochester, NY, 14627, USA, (2) CAGE - Centre for Arctic Gas Hydrate, Environment and Climate, Department of Geosciences, UiT The Arctic University of Norway in Tromsø, N-9037, Tromsø, Norway

Scanning electron microscopy (SEM) analysis of modern and fossil specimens of Melonis barleeanus from the Arctic Ocean and the Mediterranean Sea revealed the presence of minute silicate grains (i.e. sedimentary particles; ca. 3 μm) inside the majority (ca. 80%) of the tests examined. These particles were distributed in a regular and highly organized manner within each calcareous test. Based on energy-dispersive X-ray spectroscopy (EDS) and electron-backscattered diffraction (EBSD), we recognized quartz and feldspar grains, possibly suggesting a selectivity of M. barleeanus towards a specific mineralogy, a characteristic demonstrated already for several species of agglutinated foraminifera. We interpret these results to be evidence of a novel biomineralization strategy adopted by this calcareous benthic foraminiferal species. In particular, we propose that M. barleeanus can agglutinate silicate grains to promote calcite precipitation and/or to increase test strength when the organism experiences one or more environmental stress(es). The analyses of other foraminiferal species from the Arctic Ocean (e.g., Eilohedra nipponica, Nonionella stella, Lobatula lobatula, Cassidulina neoteretis) did not show the presence of grains in the tests analyzed, suggesting this to be a main characteristic of M. barleeanus only. Considering the importance of this species in paleoceanographic and paleoclimatic investigations, it is fundamental to consider its biomineralization strategy during the interpretation of geological records.