PALAIOS, 2009, v. 24, p. 440–452
Research Article
DOI: 10.2110/palo.2008.p08–124r

Evolving mineralogy of cheilostome bryozoans

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Keywords: biomineralization, seawater chemistry, aragonite acquisition, latitudinal patterns

ABSTRACT

Cheilostomes dominate bryozoan faunas today and are the only order of bryozoans to have evolved aragonitic, calcitic, and bimineralic skeletons. New XRD analyses of 177 recent species and 34 Cretaceous–Eocene species are combined with published data to probe the mineralogical evolution of cheilostomes. This is undertaken with particular reference to the effects of the late Paleogene transition from calcite to aragonite seas believed to have been driven by the increasing Mg/Ca ratio in seawater. Aragonite was absent from all of the Cretaceous and Paleocene cheilostomes analyzed, even though most came from deposits preserving aragonitic mollusk shells, but was detected in four distantly related cheilostomes from the middle Eocene (Lutetian). Examples of cheilostomes preserved as partial molds, however, suggests that bimineralic species with aragonitic outer skeletal layers may have originated as early as the Maastrichtian. A strong latitudinal gradient was evident in cheilostome mineralogy, with the proportion of aragonitic and bimineralic recent species increasing towards the tropics. Unfortunately, relatively few low-latitude bryozoans have been described from the Cretaceous and Cenozoic fossil record, where aragonitic species are likely to be most numerous and may have their oldest occurrences. A combined database of cheilostome mineralogy shows aragonite to be widely distributed across Cheilostomata, occurring in numerous genera and families belonging to the three most diverse subgroups (Flustrina, Umbonulomorpha, and Lepraliomorpha) as well as one genus of Malacostegina. In spite of the lack of a robust phylogeny for cheilostomes, it is clear that aragonite has evolved independently on multiple occasions, the earliest acquisitions antedating the onset of aragonite seas, although apparently accelerating after this transition.