DIFFERENTIALS IN THE DEPTH DISTRIBUTION OF SEEP COMMUNITIES: PAST VERSUS PRESENT DAY

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Cold-seep assemblages have relatively low diversity and are dominated by one or two taxa present in high density and high biomass. Their associated heterotrophic fauna are normally distinctive from the fauna of their surrounds and, as necessitated by the limited density of the surrounding fauna, both are restricted to aphotic habitats. In contrast, a more commonplace chemoautotrophically-based community occurs in shallow photic habitats. The associated heterotrophic fauna includes many of the species typical of the surrounding communities. This heterotrophic fauna typically dominates abundance while the chemoautotrophs dominate biomass. All modern seep assemblages are restricted to deep water $>$ 550 m. Many fossil seep assemblages occurred in water as shallow as the mid-shelf ($<$ 200 m), shallower than the limit of the shallowest modern seep assemblages. In contrast, chemoautotrophically-based communities are common in shallow waters today but not yet reported in the geological record.

We suggest that cold seeps are more common in the fossil record for two reasons. (1) The biases of preservation have accentuated their distribution by transforming chemoautotrophically-based communities into cold-seep appearing assemblages. (2) The importance of predation pressure and oligotrophy has varied, with decreased predation pressure accompanying increased oligotrophy favoring the formation of cold-seep communities. We suggest that the absence of chemoautotrophically-based communities in the fossil record is based on the reliance of paleoecological analysis on abundance data when biomass data are required to identify these faunas.

One of the trophic peculiarities of chemosynthetic communities, even in shallow water, is the absence of large filter feeders. Very likely, an increase in food supply, necessary to support large filter feeders, also permits the large filter feeders to displace the chemoautotrophs. In chemoautotrophic assemblages forming today, many more prey are preserved than required to support the preserved predators. In contrast, predators are overrepresented in the heterotrophic continental slope assemblages. Thus, chemoautotrophs are uncommon wherever predators are overrepresented in the death assemblage suggesting that predation pressure is also an important component regulating the distribution of these faunas. The distinctiveness of the fossil seep community is intensified by taphonomic processes that insert a bias against small individuals and epifaunal species in the preservational process, so that diversity declines, the small heterotrophic component of the community is significantly reduced, and the epifaunal component is minimized. The final assemblage is usually dominated by the better-preserved large infaunal clams which perchance are also the chemoautotrophic species. In contrast, preservation does not enhance the distinctiveness of the chemoautotrophs in shallow water.