

Evolutionary history of cambrian spiculate sponges: implications for the cambrian evolutionary fauna

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ABSTRACT

Broad-scale analyses of Cambrian spiculate sponges are scarce. The apparent differences between Cambrian and Ordovician sponge faunas were included in Sepkoski's concept of evolutionary faunas; in these, sponges were regarded as minor contributors to the Paleozoic and modern faunas and insignificant in the Cambrian evolutionary fauna. More recent published occurrences of Cambrian and Ordovician spiculate sponges and the inclusion of archaeocyaths in the phylum Porifera, however, have altered our understanding of the significance of sponges among Cambrian faunas. The majority of Cambrian occurrences appear to be segregated into two major associations: lower Cambrian sponges in China, and middle Cambrian sponges in North America, primarily British Columbia and Utah. The main associations of spiculate sponges are in siliciclastic deposits from middle-to-deep muddy shelf and basin environments, whereas orchoclad demosponges are associated with shallow carbonate environments. Four main aspects of sponge biology are considered potential factors dictating the distribution of sponges in the Cambrian: their trophic requirements, hydrodynamic constraints, possible biogeochemical constraints, and the sponge-sediment relationship. A series of critical steps in sponge evolutionary history occurred during the interval from the Proterozoic-Cambrian boundary to the middle-late Ordovician. The lower-middle Cambrian faunas are considered to be a Cambrian evolutionary sponge fauna, with archaeocyaths and diverse monaxonid demosponges as distinctive components. There was a transitional fauna in the upper Cambrian-Lower Ordovician, with orchoclad lithistids dominating shallow environments. Hexactinellids began to colonize nearshore siliciclastic settings during this time. The third interval, Middle-Upper Ordovician, corresponds to the Paleozoic evolutionary fauna, which is the interval during which lithistids diversified in several suborders and families and the stromatoporoid and sphinctozoan calcified sponges experienced their first radiation.