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Influence of spatiotemporal scale on the interpretation of paleocommunity structure: Lateral variation in the Imperial Formation of California

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[1]www.sepm.org/archive/index.html.

ABSTRACT

Numerous paleocommunity studies of marine ecosystems have demonstrated that water depth was the primary factor structuring paleocommunities. In contrast, many ecological studies find other factors play a greater role in delineating communities; this difference in results may be owing to the spatiotemporal scale at which the study is performed. To explore this hypothesis, the present study examines a set of Imperial Formation (Pliocene, California) paleocommunities at a scale potentially fine enough to exclude depth as a control over the communities, thus facilitating recognition of fine-scale ecological and environmental processes operating at this scale. Twenty-six taxa from 21 samples were collected in situ from an 8.5-m-thick interval within a 0.32 km^2 area. Cluster, Bray-Curtis (polar) ordination, and detrended correspondence analyses were used to infer community structure. Cluster and ordination analyses produced similar results independent of choice of distance measure. To test whether depth would be the primary control, even at fine scales, the scores from the first ordination axis for each taxon were compared with their modern mean depth; no strong correlation exists between depth and ordination scores. Cluster and ordination results indicate that life mode (as determined by modern relatives) and to a lesser extent, grain size, were the primary factors influencing paleocommunity structure at this scale. Bivalve taxa were grouped by life mode: quasi-infaunal, shallow-burrowing infaunal, byssate, and cemented. Relative to paleoecological studies conducted on much broader spatiotemporal scales, this study highlights the potential utility of embedding fine-scale studies within broader-scale studies to capture and investigate additional sources of ecological and environmental variation.