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Evaluating taphonomic bias of paleoecological data in fossil benthic foraminiferal assemblages

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ABSTRACT

Paleoecological analyses conducted over broad temporal and spatial scales can incorporate fossil assemblages of disparate taphonomic histories, resulting in samples where the record of the original communities is biased to different degrees. Testing for the effects of differential taphonomic biases is crucial to accurate interpretations of paleoecological patterns. To test for such effects in a shallow-marine benthic foraminiferal record from the early Miocene Astoria Formation, I developed a taphonomic grading system for benthic foraminifera and scored individuals for preservation state. Grading allows each sample to be subdivided into taphonomically similar subsamples. Subsamples are evaluated for similarity in species composition, species rank, and proportional abundances. Similarities are significantly higher in within-sample comparisons between taphonomic grades than they are among samples when taphonomic grade is held constant, indicating that ecological information is conserved despite variation in taphonomic grade within a single time-averaged assemblage. In addition, taphonomically homogenous subsamples (and nested sets of taphonomic grades) capture the same temporal patterns of species richness, community evenness, and the proportional abundances, although ordinations using subsamples with the poorest preservation do show some significant differences. Thus, although incorporating the most poorly preserved samples requires some caution, the quality of ecological information derived from these benthic foraminiferal samples is consistent across taphonomic grades. For this test case, I argue that paleoecological analyses will not be significantly affected by differences in preservation among samples. This method of taphonomic grading can be applied to other fossil groups and facilitates analyses of paleoecological results despite different degrees of taphonomic alteration.