PALAIOS, 2008, v. 23, p. 313–321
Research Article
DOI: 10.2110/palo.2007.p06-146r

A comparison of sampling and statistical techniques for analyzing bulk-sampled biofacies composition

James J. Zambito IV,[1]* Charles E. Mitchell,[1] and H. David Sheets[2]

[1] *University of New York at Buffalo State, Department. of Geology, Buffalo, New York 14260-3050, USA;* [2] *Canisius College, Department. of Physics, Buffalo, New York 14208, USA*
e-mail: zambitjj@uc.edu

*Corresponding author. Current address: University of Cincinnati, Department of Geology, Cincinnati, Ohio 45221-0013, USA.
Keywords: patchiness, community structure, ANOSIM, maximum likelihood, Hamilton Group.

ABSTRACT

This study seeks to test appropriate sampling and statistical regimes for comparing biofacies compositions through the use of several statistical methods developed for analyzing community structure. Bulk sampled data from the *Ambocoelia*-chonetid biofacies within the Middle Devonian Hamilton Group of New York are used as a test data set. Samples were collected from a single fourth-order regression within this dysoxic facies across a paleoenvironmental basinal gradient. Within locality, lateral replicates and subsampling are used to gauge the degree of faunal patchiness at outcrop scale and to assess the impact of patchiness within this biofacies on the effectiveness of statistical methods for detecting biofacies gradient boundaries. This study demonstrates that a sampling effort that accounts for within-outcrop patchiness (scale of 5–15 m) is adequate to test for differences in faunal composition in this biofacies across the sampled basinal gradient. Furthermore, our results show that this biofacies exhibits a gradient in within-locality patchiness, which increases as the assemblage is sampled more proximal to the sediment source. Tests of faunal patchiness and geographic differences in biofacies composition obtained with nonmetric multidimensional scaling, analysis of similarities (ANOSIM), and multinomial models using maximum likelihood and information theory (MNM/AIC) produced similar results. MNM/AIC is recommended as a compliment to ANOSIM and ordination techniques for analyzing bulk sample data because MNM/AIC allows for comparison of competing hypotheses about population distributions based on the relative likelihood of each hypothesis and the information required to construct each hypothesis. ANOSIM alone can only determine the significance of a particular clustering against a null hypothesis of no structure and not relative to alternative structures.