

A simple method of depth estimation based on presence/absence data using benthic foraminifera

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A two-step procedure for estimating paleogradients is presented. The first step requires ranges of variates corresponding to the fundamental (general) distributions at the gradient. These distributions are independent of local variations. Using species as variates and samples as objects, fundamental ecological niches along the environmental gradient represent these general distributions. The second step involves a transfer equation. It is based on the arithmetic mean of location parameters of these distributions that are weighted by their dispersion parameters. This procedure gives weight to variates with smaller dispersions, which yield more information about the location at the gradient than variates with wide dispersion. The method proposed here does not require information about

frequencies; solely the presence of variates is sufficient. Objective criteria are used to eliminate variates like species, which do not overlap in living individuals along a gradient but are mixed in samples of empty tests. This is important in estimating paleogradients because mixing of non-overlapping variates is a common effect due to taphonomic processes like transport, bioturbation, or sediment reworking. The new method is successfully applied for depth estimation using shallow-living benthic foraminifera and empty test from the NW Pacific, living smaller benthic foraminifera from the shelf and continental slope of Senegal, and benthic foraminifera with low planktic forms from the Upper Karpatian below the Styrian unconformity.