PALAIOS, 2008, v. 23, p. 649–667
Research Article
DOI: 10.2110/palo.2008.p08-033r

Analyzing variations in cephalopod abundances in shell concentrations: The combined effects of production and density-dependent cementation rates

Adam Tomašových[1,2]* and Ján Schlögl[3]

[1]University of Chicago, Department of Geophysical Sciences, Chicago, Illinois 60637, USA; [2]Slovak Academy of Sciences, Geological Institute, Dúbravská cesta 9, 84005 Bratislava, Slovakia; [3]Comenius University, Department of Geology and Paleontology, Mlynská dolina G, 84215 Bratislava, Slovakia
e-mail: tomasovych@uchicago.edu

*Corresponding author.
Keywords: paleoecology, taphonomy, Cephalopoda, shell bed, dissolution

ABSTRACT

Upper Jurassic ammonoid shell concentrations on pelagic carbonate platforms formed by the mixture of well-preserved and moldic shells provide a unique opportunity to evaluate the effects of average shell durability and productivity on variations in shell abundance preserved in the fossil record. High abundance of primary cement has significantly negative statistical effects on taphonomic alteration, reducing the proportion of ammonoid shells affected by Fe-staining and syndepositional dissolution. High proportions of internal borings indicate that shell concentrations were not rapidly buried. Significantly negative effects of taphonomic alteration on ammonoid shell-packing density and spatial variations in shell-bed thickness show that variations in ammonoid abundance are related to variations in production and destruction rates rather than to variations in sediment dilution. The close spatial association of dissolved aragonite shells and precipitated calcite in shell-rich deposits and the higher proportion of dissolved molds in shell-poor beds demonstrate the simultaneous action of dissolution and cementation in the semiconsolidated mixed layer. These relationships imply positive feedback between the high abundance of ammonoid shells and the low rate of shell destruction, with dissolved carbonate ions from high aragonite input reducing the rate of ammonoid dissolution and providing a local source for carbonate cement. Cementation has the strongest positive relationship with shell-packing density in rank correlations and generalized linear models. Proportions of ammonoid embryonic stages and early juveniles have smaller but significantly positive statistical effects on shell-packing density in simple regressions. We hypothesize that (1) ammonoid shell concentrations correspond to long-term peaks in ammonoid production, with aragonite dissolution buffering the pore-water chemistry, and (2) the increase in ammonoid production rates was related to intervals with average high fecundity coupled with high juvenile mortality.