PALAIOS, 2007, v. 22, p. 000–000
Research Article
DOI: 10.2110/palo.2006.p06-106

Signatures of sea-level rise on the carbonate margin of a Late Ordovician foreland basin: A case study from the Cincinnati Arch, USA

Patrick I. McLaughlin* and Carlton E. Brett

Bucknell University, Geology Department, Lewisburg, Pennsylvania 17837, USA;
University of Cincinnati, Department of Geology, Cincinnati, Ohio 45221-0013, USA
e-mail:pimclau@hotmail.com

*Corresponding author.
Keywords: transgression, cycle, hardground, faunal-gradient analysis, taphonomy

ABSTRACT

Analysis of the limestone-dominated Upper Ordovician (Chatfieldian-Edenian) Point Pleasant–Fulton interval provides detailed documentation of the internal composition of a transgressive systems tract within a mixed-carbonate siliciclastic foreland basin succession. This 14 m interval is divisible into 13 small-scale cycles that are widely traceable and record a lithofacies gradient from calcarenite-rich outcrops of central Kentucky into interbedded fine-grained grainstones and organic-rich shale in the subsurface of western Ohio. Hardgrounds and condensed beds are widespread and numerous and commonly cap the limestone hemicycle of small-scale cycles. Taphonomic- and faunal-gradient analyses of 233 bedding planes reveal both lateral and vertical gradients indicative of deepening from central Kentucky northward and a similar signature of deepening upward through the study interval. The deepening-upward trend within the Point Pleasant member is coincident with a decrease in the thickness of shale hemicycles, whereas the deepening-upward trend within the Fulton submember shows a slight increase in shale hemicycle thickness and quartz silt content. A polymictic intraformational conglomerate, the most complex discontinuity surface within the study interval, marks the contact of the Point Pleasant–Fulton members. The study interval, thus, is interpreted to represent distinctive early and late phases (Point Pleasant and Fulton members, respectively) of the transgressive systems tract separated by a maximum starvation surface. These patterns suggest that this widespread limestone-dominated interval formed primarily in response to basinwide, relative sea-level rise and siliciclastic sediment starvation, rather than simply through winnowing.