Assessing the allogenic and autogenic controls on cyclothem deposition of an epeiric shelf: A case study from the Upper Pennsylvanian Finis Shale of Texas

Brian Pierce

Abstract

Geochemical (XRF) and paleocommunity analysis (Forcino et al., 2010) of the Upper Pennsylvanian Finis Shale were utilized to assess the relative contributions of allogenic and autogenic processes on cyclothem deposition. Previous interpretations of the Finis Shale have relied solely on Milankovitch orbital forcing (allogenic process) to explain the unit's position between the Salem School Limestone and the Jacksboro Limestone. Four distinct stratigraphic intervals were recognized for the Finis Shale based on the geochemical and paleocommunity structure trends in the data set. Base interval samples (-0.9 – 0 m) lack benthic fossils and contain relative enrichments of Zr, V, Cu, and Ni EF indicating rapid burial with close proximity to an adjacent delta source, which is inconsistent with previous interpretations of the Finis Shale being deposited in deep water. Lower interval samples (0 – 2 m) are dominated by the brachiopod *Crurithyris* in association with several taxa of bivalves, lack appreciable enrichments of the redox proxies (Mo, V, Ni, Cu), and display relatively invariable terrigenous proxies (SiO_2, K_2O, TiO_2, Zr); these data suggest a shallow water, dysoxic environment, in which a significant amount of suspended mud was being delivered from a nearby delta source. Middle interval samples (2.1 – 2.9 m) are dominated by the brachiopod *Rhipidomella*, display a reduction in the terrigenous sediment proxies (K_2O, TiO_2, Zr), and an increase in chemical weathering in the source region (based on CIA'); these data imply a dysoxic environment wherein reduced terrigenous sedimentation related to allogenic rise in sea level rise or an autogenic lateral shift in delta deposition. Upper interval samples (above 3.0 m) display an increase in all non-brachiopod and non-bivalve taxa as well as significant enrichments in MnO EF indicative of open-marine oxic conditions. Substantial enrichment of CaO EF and the reduction of the terrigenous sediment proxies (K_2O, TiO_2, Zr) suggest an increase in the production of biogenic carbonate and a decrease in fluvial deltaic sedimentation consistent with the autogenic control of proximity to deltaic sediment source on the facies change from the Finis Shale to the Jacksboro Limestone member.