

A paleoceanographic model for the Michigan Basin during silurian time from stable isotopic analysis of brachiopods

P.J. VOICE¹, G.M. GRAMMER¹, W.B. HARRISON¹,
R.V. KRISHNAMURTHY¹ AND P.K. SWART²

¹ Department of Geosciences, Western Michigan Univ, 1903
W. Michigan Avenue, Kalamazoo, MI 49008, USA
(peter.voice@wmich.edu)

² Div. Marine Geology & Geophysics, Univ of
Miami/RSMAS, 4600 Rickenbacker Cswy, Miami, FL
33149, USA

Stable C and O isotopic analyses of microsampled brachiopod shell material from the middle Silurian Burnt Bluff Group has established fundamental information on the paleoceanographic conditions in the Michigan Basin during the Silurian. These data indicate that, despite clear lithological evidence for highly restricted conditions at times during the Silurian, the Michigan Basin was also characterized by periods of normal marine circulation.

The Michigan Basin was an equatorial depocenter during Silurian time. Fluctuations between normal marine conditions indicated by periods of luxuriant reef growth coupled with deposition of restricted marine facies and evaporites are especially prevalent during the Silurian. Little geochemical evidence exists, however, to establish the timing and magnitude of variability in paleoceanographic conditions within the basin

Non-altered pentamerid brachiopod shells have average isotopic values of $-4.50 \pm 1.0\%$ ($\delta^{18}\text{O}$) and $+1.21\% \pm 0.99$ ($\delta^{13}\text{C}$). Other time-equivalent datasets from open marine basins in Eurasia and North America show similar $\delta^{18}\text{O}$ values to those of this study, indicating that the Michigan Basin was also open to normal marine circulation. In addition, microsampling transects parallel to growth lines allows the reconstruction of isotopic patterns during the growth of the animal. In some specimens, covarying trends in O and C isotopes were observed to have a cyclic pattern, which may be a result of changes in productivity related to seasonal patterns.

Establishing isotopic conditions of marine waters in the Michigan Basin provides additional data points for the composition of normal Silurian seawater for comparison with other basins, while also shedding new insight into the circulation patterns within the Michigan Basin.