Evidence for the global SPICE event in passive margin carbonate and shale in the Appalachian Basin, USA

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Deposition of the Late Cambrian Conasauga Group in the Appalachian Basin, eastern USA, is thought to overlap with a major global organic C burial event, the Steptoean Positive Carbon Isotope Excursion (SPICE) [1,2]. Shale units from within this group (Nolichucky Fm) are possibly related to the SPICE event, and are currently the target of unconventional gas exploration within the deepest parts of the basin. We examine regional and global signatures of SPICE at an Appalachian Basin site that was situated near the continental margin of Laurentia at the time of deposition

The section represents condensed, passive margin shale deposition and carbonate ramp development on the continental shelf of Laurentia. We report $\delta^{13}C_{CARB}$ data from carbonates (primarily dolomite) within the Conasauga Group, including carbonate cement within a distal shale member of the Nolichucky Formation. These sediments record a positive $\delta^{13}C$ excursion starting in the upper Nolichucky, reaching its peak (+4.0) in the overlying Maynardville limestone. Strontium isotope ratios in the dolomitic units are only slightly offset from the expected Cambrian seawater values, suggesting minimal post-diagenetic disturbance of isotopic and trace element systematics. However, the $^{87}Sr/^{86}Sr$ of carbonate cement in the Nolichucky shale member is significantly elevated relative to Late Cambrian seawater, up to 0.71353 (corrected to 497 Ma). While it appears that Sr isotopes in carbonate cement may have been affected by interaction with the radiogenic clastic components of the sediment, this apparently did not affect the $\delta^{13}C_{CARB}$ values, which show smooth variation through the Nolichucky shale member. Drawdown of redox-sensitive trace elements following deposition of the shale indicate both regional and global burial of organic carbon, and suggest that deposition of the hydrocarbon-rich Nolichucky Formation was part of the global SPICE event.

[1] Saltzman *et al*. (1998) *Geol. Soc. Am. Bull*. **110**, 285-297.
[2] Glumac & Walker (1998) *J. Sed. Res*. **68**, 1212-1222.