The boron identity: Using $\delta^{11}B$ to examine Late Paleozoic seawater

S.A. LEGETT[1]*, E.T. RASBURY[1], E.L. GROSSMAN[2], N.G. HEMMING[3,1,4]

[1]Stony Brook University, Department of Geosciences, Stony Brook, NY 11790-2100, USA (*correspondence: shelbie.legett@stonybrook.edu)
[2]Texas A&M University, Department of Geology and Geophysics, College Station, TX 77843, USA
[3]Queens College, School of Earth and Environmental Sciences, Flushing, NY 11367, USA
[4]Lamont-Doherty Earth Observatory of Columbia University, Geochemistry, Palisades, NY 10964-8000, USA

One of the important topics today is climate change, but what do we know about climate change in the past? This study uses $\delta^{11}B$ values from low alteration Carboniferous and Permian brachiopods to examine chemical trends in seawater and how these relate to long-term and rapid climate changes.

Our preliminary results show that $\delta^{11}B$ rises rapidly going into the Carboniferous from a low of 10‰ to a high of 17‰ and remains relatively stable through the Carboniferous, despite the initiation of glaciation in the Mid Carboniferous. At the Carboniferous-Permian boundary, the $\delta^{11}B$ decends into the Early Permian before reaching its low by the Sakmarian. This decline in $\delta^{11}B$ is coincident with the decline in $^{87}Sr/^{86}Sr$ through this interval, which occurs along with multiple lines of evidence for aridity going into the Permian [1,2]. Based on this, we hypothesize that a reduction in silicate weathering drove an increase in pCO_2 and a subsequent lower pH in the ocean. With lower pH, less borate is formed leading to a major removal mechanism for boron being subdued. This direction of change is consistent because borate is isotopically light, and, therefore, seawater should become lighter as this mechanism for boron removal is reduced. Additionally, a predicted increase in boron residence time is supported by anomolously high boron concentrations for Kungurian samples seen in this study as well as in Joachimski *et al*. [3].

[1] Popp *et al*. (1986) *Geochim. et Cosmochim. Acta* 50, 1321-1328. [2] Martin and Macdougall (1995) *Chem. Geo*. 125, 73-99. [3] Joachimski *et al*. (2004) *Geochim. et Cosmochim. Acta* 69, 4035-4044.