Applying $\delta^{11}B$ as a paleogroundwater discharge proxy along coastlines

KYLE H. BROACH[1]*, ADINA PAYTAN[2], CHEN-FENG YOU[3], TSU-HAO DAVID WANG[3]

[1]EPS, UC Santa Cruz, Santa Cruz, CA 95064 USA (*correspondence: kyle.h.broach@ucsc.edu)
[2]IMS, UC Santa Cruz, Santa Cruz, CA 95064 USA (apaytan@ucsc.edu)
[3]ES, National Cheng Kung University, Tainan City, Taiwan (cfy20@mail.ncku.edu.tw, david707@hotmail.com.tw)

Global climate change and warming are proposed to alter the hydrologic cycle as the oceans and atmosphere shift the distribution of heat and moisture in new circulation regimes, but how these changes manifest at the regional scale is less clear. Increased seasonality of precipitation has been observed in modern times which may promote increased frequency of sever droughts, but baseline paleo-records of hydrologic variability need expanding, especially in locales where traditional geochemical archives (e.g. speleothems, leaf waxes) may be unavailable. Here we use the $\delta^{11}B$ pH proxy in a novel way to test its applicability as a paleogroundwater discharge proxy. $\delta^{11}B$ of carbonate has typically been used to reconstruct ocean pH or trace groundwater sources but has not explored pH as a signal for submarine groundwater discharge itself. We test this proxy in the spring water-fed estuary Celestun Lagoon in Yucatan, Mexico. Sediment cores and water samples taken adjacent to and far from the springs give spatial and temporal coverage up to an estimated 1000 years. The benthic foraminifera Ammonia parkinsoniana was selected for boron isotope analysis due to its abundance and life cycle (~3 months) averaging over diurnal pH variations. δ11B of core top (0-2 cm) A. parkinsoniana range from 8.06 to 18.5 ‰ (NBS 951 standard) with greatest variability seen near springs. δ11B of water samples along the lagoon range from 38.21 to 39.81 ‰ (IAPSO standard) and are within error of the seawater value 39.6 ‰ regardless of sample site (spring vs. ocean) suggesting there is no significant source controlling boron isotope signal in the springs. We therefore suggest spring water pH (6.83) controls the foram $\delta^{11}B$ value in absence of a discrete source. Cores taken adjacent to springs show greater ranges in $\delta^{11}B$ and suggest greater sensitivity when near low-pH sources. Future work will use radiogenic strontium and trace metals to constrain groundwater discharge amount and to correlate with the foram $\delta^{11}B$ signal.