CLUMPED ISOTOPE THERMOMETRY OF DIAGENETIC CARBONATES IN THE ILLINOIS BASIN

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Abstract

The Illinois Basin has been heavily studied, both as a sedimentary sequence recording a long epeiric deposition and burial sequence, and as a model for the formation of Mississippi Valley-type (MVT) ore deposits. There is also a sizable body of work on maturation of organics, tied to both the MVT fluid event and to the development of hydrocarbon reservoirs in southern Illinois. The full suite of diagenetic minerals in sandstones have the potential to preserve a record of the host of diagenetic processes that affected it and surrounding sediments at depth, but these mineralization cements are often too small to be analyzed with traditional drilling or dissolution techniques. Recent advances in Secondary Ionization Mass Spectrometry (SIMS) at the UW-Madison allow for the in-situ measurement of $\delta^{18}O$ and $\delta^{13}C$ from areas 10 µm in diameter, and have been used to create an extensive dataset of dolomite/ankerite cements that display isotopic zoning on the micron scale (Pollington et al., 2011; Hyodo et al., 2014; Denny et al., 2015; Sliwinski et al., 2015). However, developing a robust burial heating model from this dataset is limited by the sensitivity of $\delta^{18}O$ to fluctuations in pore-water composition, a limitation not present with clumped isotopes in carbonate. This project seeks to use clumped isotope analyses, in conjunction with this large existing dataset, to provide additional constraints on fluid composition and temperature, leading to further refinement of diagenetic carbonate formation models.

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