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Clumped isotope geochemistry reveals insights into secondary carbonates mineralisation in the Michigan Basin, Ontario

BENJAMIN R. FOSU[1], JOSUÉ J. JAUTZY[1], TOM AL[2] AND IAN CLARK[2]

[1]Geological Survey of Canada
[2]University of Ottawa
Presenting Author: fosurichben11@gmail.com

Ordovician carbonates in several parts of the Michigan Basin have been the focus of paleofluid studies, in part due to their association with hydrocarbon migration which, in turn, can be linked to secondary mineralisation. Recent investigations on vein-related fluid migrations suggest a multistage paleofluid history, with variable fluid sources, for the basin in Southwestern Ontario *[1]*. Whereas models for the fluid migration history associated with secondary mineralisation are relatively well established, an understanding of the nature and source of these participating fluids requires further refinement. Moreover, the effects of fluid mixing and fluid-rock interactions on the paleofluid evolution could be better constrained with additional investigations.

Using clumped isotopes analysis on calcite and dolomite phases in samples recovered from drilled cores (within 690–886 mBGS), we aim to reappraise the paleofluid evolution of the Ordovician stratigraphy in Southern Ontario and provide additional insights on the origin and isotopic composition of mineralising fluids and post-depositional modifications of the rock record. Clumped isotope measurements (Δ_{47}) were acquired on mm-size secondary carbonates (veins and vugs) and their host matrix material, and are evaluated against fluid inclusion micro-thermometric and geochemical data. Our preliminary Δ_{47} results reveal subtle compositional differences between veins/vugs (0.400–0.485‰, I-CDES) and matrix carbonates (0.450–0.509‰, I-CDES). Bulk $\delta^{13}C$ and $\delta^{18}O$ values are variable among sample types, ranging from -5.38 to 0.87‰ (VPDB) and 13.73 to 25.05‰ (VSMOW), respectively. By comparing the isotopic parameters of coexisting calcite and dolomite phases we will discuss and explore the diagenetic history of this sedimentary package.

[1]Petts DC, Saso JK, Diamond LW, Aschwanden L, Al TA, Jensen M (2017). Appl. Geochem, 121-137.