Large $\delta^{18}O$ and $\delta^{13}C$ Zonations in Diagenetic Dolomites of the Bakken Formation, Middle Member

ADAM C. DENNY[1], MACIEJ G. ŚLIWIŃSKI[1], IAN J. ORLAND[1], AND JOHN W. VALLEY[1]

[1]WiscSIMS, Department of Geoscience, University of Wisconsin-Madison, WI, 53706 USA

Diagenetic dolomites that obscure primary seawater signals and modify porosity in sedimentary sequences can also preserve in their chemical zonations a record of progressive heating, burial, and fluid movement within a basin [1]. To explore how dolomite zonations manifest in response to burial processes in organic-rich sedimentary systems, we used Secondary Ion Mass Spectrometry (SIMS) to make *in situ* measurements of both $\delta^{18}O$ and $\delta^{13}C$ in diagenetic dolomites, ankerites, and calcites from the middle member of the Devonian-Mississippian Bakken Fm. in the Williston Basin. Analyzed samples cover a ~250 km transect, providing cross-basin coverage for a range of depths (~1 to 3.5km) and thermal histories (75 to 165°C max temperatures [2]). Fe-zoned dolomites show large variability in both $\delta^{18}O$ (from ~20 to 35‰ VSMOW) and $\delta^{13}C$ (from ~ -10 to +5‰ VPDB) basinwide. Core-to-rim variability in individual Fe-zoned dolomite cements, some less than 100μm across, can exceed 10‰ in both $\delta^{18}O$ and $\delta^{13}C$. Deeper dolomites (>2km) show a systematic core-to-rim decline in $\delta^{18}O$ and $\delta^{13}C$ while Fe content increases. Individual dolomite growth bands can be correlated across the basin on the basis of minor element and isotope values. Late Fe-rich zones with coeval high $\delta^{18}O$ and low $\delta^{13}C$ values at the basin margin require infiltration of fluids, which we interpret as upward-migrating brines that experienced higher temperature water-rock and organic interactions at greater depths.

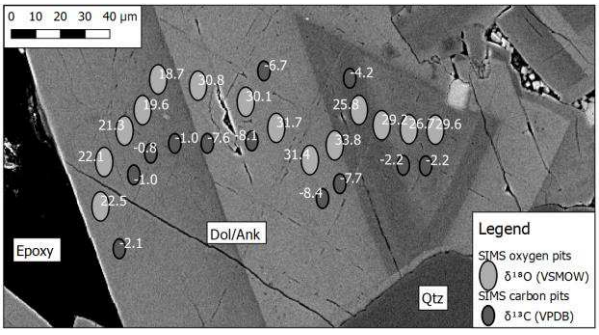

Figure 1: BSE image of a zoned dolomite-ankerite from a depth of 1141 meters, with SIMS analyses marked.

[1] Denny *et al.* (2017) *Sedimentary Geology* **361**, 91-110. [2] Kuhn *et al.* (2012) *AAPG Bulletin* **96**, 1867-1897.