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Constraining the Timing of Dolomitization of the Red River Formation using *in situ* Carbonate U-Pb Geochronology

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Few *in situ* absolute ages of diagenetic dolomites have been reported in the literature due to challenges, e.g., complicated growth histories and a lack of standards [1], though LA-ICP-MS has shown potential to better understand dolomitization events in proper geological context. For the first time, we report such data from the Williston Basin, an intracratonic epeiric marine basin in North America. Burrow-mottled carbonates of the Upper Ordovician Red River Formation of the basin record metal isotope gradients ($\delta^{44}Ca$, $\delta^{26}Mg$, $^{87}Sr/^{86}Sr$; [2,3]) that are interpreted to reflect two dolomitization events: (1) early diagenetic dolomite by brine reflux (Late Ordovician), and (2) burial dolomite by ascending hydrothermal fluids (tentatively Early Carboniferous) [2,3]. The Early Carboniferous timing of the second dolomitization event is recognized by apatite fission-track thermochronology and inferred as a basin-wide thermal anomaly of that age [4]. Paleotemperature estimates of ~ 100°C determined by clumped isotope thermometry of dolomite, and fluid inclusion analysis of saddle dolomite, exceed burial temperature estimates from stratigraphic thicknesses at this time [2]. Here we use *in situ* carbonate U-Pb geochronology to better constrain the timing of early diagenetic dolomitization from samples near the shallowly buried edges of the basin and hydrothermal dolomitization from samples in the deep center of the basin.

Identified carbonate phases (burrow dolomite & matrix calcite) from outcropping pieces of Red River C member carbonate from the erosional edge of the Williston Basin have been investigated by SEM/EDX, cathodoluminescence, and U-Pb geochronology by LA-ICP-MS. For the burrows, a preliminary age of ~ 350 Ma was obtained, with an associated matrix age of ~ 400 Ma. These results are promising in that the burrow dolomite appears to have an age that correlates with the previously proposed Late Paleozoic thermal event [2,4].

[1] Elisha, Nuriel, Kylander-Clark & Weinberger (2021) *GChron* 3, 337–349.

[2] Kimmig, Nadeau & Holmden (2021) *GCA* 311, 198–225.

[3] Holmden, Kimmig & Nadeau (2024) *GCA* 373, 151–168.

[4] Osadetz, Kohn, Feinstein & O'Sullivan (2002) *Tectonophysics* 349, 221–249.