Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.38416

U-Pb dating of dolostone: am I projecting?

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U-Pb dating of dolostone via LA-ICPMS is an emerging technique, which is potentially attractive due to dolostone's relatively strong weathering-resistance and relatively high U concentrations. This study seeks to: 1) test the viability of U-Pb dating of dolostone on samples of known age, 2) identify a matrix-matched reference material for LA-ICPMS dating, and 3) assess differences in matrix-induced fractionation for calcite vs. dolomite. To that end we have analyzed hundreds of dolomite and dolostone samples, including late Proterozoic and Paleozoic dolostones from the Kingston Peak Range of Nevada. These dolostone often has measurable $^{238}U/^{206}Pb$ ratios that define an isochron, but ratios are rarely above ~5. Curiously, isochrons constructed from these lower $^{238}U/^{206}Pb$ ratio shots tend to consistently underestimate the true age of the dolostone, rather than scatter randomly. In contrast, we obtain relatively accurate isochron ages from dark-colored, presumably organic-rich, dolostones that produce the highest $^{238}U/^{206}Pb$ ratios with the most accurate isochron ages. Efforts to identify a suitable dolostone reference material have so far failed given the typically low $^{238}U/^{206}Pb$ ratios of dolostone. However, experiments using a TIMS-dated dolomite specimen as a primary reference material demonstrate up to 20% differences in $^{238}U/^{206}Pb$ fractionation between calcite and dolomite analyzed in the same analytical session. These differences are magnified at low laser energies and underscore the potential pitfalls of U-Pb dating of dolostone relative to a calcite reference material.