

Linking high- and low-temperature processes in the crust with U–Pb dating of carbonate rocks and minerals

HOLDER, R.M.,¹ HACKER, B.R.,² RYB, U.³

¹University of California, Santa Barbara,
rholder@umail.ucsb.edu

²University of California, Santa Barbara,
hacker@geol.ucsb.edu

³CalTech, uriryb@caltech.edu

Directly dating carbonate rocks and minerals by the decay of U to Pb is a growing frontier in geochronology. The emergence of this technique in the last few years stems from i) the capability of LA-ICPMS to rapidly screen samples for their U/Pb_c ratios and to measure many spots with different U/Pb ratios to obtain precise dates free of assumptions about the composition of common Pb and ii) the ongoing characterization of LA-ICPMS reference materials for community use. U–Pb carbonate dates can be combined with cathodoluminescence imaging, major- and trace-element analysis, and clumped-isotope thermometry, allowing complex geologic/tectonic histories to be extracted from individual samples. Directly dating carbonate rocks and minerals complements traditional geochronology—mostly limited to high-temperature environments of igneous and metamorphic rocks—by providing time constraints on low-temperature processes such as sedimentation, diagenesis, metasomatism/fluid-flow, and faulting. Considered together, these constraints can be used to reconstruct thermal, compositional, and structural histories of orogens and sedimentary basins and to study the interactions among these processes.