A growing frontier in geochronology is the use of U-Pb dating of carbonate rocks and minerals by LA-ICPMS to directly date both brittle and ductile deformation. The emergence of this technique in the last few years stems from 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 and obtain precise dates free of assumptions about the composition of common Pb. Through the generosity of our colleagues we have acquired 8 reference materials ranging in age from 3 to 250 Ma. With this set of reference materials, we can now rigorously conduct case studies to address important questions about the technique. What percentage of carbonate samples have high enough U/Pb_c ratios that they can be dated? What percentage of samples yield isochronous datasets? What are the limits on precision and accuracy of carbonate U/Pb dates? What is the best analytical method in the absence of isotopically homogeneous reference materials? How do diagenesis and metamorphism modify the U/Pb-isotope ratios of carbonate rocks and minerals? To what extent can we use microstructure and composition to guide our analyses and interpretations of U-Pb carbonate data, particularly with regards to directly dating deformation?

Analyses are conducted using a 193 nm ns laser with an 80–100 μm spot and a Nu Plasma HR-ES. We measure $^{207}Pb/^{206}Pb$ using a homogeneous glass (such as NIST 614) and then calculate a $^{206}Pb/^{238}U$ correction factor based on the measured vs. known ages of the reference materials. Approximately ~50% of all carbonate samples we have analyzed have high enough U/Pb ratios that they can be dated. However, there is great heterogeneity among the sample suites: some have no datable samples, whereas one suite of 68 samples yielded 53 datable rocks. Of the samples with high U/Pb_c ratios, a majority yielded isochronous U-Pb data, indicating that the U-Pb system closed at a given time and was not subsequently disturbed.