

## ISOTOPIC MONAZITE AGE DISCORDANCY RESOLVED USING CHEMICAL-DATING AGE-DOMAIN IDENTIFICATION TECHNIQUES

LOEHN, Clayton W., Dept. of Geosciences, Virginia Tech, Blacksburg, VA 24061

Monazite (mnz) geochronology is rapidly becoming the technique of choice for unraveling local and regional polyphase thermotectonic histories. High retention for radiogenic Pb makes monazite ideal for various *in-situ* radiometric dating methods including techniques such as electron microprobe (EMP) and ion microprobe (IMP, especially SHRIMP). The EMP provides better spatial resolution and the ability to perform elemental mapping (Y, Th, U, Ca, and Pb). Given its high retention for radiogenic Pb, a single monazite grain may contain several age domains, reflecting its complex growth and recrystallization history, but which may or may not correlate with single-element chemical domains. Both techniques frequently yield "mixed ages," which are the result of IMP ablation pits and EMP spots overlapping age domain boundaries and can significantly affect the accuracy of geochronologic, microstructural, and tectonic interpretations. Isotopic age population determination (IMP) is typically performed using a U-Pb concordia plot of both concordant and discordant data, and infers that all analyses falling below concordia reflect Pb loss during a younger event. However, monazite expels all radiogenic Pb during recrystallization due to crystalline structure constraints and typically, therefore, cannot yield discordant ages in the traditional sense. New chemical-dating age-domain identification techniques have been developed from EMP traverse-line analyses that use a variety of plots to better locate nearly vertical to shallow dipping age-domain boundaries. One prominent example on which these models have been tested is a 100-micron mnz grain from the Tobacco Root Mountains, Montana (TRMR-2). It contains a low-Th older core (ca. 2.85 Ga), a higher-Th mantle domain of about 2.45 Ga, and a low-Th rim of 1.78 Ga. This grain has 6 IMP spots that range in age from 1880 Ma (near-rim) to 2785 Ma (core). Only two IMP pits fall totally within a single chemical and age zone delineated by EMP analyses or compositional maps (the medial age zone): 2451 ( $\pm 4$ ) and 2432 ( $\pm 10$ ) Ma. Domains were determined using traverse plots that depicted age plateaus and mixing lines between separate plateaus. Additionally, Th/U plots and linear probability plots were used to determine which EMP analyses yielded "mixed ages." These techniques yielded ages for this sample that are more precise and accurate and helped to explain the apparently concordant "mixed ages" obtained by IMP. Application of these techniques to younger monazites (500-350 Ma) has yielded similar results.