Improved U-(Th)-Pb dating of monazite by ion microprobe: Correcting for an isobaric interference of PrP04 on 204Pb

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High U and Th abundances, resistivity to diffusion and resilience to weathering make monazite one of the most important minerals for U-Th-Pb dating. Chemical characteristics (e.g. Y content, REE pattern) can be used as indicators of monazite growth reactions, and allow correlation of age data with metamorphic, magmatic or hydrothermal processes.

It has been noted that ion microprobe analysis of Th-rich monazite can yield discordant Pb-U and Pb-Th dates (e.g. Stern & Berman 2000; Zhu & O'Nions 1998), or may show excess scatter on the 207Pb/206Pb dates. Both effects compromise the analytical accuracy and the geological interpretation. These effects may be attributable to matrix effects, i.e. subtle crystallographic differences may result in different ablation and Pb/U characteristics of unknowns and the monazite inter-element fractionation standard used during SIMS analysis. In comparison to zircon, commonly occurring monazite cover a much wider range of chemical compositions.

To evaluate the effects, we have systematically studied a suite of monazite reference materials with a range of chemical compositions, from the brabantite (CaTh(PO4)2) as well as the huttonite (ThSiO4) solid solution series, and with varying Yttrium content. Independently determined age data exist for all these materials from TIMS measurements.

We propose that the observed excess scatter on the207Pb/206Pb ratios results from an isobaric interference of PrP04 on 204Pb that has so far been ignored in ion microprobe data reduction and correction procedures. Using a correction based on the La/Ce counts, routinely measured in monazite analytical session on SHRIMP, and extrapolating to Pr, a correction can be applied before further corrections for Th related “excess 204Pb are applied. Our correction routine has been built into the recent version of CONCH, a visual Basic program for processing of ion-microprobe analytical data developed by Nelson (2006).

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