Uranium zonation refined U-Pb thermochronology – comparison with independent thermometers

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Uranium-Pb high-temperature thermochronometers (>350°C) exploit thermally activated volume diffusive loss of daughter isotopes in accessory minerals such as apatite, titanite and rutile. Previous studies have shown that U-Pb data can be used to generate accurate continuous t-T solutions spanning hundreds of millions of years. Single grain ID-TIMS analysis yields the highest precision, but detailed analyses of $^{238}U/^{206}Pb$ date vs diffusion length scales reveal scatter beyond predictions from volume diffusion. The causes of this scatter can be numerous, and include i) metamorphic overgrowths, ii) fluid catalysed Pb-removal, iii) parent isotope zonation, iv) metamictization, and v) changes in diffusion length. We compare single grain ID-TIMS with LA-MC-ICP-MS *in-situ* U-Pb dates, combined with trace element data (from Triassic leucosomes from the Northern Andes of South America), to examine the influence of parent isotope zonation on t-T information derived from apatite. Time-T-solutions from the *in-situ* analyses are corrected for parent zonation and compared with i) apatite $^{238}U/^{206}Pb$ ID-TIMS data, and ii) $^{40}Ar/^{39}Ar$ data obtained from muscovite and biotite from the same hand-specimen. Independently obtained t-T information from the well-established regional geologic history, and P-T estimates from garnet-plagioclase-quartz-muscovite/biotite assemblages are used to constrain maximum post-crystallization pressures and temperatures.