Linking metamorphism, deformation and geochronology of accessory phases: examples from the Kaoko Belt, Namibia

D.A. FOSTER[1], S.J. COYNER[1], P.A. MUELLER[1], G.D. KAMENOV[1], D.R. GRAY[2], AND B. GOSCOMBE [3]

[1] Dept. of Geological Sci., University of Florida, Gainesville, Florida 32611 USA, dafoster@ufl.edu
[2] School of Earth Sci., University of Melbourne, 3010, Victoria Australia drgray@unimelb.edu.au
[3] Northern Territory Geological Surv., Alice Springs, NT 0871, Australia; ben.goscombe@adelaide.edu.au

U-Pb dating of accessory phases is often complicated by the presence of significant common Pb. This is especially the case in titanite, which otherwise has great potential to date specific metamorphic reactions in mafic and calcsilicate rocks or post-metamorphic cooling from very high-grade events. While the determination of a suitable common Pb composition is feasible for young igneous rocks, it is a more difficult for older, metamorphic titanite. High precision Pb-Pb and U-Pb isotope measurements by MC-ICPMS show promise for improving geochronologic data obtained from metamorphic minerals like titanite. We are conducting analyses using a Nu-Plasma MC-ICP-MS in static collector mode with Pb isotopes (206, 207, and 204) acquired on ion counters and U isotopes (235 and 238) on Faraday detectors. Pb and U isotopic ratios are referenced to a fused titanite glass made from Bancroft titanite.

Laser ablation MC-ICPMS analyses of metamorphic titanite, with relatively low-U concentrations, from the Pan-African Kaoko Belt (Damara Orogen) Namibia give an 238U-206Pb age of 533 +/- 27 Ma, by regressing uncorrected data on a 3-D Tera-Wasserburg concordia diagram. Further titanite analyses are underway from this and other samples from the Kaoko Belt with the aim of improving precision. The titantite U-Pb age is concordant with Ar-Ar hornblende and biotite ages of metamorphic rocks in the region, but significantly younger than the age of peak metamorphism (~570 Ma), based on extensive U-Pb zircon data. Titanite grew during the peak metamorphic event, which attained pressures and temperatures of about 9 kbar and 700 degrees, respectively. The apparent age of the titanite records closure of the U-Pb system along the retrograde path at about 600 degrees C. Ca. 530 Ma corresponds to a lower-grade metamorphic and deformational event recognized regionally in the Kaoko Belt, associated with rapid cooling from >600 degree C to below 300 degrees C in <10 m.y. This retrograde event is probably due to rapid erosional exhumation of the Kaoko Belt driven by orogeny in the Inland Belt of the Damara Orogen.