In-situ U-Pb dating and geochemical constraints on UHT metamorphism in the Brasilia fold belt

A. MÖLLER[1], R. MORAES[2], E. HELLEBRAND[3], A. KENNEDY[4], AND R.A. FUCK[5]

[1] Inst. f. Geowissenschaften, Universität Potsdam, Germany; amoeller@geo.uni-potsdam.de)
[2] Inst. de Geociências, Univ. de São Paulo, Brazil
[3] Max-Planck-Institut f. Chemie, Mainz, Germany
[4] Dept. Appl. Physics, Curtin University, Perth, Australia
[5] Inst. de Geociências, Univ. de Brasília, Brazil

In-situ U-Pb and trace element analysis allow direct correlation of age data to prograde and retrograde stages of the metamorphic evolution. Maintaining this context, growth reactions and petrologically relevant textures can be observed (1), and trace element analyses be used to test equilibrium. This approach is used on zircon and rutile in the UHT granulites from the Brasília fold belt to constrain the age and duration of the metamorphic event. U-Pb geochronology thus becomes a more versatile geological tool than previously utilized, when zircon ages where interpreted to date the peak of metamorphism only.

UHT granulites in the Anápolis-Itauçu Complex of the Brasília fold belt attained peak conditions of at least 1050°C at more than 10 kbar (2, 3), followed by initial decompression and nearly isobaric cooling to below 850°C, at which Opx- and zircon-bearing leucosomes crystallized. The age of euhedral zircon from these leucosomes is 631±6 Ma. Flat distribution patterns of HREE between zircon and Opx gives values at c. 10 and indicate equilibrium. Further retrograde zircon growth occurred also at 631±6 Ma as rims around rutile, which shed c. 80% of its peak temperature zirconium content during recrystallization and cooling from peak-T to about 850°C. Rare zircon cores and oldest rutile shielded in garnet are c. 50 m.y. older and may be interpreted as prograde to peak growths of this or an earlier event, given that negative Eu anomalies and flat HREE patterns in zircon indicate equilibrium with Grt and Fsp.

Post-UHT rutile recrystallization during cooling is thus identified by texture and trace analysis as a source for retrograde zircon growth after UHT metamorphism. Here, this rutile, not included in UHT minerals, is interpreted to date cooling through c. 430°C, resulting in a cooling rate of c. 15°C/Ma that indicates relatively fast exhumation.

References

[1] Möller A., O'Brien, P. J., Kennedy, A. & Kröner, A., (2003) Geol. Soc. London, Spec. Publ. **220**, 65-81.
[2] Moraes, R., Brown, M., Fuck, R.A., Camargo, M.A. & Lima, T.M. (2002) J. Petrol. **43**, 1673-1705.
[3] Baldwin, J.A., Powell, R., Brown, M., Moraes, R. & Fuck, R. A., J. met. Geol. **23**, 511-531 (2005)