Fast exhumation of UHT granulites in the Saxon granulite massif: a combined geochronologic and petrologic investigation

[1]ROMER, R.L. and [1]RÖTZLER, J. [1]GeoForschungsZentrum Potsdam, Telegrafenberg, D-14473 Potsdam, Germany.

Granulite facies metamorphism in the structurally lower part of the Saxon Granulite Massif (SGM) culminated in UHT-HP conditions around 1050°C and 21 kbar. UHT/HT conditions persisted over much of the exhumation history. In an attempt to date distinct stages along the P-T path, we have dated a sapphirine-bearing granulite, a retrograde felsic granulite, and a garnet-clinopyroxene rock.

Concordant zircon and titanite give within analytical uncertainties the same age at c. 341-342 Ma. Monazite plots discordantly and shows excess ^{206}Pb. An $^{207}Pb/^{206}Pb$ age of 341 Ma is calculated after correction for excess ^{206}Pb for a Th/U = 2.5 in the source rock. These data demonstrate similar blocking temperature for these three minerals in dry systems, i.e., a blocking temperature for titanite and monazite considerably higher than 550°C and 725°C, respectively. Garnet defines a Pb-Pb isochron with an apparently much older age than monazite, zircon, and titanite despite textural evidence of a common crystallization history and age. The isotope systematics of garnet, rutile, and apatite shows excess scatter. All these phases have low parent/daughter ratios (i.e., little radiogenic lead) and the excess scatter may reflect initial isotopic heterogeneities originating from the reaction history (changing reaction partners with contrasting U/Pb). Apatite has distinctly lower U-Pb ages reflecting its low closing temperature (c. 450°C for dry systems) and seems to have lost lead during later events. The U-Pb apatite age, however, agrees with a biotite Rb-Sr age of 324 Ma. Average exhumation rates for the SGM to a middle crustal level exceed 10 mm/y, but are less than 2 mm/y once the rocks have reached the middle crust.