Geochronological constraints on fast exhumation: the example of the Central Alps

D. RUBATTO[1], J. HERMANN[1]

[1] Research Scool of Earth Sciences, ANU, Canberra 0200;
daniela.rubatto@anu.edu.au; joerg.hermann@anu.edu.au

The rigorous correlation between ages obtained from minerals and the P-T conditions at which they formed offers direct measurement of geological rates. Particularly, dating the subduction and exhumation of crustal rocks requires chronometers that can be linked to pressure conditions.

The Duria garnet peridotite in the Central Alps underwent HP metamorphism during the Alpine orogeny. The rock contains two generations of metamorphic zircon formed in sub-solidus conditions, which have inclusions of metamorphic minerals. The composition of the inclusions, the zircon trace element composition and Ti thermometry indicate that the first zircon domain formed during decompression at 34.2±0.2 Ma. A second, crosscutting zircon domain is distinct in composition and age (32.9±0.3 Ma) and is the product of recrystallization during the formation of symplectites at lower temperature and pressure.

The data constrain fast exhumation of the peridotite from the mantle wedge above the Tertiary subduction of the European continental margin with rates of tens of km/Ma and cooling of approximately 100°C/Ma. These agree with a number of other studies, which determined that exhumation of small crustal slices is a fast, in the order of cm/year, and short lasting process. Such fast movements of rocks are only comparable to the speed of plate motion. They are generally faster than convergence rates and much higher than average erosion rates.

The ages obtained fall into a time period between 35 and 30 Ma, which seems to be particularly active for the Central Alps. At this time, two main deformation phases, major decompression associated with migmatisation and the intrusion of one of the main Alpine batholiths (Bergell) occurs in only 3-5 Ma.