Constraints on continental subduction in the Dora-Maira massif from rutile and titanite U-Pb geochronology

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The Dora-Maira massif (Western Alps) is among the most studied subducted continental terranes in the world. It consists of a tectonic stack of <km-thick units metamorphosed at different grades, from blueschist to Ultra-High-Pressure (UHP) eclogite. While the UHP unit has been extensively studied, little is known about the chronology of subduction and exhumation of other units.

We here present new petrological observations and U-Pb geochronology on rutile and titanite to constrain the prograde, peak and retrograde evolution of distinct units.

Rutile U-Pb geochronology on peak UHP assemblages is compared to existing results and is examined in light of closure temperatures for Pb diffusion. The results confirm peak metamorphism at ~35 Ma and fast cooling rates. This method is then applied to colder units (where closure temperatures are higher than peak temperatures, as shown by the preservation of the Permian age of pre-Alpine rutiles) and yields peak metamorphic ages of the different units between 39 and 32 Ma.

Rutile and titanite U-Pb geochronology help constrain the age of pervasive retrogression in the Dora Maira massif which is likely synchronous with the early exhumation of the lowermost continental unit and the transition from subduction to collision at 32-31 Ma.

We finally examine the possibility and potential consequences of melt circulation in the UHP unit during subduction.