

Crustal melting in orogens: linking melt composition, P-T conditions and ages

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Crustal anatexis, accompanied by melt extraction and ascent of magma to upper crustal levels, constitutes the most important mechanism of geochemical differentiation of the continental crust. Hence knowledge of the mechanisms, timing as well as of the composition of anatectic melts is essential for characterizing the internal differentiation of the Earth's crust.

Despite the important role of crustal anatexis in the chemical differentiation of our planet, from a petrological and geochemical point of view there is the strong urge for a better chemical characterization of natural crustal melts. From a geochronological point of view, instead, the difficulty of relating zircon and monazite ages with the prograde melting and formation of the major mineral assemblages in the rock (e.g. garnet) prevents from establishing reliable P-T-t paths and associated geodynamic scenarios for high-grade metamorphic basements.

We aim at establishing a clear link among melt compositions, P-T conditions of melting and ages. This aim of utmost importance in crustal petrology will be pursued through 1) a novel and cutting edge approach which consists in the study of inclusions of anatectic melt – preserved as glass or crystallized as "nanogranite" - trapped in peritectic minerals (e.g., garnet); 2) the application of Lu-Hf geochronology to nanogranite-bearing garnet; and 3) the application of the modern Ti-in-zircon, Zr-in-rutile and Ti-in-quartz geothermometers.

This study will involve field work, microscopy, experimental petrology and lab characterization with integrated methodologies (FEG-based SEM and EMP, LA-ICP-MS, NanoSIMS). The project can be focused on the migmatites from Ivrea Zone (Italian Alps) or on the granulites from Jubrique Sequence (Betic Cordillera, Spain), two areas in which the research team has already a solid background knowledge.

The project is part of the research line on crustal melting on which DiGeo-UniPD is a world leader (e.g., Cesare et al, *Lithos*, 2015; Bartoli et al., *Lithos*, 2016). We foresee the collaboration with the University and CSIC of Granada (Spain), the ETH (Zurich, Switzerland) and the Polish Academy of Sciences (Krakow, Poland).

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