Migmatisation in the Central Alps lasting 10 m.y.

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The southern part of the Central Alps underwent Barrovian style metamorphism that reached partial melting at upper amphibolite facies conditions. Previous geochronological constraints indicated that melting occurred in the Oligocene, around 29-32 Ma, with cooling extending into the Miocene.

SHRIMP U-Pb dating of zircons from migmatite suite from the southern Central Alps yielded variable and distinct ages between circa 31 and 22 Ma. A similar age range is recorded by the U-Th-Pb system of allanite. This range in ages is found not only across different samples, but also within single samples. For example, a leucosome from the locality of Bellinzona contains zircon grains with inherited Permian cores remnants of the magmatic protolith. The cores are overgrown by three zircon rims with different internal zoning and chemical composition, which yield distinguishable ages at circa 31, 26 and 23 Ma. In the locality of Valle Arbedo (25 km to the E) similar migmatites show distinct zircon overgrowths at circa 31, 28, 23, and 22 Ma. For all of the zircon overgrowths the inclusions, trace element composition and Ti-in-zircon thermometry indicate growth in the presence of melt at similar temperatures between 600 and 700 °C. Therefore, we conclude that this region of the Central Alps repeatedly underwent melting at similar conditions over an extended period of at least 10 Ma.

These geochronological constraints support a model where episodic melting is controlled by the availability of aqueous fluids (Berger *et al*., 2007). Local infiltration of aqueous fluid in rocks of different composition thus produced diachronous melting episodes. The southernmost part of the Central Alps evidently remained at temperatures above the wet granite solidus for at least 10 million years.

Reference

Berger A., Burri T., Alt-Epping P. and Engi M. (2007) *Lithos*, in press.

New constraints on conditions of core formation and the light element content of the Earth's core

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The concentrations of light elements in the Earth's core must have been set by metal-silicate equilibration during core formation, as was likely the case for the moderately siderophile elements. It has been shown recently that equilibration conditions of core formation can be constrained by the partitioning of FeO between liquid Fe-alloy and silicate melt in a magma ocean, based on the mantle composition and the light element content of the core (Rubie *et al*., 2004; Asahara *et al*., 2007). This is because the partitioning of FeO into liquid iron increases strongly with increasing temperature (and therefore magma ocean depth), thus decreasing the FeO content of the mantle and increasing the O content of the core. Based on a simple core formation model, Asahara *et al*. (2007) estimated that the maximum depth of metal-silicate equilibration was ~1700 km, which would have resulted in a maximum of ~8 wt% oxygen in the core. However, lower limits could not be constrained because the oxygen content of the starting (chondritic) composition is poorly constrained.

Traditionally, experimental data on the metal-silicate partitioning of siderophile elements have been used to constrain the conditions of core formation, for which an estimate of the prevailing oxygen fugacity is required. However, for a given metal-silicate bulk composition, the oxygen fugacity is fixed by the partitioning of FeO, which is a function of pressure and temperature only. Therefore we are developing core formation models based on the combination of FeO and moderately siderophile element partitioning. The model bulk composition is chondritic with an initial oxygen content that can be varied. Liquid metal and liquid silicate are assumed to equilibrate near the base of a magma ocean (defined by the peridotite solidus) and the compositions and relative proportions of the two phases are calculated using mass balance combined with formulations describing the partitioning of FeO and siderophile elements as a function of P and T. The results enable new constraints to be placed on (i) conditions of metal-silicate equilibration and therefore magma ocean depth, (ii) the bulk oxygen content of the Earth and (iii) the oxygen content of the Earth's core.

References

Rubie D.C., Gessmann C.K., and Frost D.J., (2004), *Nature* **429**, 58-61.

Asahara Y., Frost D.J., and Rubie D.C., (2007), *Earth Planet. Sci. Lett.*, 257, 435-449.