2.5.P03

Zircon fracturing, healing and rim formation: Chronology of the metamorphic process?

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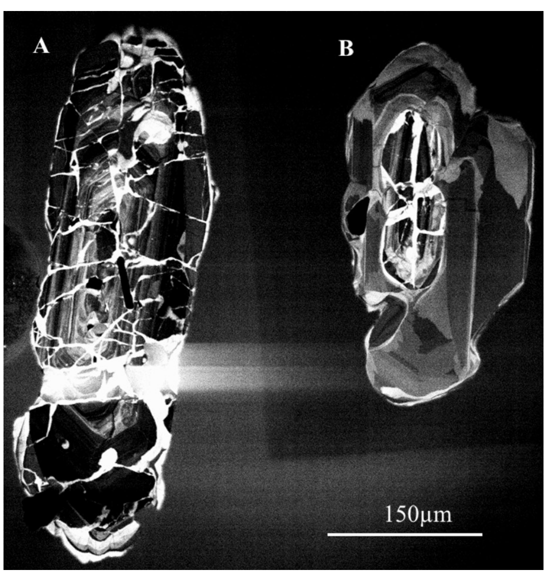
The 1.38 Ma Tjärnesjö granite in the Eastern Segment of the Sweconorwegian Orogen in SW Sweden have been strongly deformed under upper amphibolite to high-pressure granulite facies metamorphic conditions between 970 and 950 Ma [1]. Zircon from migmatised part of Tjärnesjö granite in cathodoluminescence (CL) images displays a clear oscillatory zoning pattern (OZP) typical for the magmatic zircons. Most of the zircons show up to 5 µm thick vein network, which joins into thin rims as well (grain A). Electron probe EDS analyses indicates that bright veins have identical major elements composition as zircon. CL images shows that the veins does not affect the protolith zircon- contacts is very sharp between veins and original zircon and magmatic OZP's is not disturbed. Some of the fractured grains have an additional thick CL darker rim with sector zoning (grain B). We suggest that zircons were brittly fractured prior to the formation of the CL-bright rims and the net veining is formed due to some sort of fracture filling mechanism. Sector zoned zircon rims most probably were formed during peak metamorphic conditions in the presence of melt. The geochronology and REE chemistry of these zircons will be presented and formation models discussed.



Reference

Johansson L. et al. (2001) *Precam. Res.* 261-275p.

2.5.P04

Flow and transport within layered shale-limestone rocks of the larvikite contact-aureole, Oslo graben, South Norway

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Ordovician calcareous sedimentary rock surrounding the Permian larvikite monzonitic complex within the Oslo graben, experienced contact metamorphism during the intrusion and crystallization of the large magmatic body.

The peak metamorphic temperature reached during the contact metamorphism was constrained by the stability of the phase assemblage wollastonite, clinopyroxene, garnet, scapolite and calcite in the nearby limestones to be in the vicinity of 800 ºC under equilibration with a relatively CO_2-rich fluid (XCO_2 ~ 0.600).

Within layered shale-limestone lithologies in the aureole, the occurring mineralogical changes can be outlined up to a distance of approximately 2000 meters from the intrusive contact. Oxygen isotope compositions within this zone are significantly lowered ($\delta^{18}O$: ~6 per mil) compared to normal sedimentary values within the area ($\delta^{18}O$: ~22 to 25 per mil). The lowering observed within the carbon system ($\delta^{13}C$: -4 to –2 per mil) can be traced to a distance of approximately 1000 meters from the intrusive contact, where the values raise till normal sedimentary values of $\delta^{13}C$: ~0 to 1 per mil. Purer limestone lithologies within the area remained largely unaffected with regard to changes in the stable isotopes, and Sr-isotopes report isotopically undisturbed Ordovician ages on a whole.

The scenario of fluid flow, both along and across the shale-limestone layers, can best be modelled by conventional transport theory as an up-temperature infiltration of an internally derived fluid. The transport mode across the lithological differing layers was mainly diffusion controlled, whereas the transport mode along the layers can be explained by coupled advection-diffusion-dispersion processes. The layer parallel infiltration took place by consumption of graphite within the limestone and devolatilization reactions occurring in the reactive limestone-shale interfaces, which allowed for the main fluid infiltration.

The channeled time integrated fluid fluxes ($\phi*\omega*t$) are within the order of 10^3-10^4 m^3/m^2, and the time scale to produce the observed changes of the stable isotopes within the larvik aureole is on the order of 10^4 years.