Carbonatites out of a subducted altered oceanic crust? Experimental evidences for epidote-dolomite eclogite melting at 3.8–4.2 GPa

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Current knowledge on the solidus temperature for carbonate-bearing rocks suggests that carbonatitic magmas should not at the slab-mantle interface, unless thermal relaxation is promoted by a variety of possible tectonic scenarios. For a mildly warm subduction path, COH-bearing altered MOR basaltic eclogites are expected to loose all H_2O component at epidote breakdown, located at approx. 2.8-3.0 GPa. Above this pressure limit, the solidus of a carbonated basaltic eclogite has a minimum temperature of approx. 1000 °C at 4.0-4.5 GPa. However, the oceanic crust includes a range of gabbroic rocks, altered on rifts and transforms, with An-rich plagioclase abundances from 50% to 80% in volume. It has been shown that epidote disappearance with pressure depend on the normative anorthite content of the bulk composition considered, we therefore expect that altered gabbros might display a much wider pressure range where epidote affects solidus relationships.

New experimental data from 3.8 to 4.2 GPa, 750°C to 1000 °C are intended to unravel the effect of variable bulk and volatile compositions in model eclogites, enriched in the normative anorthite component (An37 and An45). Experiments are performed in a piston cylinder and multianvil machines apparatus.

At 3.8 GPa, 800 °C, fluid saturated conditions, garnet, omphacite and kyanite coexist with epidote, dolomite and magnesite. At 900 °C, fluid-rich conditions, garnet and Na-poor clinopyroxene coexist with a silicate fluid/melt of granitoid composition, a carbonatitic melt and a Na-carbonate. Close to fluid-saturation, 4.2 GPa, 900 °C, garnet and Na-rich clinopyroxene coexist with a carbonatitic melt and dolomite. The carbonatitic melt is richer in Ca compared to dolomite, consistently with phase relationships in the model system $MgCO_3$-$FeCO_3$-$CaCO_3$. The H_2O-component deriving from a fluid-absent melting of epidote, enlarged in its pressure stability in An-rich gabbros, promotes melting of carbonates.

The possibility of extracting carbonatitic melts from a variety of gabbroic rocks in a subducting slab, at depths in the order of 120-130 km, offers new scenarios on the metasomatic processes in the lithospheric wedge of subduction zones and a new mechanism for recycling carbon.

Impact of climate change on soil microorganisms and carbon cycling in an arable ecosystem

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Carbon cycling in terrestrial ecosystems provides a feedback mechanism to climate change by releasing or sequestering additional atmospheric CO_2. However, the role of soil microorganisms as key players in this feedback mechanism is still unclear. The Hohenheim Climate Change (HoCC) experiment was established in summer 2008 to manipulate soil temperature and precipitation on an arable field. Soil temperature is increased by 2.5°C in 4 cm and is combined in a factorial design with the following precipitation manipulation treatments: a) ambient, b) precipitation amount decreased by 25% during summer and increased by 25% during winter, c) drought periods increased by 50% during summer, d) combination of b and c. The experimental plots were planted with spring wheat (*Triticum aestivum*, 2009), spring barley (*Hordeum vulgare*, 2010), oilseed rape (*Brassica napus*, 2011) and winter wheat (*Triticum aestivum*, 2012). Soil samples (0-5 cm, 5-15 cm and 15-30 cm depth) were taken at four occasions in 2009 and 2010 and at three and two occasions in 2011 and 2012, respectively. Data of aboveground biomass, soil organic carbon, soil microbial biomass, ergosterol content, hydrolytic enzyme activities and CO_2 fluxes (weekly measurements) will be presented. Results from 2009 and 2010 indicate that changes in soil temperature and precipitation differently affected aboveground biomass and that these effects depended on the crop. Effects of elevated soil temperature on microbial biomass and CO_2 fluxes were related to moisture conditions during the different seasons of the year in 2009 but not in 2010 [1]. First evaluation of ergosterol contents and enzyme activities from 2009 to 2012 indicate that soil warming increases fungal biomass and microbial activity depending on the time of sampling. Overall, the presentation will give insight into the complex interactions between climate change, soil moisture and soil microorganisms as key players of carbon cycling in the investigated arable ecosystem.

[1] Poll, Marhan, Back, Niklaus & Kandeler (2013), Agriculture, Ecosystems and Environment 165, 88-97.

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