Dehydration of metasomatic rocks along subduction and cold diapiric P-T trajectories

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Material from the subducting slabs is chemically linked to the source region of magmas produced at convergent plate margins. Hydrous fluids and chemical components from (1) subducted altered-oceanic crust and (2) the thin sedimentary veneer are added to (3) depleted mantle-wedge peridotite are invoked as the source of these melts. Exhumed subduction zone mélange show new rock compositions develop through metasomatism and advection during early subduction where metabasic rocks and other rock types are juxtaposed with serpentinites. In large enough amounts in the source, these new (metasomatic) rock compositions may alter or expand the P-T region over which large amounts of fluid or key trace elements are either retained in or released from the source rocks relative to conditions predicted by the widely applied three-component source models.

This study examines the petrologic changes along a subduction P-T trajectory followed by a cold diapiric rise into the mantle wedge; the high-P, metsomatic rock compositions used for the calculations are from the island of Syros, Greece. These following metasomatic assemblages developed under blueschist-facies conditions and were preserved between garnet-epidote-glaucophane schist and serpentinite:

(1)glaucophane+epidote+phengite+chlorite; (2)glaucophane+epidote+chlorite+omphacite; (3)epidote+chlorite+omphacite; (4)chlorite; (5)chlorite+talc.

The calculated phase relations for the metasomatic rocks compositions show that water-rich mineral like chlorite from these rocks could be stable to higher pressures, temperatures, and be more abundant than in hydrated basalt. Chlorite-rich metasomatic compositions produce more garnet than is expected from metabasalts. For example at about 805°C & 21 kbar, metasomatic rock (3) becomes 37 vol% garnet, 19 vol% pyroxene, 37 vol% amphibole; at about 910°C & 20 kbar, metasomatic rock (4) becomes 45 vol% garnet, 15 vol% spinel, 35 vol% olivine.

A decadal lipid biomarker paleohydrological record during the onset of the Younger Dryas from Northeastern Germany

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Regional expressions of global climatic changes, especially their effect on the hydrological cycle, are difficult to predict. However, their impacts, in the form of droughts or extreme precipitation events can be severe for societies and ecosystems. Therefore, a better understanding of the complex hydrological feedback mechanisms during past abrupt climate changes may ultimately lead to better predictions of regional climate changes.

High-resolution proxy data from well dated lacustrine sedimentary archives are particularly well suited for the reconstruction of regional climate changes in the past. Here we are investigating the hydrological impacts of the abrupt climate change during the onset of the Younger Dryas (YD) cold period between 13.000 and 12.400 years BP from the paleolake Rehwiese in Berlin in Northeastern Germany.

We extracted lipid biomarkers from a 122,10 cm sedimentary sequence covering a period of 600 years during the onset of the YD. We identified abundant mid- and long-chained n-alkanes, usually attributed to aquatic macrophytes and higher terrestrial plants, respectively. In addition, we found hopanes of bacterial origin as well as branched alkanes. Dinosterol, a characteristic biomarker for dinoflagellates, was also detected.

Using these samples we construct a record of hydrological changes in decadal resolution. Therefore, we are analyzing the hydrogen isotope composition of lipid biomarkers (D/H). We will evaluate this palaeohydrological record in conjunction with micro-facies, geochemical and palynological data in order to understand the hydrological evolution of regional climate during the onset of the YD in Northeastern Germany.

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