Accelerating garnet growth and related dehydration at blueschist-facies conditions, Sifnos, Greece

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While subduction is considered to be a gradual process, consisting of steadily changing pressures and temperatures, metamorphic reactions and mineral growth during subduction may, in some cases, be episodic, or pulsed. Whether the net transformation and accompanying dehydration of subducting material occurs steadily, or in one or more bursts, has important implications for subduction zone petrology and geodynamics.

Here, microdrilling based on major element zoning contours as determined by electron microprobe mapping, from a 4.9-cm diameter garnet in a quartzofeldspathic gneiss from Sifnos, Greece, in the Attic-Cycladic Blueschist Belt, provides information on the rate of mineral growth during metamorphism. Ten concentric growth zones were sampled from the garnet for Sm-Nd geochronology using ID-TIMS. After acid cleansing of mineral inclusions, many of the garnet zones contained very low (0.02 ppm) Nd concentrations, yielding very low sample sizes (~1.5 ng Nd) but very high $^{147}Sm/^{144}Nd$ (3.4 to 9.8) indicating success in the removal of adverse inclusion effects. These samples were analyzed using a NdO+ with Ta_2O_5 activator method. Garnet-matrix isochron ages reveal that growth spanned at least 7.3 ± 3.3Ma from onset in the core at 52.7 ± 3.3Ma to cessation at the rim just after 45.44 ± 0.21 Ma. Over this timespan, the garnet growth rate accelerated significantly. The innermost 1 cm of garnet (radially) grew at an average rate of ca. 0.9 cm^3/Ma, whereas the outermost 0.9 cm grew within just a few 100,000s of years at a growth rate of ca. 100 cm^3/Ma. This is an acceleration factor of at least ~ 2 orders of magnitude.

Rapidly accelerating garnet growth may occur due to gradually changing P and T, if the PT trajectory crosses closely spaced reaction isopleths. Or, the dehydration of subducted material can provide a synergistic kinetic trigger - a catalyzing fluid - further accelerating garnet growth, and thus water release. Thermodynamic analysis of the garnet forming dehydration reactions and P-T trajectories, can help elucidate the causes and consequences of this acceleration in the net reaction rate.

Microbial mobilization of arsenic from soil of the Mokrsko gold deposit, Czech Republic

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Arsenic mobilization from soil is an issue of concern, as aquatic arsenic can migrate into pristine areas, endangering aquatic organisms and people. Such mobilization in the Mokrsko gold deposit distributes nearly 1.4 kg ha^{-1} $year^{-1}$ of arsenic throughout naturally contaminated soil [1]. To gain an understanding of possible biological mechanisms contributing to this transport, mobilization of solid-phase arsenic was investigated in Mokrsko soil microcosms.

Anaerobic microcosms catalyzed rapid release of arsenic from soil containing arsenic-rich goethite, pharmacosiderite and arseniosiderite, mobilizing 33±6% of the total arsenic. Sterilization prevented this transformation. Highly positive correlation between the extracted amounts of arsenic and iron from soil under anaerobic condition implied that microbial reductive dissolution of iron oxides and iron arsenates is responsible for the arsenic release. Sequential extraction analyses designed to determine the arsenic fractionation before and after incubation experiments supported massive dissolution of amorphous and crystalline iron phases in oxalate fractions (65% reduction). The isolation technique enabled the characterization of nine arsenate–resistant bacteria, mostly related to facultative anaerobic genera *Bacillus* and *Pseudomonas*, which are using arsenate for respiration [2]. However, the link between arsenic reduction/mobilization and the isolated strains is missing and will be completed soon.

Preliminary observations indicate that a direct microbial arsenic-mobilizing activity exist in the soil, isolated strains are well known arsenic-transforming agents, and thus suggest that dissimilatory arsenic reduction may contribute to arsenic flux from anoxic condition of the Mokrsko gold deposit.

[1] Drahota *et al*. (2006) *Sci. Total Environ*. **372**, 306-316. [2] Freikowski *et al*. (2010) *Appl. Microbiol. Biotechnol*. **88**, 1363-1371.