Fluid evolution in the Byngi gold deposit, central Urals, Russia

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The Byngi gold deposit, located in the central Urals, consists of multiple quartz veins that occur in and above the apical part of a buried plagiogranite stock that is part of a gabbro-granitic complex. The volcanogenic country rocks that host the quartz veins have undergone metasomatic alteration that is associated with gold mineralization. Stock has been dated at 345-318 Ma.

The studied sample is vein quartz containing pyrite and chalcopyrite. Gold is closely associated with chalcopyrite. The ore minerals fill cracks in quartz, suggesting mineralization is later than at least some of the quartz. Pyrite shows two (or more) generations – the earliest is growth of idiomorphic crystals that trapped chalopyrite and grains of quartz inside. The second generation represents metasomatic growth of pyrite over the earlier pyrite. A later event produced fractures between the two generations of pyrite, and these were later filled by quartz and chalcopyrite. The final stage is represented by deformation of ore minerals. The sample thus contains three generations of quartz: early recrystallized quartz formed before ore minerals, quartz (± chalcopyrite) in cavities within pyrite, and finally quartz precipitated in later brecciated pyrite.

Fluid inclusion assemblages (FIAs) were measured from the earliest and latest stage quartz using a Linkam THMS-600 heating/cooling stage, Raman spectroscopy and cathodo-lumenecense. All FIA contain inclusions that contain an aqueous liquid phase and liquid±vapor CO_2 and contain about 10-20 mole% CO_2. CO_2 melts in the range -57.1 to -58.9°C, suggesting the presence of other volatiles, but no other gases were detected by Raman analysis. Salinity calculated from the melting temperature of clathrate [1] ranged from 1 to 9 wt% NaCl equivalent. Homogenization of the CO2 phase ranged from 10.5-30.1°C. FI in early quartz homognize at 110-145°C, those in intermediate quartz at 130-145°C, and the latest quartz at 200-240°C.

[1] Diamond L. W. (1992) *Geochimica et Cosmochimica Acta* **56**, 273–280.

Differences in coupling between AOM and SRR in marine sediments

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Microbially mediated anaerobic oxidation of methane (AOM) is a major methane sink in the ocean, coupled to bacterial sulfate reduction (SRR) as electron accepting process. Yet, with increasing data of AOM and SRR measured in various sedimentary environments, ranging from cold seeps to diffusion dominated habitats, the regulation and linking of both processes remains controversial. In order to investigate if the regulation of AOM and the coupling between AOM and SRR is consistent in all environments, sediment from diffusion dominated sites on the continental shelf (Aarhus Bay and Kattegat/ Denmark) and a methane seep (Black Sea) were incubated under different combinations of methane and sulfate concentrations, and the response of both AOM and SRR evaluated. The experiments confirmed the strong dependence of AOM rates on methane concentrations at all sites but demonstrated differences in sulfate reduction rates with increasing concentrations of both, methane and sulfate. Whereas a close coupling of AOM and SRR, and respectively a strong dependence of rates on both substrates, was evident at the methane seep, the rate measurements from Aarhus Bay provide direct evidence for a decoupling of both processes. Furthermore, the ratio of both rates deviated from the even stoichiometry observed at the methane seep. The experiments demonstrate that there are significant differences in the regulation and coupling of AOM rates and SRR at different sites indicating that AOM might not be mediated in the same way at all sites.