

Effects of concurrent bacterial Iron and Sulfur reduction on Arsenic mobility

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Widespread arsenic contamination of groundwaters in deltaic aquifers, especially in South and Southeast Asia, has focused recent attention on the biogeochemical interactions that affect arsenic mobility. Much research has focused on the impact of individual anaerobic bacteria, which may release arsenic through direct reduction or via secondary mechanisms. This research considers arsenic behavior in a model environmental consortium of *Desulfovibrio vulgaris*, a sulfate reducing bacterium, and *Shewanella oneidensis*, a model iron reducer incapable of sulfate reduction.

Previous research has shown that arsenic sorbed to iron oxides can be released upon dissolution performed by iron reducing bacteria [1]. Sulfate reduction shows more variable effects on arsenic mobility, due to the balance between release through secondary iron reduction and sequestration resulting from sulfide mineral precipitation [2]. Natural systems often are subject to both iron and sulfur reduction, and thus an understanding of their combined effect is critical to properly assess the fate and transport of arsenic in the environment.

Here a combination of batch and flow experiments with arsenic-doped iron oxides are inoculated with the two strains, and the aqueous and solid components of the system are monitored. Bacterial populations are tracked using fluorescent probes, allowing correlation of community dynamics with system behavior. Results indicate strong dependence of arsenic speciation and solid-solution partitioning on the mineralogical and microbiological assemblage that is present, and the relative activity of iron and sulfate reducing bacteria.

[1] Cummings D.E., Caccavo F., Fendorf S. & Rosenzweig R.F. (1999) *Environ. Sci. Technol.* **33**, 723-729. [2] O'Day P.A., Vlassopoulos D., Root R., Rivera N. (2004) *Proc. Natl. Acad. Sci. U.S.A.* **101**, 13703-13708.

Experimental modeling of chloride-bearing diamond-related liquids: A review

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On the basis of our experimental data on phase relations in chloride-carbonate-silicate systems at 5 GPa we propose a model on evolution trends and mineral assemblages of alkalic Cl-bearing carbonate-silicate and chloride-carbonate liquids occurring widely as inclusions in kimberlitic diamonds. Our data show that in dependence on the chloride/carbonate ratio interaction of primary chloride-carbonate liquids with silicates produce a wide spectrum of chloride-saturated silicate or carbonate-silicate melts. The major factor of evolution of alkalic liquids is a wide immiscibility gap between Cl-saturated carbonate-silicate and Si-saturated chloride-carbonate melts. Precipitation of silicates from Cl-saturated carbonate-silicate melts within a wide compositional interval shifts compositions of coexisting liquids along the gap boundaries toward the low-temperature alkali-carbonate region, while the miscibility gap is getting narrow. As a result, the compositional range of the homogeneous chloride-carbonate melt coexisting with crystalline silicates expands. Such evolution of liquids is consistent with regular compositional trends observed for liquid inclusions in diamonds from Botswana, Brazil, Yakutia, and Canada. Our data indicate that these trends correspond to evolution of liquids during cooling.

Contrast SiO₂ and Al₂O₃ contents in silicates and coexisting chloride-carbonate melt results in active dissolution of crystalline silicates with the formation of Si and/or Al-undersaturated phases (olivine, spinel, periclase, Si-rich mica). Strong K-Na exchange between jadeite component and KCl-bearing fluids and melts results in active melting of eclogite assemblages with the formation of low-temperature alkalic melts, which are comparable with those in partially molten eclogite xenoliths. In contrast, alkali chlorides seem to have negligible effect on melting of peridotite assemblages. Their interaction with the chloride-carbonate liquids is managed mainly by carbonate components.

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