Impact of microbial activity on the fate of arsenic in offshore sediment

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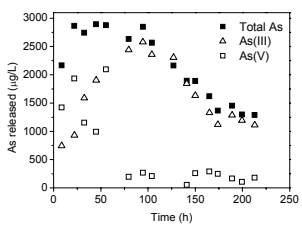
The fate and bioavailability of the arsenic in offshore sediments are affected by microbial activities. The objective of this work was to study the impact of microbial activities on the fate of arsenic in offshore sediments.

The sediment sample was collected from Jinzhou Bay in Northeastern China. This bay is heavily polluted by a variety of toxic heavy metals due to the operation of a zinc smelter. The concentration of arsenic in the sediment was determined to be 718.5 μg/g. The sediment was dispersed in sea water spiked with lactate as carbon source at liquid/solid ratio of 100/1 (120 ml of sea water, 1.2 g of sediment). The slurry was incubated under anaerobic condition at 30ºC. The concentration of released arsenic (total As, As(III) and As(V)) in aqueous phase was monitored with incubation time (Fig.1). The concentration of phosphate-extractable arsenic in solid was also determined (Fig. 2).



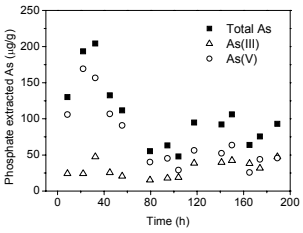


Figure 1: Concentration ofreleased arsenic in aqueous phase.
Figure 2: Concentration of phosphate- extractable arsenic in solid.

There was a remarkable release of arsenic from the sediment as a result of incubation. The concentration of total As reached ~2900 μg/L after about 1 day, implying that about half of the arsenic in the sediment was released. Both As(V) and As(III) were released, but As(V) was microbially reduced to As(III) as showed in Fig.1. However, after ~4 day incubation, where nearly all aqueous arsenic was present as As(III), arsenic concentration decreased greatly indicating that arsenic was re-immobilized. Arsenic sulfide was probably formed since H_2S was detected in the atmosphere of the incubation vials. The amount of phosphate-extractable As also decreased sharply with incubation time, suggesting that the adsorbed arsenic was largely transformed to less soluble arsenic minerals and/or released to aqueous phase due to microbial activities.

Mesozoic lithospheric mantle of the Central North China craton: Evidence from peridotite xenoliths

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Peridotite xenoliths entrained by the early Cretaceous (125Ma) high-Mg diorites (Mg#= [Mg/(Mg+Fe^{2+})], 51-64) in the Taihang Mts provide insight into the nature of the Mesozoic lithospheric mantle in the central North China Craton (NCC). The peridotite xenoliths consist of chromite-bearing dunite, spinel-bearing harzburgite and lherzolite with tabular and metasomatic textures. Secondary amphibole and phlogopite can be found in them. Spinel (Cr#=27-33) contacted with amphibole and phlogopite was replaced by chromite (Cr#=41-65), while chromites in dunites have the highest Cr# (73-81). Mg# of olivines in dunite, harzburgite and lherzolite is 88-91, 92-93 and 91-93, respectively. CaO contents of olivines are less than 0.10%. The estimated equilibration temperatures for the dominant peridotite xenoliths range from 812 to 939°C (except for one sample, 1097°C) [1]. The peridotite xenoliths have low Al_2O_3 (0.15-1.20%) and CaO contents (0.31-1.06%) and are characterized by enrichment in light rare earth elements and large ionic lithophile elements as well as Pb and U. Taken together, these results indicate that the peridotite xenoliths represent the residues remaining after the extraction of large degrees of polybaric melting and be late subjected to late modification by the infiltration of a hydrous melt. The harzburgite and lherzolite xeoliths have olivine Mg# similar to the Archean lithospheric mantle from the eastern block of the North China craton. We therefore suggest presence of Archean mantle beneath the cental belt of the North China Craton in the Early Cretaceous.

[1] Wood & Banno (1973) *Contrib. Mineral. and Petrol.* **42**, 109-124.