Cadmium sorption by green rust

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Cadmium pollution, released into soils from agricultural and industrial activities, is considered a potential threat to biota. As with other pollutants, Cd mobility and bioavailability in soils largely depend on sorption-desorption processes at the interface between soil solution and mineral surfaces. Fe (oxyhydr)oxides are ubiquitous in soils. They have a large surface area and can adsorb and incorporate metals, meaning that these minerals are likely to affect Cd migration. The interaction of Cd with soil minerals has been investigated thoroughly but we know of no study on Cd interaction with green rust (GR). GR consists of brucite like layers of Fe(II),Fe(III) hydroxide separared by interlayers of water molecules and anions. These minerals are highly redox active, can form both by biotic and abiotic processes, and are likely to be present in soils and groundwater. The aim of this work was to determine if Cd can be sorbedand effectively immobilized by GR.

GR was synthesised at circumneutral pH by two methods: transformation of ferrihydrite in an Fe(II) solution and oxidation of an Fe(II) solution. Cadmium was added, at a series of concentrations either in the initial Fe(II) solution or in suspensions with preformed GR. X-ray diffraction (XRD) and transmission electron microscopy (TEM) showed that Cd^{2+} was not reduced by preformed GR nor incorporated in freshly forming GR. However, GR_{SO4} partially sorbed the divalent heavy metal, with higher sorption occurring at lower Cd concentrations. Upon oxidation of GR, Cd^{2+} remained associated with the Fe(III) solid. X-ray photoelectron spectroscopy (XPS) showed that it was sorbed by newly formed lepidocrocite.

These results contribute to fundamental understanding of contaminant interaction with green rust and can be implemented in current reactive transport models. We also demonstrated that Cd^{2+} mobility will be affected to some extent by sorption to GR, which can be present naturally in soil and form from iron corrosion, for example in permeable reactive barriers or pipes.

Zircon U-Pb-ages, Hf isotope and trace element composition in the evolution of the IVAC Complex (Urals, Russia)

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It has been widely accepted that Hf isotope composition of zircon is relatively stable and is not affected by significant alteration due to influence of the hypogenic processes [1]. We have studied Hf isotope composition (coupled with U-Pb-age) in different populations of zircon from Ilmeny-Vishnevorsky Alkaline Complex (IVAC), Uralian Fold Belt.

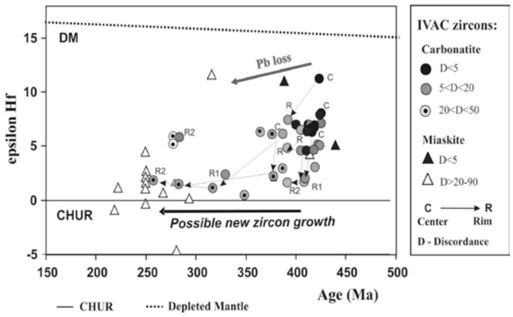

Figure: Hf isotope composition of the IVAC zircons (calculated for individual zircon ages) plotted against U-Pb ages, where D presents percentage of their age discordance.

The results indicate that the early zircons I from IVAC carbonatites and miaskites form concordant age cluster (U-Pb-age 410-424 Ma, $D<5$) and displays moderately depleted isotope Hf composition (εHf=11.7-4.7), where variations plausibly reflect primary heterogeneity of the magma source(s). The outer zones of the zircon I grains are characterized by disturbed U-Pb systems ($5<D<20$) and lower εHf values (shifting by 3-4 units in regard to the central parts of grains). These shifts do not correspond to the lines of Hf isotope evolution of zircons compositions or radiogenic Pb loss trends (Figure). The later newforming zircons II dated at T=250-320 Ma (frequently $D>50$-90, εHf = -5 to +11).

Both, the disturbance of U-Pb-system and formation of zircons with distinct, less radiogenic Hf-isotope composition could be related to the later ca 250 Ma metamorphic event.

[1] Patchett *et al*. (1981) *ContrMinPet* **78**, 279-297.

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