Lead, zinc and antimony leaching from glass-works fly ash in simple organic acids

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The release of hazardous elements from anomalous geomaterials represent risk for the environment. In our research, we focused on exogenic alteration of fly ash (FA) originating from glass-works in Svetla nad Sazavou (Czech Republic). This factory produces glass with high amounts of PbO. FA from electrostatic filter contains elevated concentrations of Pb, Zn and Sb. The main mineral phases of this material detected by X-ray diffraction are calcite $CaCO_3$ (79%), witherite $BaCO_3$ (10%), quartz SiO_2 (6%) and senarmontite Sb_2O_3 (5%). Small amount of FA may be emitted from factory and can settle in the surrounding environment (soil).

Low-molecular-weight organic acids (citric, acetic and oxalic in concentration of 0.5 mmol/L), simulating soil-like environments and deionised water, were used to test possible mobilization of risk elements from the FA. The leaching experiments were carried out at liquid-to-solid (L/S) ratio of 10 (1 g of FA in 10 ml of leaching medium). The solutions were shaked in ten different times (0.5 to 1440 hours). Leachates were analyzed by inductively coupled plasma mass spectrometry (ICP-MS).

Lead, Zn and Sb exhibit different kinetic leaching curves corresponding to different behaviour of cations (Zn, Pb) and anion (Sb). The concentration of Zn in leachate initially increased, then rapidly decreased and subsequently wery slowly increased. The Pb concentration increased rapidly at the beginning and then very slowly decreased due to possible sorption on present and newly formed phases. Concentration of Sb in leachate increased during all the experiment, which can be attributed to the slow dissolution of senarmontite. Large differences between four leaching solutions were not observed. The leaching is fastest in the citric acid solution. The initial pH were about 3.3–4.0 for organic acids and about 5.6 for deionised water). All the leachates reached the pH value about 10, which corresponds to the equilibrium with calcite present in the FA.

Newly discovered MIL 090030, MIL 090032, and MIL 090136 nakhlites: Paired with MIL 03346?

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Here we present the petrology of newly discovered (2009-2010) meteorites: MIL 090030, MIL 090032 and MIL 090136 from Miller Range, Antarctica. Our aim is to test the hypothesis [1, 2] that these meteorites are paired with nakhlite MIL 03346, which underwent less equilibration and faster cooling that the other nakhlites, and so originate from the top of the nakhlite cumulate pile [3].

The mineralogy of these nakhlites is dominated by cumulus euhedral augite and less-abundant cumulus olivine. They also display a fine-grained albitic intercumulus matrix composition, which exhibits fayalite-magnetite filaments, and skeletal ilmenite. Pyroxene displays a 10 µm Fe-rich rim, suggesting reequilibration with intercumulus matrix. Iddingsite has been observed, representing the aqueous alteration product of olivine. Pyroxene cores have a composition of Wo_{40} and En_{36}, and pyroxene rims have an average composition of Wo_{32-40} and En_{8-12}. Olivine has a composition of Fo_{35-42}, and interstitial olivine has a composition >Fa_{90}, which are similar to those of MIL 03346 [3].

Similarities in mineral compositions, abundances, and textures infer that these nakhlites are paired with MIL 03346. Major and trace elements combined with CSD analyses, will determine the location of these three nakhlites within the cumulate pile and further assess the possibility of a pairing with nakhlite MIL 03346. This enables the petrologic variability to be constrained within a much larger sample of MIL 03346.

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