

Possible rhenium fractionation during standard Re-Os dissolution and chemical separation procedures

A. ZIMMERMAN¹, S. GEORGIEV^{1,2}, G. YANG¹,
H. STEIN^{1,2} AND J. HANNAH^{1,2}

¹AIRIE Program, Colorado State University, USA

²Geological Survey of Norway, 7491 Trondheim

A recent curiosity-driven experiment revealed surprising apparent fractionation of rhenium isotopes during standard Re-Os chemical procedures for Carius tube digestion and elemental separation. A non-standard ¹⁸⁵Re/¹⁸⁷Re ratio of ~0.602 was measured from a standard Re solution after Carius tube digestion and anion exchange chromatography. A replicate produced a similar, though not identical ratio. These surprising results led to a series of quantitative tests to identify procedure(s) that may have led to Re fractionation.

In the original experiments, Re standard solution, Os standard solution, and inverse *aqua regia* were digested in Carius tubes at 250 °C for 12 hours. The Os was extracted using chloroform-HBr solvent extraction. The isolated Os underwent microdistillation and was measured for its isotopic composition (IC). Os IC ratios matched expected values. After solvent extraction, the Re was collected via anion exchange chromatography and purified using a single bead clean-up. The final measured ¹⁸⁵Re/¹⁸⁷Re was 0.601608 versus the expected value of 0.597393. The replicate yielded an IC of 0.599062. Additional tests of Re standard solution loaded directly onto exchange columns and directly onto single beads yielded similarly elevated ratios.

Given such results, a more detailed experiment excluded the Carius tube digestion and loaded diluted Re standard solution directly on the anion exchange columns. One mL fractions were collected as the Re eluted from the column. Half of each 1 mL aliquot was loaded directly onto Pt filaments for IC measurements whereas the second half underwent single bead cleaning prior to IC measurement. Re was only found in the first three of seven 1 mL splits. Only the third 1 mL fraction produced ratios significantly different than the expected ratio. In all cases, the single bead-treated and straight-off-the-column Re IC ratios matched, thereby showing that Re fractionation does not occur during the single bead clean-up procedure.

Given the apparent lack of Re fractionation in the most recent experiment, which bypassed the Carius tube step, a final experiment utilizing the Carius tube digestion along with step-wise column collection is being conducted. This experiment should replicate the original inquiry and also help identify if and when Re fractionation occurs.

Risk element sorption in soil amended by urban particulate matter

D. ZIMMERMANNOVÁ¹, J. SZÁKOVÁ^{1*}, M. KOMÁREK¹
AND J. SYSALOVÁ²

¹Czech University of Life Sciences, CZ-165 21 Prague 6,
Czech Republic (*correspondence: szakova@af.czu.cz)

²Institute of Chemical Technology, CZ-166 28 Prague 6,
Czech Republic (Jirina.Sysalova@vscht.cz)

Introduction

Our previous experiment showed that although the element contents in dust samples exceeded significantly those in soil, the element contents in plants were not affected by single-rate soil amendment with the rural dust sample [1]. Therefore, we tested the potential effect of urban particulate matter (PM) amendment to two soils differing in their physicochemical parameters (rate: 0.6 g of PM per 1 kg of the soil) on sorption characteristics described by Freundlich and Langmuir isotherms.

Soil	E	K _L	S _{max} (mmol/kg)
Chernozem	0.978	15.6	86.1
Chernozem+PM	0.959	13.6	81.4
Fluvisol	0.963	1.93	137
Fluvisol+PM	0.939	1.09	165

Table 1. Parameters derived from the fitting of the sorption isotherms of Cd with the Langmuir equation

Discussion of the results

Whereas the Freundlich isotherms did not indicate any effect of PM addition to the soils, the Langmuir isotherm allowed us to estimate the potential behavior of the PM in the soil. The results for Cd are summarized in Table 1. The PM added to the Chernozem did not lead to substantial changes in sorption characteristics. On the contrary, the presence of PM in the Fluvisol increased the number of potential sorption sites in the soil. However, the results of the approximation showed a lower affinity of Cd for the Fluvisol and a better stability and a lower bioavailability of Cd in the Chernozem. The results are supported by the decreasing Cd contents in both lettuce and chard biomass growing in PM amended Fluvisol compared to the unamended one.

[1] Száková, J., Sysalová, J., Tlustoš, P.: (2005): *Plant Soil Environ.* **51**, 376. Financial support for these investigations was provided by GAČR Project No. 521/09/1150.