Stable Zinc isotope fractionation between plant and growth water

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Understanding the mechanisms of zinc uptake, transport and storage by plants is of critical importance as plants represent the entrance to the food chain and because of the potential of plants to extract Zn from contaminated soil. Whilst elemental analysis allows to document the distribution of Zn in water, soil and plant, one potential way to improve our understanding of uptake of Zn by plant from water and soil is to use stable zinc isotope ratios. Our objective was to investigate the effect of Zn level in growth solution and we have selected to compare the behavior of two closely related *Arabidopsis* species that differ in their tolerance and in the level of translocation from root to shoot for that purpose. The first species is the zinc-hyperaccumulating and zinc-tolerant *Arabidopsis halleri* and the second one is the non-hyperaccumulating and zinc sensitive *Arabidopsis petreae*. The zinc-hyperaccumulating species was found to present a higher δ^{66}Zn in the root (by about 0.5‰) and slightly lower δ^{66}Zn (by about -0.1‰) in the shoot than in the growth solution. Due to high shoot/root Zn mass ratio, the isotope depletion between the whole plant and growth solution is close to that observed between shoot and solution. The temporal variation in δ^{66}Zn of the growth solution was found consistent with a Rayleigh model for Zn uptake. The Zn isotope fractionation between solution and root for the zinc-hyperaccumulating plant was found larger for non-hyperaccumulating species and thus to depend on zinc transfer between the solution, root vacuole and periderm.

Source and evolution of Mo in the porphyry-Mo(Nb) deposit at Cave Peak, Texas

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Although the general principles leading to porphyry-Mo mineralization are relatively well understood there is little agreement regarding the source Mo in these deposits. Based on the observation that basement rocks in the vicinity of Mo porphyries in the USA and Norway host local Mo impregnations of various age it has been suggested that these represent large-scale crustal anomalies and that the Mo contained in the porphyries was for the short term derived from the crust (and not from coexisting mafic magmas, as seems to be case in porphyry-Cu deposits).

At the Cave Peak deposit [1], which formed ~36 Ma ago during the initial stages of the Rio Grande Rift, anomalously high Mo concentrations in the mineralizing magmas can be linked directly to mafic alkaline rocks exposed in the nearby Marble Canyon stock. Melt inclusions hosted by apatite, olivine, clinopyroxene and quartz in rocks ranging from nepheline-bearing monzogabbro (50 wt% SiO_2) to rhyolite (76 wt% SiO_2) were analyzed by LA-ICP-MS for 27 major and trace elements. The most mafic melt inclusions analyzed are nepheline monzosyenitic in composition (~50 wt% SiO_2) and have a geochemical signature similar to that of ocean island basalts. Incompatible trace element abundances define continuous trends reaching up to 100 times average upper continental crust, indicating element enrichment through fractional crystallization of the mafic input magma. Molybdenum increases from 4 ppm in the most primitive melts to 10-12 ppm in melts immediately before Mo mineralization. During ore formation the Mo content of the melt decreased gradually back to 5 ppm, in accord with fluid/melt partition coefficients of 17-20 determined on coexisting melt and fluid inclusions in aplitic rocks of the Marble Canyon stock. A high sulfur fugacity in the mafic input magma is indicated by early pyrrhotite saturation. To account for the 0.4-1.5 Mt Mo present in the Cave Peak deposit a volume of $\geq$1.4-5.2 km^3 pre-mineralization melt (12 ppm Mo) is needed, or $\geq$3.4-12 km^3 of mafic input melt (4 ppm Mo).

[1] Sharp (1979*) Economic Geology* **74**, 517-534.