

Geochemical and mineralogical characterization of Arsenic-contaminated soil at Chonam gold mine, South Korea

MIHYE KONG¹, HYEON YOON², CHEOLHO YOON²
AND YUL ROH^{1*}

¹Dept. of Earth and Environmental Sciences, Chonnam National University, 300 YongBong-dong, Buk-gu, Gwangju, Rep. of Korea
(*correspondence: rohy@jnu.ac.kr)

²Korea Basic Science Institute, Seoul Center, 126-16, Anam-Dong, Seongbuk-Gu, Seoul, Korea

Solubility of arsenic in the soil environment is mediated by redox reaction and by its association with other elements and solid phases in soil matrix. The objective of this study was to investigate the nature of arsenic contamination and its association with soil matrix by chemical extractions and mineralogical characterization.

This study examined arsenic-contaminated soil samples obtained from Chonam gold mine, Chonnam Province, South Korea. Three extractants including hydrogen peroxide [1], citrate and dithionite [2], and oxalate (pH 3) [3] were tested for chemical leaching of arsenic from the soil. Sedimentation method was used particle size separation of the As-contaminated soil. And mineralogical characterizations of the particle-size separated soils were performed by SEM, TEM, EDS, and XRD analyses.

Arsenic concentration of the soils ranged from 1140 to 1688 mg/kg at the gold mine. Leaching results showed that the three extractants extracted 2.6% of the total arsenic for the As-contaminated soils. Particle size analysis showed that soil texture of the soil was silt. Major minerals of sand and silt were muscovite, orthoclase, quartz, and vermiculite. Clay fraction was composed of kaolinite, muscovite, quartz, and vermiculite. Although As-bearing phases were not founded in clay fraction by XRD analysis, both SEM-EDS and TEM-EDS analyses showed arsenic was associated with clay minerals. These results suggest that arsenic was not mainly associated with organic matter and iron oxides. It may be adsorbed or co-precipitated with clay minerals in the soil matrix.

[1] Kunze & Dixon (1986) *Am. Soc. Agron.* Madison, WI 92–94. [2] Holmgren (1976) *Proc. Nat'l Acad Sci.* **73**, 2275–2279. [3] Schwertmann (1964) *Z Pflanzenerndhr. Bodenkd.* **105**, 194–202. [4] McKeague & Day (1966) *Can. J. Soil Sci.* **46**, 13–22

The bulk silicate Earth's W budget revised: Implications for the timing of core formation

STEPHAN KÖNIG^{1*}, CARSTEN MÜNKER², SIMON HOHL¹,
HOLGER PAULICK¹ AND ANNE KÖHLER¹

¹Universität Bonn, Steinmann Institut für Geologie, Mineralogie und Paläontologie, Poppelsdorfer Schloss, 53115 Bonn, Germany

²Universität zu Köln, Institut für Geologie und Mineralogie, Albertus-Magnus-Platz, 50674 Köln, Germany

In the past years, new high-precision W concentration data have revealed strong fractionations of W from other highly incompatible lithophile elements (e.g. W, U, Ta) in arc rocks [3], in contrast to the traditional view [1;2] arguing for near constant W/U and W/Th ratios in most silicate reservoirs on Earth due to a similar incompatibility of these elements. The observed trace element fractionations reflect a selective enrichment of W in the sub-arc mantle via fluid-like subduction components [3]. Here we present further high-precision HFSE data for rocks from other tectonic settings (MORB, OIB), revealing a selective depletion of W in OIBs and MORBs relative to immobile HFSE (e.g. high Ta/W). The W budget in MORBs reflects cpx-controlled partial melting and cannot be explained by residual W-rich phases as claimed elsewhere [4]. Rather, the W depletion in MORBs and OIBs (high Ta/W) is complementary to the enrichment observed in arc rocks (low Ta/W). Together with estimated compositions of the continental crust, our data therefore permits an independent estimate of the Ta/W ratio of the Earth's primitive mantle. Similar to previous interpretations based on Nb/U and Ce/Pb systematics, our Ta/W data reveal a depletion of the depleted upper mantle (DM) in fluid mobile elements relative to the primitive mantle (PRIMA), including W. The abundance of W relative to other incompatible elements (i. e. Ta/W, W/Th) in the depleted mantle is therefore not representative of the primitive mantle. According to our mass balance calculations, the W abundance of the Earth's primitive mantle is significantly lower (11 ppb) and the Hf-W ratio of the BSE is higher (ca. 27.6) than previously estimated (13–16 ppb and 17.6 [1;2]). This results in a younger core formation age that is typically inferred from ¹⁸²W abundance and the Hf/W of the silicate Earth.

[1] Newsom *et al.* (1996) *GCA* **60**, 1155–1169. [2] Arevalo & McDonough (2008) *EPSL* **272**, 656–665. [3] König *et al.* (2008) *EPSL* **274**, 82–92. [4] Babechuk *et al.* (2010) *GCA* **74**, 1448–1470.