

## What does cause a bell-shaped profile of aqueous As in contaminated Holocene aquifer?

T. ITAI<sup>1\*</sup>, Y. TAKAHASHI<sup>1</sup>, A.A. SEDDIQUE<sup>2</sup>, M. MITAMURA<sup>2</sup>, T. MARUOKA<sup>3</sup> AND H. MASUDA<sup>2</sup>

<sup>1</sup>Hiroshima University, Japan.

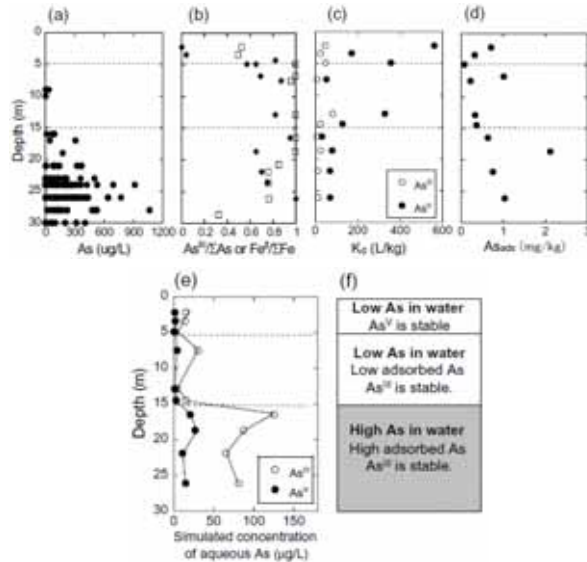
(\*correspondence: itai-epss@hiroshima-u.ac.jp)

<sup>2</sup>Osaka-city University, Japan.

<sup>3</sup>University of Tsukuba, Japan

Groundwater in Bangladesh is seriously contaminated by As, and aqueous As typically distributes as a “bell-shape” profile. (Fig. 1a) [1]. Interestingly, this profile is not consistent with changes in oxidation states of As and Fe, which are the key factor to control mobility of As (Fig. 1b) [2]. We investigated sediment-water As-partitioning to reveal formation processes of the bell-shaped profile.

Apparent distribution coefficient ( $K_d = A_{s,ads}/A_{s,aq}$ ) is always higher for  $As^V$  than  $As^{III}$  (Fig. 1c). Small variation of  $K_d(As^{III})$  is not consistent with the bell-shaped profile. However, simulated concentration of dissolved As ( $A_{s,ads} * K_d^{-1}$ ) well corresponds the bell-shaped profile due to significantly lower concentration of P-extractable As from 4 to 15 m than below 15 m (Fig.1 d,e). Hence, fundamental difference between two depth regions with high and low As abundance is amount of adsorbed As. The findings of this study are summarized in Fig. 1f.



**Figure 1:** Depth profiles of (a) dissolved As, (b) oxidation states of As and Fe in sediment, (c)  $K_d$  of  $As^{III}$  and  $As^V$ , (d) P-extractable As, (e) simulated concentration of aqueous As, and (f) schematic figure of formation processes of bell-shaped profile.

[1] Harvey *et al.* (2002) *Science*. **298**, 1602-1606. [2] Itai *et al.* (2006) *Chem. Lett.* **35**, 866-867.

## Some geochemical consequences of the dynamics and melting of a veined mantle

GARRETT ITO<sup>1</sup>, TODD BIANCO<sup>1</sup>, JOHN J. MAHONEY<sup>1</sup>, JEROEN VAN HUNEN<sup>2</sup> AND MAXIM BALLMER<sup>3</sup>

<sup>1</sup>SOEST, Univ. of Hawaii, USA (gito@hawaii.edu,

rixctf@soest.hawaii.edu, jmahoney@hawaii.edu)

<sup>2</sup>Durham Univ., UK (jeroen.van-hunen@durham.ac.uk)

<sup>3</sup>ETH Zurich, Switzerland (ballmer@tomo.ig.erdw.ethz.ch)

The processes that deliver chemical heterogeneity from the mantle source to melts erupted at the surface constitute a vibrant topic in geodynamics and igneous geochemistry. Our chemical-geodynamic models couple upper mantle flow and temperature to melting of distinct source components, which have melting functions that depend on volatile content and mafic versus ultramafic composition. Models predict that the isotopic and incompatible element compositions of eruptible magmas are sensitive to vertical variations in mantle upwelling as well as lithospheric thickness. One finding is that many of the major differences in Sr, Nd, Pb, and He isotopic characteristics of hotspot basalts, compared to non-hotspot, mid-ocean ridge basalts, can be caused by relatively thick lithosphere and buoyant mantle upwelling beneath hotspots, which both tend to preferentially melt the least refractory components. The broader implication is that any mantle-wide compositional stratification is weaker than previously thought. Another finding is that the upper mantle dynamics associated with mantle plume-lithosphere interaction can give rise to a regional spatial zoning in surface lava composition if the source is veined but, itself, lacks any regional-scale compositional zoning. For an intra-plate hotspot such as Hawaii, these models predict some of the major differences between the “Loa” and “Kea” sub-chains as well as between the main shield-building phase, the post-shield phase, and secondary (including rejuvenated) volcanism in terms of Nd-isotopes. These results pave the way for future work to better constrain the nature of any potential zonations in the mantle. Finally, a simplifying assumption of the above models is that the flux of melt from each source component is proportional to the rate that each melts by decompression, without being influenced by chemical reactions with other components. The degree to which chemical reactions affect lava compositions depends on whether the upward migration of melts from individual heterogeneities occurs by pervasive percolation over large volumes of the mantle, or is confined to high-porosity channels that remain physically separate from most of the surrounding mantle.