Evolution of anthropogenic contamination in the Seine River (France) over the last 15 years revealed by boron isotope ratios

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Boron is an ubiquist constituant of plants and materials and is widely used by human activities (borosilicate glasses and ceramics, detergents, fertilizers, cosmetics…). Boron has a relatively conservative behaviour within the hydrosphere, and its isotopic compositions are possible tracers of anthropogenic activities. Following the work by Chetelat and Gaillardet (Env. Sci. Tech. 2005) on boron isotopes as a probe for anthropogenic contamination in the Seine River (France), we investigate 3 other series of water samples collected in Paris (monthly between 2004 and 2007) and on the whole Seine Basin (at high- and low-water stages) between 2004 and 2012 that complement their 1994 series. $^{11}B/^{10}B$ ratios have been measured by MC-ICP-MS with d-DIHEN as sample introduction device (Louvat, Bouchez and Paris, Geostand. Geoanal. Res. 2011) after boron extraction on resin Amberlite IRA 743 (adapted from Lemarchand *et al*.., Chem. Geol. 2002). They are expressed in ‰, notation $\delta^{11}B$.

From 1994 to 2007, B concentrations ([B]) have been reduced by a factor of up to 2 for the Seine River in Paris, and the range of $\delta^{11}B$ variations restricted (2 to 9 ‰). On the whole Seine River Basin, [B] are the highest downstream from Paris, associated to the lowest $\delta^{11}B$. These characteristics are even more pronouced during low-water stage. There is however no marked evolution of [B] and $\delta^{11}B$ between the sampling session of 2004-2007 and the more recent ones of 2009 and 2011-2012.

Low $\delta^{11}B$ and high [B] are attributed to anthropogenic sources of boron within the Basin, which are increasing downstrean with increasing population density and industrial activities. Two hypotheses are tested to explain the variation of [B] and $\delta^{11}B$ in Paris between 1994 and 2006: i/ changing of the $\delta^{11}B$ signature for the plant treated waste waters from -10‰ to 0‰, ii/ decrease of the anthropogenic input of boron to the Basin.

A high T cell for the *in situ* study of flux-driven magmatic processes

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Aqueous fluids and vapors that exsolve from silicate melt as magma rises through the upper crust are of critical importance in volcanic arcs. They can for instance affect the dynamics of magma ascent and trigger eruption or favor the mobilization of metals as Cu, Au and Mo at the origin of the formation of porphyry ore deposits [1, 2]. Up to now, constraints on the nature of theses volatile-rich phases and their relation to silicate melts are mainly limited to the chemical analysis of volcanic fumaroles and the study of melt and fluid inclusions [3]. Furthermore, experiments investigating aqueous fluids or vapor phases in complex systems involving both fluids and melts are challenging, scarce and rely either on mass balance calculations [4] or synthetic fluid inclusions [5].

Here, we present an hydrothermal cell [6] developed to achieve P-T conditions relevant to the *in situ* study of magmatic-hydrothermal processes. This device enables visual monitoring of the high P-T sample but also Raman, X-ray fluorescence (SXRF) and X-ray absorption (XAS) measurements up to 950 °C and 1.5 kbar. Preliminary studies focused on determining 1) phase relations, fluid densities and volatiles speciation in H_2O-CO_2, H_2O-CO_2-NaCl and H_2O-CO_2-Hpg melt systems from 200 to 950 °C and 0.5 to 1.5 kbar and 2) the effect of pressure, temperature and fluid composition on the fractionation and speciation of Cu in fluid-melt systems.

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