Evidence for mantle heterogeneity from Selenium-Tellurium systematics in peridotites

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Selenium and Tellurium belong to the group of highly siderophile elements (HSE), which may constitute key tracers for planetary processes such as formation of the Earth's core and the Late Veneer composition. Constraints on HSE systematics on the planetary scale require a solid understanding regarding the behaviour of these elements during petrogenetic processes and their abundances in the Earth's mantle. However, the upper mantle has been shown to bear significant long-term geochemical and lithological heterogeneities as a result of repeated melt depletion and re-enrichment processes. In addition to petrographic and mineralogical investigations and geochemical and isotopic studies on platinum group element systematics, these mantle heterogeneities can now be further constrained with new results obtained from Se and Te geochemistry.

Recent studies have shown systematic differences in Se/Te between fertile lherzolites and depleted harzburgites from both oceanic and continental settings. In contrast to fertile lherzolites which scatter around broadly chondritic values of ca. 9 [1,2], depleted peridotites are generally highly fractionated with up to suprachondritic Se/Te (up to 35). The increase of Se/Te correlates with decreasing Te concentrations [3]. Similar fractionations are also observed at the scale of single samples and likely result from the heterogeneous distribution of micrometer sized Te-bearing host phases in highly depleted harzburgites. The marked differences in Se-Te systematics observed between fertile lherzolites and depleted harzburgites as well as the μm-scale heterogeneity can be explained by the combined effect of i) different abundances and proportions of residual and metasomatic base metal sulfides and ii) discrete micrometric to nanometric platinum-group minerals. Together with platinum group elements, the Se-Te systematics in ophiolitic peridotites, mantle-derived peridotite xenoliths (both alkali-basalt and kimberlite-hosted) and orogenic massifs therefore provide further evidence for the mineralogical control on the heterogeneity of highly siderophile elements as well as osmium isotope signatures in the Earth's mantle.

[1] Lorand and Alard (2010) *Chem Geol* **278**, 120-130. [2] Wang *et al*. (2013) *GCA* **108,** 21-44. [3] König *et al*. (2012) *GCA* **98**, 354-366.

Depressurization-induced gas production from methane hydrate sediment formed in a giant cell

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We have conducted a gas production test from methane-hydrate-bearing sediment artificially formed in a giant pressure-cell to evaluate feasibility of depressurization method. Unique apparatus named High-pressure Giant Unit for Methane-hydrate Analyses (HiGUMA), which is consist of a pressure-cell with an internal volume of 1710 liter, a vertical well system, and a separator for gas and water, was used for the test.

Methane hydrate with saturation of over 60% was formed in artificial sediment made of Toyoura standard sand within the pressure-cell. Production test was performed by decreasing the pressure of vertical well from 10 MPa to 5.0 MPa. Gas production rate showed the increasing tendency during pressure reduction of the well. The gas water ratio of production fluid increased to about 150 with time. Gas from methane hydrate was successfully produced by this method.

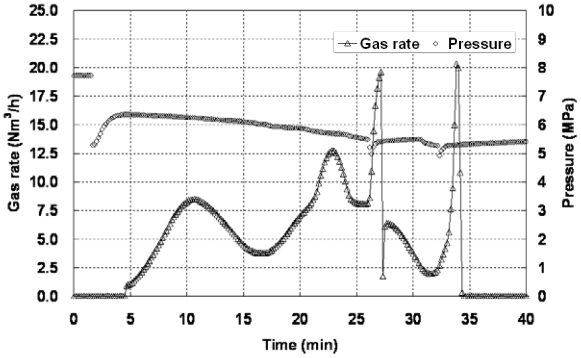

Figure 1: Time-dependent variations of gas production rate and well pressure.

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