Potential of the Earth's core as a reservoir for noble gases?

M.A. BOUHIFD[1], A.P. JEPHCOAT[2], S.P. KELLEY[3], D. PORCELLI[4] AND B. MARTY[5]

[1]Laboratoire Magmas et Volcans, Clermont-Ferrand, France
[2]Institute for Study of the Earth's Interior Okayama University, Japan.
[3]Open University, Milton Keynes, UK.
[4]Oxford University, Dept. of Earth Sciences, UK.
[5]CRPG – Nancy, France.

We have developed experimental techniques to simulate the conditions of the formation of the early Earth (*in presence of noble gases*) in a laser-heated diamond-anvil cell (LHDAC) at high pressures. In this work we have studied Ne and He partitioning between metal and silicate liquids at high-pressure and temperature up to 20 GPa and 3000 K. Microanalysis of LHDAC samples with Ultra Violet Laser Ablation Mass Spectrometry provided a spatially-resolved depth profile in samples.

Both helium and neon would have partitioned early into the core during its formation and in proportion to their early abundance, creating a potential reservoir for at least He and Ne. Our experiments show that the core He and Ne could clearly contribute to the mantle ^{3}He-^{4}He and ^{3}He-^{22}Ne budgets -- highlighting the exchange mechanisms at the core-mantle boundary through the 4.5 billion years of Earth's history. Our experimental results also indicate that the early Earth's core could have incorporated enough He and Ne in such way any contribution from the core to the deep-rooted plumes has the potential to lower their ^{3}He/^{22}Ne as well as to increase their ^{3}He/^{4}He ratios.

We will present and discuss our results on metal-silicate partitioning of Ne and He between CI-chondrite and iron-rich metal liquids. We will also discuss the potential of the Earth's core as a reservoir for noble gases (*at least for He and Ne*).