Noble gas partitioning between Earth's mantle and core: Implications for Earth's global geodynamics.

A.D. ROSA[1*], M.A. BOUHIFD[2], R. BRIGGS[1], G. MORARD[3] ,G. GARBARINO[1] AND T. IRIFUNE[4]

[1] ESRF – 38000 Grenoble, France (*correspondence: arosa@esrf.fr)
[2] Laboratoire Magmas et Volcans, Clermont-Ferrand, France
[3] IMPMC-L'Institut de Minéralogie, de Physique des Matériaux et de cosmochimie - 75005 Paris, France
[4] Geodynamics Research Center, Ehime Univ., Japan

Noble gases and their isotopes are key elements allowing to reconstruct a variety of fundamental planetary processes including the formation and evolution of the planet and its atmosphere. Modeling these processes requires however precise knowledge on the noble gas storage capacity of the liquid outer Earth's core and even more crucially core-mantle partitioning data.

We have developed experimental techniques to simulate the conditions of the formation of the early Earth in a laser-heated diamond-anvil cell (LHDAC) up to high P/T conditions relevant for the Earth's lower mantle. Here, we report on Kr solubility in pure Ni, $Fe_{88}S_{12}$ and $Fe_{85}S_{10}Ni_5$ alloys up to 110 GPa and > 3500 K. Microprobe analyses of quenched samples demonstrate a preference of Krypton for pure Ni as well as $Fe_{88}S_{12}$. In addition, we present Kr partitioning data between metal and oxides ($D_{Fe_{88}S_{12}/(Mg,Fe)O}$) up to 60 GPa and > 3000 K. We found an extremely high storage capacity of (Mg,Fe)O for Krypton and Dmetal/(Mg,Fe)O values clearly below unity.

We will discuss our results on metal-silicate partitioning between (Mg,Fe)O and Fe-rich liquids up to 60 GPa and their potential implications for Earth's global geodynamics.