ISOTOPIC CONSTRAINTS OF MODERATELY VOLATILE AND SIDEROPHILE ELEMENTS DURING CORE FORMATION.

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Introduction: Scenarios of core-mantle formation and subsequent processes of planetary accretion leading to the observed elemental composition of the Earth upper mantle are based on experimental metal-silicate partitioning of siderophile elements. Recent models require homogeneous accretion at high *P (≈30-40GPa)*, *T* (≈3000°K) conditions with an increase with time of oxygen fugacity to account for the budget (depletion) of moderately siderophile elements in the mantle [1,2]. However, these models differ on the (P, T, fO_2) conditions relevant to the depletion of the moderately volatile siderophile element (e.g. Ge) in the Earth upper mantle. These elements provide additional constraints on the possible loss of volatile elements during impact processes, which are linked to the main metal-silicate differentiation stage. Specifically, isotopes of these elements can be strongly fractionated during evaporation processes, which makes isotopic composition an appropriate tool for testing the role of volatility processes.

Results-Discussion: New germanium isotopic data (δ^{74}Ge relative to JMC standard, $2\sigma \pm 0.2$‰) were obtained on Earth silicate mantle (peridotites, basalts) and carbonaceous chondrites (CC), and then compared with Ge isotopic composition of iron meteorites [3]. Earth silicate mantle samples have δ^{74}Ge=+0.892±0.062‰, which is significantly lower than the mean value for magmatic iron meteorites (δ^{74}Ge=+1.77±0.22‰). First δ^{74}Ge data of some carbonaceous chondrites indicate light isotopic composition.

The heavy Ge isotopic composition of Fe-meteorites and Earth silicates with respect to CC would indicate a major loss of Ge during core formation, most probably due to evaporation induced by a Moon-forming impact. This isotopic effect of evaporation leads to a strong isotopic fractionation which would hide the small if detectable kinetic isotopic fractionation associated to diffusion of Ge from the silicate to the metal phase under the reducing conditions of metal-silicate segregation [4]. The light Ge isotopic composition of the Earth silicate mantle cannot represent the resulting silicate phase (Bulk Silicate Earth) after core segregation, this silicate depleted reservoir (≈ 1ppm Ge) would have in this case heavier Ge isotopic composition than the core. It is suggested that the δ^{74}Ge value of +0.892 ‰ is representative of the Earth Upper Mantle. The Ge isotopic composition of the silicate phase at the P,T, fO_2 conditions of core segregation would reflect the change in oxidation state and valence of Ge associated with pressure [1,2].

References: [1] Siebert J. et al. 2011. *Geochimica Cosmochimica Acta* 62:1631-1642 [2] Righter K. 2011. *Earth and Planetary Science Letters* 304:379-388. [3] Luais B. 2007 *Earth and Planetary Science Letters* 262:21-36.[4] Luais et al. 2007. *Eos Trans. AGU, 88(52),* Fall Meet. Suppl., Abstract # V51E-0833.