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Early Planet formation pictured from Germanium isotopes: the Earth-Mars and Moon-Vesta dichotomy.

BEATRICE LUAIS AND DAMIEN CIVIDINI

Université de Lorraine, CNRS-CRPG, France

Presenting Author: luais@crpg.cnrs-nancy.fr

The distribution of siderophile and volatile elements between metallic and mantle reservoirs of terrestrial planets and the Moon points to a strong depletion in their silicate reservoirs under P-T-fO_2 conditions of planetary body early evolution. A major concern is to identify and quantify what combination of processes - metal-silicate segregation, volatile loss during magma ocean stages, and accretion- could explain the variability in moderately siderophile (MSE) and volatile (MVE) element abundances, for example in germanium, between Earth-Mars (0.7-2ppm) and the Moon-Vesta (HED) (≤0.05ppm). The Germanium isotopes have also shown to be strongly fractionated between chondrites [1,2], iron meteorites [3,4], and terrestrial crust-mantle samples with a positive $\Delta^{74/70}Ge_{irons\text{-}silicate\ \ Earth}$ fractionation [4]. Completing the picture using Ge isotopes in silicate reservoirs of Mars, Vesta, and the Moon will add complementary constraints on their formation and evolution.

We present first-ever high precision germanium isotopic data obtained on shergottite-nackhlite-chassignite Martian meteorites, eucrite-diogenite meteorites thought to originate from Vesta, and one lunar basalt. Bulk Ge concentration and isotopic measurements were performed at CRPG-Nancy using solution ICP-MS (SARM facilities), and HG-MC-ICPMS techniques ($\delta^{74/70}Ge_{NIST3120a}$ ≤0.1‰, 2σ SD) [4], respectively.

The Germanium isotopic signatures of planetary silicate reservoirs confirm the fundamental dichotomy based on Ge abundances, at different scales: (1) *on a planetary scale:* Mars and the Earth display overlapping $\delta^{74/70}Ge$ values (+0.35 to 0.84‰) that are lighter than CI-chondrites and iron meteorites, emphazing a positive $\Delta^{74/70}Ge_{irons\text{-}silicate}$. It is opposed to highly Ge-depleted HEDs and the Moon having similar to higher values (+1.07 to +1.74‰) than CI-chondrite and irons. Negative [Ge]-$\delta^{74/70}Ge$ correlation for Earth-Mars and HED-Moon would indicate distinct volatility mechanisms superimposed to core formation [5]; (2) *on a Mars scale:* higher $\delta^{74/70}Ge$ and lower [Ge] (+0.84‰, 0.73 ppm) in shergottites than in nakhlites (+0.35‰, 2.2 ppm) emphasize outgassing processes [6]. Forthcoming $\delta^{74/70}Ge$ data of Chassigny can constrain the nakhlite-chassignite filiation.

References: [1] Luais et al. (2022), 85th *MetSoc*, #57. [2] Florin et al. (2020), *GCA* 269*,* 270-291. [3] Luais (2007), *EPSL* 262, 21-36. [4] Luais (2012), *Chem. Geol.* 334*,* 295-311. [5] Sossi et al. (2019), *GCA* 260, 204-231. [6] Humayun et al. (2016) *47th LPSC,* #2459