Germanium isotopic variations in metals in H chondrites: implications for metal-silicate segregation

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Formation of metallic cores in planetesimals and terrestrial planets implies differentiation, which is the result of the metal-silicate segregation processes. The most common processes involve different degrees of partial melting of an undifferentiated parent body, possibly combined with deformation [1]. Deformation, caused by high energetic impacts, may result in partial melting of the metallic phases and subsequent migration of metallic liquid. In this study, we are using siderophile elements, e.g. germanium, to compare metal composition from (1) undifferentiated objects such as H chondrites that represent the initial material; with (2) differentiated objects such as iron meteorites, which are planetary body cores proxys and represent the final composition of the metallic phase. Comparaison between Ge contents and Ge isotopes from metal hosted in chondrites with iron meteorites can trace elemental and isotopic variations at all stages of metal segregation and migration.

We have studied seven well-known H chondrites with petrologic groups from H3.4 to H7. According to the onion shell structure, we thus sample every layer of a planetesimal. Fe-Ni metal phase has been carefully isolated from troilite (FeS) and silicate to obtain high-purity separates. Ge chemistry and isotopic measurements have been performed, following the methodology developed at the CRPG-Nancy [2], and using the MC-ICPMS Neptune*Plus*.

First Ge isotopic results on metal phase of H6 chondrites Guareña and Kernouve show respectively $\delta^{74/70}Ge_{(NIST3120a)}$= -0.52±0.06‰ and -0.48±0.01‰, 2σSD. Values are lower than those of magmatic irons representing metal cores [2, 3], but similar to $\delta^{74}Ge$ of IIE non-magmatic iron meteorites (from -0.19‰ to -0.63‰) [2, 3]. This re-emphasizes the genetic link between IIE silicates and H chondrites on the basis of oxygen isotopes [4]. Ge isotopic measurements of metal from chondrites with lower petrologic grades are in progress, and will give insights into additionnal effects of metamorphism.

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