$^{182}Hf/^{182}W$ chronometry and the evolution of HED parent body

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The Howardite-Eucrite-Diogenite (HED) clan consists of basalts, cumulate gabbros and orthopyroxenites, and probably originated from the crustal portions of the asteroid 4 Vesta. Many models have been proposed to explain the petrogenetic history of the HED parent body, including partial melting of a primitive precursor, and fractional crystallization, equilibrium crystallization, and *in situ* crystallization of a magma ocean. However, none of these models seems to be able to explain all the observations (Mittlefehldt and Lindstrom, 2003), and also that HED meteorites might have formed by different igneous processes (Barrat *et al*., 2006). In order to better constrain the genetic relationship among the HED meteorites, a suite of diogenites and howardites have been analyzed with the short-lived $^{182}Hf/^{182}W$ chronometer to compliment the existing data (Quitté *et al*., 2000), and to better understand the petrogenetic history of the HED parent body.

All the meteorites included in this study were requested from the NASA Antarctic meteorite collections, except for Tatahouine. Similar to the eucrites, the preliminary data of the diogenites and howardites studied here all exhibit super-chondritic ε_w, varying from +10 to +21, and Hf/W ratios. In addition, the diogenite and howardite data seem to fall on the isochron defined by the eucrites (Quitté *et al*., 2001), even though the data are more scattered compared to the eucrites. Although more detailed isochron studies are needed in order to tell if HED meteorites were indeed co-genetic in terms of the Hf-W system, the preliminary data do suggest that both diogenites and howardites formed around the same time as the eucrites. As expected, diogenites exhibit significantly lower Hf and W concentrations and slightly lower Hf/W ratios compared to the eucrites. In general, diogenites should have higher Hf/W ratios compared to the eucrites, unless W became less incompatible than Hf in the HED parent body during oxidized condition. As for howardites, they show overall similar Hf and W concentrations and Hf/W ratios as the eucrites. It is difficult to reconcile that howardites have the same Hf and W concentrations as the eucrites, because petrographically they are supposed to be mixtures of eucrites and diogenites. More detail modeling and internal Hf-W isochron studies for howardites, eucrites and diogenites are needed in order to better constrain the petrogenesis of HED meteorites in terms of Hf-W system.

References

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Effect of carbonates on the sorption of U(VI) onto granite: Correlation with aqueous speciation

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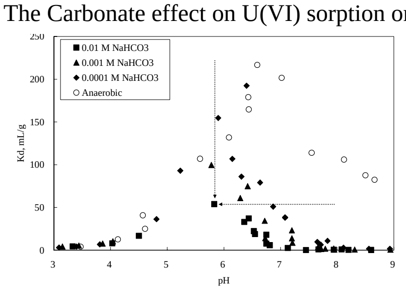
The mobilization of metal contaminants through geological media is strongly influenced by the reaction between metals and the surrounding rocks and mineral phases. In this study, the effect of carbonates on the sorption of U(VI) onto a Korean crushed granite was investigated by performing batch sorption experiments. A correlation between the uranium sorption behavior and the aqueous speciation of U(VI) in the solution was also analyzed. The chemical speciation of uranium was calculated by MINTEQA2 at different geochemical conditions.

Figure 1: The Carbonate effect on U(VI) sorption onto granite



The distribution coefficients (K_d) of U(VI) onto granite were found to be highly dependent on the solution pH and the aqueous carbonate concentration. As shown in Figure 1, The maximum K_d was significantly decreased and the peak was shifted to a lower pH side as the carbonate concentration increased. Thus the concentration of carbonate can be directly related to the distrbution of the aqueous U(VI) speciation. The K_d values were decreased even in the absence of carbonate which was correspondent with the formation of anionic uranyl hydroxo complexes.

Based upon the calculations at 10^{-6} M of U(VI) and acidic pH, free uranyl ion (UO_2^{2+}) was the dominant species sorbed onto crushed granite in the absence of carbonate. However, the uranyl carbonates such as UO_2CO_3(aq) and $UO_2(CO_3)_2^{2-}$ were dominant in 10^{-4} and 10^{-2} M of carbonate concentrations, respectively. This reveals that U(VI) sorption on granite is inhibited by forming uranyl carbonate complexes, resulting in a lower sorption affinity to the granite at a neutral pH region. Thus the formation of uranyl carbonates is one of the most important factors in the prediction of the uranium migration in natural environemnts.

References

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