The investigation of magnesium isotope fractionation during granite differentiation

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Magnesium isotope fractionation during differentiation of basaltic magmas is insignificant, based on studies of global oceanic basalts [1, 2]. It is however uncertain whether or not resolvable Mg isotope fractionation may occur during differentiation of granites, which generally occurs at lower temperatures. To address this issue, here, we report high-precision Mg isotopic data for a suite of well-studied I-type granitoids and associated hornblende and biotite minerals from the Dabie Orogen, central China.

Although these granitoids formed through various degrees of partial melting and fractional crystallization, their δ^{26}Mg values show a limited range from -0.26 to -0.15, indistinguishable within our external analytical precision (± 0.07‰; 2SD). Coexisting hornblendes and biotites display similar δ^{26}Mg values that are identical to those of their hosting granitoids. The limited inter-mineral isotope fractionation agrees with theoretical predictions. Overall, the data from granitoid whole rocks and mineral separates suggest that Mg isotopes do not significantly fractionate during granite differentiation.

Magnesium isotopic compositions of the Dabie granitoids are similar to those of previously studied I-type granitoids and terrestrial basalts and peridotites [1-5], further confirming that magma processes do not significantly fractionate Mg isotopes. The deep continental crust, as sampled by I-type granitoids, has a mantle-like Mg isotopic composition. Given that Mg isotopes significantly fractionate during surface weathering processes, Mg isotopes can thus potentially be used for tracing recycling of surface materials.

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Performance assessment for Beishan HLW repository site based on the preliminary FEP analysis

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The preliminary FEP analysis for the Beishan HLW Repository Site of China is very important currently. China began nuclear research and development about several decades. China now has an ambitious plan to develop nuclear power generation in order to meet rapid economic development and mitigate global warming effect by reducing fissile fuel dependence. At the same time, China will generate a considerable amount of HLW. For protecting the environment, China has selected Beishan area in Gansu Province as the geological disposal of HLW.

However, during HLW disposal, performance assessment is necessary. Currently, China scientists began the first performance assessment (PA) to Beishan repository site, In this large and systematic research and development process, preliminary FEP analysis for Chinese Beishan site is the first, and important, step. Features, Events and Processes (FEP) are adopted in safety and performance evaluation of radioactive waste repository systems. There are several FEP catalogues publicly available, like the NEA (Nuclear Energy Agency) FEP database and SKB FEP database. Among these databases, the SKB's database is best fit the Chinese program because of similarities disposal concept and host rock. As a preliminary analysis, note that not all the included FEPs must be included in PA is important. The iterations of screening and auditing are needed to determine the importance levels of the included FEPs. This will involves experts of different fields or subsystems to provide in-depth technical basis and reach consensus on whether a FEP should be modeled, treated as a parameter.