

What is recorded in Mg isotopes of carbonate-hosted REE deposit?

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Recently, Mg isotopes in natural samples have been widely used for investigating various geochemical and biological processes because the large mass differences between the isotopes of Mg (8%, ²⁴Mg and ²⁶Mg) result in large isotopic variations in natural systems. Because Mg are fluid-mobile and one of the major elements in the Earth's surface, its stable isotopic compositions in rocks and minerals are useful for deciphering fluid/melt-rock interactions in the Earth's surface systems. Especially, carbonate-hosted deposits such as carbonatite-related rare earth element (REE) deposit and Mississippi Valley-type Zn-Pb deposit are economically important and have been developed all over the world as main REE and Zn-Pb resources, respectively. These backgrounds indicate that Mg and its isotopes, one of the major elements in the deposits, are expected to be a good tool for constraining ore genesis of these kind of deposits. Moreover, large Mg isotopic differences between igneous rocks and biogenic carbonate such as coral and foraminifera may be useful to quantify rate of their Mg contribution to the deposits. Condition of dolomitization before mineralization (e.g. dolomitization temperature and source of Mg in dolomite) is also likely to be estimated by Mg isotopic studies in the deposits. Therefore, as a case study, we investigated the Rock Canyon Creek (RCC) REE-fluorite deposit, one of the carbonate-hosted REE deposits in British Columbia, Canada.

In the British Columbia alkaline province, 43 REE occurrences have been reported, which consists of carbonatites, nepheline and sodalite syenites, ijolite series rocks, kimberlite, and many ultramafic and lamprophyre diatremes, breccias, and dikes. Among 43 REE occurrences, the RCC REE-fluorite deposit is one of the most promising REE prospects in British Columbia. The RCC REE-fluorite deposit is hosted by Middle Devonian carbonate rocks of the Cedared and Burnais formations and consists mainly of dolostone, breccia, and laminated silty, calcareous gypsum. The main REE-fluorite mineralized zone was drilled for collecting core samples of the deposit. In this study, we reported Mg isotope compositions as well as radiogenic Sr isotope compositions of separated minerals (dolomite, calcite, and fluorite) from core samples of RCC REE-fluorite deposit for evaluating what factors mainly control Mg isotope in the deposit (e.g. condition of dolomitization, Mg isotope history of seawater, and ore-forming process).

Keywords: Mg isotope, REE deposit, carbonate