

## **Combined in-situ Sr isotopic and chemical investigation of the host dolomite within the giant Bayan Obo Nb-REE-Fe deposit**

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Genesis of the giant Bayan Obo Nb-REE-Fe deposit has been intensely debated, and both sedimentary and igneous origin of the host dolomite has been proposed. In this study, we perform a comprehensive petrographic and in-situ Sr isotopic and chemical investigation of the host dolomite from the east orebody. The result shows huge range of grain sizes for the dolomite (10 to 500  $\mu\text{m}$ ), and positive correlations are observed between the chemical signatures (e.g., REE and Sr abundances, (La/Yb)<sub>N</sub> ratios) and the grain size. The uniform coarse grained dolomite (i.e., 500  $\mu\text{m}$ ) contains the highest REE and Sr concentrations and the largest LREE to HREE fractionation. The associated in-situ  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio for the dolomite defines a large range from 0.7028 to 0.7050, and the degree of isotopic variation indicates correlations with grain size as well. Coarse-grained dolomite and the associated monazite display a relatively consistent unradiogenic Sr isotope composition ( $^{87}\text{Sr}/^{86}\text{Sr}=0.7028-0.7031$ ), which is similar to that for the Mesoproterozoic mantle and confirms their igneous origin. The largest variation of geochemical data has been identified on the samples with variable grain-sized dolomite, and even on a single huge crystal. However, no general core to rim variation trend has been identified for these grains.

The combined isotopic and chemical compositions for Bayan Obo dolomite can be modelled by the mixing of the primary carbonatite and the sedimentary carbonate. Petrographic and geochemical evidences for the uniform coarse grained dolomite support their igneous origin, whereas those for fine grained and variable sized dolomite record extensive hydrothermal metasomatism between the carbonatite and the sedimentary carbonate rocks. Thus we suggest the formation history of Bayan Obo to be that the original carbonatite intruded into meta-sedimentary carbonate strata which accompanied by extensive hydrothermal metasomatism.