

U-Pb ages and Sr–Nd isotopic compositions of perovskite from the Yakutian kimberlites, Siberian Craton

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Perovskite in kimberlites commonly contain high contents of U, Sr and Nd, and thus could provide effective constraints on the emplacement age and Sr-Nd isotopes of kimberlitic magmas [1, 2]. In this study, perovskite have been selected from 38 kimberlites from 10 fields in the Yakutian area, Siberian Craton, and analysed in-situ by LA-MC-ICPMS method. The obtained perovskite U-Pb ages suggest that kimberlites in the Yakutian field were emplaced in four episodes, ~420 Ma, ~360 Ma, ~220 Ma and ~160 Ma. Different kimberlite pipes in the same field were emplaced at the same time. Furthermore, all the diamondiferous kimberlites in Yakutian field were erupted around 360 Ma. The perovskites display ⁸⁷Sr/⁸⁶Sr ratios ranging from 0.70282 to 0.70375 and ¹⁴³Nd/¹⁴⁷Nd ratios from 0.51229 to 0.51271. The Sr-Nd isotope range displayed by perovskites is much narrower than that given by the whole-rock Sr-Nd isotopic compositions, i.e., 0.70318–0.70641 and 0.51048–0.51270, respectively [3]. On one hand, this suggests that whole-rock Sr-Nd isotope compositions of kimberlites have been contaminated during erupted route to surface. On the other hand, the relatively depleted Sr-Nd isotopic compositions shown by the perovskites also indicate that the Yakutian kimberlites belong to the Group-I kimberlite, and were derived from a similarly depleted mantle source.

[1] Yang *et al.* (2009) *Chemical Geology* **264**, 24-42. [2] Wu *et al.* (2010) *Lithos* **115**, 205-222. [3] Kostrovitsky *et al.* (2007) *Russian Geology and Geophysics* **48**, 272-290.

The formation of the giant Bayan Obo REE deposit: Constraints from Mg isotopes

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The Bayan Obo REE-Nb-Th-Fe deposit, located in Inner Mongolia, North China, is the largest REE deposit and the second largest Nb deposit in the world. Its genesis is highly debated, ranging from carbonatite magmatism, alteration of sedimentary carbonate rocks, through deposition of carbonates on the sea floor accompanied by simultaneous metasomatism, to formation due to Caledonian subduction. None of the models so far proposed can fully explain all the major facts^[1, 2]. The key problem is the relationship between carbonatite dykes, sedimentary dolomite, REE ore body and iron ore body. The REE ore bodies have trace element patterns and initial Nd isotope values identical to those of carbonatite dykes nearby, implying genetic links. Carbon isotopic composition of the carbonatite dyke is similar to the normal mantle $\delta^{13}\text{C}$ value of $-5\pm 2\%$, but their O isotope compositions range from 13.9 to 16.4‰ for calcite, which are much higher than the mantle $\delta^{18}\text{O}$ value of $5.7\pm 1.0\%$. Consistently, the Mg isotopes of calcite carbonatite dykes range from mantle value to sedimentary values. All these indicate that the calcite carbonatite dykes have major sedimentary components, through recycling or assimilation, or a combination of both. By contrast, Mg isotopic compositions of ore bodies and dolomite carbonatite dykes are all close to mantle value, indicating major components from the mantle. The age of ore-forming monazite (330 to 760 Ma) is scattered with a main peak at about 400 Ma, roughly coincident with the evolution of the Central Asian orogenic belt nearby, but is much younger than carbonatite dykes (1300 Ma). Such large age dispersal indicates protracted mineralization driven by a persistent heat source for about 400 Ma. Considering that the host dolomite has high SiO₂ contents and carbon and oxygen isotopes distinctively different from those of carbonatite dykes, all these observations point to protracted steam-cooking of carbonatite by subduction released high-Si fluids, which leached Fe from the mantle wedge and, REE, Nb and Th from carbonatite, forming the Bayan Obo deposit in overlying sedimentary carbonate.

[1] Yang X Y, Sun W D, Zhang Y X, et al. *Geochimica et Cosmochimica Acta*, 2009, 73: 1417-1435

[2] Liu Y L, Williams I S, Chen J F, et al. *American Journal of Science*, 2008, 308: 379-397