Multi-stage petrogenetic history of the Oka carbonatite complex recorded by perovskite

WEI CHEN[1]

[1]State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan, China 430074. Email: wchen@cug.edu.cn

The Oka carbonatite complex is the most westly intrusion of the Monteregian Igneous Province (Quebec, Canada). Perovskite (including two zoned grains) within okaite from Oka are investigated for their chemical, isotopic and geochronlogical compositions in the aim to resolve their formation history. Perovskite grains display reverse zoning, with Nb_2O_5 contents enriched in rim (7.25-10.80 wt.%) relative to their respective central regions of the crystals (<5 wt.%). The rim perovskite is characterized by high abundances of REEs, Sr, Ta, Na, Fe, Al. The combined chemical and geochronlogical results indicate that the crystal cores have undergone Pb loss since these are characterized by younger ages (e.g., 115.7 ±3.9 Ma) resulting from higher U abundances relative to the rim (~139.4 ±2.5 Ma). In addiion, the core areas are characterized by more radiogenic Sr (and comparable Nd) isotopic ratios compared to the remaining perovskite, as well as distinct chemical compositions (i.e., lower Nb/Zr). The distinct, more radiogenic $^{87}Sr/^{86}Sr$ isotope ratios for the perovskite cores may be attributed to either crystallization from a melt derived from a distinct mantle source, or perturbation by a contamination/alteration process(es).

A possible forrmational history for the reversely zoned perovskite grains is as follows: (1) the cores formed from a first batch of magma; (2) this was followed by the influx of a new (distinct) batch of magma with lower $^{87}Sr/^{86}Sr$ ratio, which resulted in the crystallization of the rims; (3) the latter was associated with an “autometasomatic” event in which fluids scavenged the Nb from the core towards the rim. The combined chemical, isotopic, and geochronological data is best explained by invoking the periodic generation of small volume, partial melts generated from hesterogeneous mantle for the formation of the Oka carbonatite complex.