Abstract

Widespread, Late Paleozoic carbonatites in the Canadian Cordillera are unusual. In contrast to most carbonatites, which are restricted to intracrustal settings, they formed in an active tectonic setting, along the western margin of Laurasia. We investigate the source and evolution of parental magmas at nine 340–350 Ma complexes in east-central British Columbia (Blue River area), we studied isotope (~C0.97–0.56Nd) and elemental compositions of minerals from carbonatites and related rocks. These data allow us to infer a 750°C, equilibrated (2PFOZ ~ 0.5 to 0.5) magma from heterogeneous, depleted mantle. Isotopic compositions (Ga and εNd) of 34 Ma and Nd values of 0.566–0.569, an unusual combination of isotopic and Nd values. These data are consistent with a mantle source that is significantly enriched in radiogenic Nd.

Petrography and mineral chemistry

We examined petrography, mineral chemistry, and isotope systemsatics (C-O-C0.97–0.56Nd) of carbonatite and related rocks from nine intrusive complexes in the Blue River area, east-central British Columbia. We investigated three veins and Ni- and Zn-ZnO mineralization. Separated mineral fractions (carbonate, silicate, oxide, sulfide, apatite) from 34 rock samples were analyzed by EPMA and LA-ICPMS (plus in situ analysis), electron microprobe (EPMA), TIMS, and SEM using standard methods (details are available from authors).

Geological setting

The study area lies within the Okanagan basin and is characterized by potassic, amphibole-facies lithology and tectonics. Several carbonatite-olistoliths and alkalic rocks (at least 150 Ma) were found in the area. The Blue River carbonatites are structurally and mineralogically indistinguishable from other alkaline carbonatites generated by Na-rich magmas. The back-arc extension from seaward subduction that led to the Miocene oceanic crust is characteristic of a mantle–plume setting.

Thermobarometry

The Blue River carbonatites formed from relatively hot (~775–822°C), metal-rich (AQEM = 0.5 to 0.5) parental magma, derived from a heterogeneous, sublithospheric mantle, involving mixing of FOZO and EM1 end-members, and the fluids released from the mineralized rocks. The Blue River carbonatites are identical to other carbonatites generated by plume-related mantle sources.

Isotopic systemsatics

The Blue River carbonatites are similar to other carbonatites generated by plume-related mantle sources. The Blue River carbonatites are distinct from other carbonatites generated by plume-related mantle sources.