

Evidence of a transformation from pyrochlore into columbite-(Fe) at the Saint-Honoré carbonatite, Québec (Canada)

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Overview

The Saint-Honoré carbonatite is located in the Saguenay region of Québec, Canada. The carbonatite is enclosed within the central part of an alkaline complex and is characterized by calcite rocks in its external portion and dolomite and ankerite towards its core [1]. It has been exploited for niobium through underground mining since 1976. Nb-bearing minerals are found predominantly within the dolomitic and calcitic units.

Historically, niobium was mainly extracted from fluornatropyrochlore [(Ca,Na)₂(Nb,Ti)₂O₆(O,OH,F)] (Pcl) with a minor contribution from columbite-(Fe) [(Fe,Mn)(Nb,Ti)₂O₆] (Clb). However, the abundance of columbite-(Fe) increases as exploitation of the deposit progresses. Pcl grains are euhedral, often zoned, and generally inclusion-free. Most Clb grains are anhedral, show no zoning, may be fractured, and have many inclusions of calcite and fluorite. Both minerals are observed within apatite-rich bands. However, unaffected Pcl and Pcl transforming into Clb are rarely observed together in the same apatite bands.

Evidence of transformation

The alteration of pyrochlore into columbite within carbonatites was first studied in 1958 [2]. This transformation involves the addition of Fe and Mn and the removal of Ca, Na, and F. Most Clb grains from the Saint-Honoré carbonatite show a similar texture and have calcite and fluorite inclusions. Pcl grains at different stages of transformation into Clb were observed and analyzed by SEM-EDS. Alteration occurs initially along grain margins or within fractures. Pcl grains associated with a transformation into Clb have a mineral chemistry typical of hydrothermal alteration.

[1] Thivierge *et al.* (1983) *Min. Dep.* **18**, 267–283.

[2] James & McKie (1958) *Min. Mag.* **31**, 889–902.