Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.7335

Geochemical variation of magmatic Fe-Ti-P mineralization associated with Proterozoic massif-type anorthosites from the Grenville Province, Quebec: tracking magma differentiation using oxide, apatite and plagioclase chemistry of the Vanel Anorthosite Suite

PEDRO MILOSKI[1], SARAH A. S. DARE[2] AND CAROLINE EMMANUELLE MORISSET[3]

[1]University of Quebec at Chicoutimi (UQAC)
[2]Universite du Quebec a Chicoutimi (UQAC)
[3]Canadian Space Agency

Presenting Author: miloski.geo@gmail.com

Magmatic oxide-apatite mineralization is spatially and temporally associated with Proterozoic massif-type anorthosites, providing important resources for TiO_2 (hemo-ilmenite: Fe_2O_3-$FeTiO_3$), V (magnetite: Fe_3O_4) and P (apatite: $Ca_5(PO_4)_3(OH,F,Cl)$). For example, the world's largest producer of TiO_2, Lac Tio mine, is a hemo-ilmenite-deposit within the anorthosite massif of Havre St. Pierre, Quebec. However, the origin and genetic relationship of both the anorthosite host and oxide-apatite mineralization are still highly debated, as well as the exact tectonic setting. The type of oxide mineralogy (Ti-magnetite, ilmenite, hemo-ilmenite) appears to vary with the composition of plagioclase of the massif anorthosite (labradorite or andesine) which may relate to different parental melts and/or degrees of crustal contamination during emplacement of plagioclase rich-mushes into the crust [1, 2]. In the Grenville Province, Quebec, the oxide mineralogy generally changes as a function of the anorthosite age: andesine-type anorthosites that are younger than 1100Ma are orthopyroxene-bearing and host hemo-ilmenite mineralization, whereas labradorite-type anorthosites are older than 1100Ma, are olivine-bearing and host Ti-magnetite mineralization [3, 4]. The aim of this research is to improve our understanding of what causes these changes with time by studying the mineralogical and geochemical variation (whole-rock and trace-element mineral chemistry) of different Fe-Ti-P mineralization, here associated with the 1.06Ga Vanel Anorthosite Suite, Central Grenville. A detailed stratigraphical study of silicates (Fig.1), oxides and apatite for the Lac à L'Orignal Ti-P occurrence reveals geochemical variation related to magma differentiation within a single mineralized body. Comparison with nearby, coeval oxide-apatite-rich occurrences (Lac Mirepoix, Lac Périgny and Lac de L'Abbondance) provides an opportunity to evaluate the role of fractional crystallization, magma dynamics and assimilation of crustal rocks in forming Ti-P deposits in anorthosite massifs.

[1] Morse, S. A. 2006. Lithos, 89(1 2), 202-221.

[2] Woodruff, L. G., Nicholson, S. W., Fey, D.L. 2013. USGS Report 2013-5091 (47 pp.).

[3] Corriveau, L., Perreault, S., Davidson, A., 2007. Geological Survey of Canada, Special Publication, pp. 819-847.

[4] Hébert, C., Van Breemen, O., Cadieux, A. M., & Gosselin, C. 2009. Synthèse géologique. Ressources naturelles et faune, Québec.

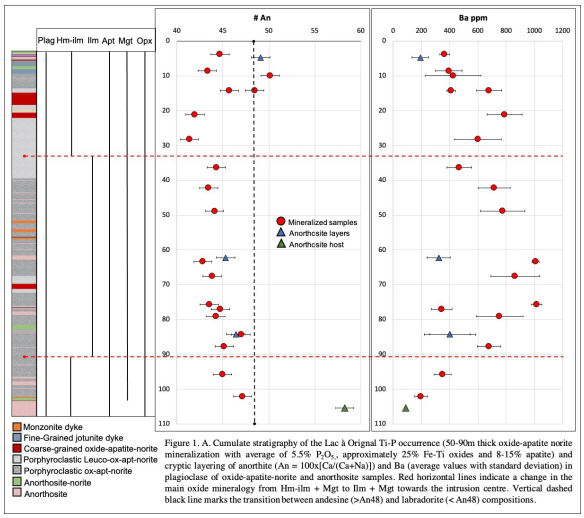

Figure 1. A. Cumulate stratigraphy of the Lac à Orignal Ti-P occurrence (50-90m thick oxide-apatite norite mineralization with average of 5.5% P_2O_5, approximately 25% Fe-Ti oxides and 8-15% apatite) and cryptic layering of anorthite (An = 100x[Ca/(Ca+Na)]) and Ba (average values with standard deviation) in plagioclase of oxide-apatite-norite and anorthosite samples. Red horizontal lines indicate a change in the main oxide mineralogy from Hm-ilm + Mgt to Ilm + Mgt towards the intrusion centre. Vertical dashed black line marks the transition between andesine (>An48) and labradorite (< An48) compositions.