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# Clinopyroxene as a key for tracing a history of crystallization and recrystallization of coronitic metagabbro in high-grade metamorphic terranes

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The evaluation PT-parameters of magmatic crystallization is usually complicated for metagabbros in high-grade metamorphic terranes. Sometimes intensively metamorphosed coronitic gabbronorites preserve relics of primary magmatic mineral assemblage that could give valuable information on the conditions of melt crystallization. However, to use the composition of this relict minerals one should be sure that relict magmatic minerals in coronotic metagabbros did not change their primary composition despite the fact of high-grade metamorphic overprinting.

Clinopyroxene is the most important concentrator of REE in igneous and metamorphic mafic rocks because its trace element composition is a sensitive indicator of physico-chemical conditions of the clinopyroxene-bearing-rocks formation.

The Belomorian mobile belt (BMB) of the eastern part of the Fennoscandian Shield is high-garde metamorphic terrane. High-Mg coronitic metagabbronorites are widespread in BMB. In spite of metamorphic alteration at high-pressure amphibolite (to eclogite) facies conditions they often preserve relicts of primary igneous mineral assemblages that consist of olivine, orthopyroxene, clinopyroxene (augite) and plagioclase. Corona textures usually developed between mafic minerals and plagioclase. In general, coronas consist of orthopyroxene, clinopyroxene (Na-rich diopside), hornblende (with or without spinel inclusions) and garnet. Trace element composition of relict (primary-igneous?) and corona-forming (around magmatic orthopyroxene) clinopyroxenes from paleoproterozoic coronitic metagabbronorites of the BMB was studied using SIMS Cameca IMS 4f. Igneous clinopyroxenes from fresh olivine gabbronorites of age ca. 2.45 Ga in the Karelian craton were used as reference composition for igneous clinopyroxenes.

The major element contents in relict clinopyroxenes from coronitic metagabbronorites determined using EDS EPMA is very similar to the igneous clinopyroxene from gabbronorites of the Karelian craton. Analyzed clinopyroxenes can be classified as high-magnesium (XMgFetot=77-81) Cr-rich (Cr=2875-6137 ppm) augites. All of them are slightly depleted in LREE ((La/Sm)n=0.27-0.57) and characterized by unfractionated HREE patterns ((Dy/Yb)n=0.73-1.1). Trace elements patterns for augites show strong depletions for the HFSE. Corona-forming clinopyroxenes compared to relict clinopyroxenes have higher CaO, $Al2O_3$ and Na2O and lower Cr (305-3872 ppm) contents. Their REE patterns are similar, and show enrichment in LREE relative to HREE ((La/Yb)n=2.1-5.0), slightly fractionated HREE patterns ((Dy/Yb)n=0.44-0.89) and positive anomalies of Eu ((Eu/Eu)*=2.2-3.3). Trace element distribution patterns of corona-forming clinopyroxenes are characterized by significant negative Nb, Sr, Zr and Ti -anomalies.

Thus, similar major and trace element composition, REE and TE patterns for augites from coronitic metagabbronorites and from unmetamorphosed gabbronorites suggest that relicts of magmatic minerals from coronitic metagabbronorites can preserve primary igneous composition. So they can be used for evaluation PT-parameters of melt crystallization. REE patterns for corona-forming clinopyroxenes suggest that coexisting diopside and garnet were not in equilibrium and were formed under different PT-conditions at the early stage of metamorphic overprinting.

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