Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11015

Characterization of mineral parageneses and metamorphic textures in eclogite- to high-pressure granulite-facies marble at Allmenningen, Roan, western Norway.

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The Roan peninsula in western Norway, Vestranden, is known for exposing one of the deepest parts of the Scandinavian Caledonian orogen, similar to the Western Gneiss Region. Throughout the Roan area, eclogites and high-pressure granulite- and amphibolite-facies gneisses occur, associated with supra-crustal rocks, including marbles, calc-silicate rocks, and amphibolites.

The studied rocks belong to the Einarsdalen Supracrustal Unit, composed of paragneisses, marbles, calc-silicate rocks with mafic lenses, and amphibolites, and were sampled from Allmenningen. In this study, the petrography, textural characteristics, and mineral chemistry are determined in marbles, calc-silicates, and associated mafic rocks, since mineralogical and petrographical data from Allmenningen are limited. A connection between the parameters mentioned above, and the metamorphic conditions in the Roan peninsula, is examined.

The petrographic data show that the mineral assemblage in the marbles is calcite + dolomite + clinopyroxene + scapolite ± epidote + phlogopite + amphibole + quartz. Calc-silicate rocks are composed of calcite + dolomite + clinopyroxene ± amphibole + scapolite + phlogopite + garnet + quartz. Mafic rocks contain garnet + clinopyroxene + zoisite + plagioclase ± amphibole + calcite. Accessory minerals include titanite, apatite, zircon, and opaques (Fe-oxides and Fe-sulphides). All three rock types have mineral assemblages that indicate high-pressure granulite-facies metamorphism. P–T estimates using TWQ suggest peak conditions of ~875°C and ~14 kbar during the formation of a second-generation garnet rim in a garnet-rich mafic calc-silicate rock. At the time of equilibration, the fluid phase was composed of 75% CO_2 and 25% H_2O.

Diopside and grossular-rich garnet are formed by heating and devolatilization in carbonate and mafic rocks. The dominant minerals consumed are zoisite, calcite, plagioclase, and quartz. Therefore, calcareous rocks are of environmental importance because they emit significant amounts of CO_2 into the atmosphere during metamorphism, contributing to crustal degassing processes. Fluorine is present mainly in apatite and, in minor amounts, in phlogopite and amphibole, suggesting that the CO_2-rich fluid phase contained minor amounts of dissolved halogens during metamorphism.