

High-grade metamorphism of the Archean to Palaeoproterozoic gneiss complex in Vesterålen, North Norway

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The Archean to Palaeoproterozoic Gneiss Complex of Vesterålen, North Norway, is dominated by orthopyroxene-bearing migmatitic gneisses. The gneiss complex includes horizons of quartzites, calc-silicates and amphibolites, and is intruded by a Palaeoproterozoic AMCG-suite and gabbros. Evolution of high-grade metamorphism is constrained from garnet-orthopyroxene-bearing parts of the migmatitic gneiss complex: The gneisses occur as banded rocks with migmatitic layers and are typically characterized by a brownish colour. Locally preserved relationships illustrate the migmatitisation process where leucosome intrusive melts breaks up finer grained and foliated restites preserved in lenses. The gneisses consist of perthitic feldspar, quartz, orthopyroxene, minor plagioclase and a variable content of biotite. Garnet is present in extensive parts of the complex. The perthite is normally mesoperthite, but patch perthite and antiperthite is present. Plagioclase is An₂₇₋₃₃, orthopyroxene En₄₉₋₆₀ and garnet Alm₅₉₋₇₂Prp₁₄₋₃₁Grs₄₋₁₃Sps₂₋₄ with Mg# = 0.17-0.37. Biotite has Mg# = 0.54-0.65. P-T condition of the metamorphic event is modelled by conventional thermobarometry using Thermocalc software and calculations of P-T pseudosection by TheriakDomino. P-T calculation yields estimates of P up to 0.86 ± 0.23 GPa and T up to 903 ± 113 °C. For the calculated P-T-range, pseudosection modeling shows liquid-in above 830-860 °C, biotite-out above 840-870 °C and garnet-in above 0.60-0.85 GPa. Calculation of garnet isopleths for grossular and Mg# restricts the conditions for P to 0.8-0.9 GPa and T=860-880 °C, in accordance with the upper stability field of biotite and presence of melt. Local corona-growth of garnet and amphibole on orthopyroxene reflect a retrograde or secondary high-grade influence. Our geological mapping in combination with petrographic and petrological studies and modeled P-T conditions of the gneisses document a regionally extensive medium-pressure granulite-facies metamorphism of the Archean to Palaeoproterozoic Gneiss Complex in Vesterålen.