



Metamorphism in southern West Greenland and South-West Greenland

John C. Schumacher (1), Nynke Keulen (2), Charlotte Stamper (1), Gemma Sherwood (1), and Vincent van Hinsberg (3)

(1) University of Bristol, Earth Sciences, Bristol, United Kingdom (j.c.schumacher@bristol.ac.uk), (2) Geological Survey of Denmark and Greenland, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark, (3) Department of Earth Sciences, University of Oxford, South Park Road, Oxford, UK

The exposed Archaean of southern West Greenland and South-West Greenland that lies south of Nuuk (about 64-61.5°N) is comprised of more than 12000 sq-km of metamorphosed TTG (tonalite, trondhjemite, granodiorite) gneisses, which are interlayered with and enclose mafic rocks (volcanic protoliths), suites of anorthosite plus gabbro, small ultramafic bodies, and units mapped as “metasediments.” The TTG gneisses are the most abundant rock type, but, locally in the northern part of the study area, anorthositic and associated rocks may also be extensive. However, mineral assemblages in TTG and anorthositic rocks are poor recorders of both P-T conditions and P-T evolution.

Mafic rocks are better for preserving peak metamorphic conditions, which are mostly amphibolite- to granulite-facies. Evidence for prevailing amphibolite-facies conditions is the presence of amphibolite ± clinopyroxene ± garnet ± epidote that displays the typical L to L-S fabric. In low-Ca amphibolites the equilibrium coexistence with hornblende + Fe-Mg amphibole + plagioclase is another indication of amphibolite-facies conditions. Granulite-facies conditions in mafic rock compositions show clinopyroxene + orthopyroxene with plagioclase ± hornblende at pressures below about 6-7 kbar over a range of temperatures starting at about 700°C. Above these pressures, amphibolites would contain clinopyroxene + garnet in the granulite facies, but this is not a diagnostic mineral assemblage, because clinopyroxene-garnet amphibolite is also stable in the upper amphibolite facies.

Granulite-facies rocks crop out in a large part of the area between about 64-63°N and, as presently understood, form a broad band trending north from the Fiskenaesset region then turning northeast. Peak P-T conditions appear to be lower granulite facies (< 800°C and < 8 kbar). Upper amphibolite-facies conditions (ca. 640-680°C and 7 kbar) are found northeast of the granulite-facies rocks (64-63°N). South of the granulite-facies area (south of about 63°N), amphibolite-facies conditions prevail, but seem to decrease from upper to middle/lower amphibolite-facies farther to the south. Estimates from Neria and Qasigialik fjords suggest a median set of conditions of about 650°C and 5 kbar, while about 25 km farther south a locality from Sermiligaarsuk fjord gives a median set of conditions of 600°C and 4 kbar.

Deriving P-T trajectories for this extensive metamorphic terrane has only just begun. Aluminous gneisses, which are among the rock types mapped as “metasediments” (mica schist and gneiss on newer maps), from three localities are the most useful rock type. Two localities in the northern part of the study area (Qilanngaarsuit island and east of Qarajat Iluat fjord) and one farther to the south (Ikkattup Nunaa) have been studied. All of these localities contain staurolite, which places their maximum T conditions within the amphibolite facies. At Qilanngaarsuit island and the area east of Qarajat Iluat fjord, maximum temperatures are 600-650°C at about 4-5 kbar, and reaction sequences involving cordierite formation suggest a roughly clockwise P-T trajectory. The locality at Ikkattup Nunaa gives lower peak temperature and slightly higher pressure estimates of about 480-580°C at P below 6-5 kbar. Textures involving the reaction of staurolite and garnet in several rocks also suggest a roughly clockwise P-T trajectory.

More regional P-T estimates are needed, but these data suggest that pressures of about 4-8 kbar across the whole terrane. The granulite-facies areas give the highest pressures, which indicates exposure of deeper crustal levels in the granulite-facies area.