



The metamorphic record of subduction-accretion processes in the Neoarchaeon: the Nuuk region, southern West Greenland.

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The Nuuk region of southern West Greenland exposes an exceptionally well preserved section through Archaean mid- to lower continental crust, and therefore provides a natural laboratory to study the tectonic processes in the Archaean. The area mainly consists of amphibolite to granulite facies TTG gneisses, narrow supracrustal belts, and minor late-tectonic granites. It is made up of several distinct terranes, including, from NW to SE, the Færingehavn, Tre Brødre, and Tasiusarsuaq terranes.

Extensive high-grade metamorphism and a clockwise PT evolution of the Færingehavn terrane in the Neoarchaeon (2.72-2.71 Ga) have been interpreted as a result of crustal thickening and thrusting of the Tasiusarsuaq terrane on top of the Tre Brødre and Færingehavn terranes (Nutman and Friend, 2007). Prior to final collision, the Tasiusarsuaq terrane (the upper plate in a plate tectonic model) underwent a prolonged period of compressive deformation between 2.8 and 2.72 Ga (Kolb et al., 2012). The structural evolution was associated with near-isobaric cooling from medium-pressure granulite facies conditions of ca. 850°C and 7.5 kbar to amphibolite facies conditions of ca. 700°C and 6.5-7 kbar (Dziggel et al., 2012). Despite this long period of crustal convergence, there is no evidence for exhumation and/or loading, pointing to a rheologically weak and unstable Archaean crust perhaps due to low density differences and ongoing melt extraction.

Rocks of the structurally underlying Færingehavn terrane record a distinctly different metamorphic evolution. Although generally more strongly retrogressed, relict higher-pressure mineral assemblages in mafic granulites and felsic gneisses record conditions of > 8-9 kbar and $\geq 750^\circ\text{C}$, indicating burial to depths of at least 30 km along an apparent geothermal gradient of 20-25°C/km. The peak of metamorphism was followed by isothermal decompression at ca. 2.715 Ga (Nutman and Friend, 2007), indicating rapid exhumation of lower crustal rocks during, or shortly after, the main accretionary event.

The existence of dual thermal regimes with contrasting PT paths, as well as the good correlation between the timing of collision, high-pressure metamorphism and rapid exhumation are all consistent with plate-tectonic processes operating in the Neoarchaeon. However, the crustal convergence in the Nuuk region was not associated with the extreme crustal thickening observed in many younger orogenic belts, and this likely reflects the generally higher mantle temperatures in the Neoarchaeon. The prolonged period of crustal convergence prior to final collision may further indicate that the convergence rates in the Archaean were rather low.

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