Evolution of an Archean large hot (collisional) orogen, SW Greenland.

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There is increasing evidence that the gradual emergence of plate tectonics on Earth occurred during the Meso- to Neoarchean, a time period that coincides with a major peak of crust formation and recycling in the geological record. In the Meso- to Neoarchean geology of SW Greenland, one-side subduction is indicated by paired metamorphism and regional-scale compressional deformation that resulted in the juxtaposition of several distinct terranes [1]. The evolution of the continental upper plate (Tasiusarsuaq terrane) involved a series of igneous and tectonic events between c. 2970 and 2700 Ma. Following early terrane accretion and migration of the plate interface at c. 2890-2870 Ma, further convergence was associated with substantial crustal thickening, resulting in high-pressure (≥ 9 kbar) granulite facies metamorphism at c. 2800 Ma [2]. Ongoing convergence and the arrival and underthrusting of Eoarchean continental crust (Færingehavn terrane) led to the melt-assisted emplacement of hot, deep-crustal granulite nappes in the hinterland of the orogen at c. 2760 to 2720 Ma [2]. Elevated geothermal gradients were maintained until final collision of the Færingehavn and Tasiusarsuaq terranes at c. 2720-2700 Ma, with pseudosection modelling and geophysical studies indicating a crustal thickness of ~ 60 km. These characteristics are similar to those of other post-Archean large hot orogens [3]. Collectively, our data therefore point to a relatively evolved plate tectonic regime that is characterized by continuous convergence rather than intermittent subduction, suggesting that Mesoarchean mantle temperatures were low enough for plate tectonics to readily operate.

[1] Dziggel *et al.* (2014) Prec Res **242**, 22-38. [2] Dziggel *et al.* (2017) Prec Res **300**, 223-245. [3] Beaumont *et al.* (2006). Geol Society Lond Spec Publ **268**, 91-145.