Pressure–temperature history of the >3 Ga Tartoq greenstone belt in SW Greenland: Evidence for an early style of subduction.

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The Tartoq greenstone belt of SW Greenland represents a well-preserved section through >3 Ga old oceanic crust and has the potential to provide important constraints on the composition and geodynamics of the Archaean crust. Based on a detailed structural examination, it has been proposed that the belt records an early style of horizontal convergent plate tectonics where elevated temperatures, compared to the modern-day, led to repeated aborted subduction and TTG type melt formation. This interpretation hinges on *P-T* constraints for the belt, for which only preliminary estimates are currently available.

Here, we present a detailed study of the *P-T* conditions and metamorphic histories for rocks from the Tartoq belt using pseudosection modelling and geothermobarometry. We show that peak conditions are predominantly amphibolite facies, but range from 450 to 800 °C at up to 7.5 kbar; reaching anatexis with formation of TTG-type partial melts in the Bikuben segment. Emplacement of the Tartoq segments into the host TTG gneisses took place at approximately 3 Ga at 450–500 °C and 4 kbar, and was followed by extensive hydrothermal retrogression related to shearzone-hosted gold mineralisation. Tourmaline thermometry and retrograde parageneses in mafic and ultramafic lithologies constrain this event to 380 ± 50 °C at a pressure below 1 kbar.

Our results indicate that the convergent tectonics recorded by the Tartoq belt took place at a *P–T* gradient markedly shallower than that of modern-day subduction, resulting in a hot, weak and buoyant slab unable to generate and transfer 'slab pull', nor sustain a single continuous downgoing slab. The Tartoq belt suggests that convergence was instead accomplished by under-stacking of slabs from repeated aborted subduction. The shallow *P–T* path combined with thermal relaxation following subduction stalling subsequently resulted in partial melting and formation of TTG melts.