

No record of horizontal tectonics in the North Atlantic craton until after ~2900 Ma

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When subduction emerged on earth is a highly contentious topic, with estimates ranging from ~3800 to 2500 Ma and possible onset occurring locally or episodically¹. Alternative mechanisms of generating crust, and specifically continental crust through crustal melting, during the Archean involve heat-pipe/vertical tectonic regimes²⁻⁴. Examining evidence for varying types of tectonic process on relatively local scales from individual cratons has the potential to illuminate the variety of tectonic processes operating throughout the Archean. In the central and northern North Atlantic craton (NAC) in West Greenland, the variety and timing of different tectonic regimes in operation during the Archean sheds light on the onset of horizontal tectonics, at least in this area. Recent Hf isotopic studies of zircon³ and estimates of peak metamorphism^{2,4} support vertical tectonic processes for the origin of prominent NAC gneiss terranes ranging in age from >3800 Ma to ~3000 Ma (the Itsaq gneiss complex and Akia terrane). In contrast, bimodal (supra- and sub-chondritic) bulk-rock ϵNd ⁵ and the geochronology of deformation events⁶ strongly support an origin by subduction and orogenesis for the 2870 to 2730 Ma Nagssugtoqidian gneisses. In addition, a separating tectonic mélangé between the Nagssugtoqidian region and the Akia terrane (Alangua complex⁷) in combination with widespread ~2700 Ma high-grade metamorphism across all regional crustal terranes implies tectonic aggregation, via lateral accretion, of unrelated terranes by ~2700 Ma. Our synthesis shows that the onset of horizontal tectonics as recorded in the NAC likely occurred post-2900 Ma.

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