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Paleoproterozoic Cordilleran-Type Tectonics in central West Greenland

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A new tectonic model is presented to explain the tectonostratigraphic evolution of the Paleoproterozoic Karrat Group in central West Greenland and the polyphase deformation, magmatism and metamorphism in the Rinkian orogen recorded in Paleoproterozoic rocks and Archaean complexes. The Karrat Group (from c. 71°00' to 73°00' N) formed in an intra-cratonic sag basin after c. 2000 Ma with basal quartzites of the Qaarsukassak and Marmorilik formations unconformably overlaying Archaean gneisses of the Rae Craton. From 1950 to 1900 Ma a carbonate platform represented by the Marmorilik Formation developed toward the south, while rift related alkaline volcanic rocks represented by the alkaline member of the Kangilleq Formation and syn-rift siliciclastic and volcanoclastic sediments of the Nûkavsak Formation were deposited to the north. The rifting was succeeded by a back-arc system, represented by the transitional member of the Kangilleq Formation. Concomitantly with development of the back-arc system, arc-related granitoids of the Prøven Intrusive Complex (PIC) intruded into and along the basal contact of the Karrat Group around 1900 Ma with major pulses at c. 1870 and c. 1850 Ma. The Karrat Group and the magmatic arc rocks underwent HT-metamorphism at c. 1830–1800 Ma during the collisional phase of the Rinkian orogen. The metamorphic grade increases from greenschist facies in the south, to granulite facies in the north, where the metamorphism is associated with migmatization and emplacement of the S-type Qinnua leucogranites. Extensive thrust emplacement and folding characterize the Rinkian orogen south of the PIC and the eastern boundary of the magmatic arc is reworked along a top to ESE shear zone post-dating the HT-metamorphism. The ESE-ward emplacement of allochthonous thrust sheets during an early stage of thin-skinned tectonics is followed by NE-ward emplacement of basement nappes and finally by a NW-SE compression stage resulting in tectonic inversion of basin normal faults. The back-arc extension and Cordilleran-type magmatism were driven by eastward subduction of oceanic crust during the Trans-Hudson Orogeny resulting from the convergence of the Superior, Meta Incognita and Rae Archean cratons between 1870–1800 Ma. The Karrat Group north of the PIC together with the time-correlative Piling Group of Baffin Island (Canada) probably represented the passive margin succession of the Rae craton that evolved into a forearc setting during the Trans-Hudson Orogeny. The Rinkian orogen is an example of Cordilleran-type tectonics resulting from the deformation of the Rae continental margin intruded by magmatic arc granites during subduction, followed by HT-metamorphism in the upper plate and the structuring of a back-arc fold and thrust system antithetic to the subducting plate.

