How 800 Million Years of Tectonics in the Southern Rae Craton Controlled the Distant-hinterland Expression of 1.8 Ga Trans-Hudson Orogenesis

By: Dr. Eric Thiessen (Laurentian University)

Abstract:

This study investigates the tectonic, structural and metamorphic history of a poorly examined region in the southwest Rae craton of the Canadian Shield in Northwest Territories. At least five orogenic events over 800-million-years have affected the Rae, which has resulted in a complex crustal architecture that preserves seemingly disparate geologic histories in a variety of structurally bound domains. By combining new bedrock mapping, structural and metamorphic analysis as well as U-Pb geochronology, the two principal objectives for this work are: i) to characterize the kinematics, age relationships and tectonic roles of three poorly studied 100 to 500 km-long high-strain zones, at the western limit of the southern Rae craton, and ii) to better characterize the regional poly-cyclic metamorphic histories of crustal domains in order to understand their evolution with respect to the history of the high-strain zones and ultimately their control on the current crustal architecture.

Our results are combined with existing data to propose a model for the tectonic evolution of the southern Rae craton over an 800-million-year timeframe. Highlights from our new data from the southwest Rae include: 1) Archean basement preserves low-pressure, high-temperature metamorphism at ca. 2.6 Ga, which agrees with models for convergence and high-pressure metamorphism at 2.55–2.53 Ga 250 km away along the eastern Rae craton margin; 2) metamorphism at ca. 2.36 Ga is recorded within a <2.56 Ga metasedimentary unit, however, the area west of our study area may preserve a correlative orogenic lid, which adds to the complexity of the expression of that event; 3) a shear-zone hosted pelite deposited between 2.04 and 1.85 Ga records a period of extension and orogenic quiescence, and 4) the high-strain zones examined preserve a dominantly right-lateral strike-slip deformation history at 1.82 Ga, which may relate to tectonic escape structures that coincide with terminal Trans-Hudson collision. Our analysis and discussion of the new and previous data constrains a tectonic model that reconciles the exhumation levels of multiple orogenies in the southern Rae that best explains the modern-day complex crustal architecture.

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Dr. Eric Thiessen
Laurentian University
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