Before the Manikewan Ocean: Bridging the Superior, Hearne and Sask cratons in Manitoba

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Arguably the oldest well documented example of a classic Wilson cycle in Earth history lead to formation of the Paleoproterozoic supercraton Laurentia in North America. In northern Manitoba, the Manikewan ocean basin records the break-up of Neoarchean landmasses of 'Kenorland' between 2.2 and 2.1 Ga , and was later consumed by subduction. The Trans-Hudson Orogen preserved evidence of ca.1.89 Ga arc magmatism and ca.1.85-1.80 Ga arc- and continent-continent collisions associated with basin closure.

The focus here is on the Archean building blocks that formed the cratonic foundation of Manitoba prior to Laurentia. Integrated geological mapping of Archean terranes over the past decade has significantly advanced our knowledge of the Superior, Hearne, and Sask cratonic fragments in Manitoba. Detailed comparison of the nature and tectono-metamorphic history of the Archean basement and the lithostratigraphy of the associated cover sequences are being used to test if and when the different cratons were connected, had a shared history, or evolved independently.

The Manitoba portions of the Superior, Hearne, and Sask cratons preserve ancient(>3.0 Ga) crust, the record of which, however, tends to be cryptic and insufficient for robust comparisons. The records of Neoarchean magmatism and tectono-metamorphism, in contrast, are more detailed and reveal significant differences. In the northwest Superior Province, main periods of magmatism are ca.2.75-2.71 Ga followed by pulses of high-grade metamorphism and subprovince accretion from ca.2.71 to 2.64 Ga. The southeast Hearne craton, in comparison, is characterized by ca.2.70 and ca.2.58 Ga main periods of magmatism, followed by ca.2.57–2.55 Ga high-grade metamorphism. Furthermore, main tectono-metamorphism in the Sask craton appears to be ca. 2.45 Ga. Hence, the three Archean cratons in Manitoba show no evidence of a direct connection during the Neoarchean, which is also supported by the distinct ages of their contained mafic dike swarms.

Of major interest is the comparison of the cover sequences of the Archean Hearne, Superior, and potentially Sask cratons in Manitoba. Although detailed lithostratigraphies have been compiled for the Hurwitz and Wollaston groups of the southeast Hearne craton and for the Ospwagan Group of the northwest Superior craton, ages of sediment deposition remain poorly constrained, yet are key to their potential relationship. Consequently, it is still unresolved whether these ca. 2.45–1.90 Ga cover sequences formed contemporaneously and in a similar or related tectonic setting over hundreds of kilometres in Manitoba. Their common stratigraphic successions of quartzite, arkose, calc-silicate, psammite, semipelite and pelite (from base to top) reflect deposition as a passive-margin sequence along the rifted Superior craton and within basins along and inboard from the Hearne craton margin. Locally abundant 2.3-2.45 Ga detrital zircons in some sedimentary samples from the southeast Hearne craton lack a presently known continental source. Based on the presence of similar-age crust in the South Indian and Peter Lake domains of the northern Trans-Hudson Orogen, the 2.3-2.45 Ga detritus could be the link to a previously unknown cover sequence of the Sask craton.