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Characterising the southern part of the Hearne Province: a forgotten part of Canada's Shield revisited

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Abstract

The Hearne craton comprises the southeastern part of the western Churchill craton. The central part of the craton has been well studied in Nunavut and northeastern Saskatchewan in comparison with the southern part of the craton, which is mainly exposed south of the Athabasca Basin in Saskatchewan. Mapping and analytical results indicate that the southern Hearne craton is dominated by a felsic orthogneiss complex derived mainly from tonalites with crystallisation ages in the range 2.81 to 2.78 Ga and ca. 2.73 Ga. Sm-Nd isotopic analysis suggests that these evolved plutons (mean $\epsilon_{Nd} = -3.3$) were derived from a Mesoarchean to Paleoproterozoic source. Other components of the orthogneisses include leucotonalite intrusions dated at ca. 2.664 Ga and regionally extensive K-feldspar phyric granites emplaced between 2.63 and 2.60 Ga. Both of these suites have Sm-Nd isotopic signatures similar to the older tonalites. A suite of granodiorite and quartz diorite, one of which yielded a crystallisation age of 2.654 Ga, has unique Sm-Nd isotopic results with ϵ_{Nd} values near CHUR. The felsic orthogneiss complex is unconformably overlain by the Black Birch Lake assemblage, which contains dominantly orthoquartzites, mafic volcanic rocks and pelites. Detrital zircon signatures in the orthoquartzites are dominated by Archean sources and indicate that the supracrustal rocks were deposited after 2.60 Ga.

The central Hearne Province extends into northeastern corner of Saskatchewan. It contains oceanic mafic volcanic rocks of the Ennadai Group that were intruded by juvenile tonalites at 2.71 to 2.70 Ga. The age and isotopic character of these tonalites contrasts markedly with those in the felsic orthogneiss complex of the southern Hearne Province. A comparison of plutonic suites and supracrustal assemblages of the central and southern Hearne Provinces suggests that there is heterogeneity between the two entities. Analysis of geophysical data, coupled with existing geological maps, suggest that an important tectonic boundary separates them. The current age relationships in the central and southern parts of the Hearne province imply that the two were juxtaposed after 2.60 Ga; however, the time of suturing remains equivocal.

Keywords

southern Hearne; felsic orthogneiss complex; Black Birch Lake assemblage; U-Pb geochronology; Sm-Nd isotopes; central Hearne

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