

Geochronology of the south-central Paleoproterozoic Wopmay Orogen, northwestern Canadian Shield

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Summary

South-central Wopmay Orogen, between 64°N and 65°N latitude, is the focus of a bedrock mapping project by the Northwest Territories Geoscience Office in collaboration with the Geological Survey of Canada and university partners. As part of the mapping, geochronological investigations provide new U-Pb zircon crystallization ages and detrital zircon data that further constrain the timing of major events during the evolution of Wopmay Orogen.

From east to west, the main elements of Wopmay Orogen are: 1) Archean basement of the Slave craton; 2) Coronation margin, consisting of a ca. 1900 Ma Paleoproterozoic sedimentary (\pm volcanic) cover overlying Slave basement and a metamorphic internal zone, defined by a thrust sequence of cover and plutonic rocks; 3) the north-striking Wopmay fault zone; 4) the Great Bear magmatic zone (GBMZ), represented by ca. 1875-1865 Ma arc-like volcanic rocks and extensive ca. 1865-1855 post-orogenic intrusions; and 5) the Hottah Terrane, a crustal block composed of ca. 2400-2200 Ma components upon which a ca. 2000-1900 Ma volcanic arc and the GBMZ were constructed.

Surface exposures of reworked Archean rocks of the Slave craton are restricted to the Coronation margin and consist of medium- to high-grade metasedimentary migmatites and two-mica granite with Neoproterozoic crystallization ages (ca. 2620 to 2580 Ma). The extent of Archean rocks in this region is significantly greater than depicted in the literature. Paleoproterozoic strata of the Coronation margin consist of basal clastic sedimentary rocks (siltstone with less abundant quartz arenite and conglomerate) and upper carbonates. Historically, the platformal strata adjacent to Slave craton have been referred to as the (autochthonous) Snare Group and those within the metamorphic internal zone have been referred to as the (allochthonous) Akaitcho Group (or alternatively the Grant Group or sub-Group). However, in the Grant Lake area, we recognize an unconformity between sedimentary rocks currently assigned to the Akaitcho Group

and highly deformed granitoids. Forthcoming U-Pb zircon analyses are aimed at determining whether the underlying basement rocks are Archean and characterizing the sedimentary cover. U-Pb detrital zircon data has been collected from quartz arenites across the Coronation margin. The detrital source for the Snare Group was the Slave craton, and in fact all major tectonic assemblages of the Slave craton are represented in the Snare Group detritus. The Akaitcho Group “equivalents” have a mixed source that contains both Archean and Paleoproterozoic detritus; the latter correlates well with historical data on ages for the Hottah Terrane, but the data as a whole challenge the presumption that the Akaitcho Group is allochthonous. In the GBMZ, to the west of Wopmay fault zone, the Treasure Lake Group is a sequence of clastic sedimentary rocks and interbedded carbonate that has been interpreted as a platformal sequence (much like the Snare Group). Detrital zircon results indicate a maximum deposition age of ca. 1884 Ma with detritus including ca. 2490 to 2035 Ma sources, but in contrast to previously published data there is a significant Archean component ranging from ca. 3120 to 2590 Ma.

Volcanic and sub-volcanic phases of the GBMZ include a ca. 1869-1860 Ma calc-alkaline suite that is correlative with the Faber Group, a ca. 1872 Ma deformed and pervasively sodically-altered suite, and the ca. 1875 Ma (Hildebrand et al., 1987) Dumas Group (previously the Dumas Group was considered one of the youngest phases in the magmatic zone). U-Pb zircon crystallization ages indicate that late- to post-orogenic magmatism on both sides of Wopmay fault zone was broadly coeval; the main plutonic phases were emplaced between ca. 1868 - 1862 Ma and between ca. 1860 - 1855 Ma; the latter event includes a post-orogenic rapakivi suite. A ca. 1875 Ma zircon age obtained from a pre-to syn-deformational granite dyke associated with the Treasure Lake Group is the oldest age from a plutonic phase in the GBMZ. A Re-Os molybdenite age of ca. 1873 Ma links Cu-Mo-U mineralization with this early phase of plutonism.

U-Pb zircon studies are also aimed at quantifying the timing of Calderian deformation and its relationship with Hottah Terrane collision. To this end, age data is pending from a granite sill that pre-dates main phase (F_2 ?) folding and for a sample of the Rodrigues pluton, which intrudes high-grade Snare Group metasedimentary rocks. This pluton has been previously interpreted as part of the syn-orogenic ca. 1880 Ma Hepburn intrusive suite, but field evidence suggests it represents younger magmatism.

The presented data further constrain and corroborate the timing of major events in Wopmay orogen. The widespread occurrence of Archean detritus in clastic sedimentary rocks preserved within both the Coronation margin and the GBMZ questions whether the Akaitcho and Snare groups are equivalent (should the stratigraphy be revised?) and requires that tectonic models incorporate an Archean terrain during deposition of the Treasure Lake Group at ca. 1884 Ma.

References

Hildebrand, R.S., Bowring, S.A., Andrew, K.P.E., Gibbins, S.E., and Squires, G.C., 1987, Geological investigations in Calder River map area, central Wopmay orogen, District of Mackenzie: *in* Current Research, Part A; Geological Survey of Canada, Paper 87-1A, p. 699-711.