Notigi–Tullibee lakes aeromagnetic map: residual total field with shaded relief

Compiled by L.A. Murphy and H.V. Zwanzig (2019)

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Abstract

This set of geoscientific maps (MAP2019-1 to MAP2019-6) presents newly compiled results and interpretations of geological investigations on the northern and eastern parts of the Kisseynew domain (KD), in the internal zone of the Trans-Hudson orogen (THO) in Manitoba. Fieldwork by the Manitoba Geological Survey (MGS) was part of the Targeted Geoscience Initiative, Phase 3 (TGI-3) from 2006 to 2009, a national collaborative geoscience program led by the Geological Survey of Canada (GSC). The work combined outcrop examination, petrology, geochemistry, Nd-isotope work and zircon geochronology of the Paleoproterozoic and Archean high-grade metasedimentary and meta-igneous rocks. New structural analysis is shown in detail for the Notigi Lake area (MAP2019-2; Murphy and Zwanzig, 2007) and in simplified form for the Wuskwatim Lake area (MAP2019-5). The maps of economic and structural key areas from Granville Lake southeast to Wuskwatim Lake include much of the data of previously published maps (Baldwin et al., 1979). They also include the reconnaissance work by the GSC (e.g. Percival et al., 2006). Areas of heavy overburden rely on recent intermediate-level aeromagnetic maps (Coyle and Kiss, 2006; Kiss and Coyle, 2008).

Unit descriptions, tectonostratigraphy, structural analysis, geochemistry, geochronology, tectonics and economic geology will be covered in an upcoming publication (Geology of the Wuskwatim–Granville lakes corridor, Kisseynew domain, Manitoba (NTS 63O15 and 64B3) by L.A. Murphy and H.V. Zwanzig, work in progress). The main findings in these Paleoproterozoic rocks have included Archean basement gneiss (units Ag, Ai) at Wuskwatim Lake (MAP2019-5) with an unconformably overlying cover, the Wuskwatim Lake sequence (unit W). Unit W quartzite, pelite and sulphide iron formation resemble the Paleoproterozoic cover (Ospwagan group) of the Superior craton margin in the Thompson nickel belt (TNB), but the sequence and its basement in the KD may be more exotic.

Findings have also included confirmation of a suture zone (~1.9–1.87 Ga Granville complex, unit G) between the 1.89–1.83 Ga volcanic-arc meta-granitoid rocks of the tectonostratigraphic Leaf Rapids domain (LRD) in the north, and the 1.85–1.84 Ga amphibolite- to migmatite-grade deep-marine turbidites (Burntwood group, unit B) of the Kisseynew domain (KD) north flank. The older units are unconformably overlain by the 1.84–1.83 Ga Sickle group (K), but unit B is conformably/disconformably overlain by K, which is a partly coeval terrestrial and shallow-water facies of B. These units occur in an overturned thrust stack that is interpreted to include the "Burntwood megathrust" at the sole of the unit G back-arc metabasalt and gabbro (Gt, Gg), interlayered ocean-island mafic–ultramafic rocks (Gu), and thin, capping, cherty to iron-sulphide-rich and clastic metasedimentary rocks (Gs). Younger marine metasedimentary rocks with ~1.87 Ga felsic tuff/reworked tuff are mapped as Gsa to Gsd and tentatively interpreted as fore-arc deposits to the LRD. Thus the Granville complex is interpreted as a >1.83 Ga accretionary subduction complex in which Gt, Gu, Gg represent a partial supra-subduction ophiolite.

Structural analysis and Canada-wide correlations indicate a history of multi-phase deformation during repeated collision tectonics (orogenies). This history is traced for 130 m.y. from the development of the LRD volcanic-arc terrane, its back-arc ocean floor (Gt, Gu, Gg) and probable fore-arc deposits (part of Gs) through three or four major stages of deformation, each marked by a change in the direction of tectonic transport. The end result is a complexly interleaved zone, up to 60 km wide continuing for more than 300 km across northwestern Manitoba. The Northeast-Kisseynew subdomain (NE-KSD) with underlying or interleaved Archean gneiss and cover (W) extends from the TNB to an area 120 km to the northwest and for an equal distance southwest along the TNB. Its width is uncertain. These rocks (Ag, Ai, W) are exposed under the widespread, mainly juvenile, volcanic-arc–sourced Burntwood group (B) in local structural culminations, as windows through the upper thrust sheet and large recumbent folds (nappes). A suite of potassic alkaline–calcalkaline granitoid plutons (qm) that intruded Ag and W carry a strong Archean Nd-isotope signature. These well exposed bodies delineate the hidden extent of Archean basement gneiss and its cover under the younger nappes. North and northwest of the NE-KSD, similar culminations occur at the intersection of advanced, peak-metamorphic (~1.81 Ga), southwest-verging recumbent antiforms (F_{2b}) and large post-peak (~1.77 Ga), northeast-trending, upright F_3 antiforms. Units Gtb tectonite, B and K in lower recumbent folds indicate that the Granville suture zone is multiply folded as part of crustal-scale interleaving. Notigi Lake is the site of such culminations (MAP2019-3). Granulite grade was reached in the deepest layers, and nearly vein-free rock occurs in some structural basins of B and in the nearly inverted lower limb of a large northerly verging nappe (F_{2b}) at Granville Lake. These form the roof of the KD migmatite complex and include some plutons of S-type leucogranitoids and pegmatite melts that migrated up from below.

An economic nickel potential for the area lies in possible ultramafic intrusions into sulphide-facies iron formation, Wi(su), as is the case in the TNB. A known gold potential, with a showing adjacent to capping iron formation and widespread sulphide showings along a sliver of the Granville complex (Gt, Gg), lies south of Granville Lake. A similar type of showing occurs at the southwest end of the Lynn Lake belt (part of the LRD). The main belt of G features strongly altered mafic–ultramafic rocks with high arsenic contents. The arsenic anomaly and trace gold occur in tills south across the KD (Kaszycki et al., 1988). Possibilities that are more speculative based on tectonic origins and deposits in adjoining areas include gold in shear zones in the LRD plutons, rare metal deposits in late plutons and sedimentary copper in the Sickle Group (Baldwin, 1980). An interesting diamond potential is associated with Archean mantle underlying the basement gneiss and unit qm, the latter being almost certainly sourced from such mantle (Whalen et al., 2008).

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