Natural Resources Canada / Ressources naturelles Canada

DESCRIPTIVE NOTES

INTRODUCTION

This Half Way Hills and Whitehills Lake map is one of a group of new A-series bedrock geology maps arising from the Woodburn project, under the auspices of the Western Churchill NATMAP program. Fieldwork from 1996–2000 addressed the stratigraphic relationships, age, tectonic setting, and deformation history of supracrustal and plutonic rocks in the Churchill Province north of Baker Lake, Nunavut (Fig. 1). The geology of the Half Way Hills and Whitehills Lake map is based primarily on mapping carried out during 1997, 1999 and 2000, supplemented in the western half of the area by field observations by F.C. Taylor and I.R. Annesley in 1980, and J.R. Henderson, M.N. Henderson and L. Pryer in 1989 (Taylor, 1985; Henderson and Henderson, 1994). This new A-series map supersedes previously published preliminary Open File maps (Zaleski et al., 2001b) and Current Research papers (Zaleski et al., 2000) on the area.

Supracrustal rocks in the map area have been previously assigned to the 'Woodburn Lake group' and 'Ketyet River group'. In past usage, the two groups run into each other with no clear distinction between their constituent lithological assemblages. The informal name 'Woodburn Lake group' was originally used in 1978 for Archean volcanic rocks, including ultramafic flows, and associated sedimentary rocks north of Tehek Lake and near the Meadowbank River (Amer Lake NTS 66 H/1, Ashton, 1988) (Fig. 2). Schau (1983) applied the informal name 'Ketyet River group' to supracrustal rocks, interpreted as Archean, east of Tehek and Whitehills lakes. In the Half Way Hills area, contiguous with the western margin of Schau's map, Taylor (1985) considered all the supracrustal rocks to be Archean and likely correlative with the 'Woodburn Lake group'. Henderson and Henderson (1994) referred to supracrustal rocks from north of Tehek Lake to Whitehills Lake (Fig. 2) as 'Woodburn Lake group'. New mapping and geochronology conducted during the Woodburn project show that the Ketyet River group and the Half Way Hills area include both Archean and Proterozoic supracrustal rocks (Zaleski et al., 2001b; Davis and Zaleski, unpublished data). Archean supracrustal rocks from the Meadowbank River to Whitehills Lake can be interpreted as a stratigraphic succession to which we apply the name Woodburn group.

The Woodburn group as defined here comprises a lower volcanic succession, the Meadowbank formation, overlain by an upper succession of dominantly sedimentary rocks subdivided into the Amarulik formation and the Ukalik formation (Table 1). The Meadowbank formation is further subdivided into four assemblages comprising three dated volcanic cycles (Davis and Zaleski, 1998; unpublished data): 1) the 2.735 Ga Sanningajukuluk assemblage, 2) the 2.72 Ga Nutiplilik assemblage, 3) the Quqqiilik assemblage of unknown age, and 4) the 2.71 Ga Apuqti'naaqtuq

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and subarkose (unit APwqm) are locally present within the quartzite and around its periphery and, in some cases, adjacent to contacts with volcanic rocks. Oligomictic conglomerate is exposed along the contact with volcanic rocks in the hinge region of the F_2 synform west of Whitehills Lake (64°33' N, 96°18.5' W). The conglomerate fines from boulder-cobble conglomerate to pebbly sandstone toward the volcanic rocks. Fine-grained quartzite is typically massive to strongly cleaved, but schistose micaceous interbeds can be recognized locally. Metamorphic kyanite or sillimanite, and fuchsite are rare. Younging directions were determined based on locally preserved crossbedding and wave ripple marks.

Mafic to intermediate volcanic rocks (unit APwmi) of the Whitehills belt are at least in part interbedded with quartzite, locally with 'dirty' feldspathic quartzite or conglomeratic units along the contact. The volcanic rocks are remarkably homogeneous and massive, characterized by sparse to abundant plagioclase megacrysts in an ophitic to subophitic matrix. The megacrysts distinguish the volcanic rocks from those of the Sanningajukuluk assemblage, especially southeast of Sanningajukuluk where both volcanic suites occur together. The distinction is supported by geochemical analyses, which indicate a calc-alkaline signature for Whitehills rocks, in contrast to komatiitic and tholeiitic signatures for Sanningajukuluk rocks (Kerswill et al., 1999). Near the northern margin of the Whitehills belt, plagioclase megacrystic volcanic rocks are interlayered with quartzite. In one location (64°39.95' N, 96°8.63' W), dark quartzite in contact with volcanic rocks apparently contains detritus derived from the local volcanic substrate. North of Qaamiutaq and southeast of Sanningajukuluk, discontinuous volcanic rocks are apparently linked by a recessively weathering unit of subarkose or feldspathic quartzite, suggesting possible facies transitions.

In the higher grade domain east of Whitehills Lake, fine-grained homogeneous amphibolite and associated quartzite were interpreted as being equivalent to volcanic rocks and quartzite of the Whitehills belt. Black sulphidic pelite (unit APwpt) and minor associated paragneiss (unit APwpa) are tentatively included with the Whitehills belt, an interpretation supported by the presence of sulphidic pelite associated with quartzite and volcanic rocks on the southwestern and southern shores of Whitehills Lake. East of Whitehills Lake, quartzite to the south of sulphidic pelite contains numerous silicate-sulphide iron-formations (unit APwif) and gossans, atypical of the main Whitehills belt. Isolated zones of quartzite, pelite and paragneiss interleaved with tonalite (units Atng, Atnq) and granite (unit Agt) in the tectonized domain south of Whitehills Lake are tentatively considered to belong to the Whitehills belt.

Tasirjuaq conglomerate

Tasirjuak conglomerate as defined here comprises polymictic conglomerate (unit PTcg) and interbedded slate (unit PTsl) and wacke (unit PTwk) in discontinuous exposures in three narrow zones, localized along D_2 structures. Tasirjuaq conglomerate is present along the faulted contacts of the Sanningajukuluk assemblage with Amarulik wacke to the

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West of Kinngaaquk Tasia, kyanite in Whitehills quartzite is interpreted as being derived from pyrophyllite decomposition, constraining temperatures to ca. 400°–500°C and pressures to ca. 2.7–3.6 kb (Spear, 1993 and references therein). A greenschist- to amphibolite-facies transition is defined by the change from kyanite and chloritoid in quartzite, to sillimanite- and staurolite-bearing parageneses in metasedimentary rocks to the east, suggesting temperatures in excess of ca. 550°C. Parageneses in metabasites change from greenschist-facies to hornblende-clinopyroxene-plagioclase consistent with amphibolite-facies. Polyphase metamorphism and structural telescoping may have played a role in the distribution of parageneses. For example, two instances of isolated high-grade parageneses (garnet-clinopyroxene in metabasite, and K-feldspar-sillimanite in paragneiss) have been noted near the greenschist-amphibolite transition. The position of the southern extension of the transition is poorly constrained, but biotite-aluminosilicate parageneses continue east of Whitehills Lake. At the southeastern end of Kinngaaquk Tasia, relict andalusite porphyroblasts are overgrown by sillimanite and a transition from andalusite-biotite to sillimanite-biotite-bearing parageneses can be traced to the southeast in pelitic rocks. If the aluminosilicate-bearing pelitic parageneses represent a prograde sequence, then they also suggest relatively low-pressure metamorphic conditions (< 3–4 kb).

In low-grade rocks, micas and chlorite define S_1 schistosity and S_2 foliation or crenulation cleavage, and are kinked and crenulated by F_3 and F_4 microfolds. In medium- to high-grade rocks east of Whitehills Lake, amphibole porphyroblasts in metabasite define a strong lineation and S_2 mineral schistosity. In pelitic rocks with two aluminosilicate minerals, relict andalusite porphyroblasts are overgrown by sillimanite knots that define the dominant schistosity. Sillimanite is crenulated by F_3 and F_4 microfolds and overgrown by coarse, randomly oriented or weakly kinked biotite and muscovite plates. This suggests that the main regional metamorphism is broadly syn-D_2 and, hence, bracketed to < 2.0 Ga by the syntectonic Tasirjuak conglomerate, which contains D_2 fabrics, and > 1.835 Ga based on the age of Hudson granite dykes that cut fabrics in the Amarulik wacke to the north (Roddick et al., 1992). Medium-to high-grade rocks involved in F_3 and F_4 folds east of Whitehills Lake are extensively intruded by massive granite (unit PHgt), considered to be correlative to the Hudson granite dykes. Although the granite east of Whitehills Lake has not been dated, this correlation implies that the minimum age bracket of 1.835 Ga for D_2 deformation may also apply to D_3 and D_4 deformation. Numerous massive lamprophyre intrusions (unit PMlm) apparently cut across D_3 and D_4 structures, for example in the hinge region of the F_4 fold through Whitehills Lake. This relationship supports a minimum age bracket of 1.81 Ga for D_3 and D_4 deformation, based on the age of a syenite intrusion that cuts ultrapotassic rocks of the lower Baker Lake Group (Rainbird et al., 2002).

ECONOMIC GEOLOGY

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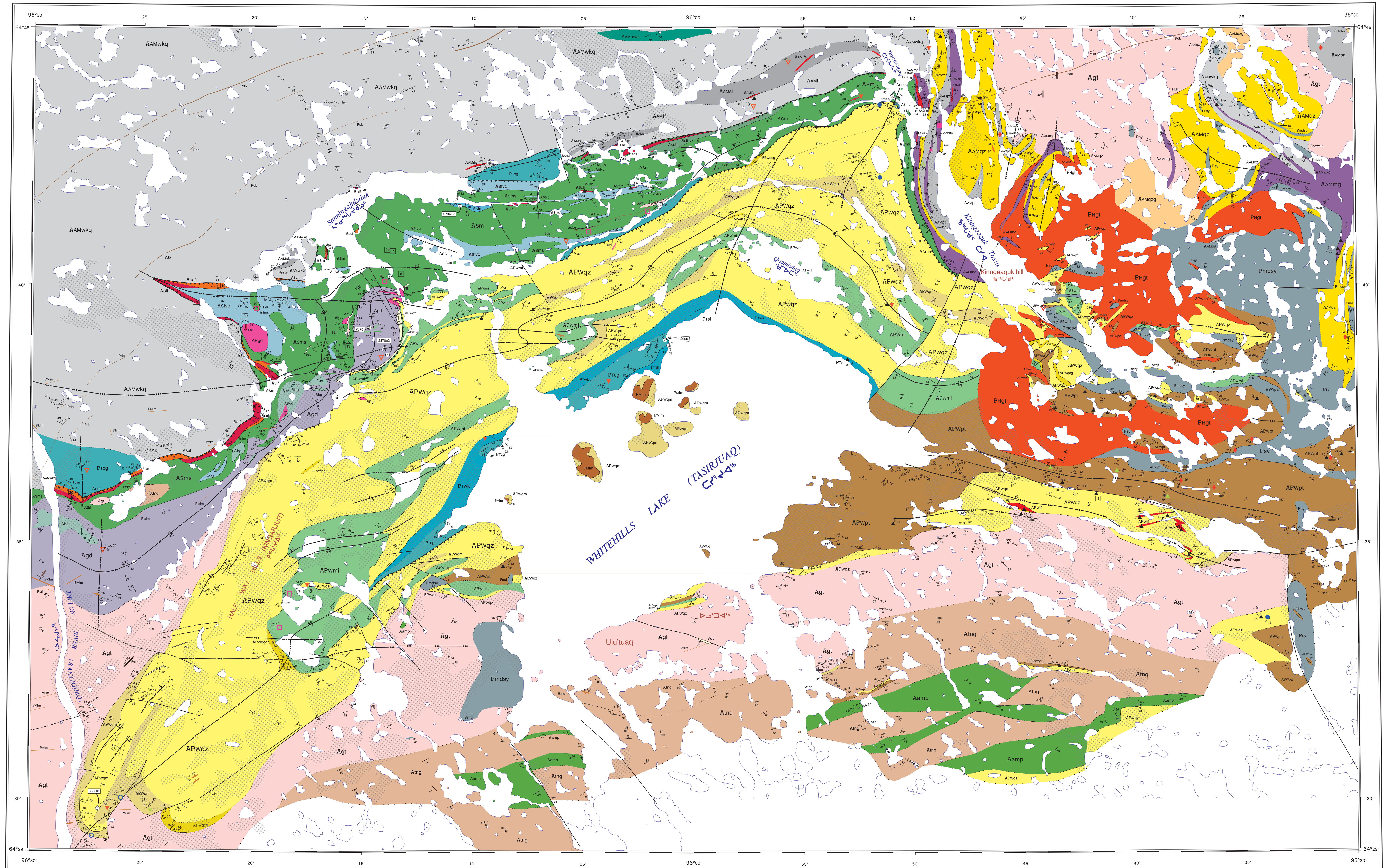

Authors: E. Zaleski and S. Pehrsson

Geology by I. Annesley (1980), N. Duke (1999), E. Greiner (1999–2000), J.R. Henderson (1989), M.N. Henderson (1989), R. L'Heureux (1999), S. Pehrsson (1999), L. Pryer (1989), F.C. Taylor (1980), L. Wilkinson (1997), E. Zaleski (1997–2000)

Digital geological compilation by E. Zaleski (1999–2002)

Co-ordinated through the auspices of the Western Churchill NATMAP Project

Digital cartography by J.D. Narraway, Earth Sciences Sector Information Division (ESS Info)

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

MAP 2069A

GEOLOGY

HALF WAY HILLS AND WHITEHILLS LAKE AREA

NUNAVUT

Scale 1:50 000/Échelle 1/50 000

kilometres 1 0 1 2 3 4 kilomètres

Universal Transverse Mercator Projection
North American Datum 1927

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1927

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