Introduction The Whitehills-Tehek Lakes area is located in the District of Keewatin north of Baker Lake. The area was chosen for study in order to provide a geological map of an area partially mapped by several previous geological surveys (see below), and to establish the regional distribution of iron formation that hosts gold mineralization in the Third Portage Lake area (Barham & Mudry, 1990). Recent high resolution aeromagnetic total field and vertical magnetic gradient maps (Energy Mines and Resources Canada, 1990a, b, c, d) were useful to correlate iron formations and other magnetic lithologies. The map area comprises portions of four adjoining National Topographic System (NTS) 1:250 000 scale maps: 56D (Baker Lake), 66A (Schultz Lake), 66H (Amer Lake), and 56E (Woodburn Lake).

Location and Access The south margin of the Whitehills-Tehek map area is 25 km north of Baker Lake village, which is served by regularly scheduled aircraft from Rankin Inlet. Baker Lake is accessible by ship from Hudson Bay and Chesterfield Inlet. The Thelon River, which empties into Baker Lake, provides shallow-draft boat access to the southwestern corner of the map area. Many lakes in the region are large enough for ice and water landings by fixed-wing aircraft, but there are very few natural sand and gravel air strips suitable for landling with wheeled aircraft.

Previous Work The Whitehills-Tehek area comprises part of the central Keewatin region mapped in the 1950's by Wright (1955, 1967). Geological mapping at 1:250 000 scale in the western part of the Whitehills-Tehek area was done by Donaldson (1966, Schultz Lake, NTS 66A), in the northwest by Tella and Heywood (1983, Amer Lake, NTS 66H), in the northeast by Fraser (1988, Woodburn Lake, NTS 56E), and in the east by Schau (1983, NTS 56D). Previous geological mapping at 1:50 000 scale that overlaps wholly or in part with the present map was done by Taylor (1985, NTS 66A/9), and Ashton (1988, NTS 66H/1). In addition, Nadeau (1981) mapped NTS 56D/12.

General Geology Whitehills-Tehek area is located within a region composed mainly of deformed Archean supracrustal rocks of the Woodburn Lake group (Ashton 1981, 1982, 1988; Fraser, 1988) that have been metamorphosed to middle greenschist facies, and are intruded by Late Archean granitic batholiths. U-Pb geochronology on zircon indicates that dacitic metavolcanic rocks occurring near the structural base of the Woodburn Lake group erupted at 2787±9 Ma (Roddick et al. 1992). Near Amer Lake, 20 km northwest of the map area, (Tella 1984) obtained a 2801±20 Ma U-Pb Mariette Henderson, Lynn Pryer and Richard Cresswell shared responsibility in the mapping. We gratefully zircon age from dacite porphyry. Supracrustal rocks of similar age and lithology assigned to the Prince Albert Group (Heywood, 1967) can be traced discontinuously 800 km northeast of the Whitehills-Tehek area (Fig. 1; Schau, 1982; Jefferson and Schau, 1992). Probably correlative rocks assigned to the Mary River Group (Jackson and Taylor, 1972)

occur in northern Baffin Island. Rocks older than the Woodburn Lake group have not been identified in this study. Late Archean (Kenoran) granitic batholiths intruding the supracrustal rocks have been dated by the U-Pb method on zircon at 2621±2 Ma (Ashton, 1988) and 2612±4 Ma (Roddick et al., 1992). Regional metamorphism, folding and foliation-forming events occurred prior to intrusion of the 2612 Ma granite, which is not foliated. A discordant titanite ²⁰⁷ Pb-²⁰⁶ Pb age of 2739±3 Ma (Roddick et al., 1992) from metadacite is considered to be a maximum age for biotite-grade regional metamorphism. A concordant ²⁰⁷ Pb-²⁰⁶ Pb monazite age of 1835±1 Ma (Roddick et al., 1992) from an undeformed three-metre-wide granite dyke cutting Woodburn Lake group metagreywacke indicates the time of crystallization of the dyke. This age is similar to 1.83-1.81Ga ages of abundant late-kinematic Hudsonian granites (LeCheminant et al., 1987) intruding multiply-deformed sillimanite grade (upper amphibolite facies) early Proterozoic Penrhyn Group rocks north of Wager Shear Zone, and is distinctly older than ca. 1.76-1.74 Ga magmatic activity mentioned by LeCheminant (1992) associated with formation of the Thelon and Baker Lake basins south and west of the Whitehills-Tehek area.

Stratigraphy of Woodburn Lake group

Stratigraphic succession in the Woodburn Lake group is uncertain because few younging indicators were found, few bedding measurements were obtained, formations are discontinuous, and a consistent sequence of lithologic formations was not observed. Taylor (1985) considered the structural sequence in the Half Way Hills area to comprise a lower polymictic conglomerate, overlain by slate, metagreywacke, a thin complex horizon of iron formationkomatiite-slate- dolomite, greenstone, quartzite, and greenstone. Fraser (1988) concluded that in the Woodburn Lake area, the Woodburn Lake group comprises a conformable succession consisting of a lower sequence of metavolcanic rocks, and an upper sequence of shallow-water-platform type metasedimentary rocks. A similar stratigraphy for the Woodburn Lake group was proposed by Ashton (1988), but with an inferred unconformity between the metavolcanic-dominated lower sequence and the quartzite-dominated upper sequence. In the Whitehills-Tehek area, structural superposition in the Woodburn Lake group south of Amarulik Lake comprises 2787±9 Ma dacitic metavolcanic and volcaniclastic rocks with some discontinuous magnetic iron formation

and greywacke lenses centred in a dome around Amarulik Lake (Fig. 2), which are overlain to the south by poorly-bedded metagreywacke. Detrital zircons separated from a sample of tuffaceous metagreywacke collected above the metadacite have a single population with an age of about 2770 Ma, and would appear to be locally derived from the metavolcanic rocks (Roddick et al., 1992). To the south, black slate, spinifex-textured komatiite, and magnetic iron formation discontinuously overlie metagreywacke, and these rocks are overlain by mafic metavolcanic rocks. A thick unit of massive quartzite and quartz-muscovite schist overlies the mafic metavolcanic unit north of Whitehills Lake, and is overlain by a lens of graphitic slate and a quartz-feldspar porphyry. Matic metavolcanic rocks occur to the south of the felsic porphyry, and continue to the west of longitude 96°W into the area mapped by Taylor (1985). According to Taylor's (1985) map, quartzite is repeated on the south limb of a very large overturned synform north of Whitehills Lake, and is overthrust by polymictic conglomerate. The conglomerate is interpreted by Taylor (1985) to be the oldest unit of the Woodburn Lake group, and to contain cobbles of syenite derived from underlying basement which crops out nearby. East and south of Whitehills Lake, Late Archean granitic rocks intrude the Woodburn Lake group and obscure the

structural sequence, but to the north of Amarulik Lake and south of Third Portage Lake, intermediate metavolcanic and volcaniclastic rocks are overlain by metagreywacke, magnetic iron formation, and quartzite. Intermediate metavolcanic and volcaniclastic rocks to the north of the metagreywacke are interpreted to be repeated on the north limb of a tight synform cored by quartzite and magnetic iron formation that apparently closes in Third Portage Lake. The area around Third Portage Lake is structurally very complex. This region was mapped also by Ashton (1988), but the present mapping could not confirm the sequence of either Ashton or Fraser (1988). However, their two-fold subdivision of the group is fundamentally the same as Taylor (1985), and this study, but in this study the unconformity and thrust faults of previous workers were not documented. Lithological Units

Intermediate volcanic & volcaniclastic rocks Massive fine-grained grey meta-andesite and very poorly-bedded andesitic volcaniclastic rocks characterize this rock unit, which dominates the area around Amarulik Lake, and to the north in the Third Portage Lake area. U-Pb zircon dating indicates a time of volcanism at 2787±9 Ma (Roddick et al., 1992).

Metagreywacke, slate and metapelitic rocks Metagreywacke is psammitic and characterized by thick beds; in very few localities normal graded beds were recognized, but pelitic tops to turbidites are rare. Black meta-argillite and slate occur in association with BIF and ultramafic schist between metagreywacke and pillowed metabasalt south of Amarulik Lake. North of Third Portage Lake metagreywacke, slate and metapelitic rocks appear to be absent from the Woodburn Lake group. Detrital zircons from this unit south of Amarulik Lake indicate a source terrane about 2770 Ma (Roddick et al., 1992).

Magnetic iron-formation (BIF) is black, fine-grained, and composed of cm-thick magnetite-rich and quartz-rich beds. It occurs as lenses within intermediate volcaniclastic rocks and metagreywacke south of Third Portage Lake. In and around Third Portage lake BIF is generally associated with metakomatiite and quartzite, where it forms several regionally-extensive horizons. Where pyrrhotite and/or pyrite occur, BIF may be auriferous in the Third Portage Lake area (Barham & Mudry, 1990).

Metakomatiite, ultramafic schist and marble A thirty-metre-wide layer of spinifex-textured komatilite occurs between BIF and pillowed basalt about five km north of Whitehills Lake. This remarkably unaltered exposure is described by Taylor (1985, p.8). Northwest of the Whitehills-Tehek area, spinifex-textured komatiite occurrences have been well-documented by Ashton (1981,1982,1988) and Annesley (1981a, 1981b, 1989). Generally, ultramafic rocks are altered to chlorite-talcserpentine schist and dolomitic marble.

Pillow basalt, greenstone Pillowed metabasalt extensively overlies BIF, komatiite and metagreywacke north of Whitehills Lake. This unit is altered to chlorite-actinolite-plagioclase schist, and pillow-structures are poorly-preserved. Similar mafic schist LeCheminant, A.N. overlies quartzite and quartz-feldspar porphyry north of Whitehills Lake. Mafic schist forms an important component of the unit mapped as ultramafic schist around Third Portage Lake. Polymictic conglomerate

Polymictic conglomerate occurs along the northwest shore of Whitehiills Lake (Taylor, 1985). It is characterized by well-rounded cobbles and boulders of granite, syenite, quartzite and dolomite according to Taylor (1985, p. 3-4), and overlies syenite in several exposures. Taylor considered the syenite to comprise basement to the Woodburn Lake group, however, this assignment has never been confirmed by radiometric dating. Quartzite and muscovite schist

Massive, white to grey, medium-grained, poorly-bedded quartzite, muscovite quartzite and quartz-muscovite schist

intermediate and ultramafic volcanic rocks, as well as quartzite. In Third Portage Lake several small bodies of

apparently overlies the majority of intermediate and mafic volcanic and turbiditic rocks in the south of the map area. In the north part of the map area, quartz-rich metasedimentary rocks are associated mainly with ultramafic schist. Quartz-feldspar Porphyry Felsic porphyry is a distinctive white to pale-orange weathering, massive volcanic rock. It occurs at several apparent stratigraphic horizons within the Woodburn Lake group: a large mass overlies quartzite and underlies mafic volcanic rocks north of Whitehills Lake, and in the north of the area several stratiform felsic porphyries occur with

quartz-feldspar porphyry occur on islands.

Post-Hudsonian Proterozoic Basins BL - Baker Lake
TH - Thelon

Pre-Hudsonian Proterozoic Supracrustal Rocks

age (Roddick et al., 1992).

Massive, coarse-grained, unfoliated hornblende gabbro occurs as small plutons in the area of Third Portage Lake. Granitic rocks Coarse grained, pale weathering biotite and biotite-hornblende granitic batholiths surround and intrude Woodburn Lake group. Contacts generally are abrupt, xenoliths are not common, and dykes rarely emanate into the supracrustal rocks. Batholiths intruded late in the deformation history of the group, and are generally unfoliated to weakly foliated. Granitic rocks shown on the map are late Archean (Kenoran). Uncommonly, undeformed granitic dykes intrude the

group, but are too small to show on the map. Monazite from one dyke gave an early Proterozoic (Hudsonian) U-Pb

Numerous plutons of syenite crop out on several islands in Whitehills Lake, and have been described and assigned to the post-Hudsonian Proterozoic Martell Intrusive Suite by Taylor (1985). East of the map area, Nadeau (1981) mapped numerous post-tectonic syenite plutons intruding late Archean granite. Taylor (1985) shows numerous small lamprophyre dykes in the Halfway Hills area that are too small to portray on the present map.

Diabase dykes Several diabase dykes form east-west-trending magnetic anomalies between Amarulik and Whitehills Lakes. The dykes are probably the youngest rocks in the Whitehills-Tehek area, but they have not been dated or assigned to any recognized swarm.

Structural fabric elements recorded in the field are bedding, mineral foliation (S₁), mineral lineation (L₁), crenulation cleavage (S2), and crenulation lineation (L2). Bedding attitudes were difficult to obtain due to the strong overprint of S1, which is invariably parallel to bedding in rocks where both structures were observed, as well as a general absence of well-bedded rocks. Mesoscale F_2 folds are common, and axial planes and axes were recorded. The largest structures observed in the area are F2 folds (Fig. 2): a north-vergent synform is located north and west of Whitehills Lake, an upright elliptical dome trending east-west occurs in the centre of the sheet, a north-vergent synform is north of Amarulik Lake, and the lower limb of a north-vergent antiform appears to be present north of Third Portage Lake. Major, north-north- east trending, upright F₃ folds overprint the older folds north of Whitehills Lake and in Third Portage Lake. The latter structure is a tight W-shaped synform in Third Portage Lake, and loses amplitude and definition to the north and south. North of Third Portage Lake S₁ foliation dips to the southeast in an area of several-hundred km², strongly suggesting that D₁ deformation was north-vergent, like F₂/D₂ to the south.

96°30'

Throughout the Whitehills-Tehek area, Woodburn Lake group rocks exhibit upper greenschist to lower amphibolite grade metamorphism. In metapelites, biotite is ubiquitous, and in siliceous iron-formation garnet and amphibole commonly occur. Mafic volcanic rocks contain actinolite, chlorite and plagioclase, ultramafic volcanic rocks commonly are carbonatized or altered to chlorite- talc-serpentine schist. Quartz and muscovite are common in quartzite, but north of Third Portage Lake Ashton (1988) and Tella (personal communication) identified kyanite, although garnet is not present in adjacent silicate-rich iron-formation. Armitage (1992) assigned the rocks in Third Portage Lake area to greenschist metamorphic conditions in the range 370-520°/C and pressures above 2.3 kbars.

Economic Geology Gold occurrences are spatially associated with pyrrhotite-pyrite-bearing parts of magnetite-bearing BIF in the Third Portage Lake area. Extensive prospecting has been carried-out in the region, and the most promising exploration target found is indicated onThird Portage Lake, where diamond drilling has been done (Barham & Mudry, 1990).

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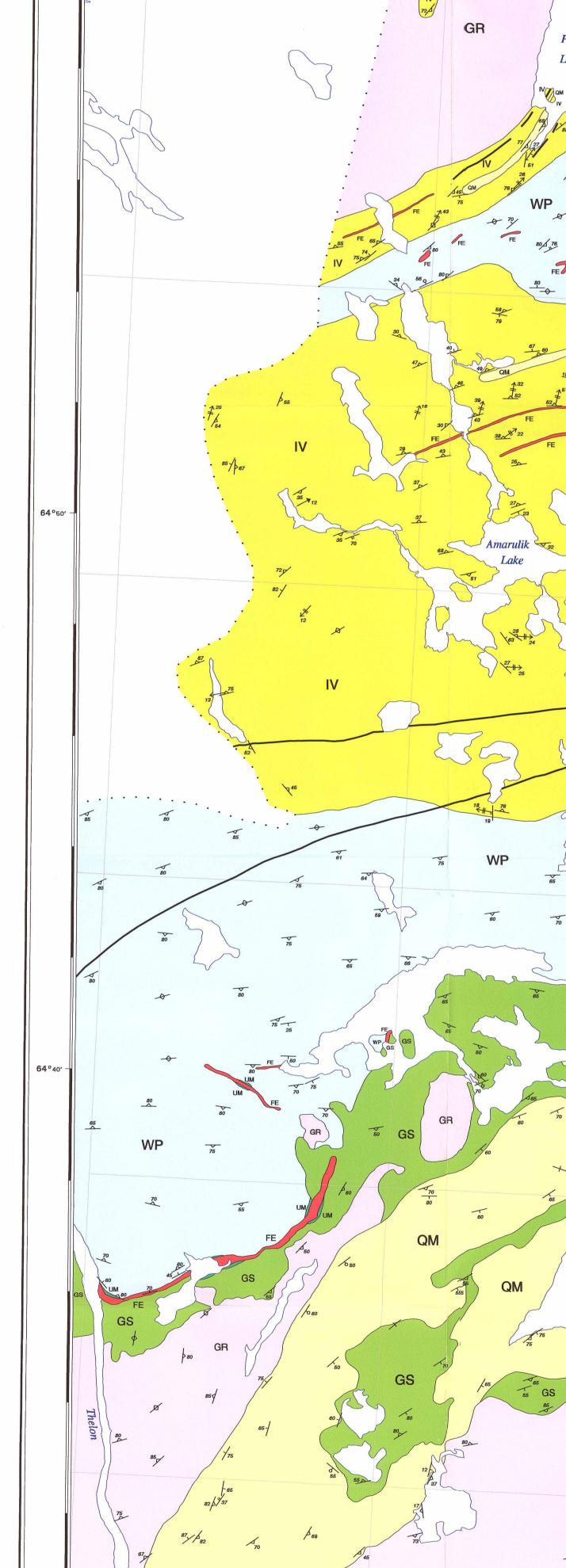
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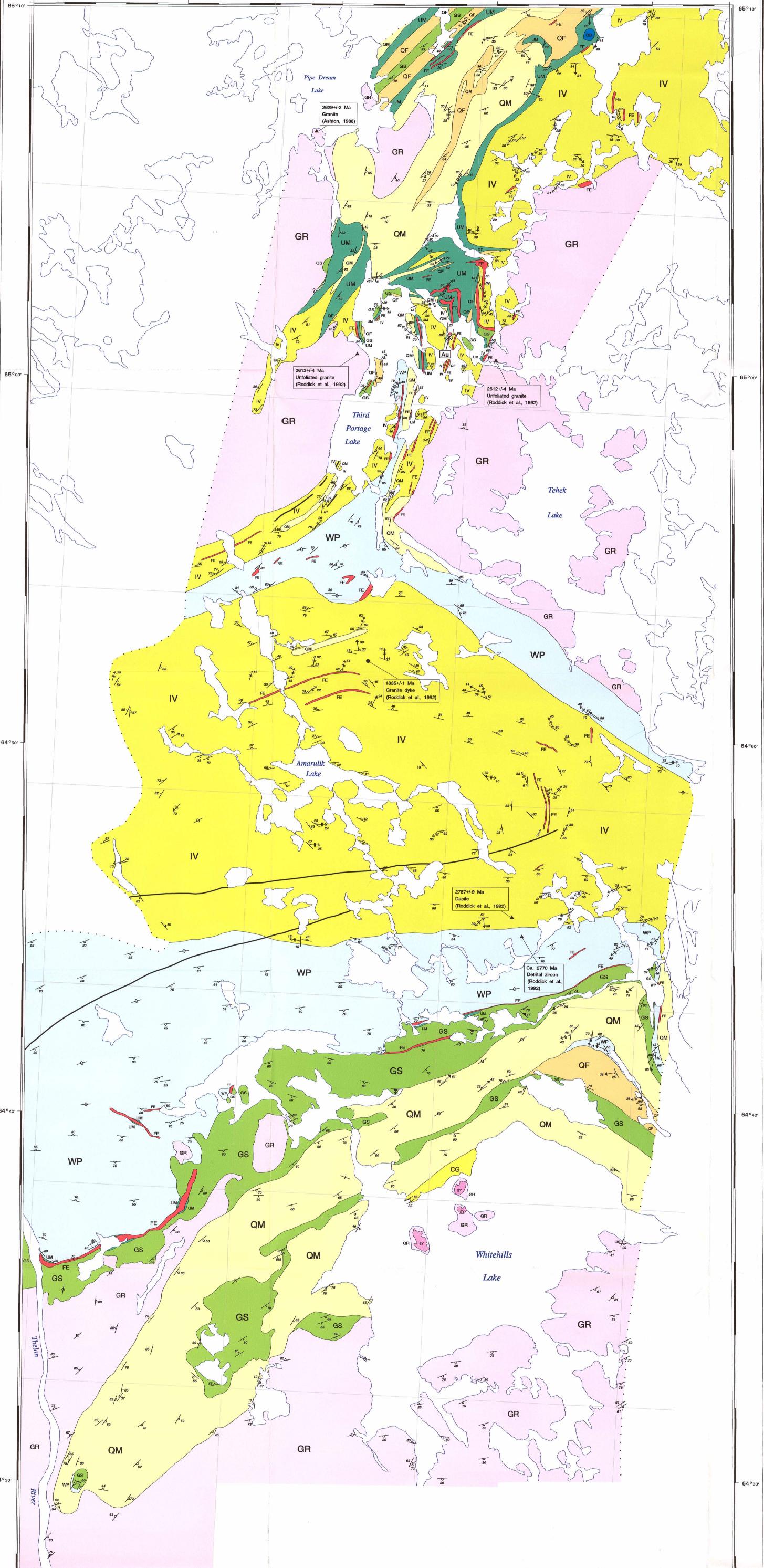
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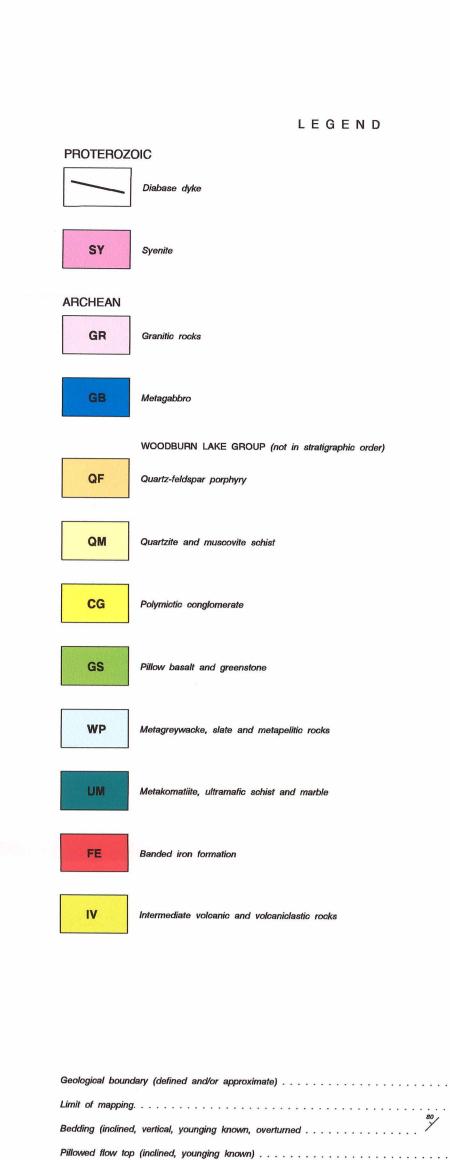
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S1 foliation (inclined, vertical) . L₁ mineral lineation (plunging). . . S₂ crenulation cleavage (inclined) . . Locality where radiometric age (Ma) has been determined (U-Pb method)

> Geology by J.R. Henderson, M.N. Henderson, L.L. Pryer and R.G. Cresswell 1990; additional data from F.C. Taylor (1985), Geological Survey of Canada Map compilation by J.R. Henderson Digital cartography by J. Dohar, Geological Survey of Canada Electrostatic plot produced by the Geological Survey of Canada Any revisions or additional information known to the user would be welcomed by the Geological Survey of Canada Base map produced by the Geological Survey of Canada Copies of the topographical editions covering this map area may be obtained from the Canada Map Office, Natural Resources Canada, Ottawa, Ontario, K1A 0E9 The proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area. Mean magnetic declination 1994, 0°55' W, increasing 12.4' annually. Readings vary from 0°25' E in the SW corner to 2°21' W in the NE corner of the map

OPEN FILE 2923 **GEOLOGY**

WHITEHILLS - TEHEK LAKES AREA DISTRICT OF KEEWATIN

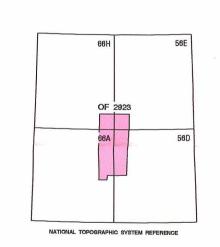
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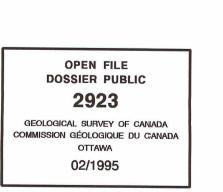
M.C. 96°07'30", facteur d'échelle 1,

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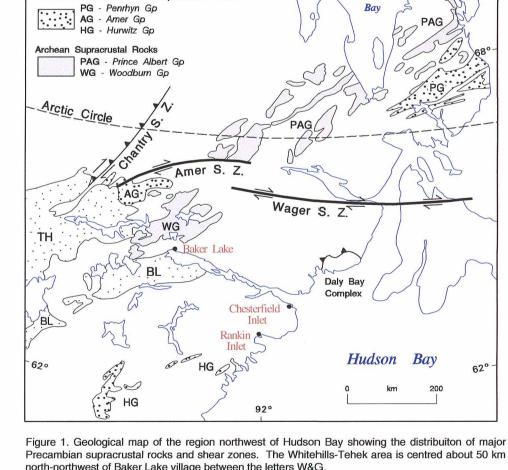
CM 96°07'30", Scale Factor 1.0

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Henderson, J.R. and Henderson M.N. 1994: Geology of the Whitehills - Tehek Lakes Area, District of Keewatin, Northwest Territories; Geological Survey of Canada, Open file 2923 scale 1:100 000



Precambian supracrustal rocks and shear zones. The Whitehills-Tehek area is centred about 50 km north-northwest of Baker Lake village between the letters W&G.

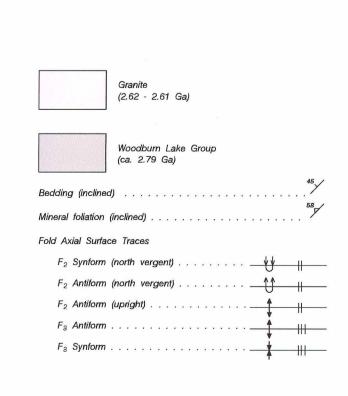


Figure 2. Major structures of the Woodburn Lake group in the Whitehills-Tehek area (after Henderson, et al., 1991; Taylor, 1985; Nadeau, 1981; Ashton, 1988, and J.R. Henderson, unpublished). Beddingparallel mineral foliation (S₁) is the most common structural element, and reveals a north-vergent F₂ synform in the southwest, an upright dome around Amarulik Lake, and north-vergent antiform north of Third Portage Lake. These folds are deformed by north-northeast-trending upright folds north of Whitehills Lake and at Third Portage Lake.

64°27'

Copies of this map may be obtained

601 Booth Street, Ottawa, Ontario K1A 0E8

Canadä