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DESCRIPTIVE NOTES

INTRODUCTION

New 1:50,000-scale mapping in the Mackenzie-Victory lakes area (Figure 1) indicates that: 1) the belt of siliciclastic rocks extending for ca. 40 km from southwest of Mackenzie Lake to northwestern Victory Lake and previously mapped as "Mackenzie Lake metasediments" (Bell, 1968; 1971; Davidson, 1970; Hanmer et al., 1998), correlate with the lower part of the Hurwitz Group; 2) Archean volcanogenic strata (Kaminak Group) which host base metal massive sulphide prospects are unconformably beneath the Hurwitz Group; 3) both basement and cover experienced penetrative deformation (including tight to isoclinal folding) and upper greenschist facies metamorphism before ca. 1.83 Ga (presumed age of undeformed and unmetamorphosed lamprophyre dykes); and 4) structures reflect intense Paleoproterozoic deformation, and the effects of Archean strain are not obvious.

Kaminak Group: (units Am; Af)

The oldest lithostratigraphic unit in the area comprises a succession of bimodal mafic-felsic volcanic rocks and volcanogenic sedimentary interbeds. The volcanic rocks form a continuum that ranges from mafic flows with local felsic intercalations (unit Am) to felsic flows and tuffs with minor mafic layers (unit Af). The mafic volcanic rocks are typically massive but locally contain pillows and brecciated beds. Similarly, quartz-phyric felsic beds are generally massive and contain only rare proximal-type volcanic breccias. Highly cleaved tuffs and tuffaceous sandstones and siltstones form metre-scale beds within mixed mafic-felsic units. Mafic volcanic and tuffaceous units commonly contain coarse hornblende-plagioclase ± garnet; some pelitic beds within tuffaceous units are cordierite-bearing.

Granite, granodiorite, diorite (unit Ag)

On the northwestern and northern margins of the map area, granitic to dioritic rocks (unit Ag) are in fault contact with the Kaminak Group. Intrusive relationships are inferred because, adjacent to the contacts, the granitic bodies contain numerous supracrustal enclaves and the supracrustal rocks are cut by granitic satellite dykes.

Gabbro dykes (Kaminak swarm; unit Kdy)

Rare north and northeast-trending gabbro dykes (unit Kdy), locally containing feldspar megacrysts, cross cut the Archean supracrustal and granitic rocks. Significantly (see Structure below), the dykes contain a penetrative foliation that is concordant with fabrics in the host rocks. They are likely part of the ca. 2.45 Ga (Heaman, 1994) Kaminak swarm.

Hurwitz Group (units PHN; PHPm; PHPp PHPm ± p; PHKm; PHKmqpc)

A sequence of siliciclastic rocks originally mapped as "Mackenzie Lake metasediments" outcrops in a belt from southwest of Mackenzie Lake to northeast of Victory Lake. Contacts of this sequence are faulted, but a basal unconformity is inferred because: 1) conglomerate-bearing beds in the sequence contain clasts derived from subjacent granitic and volcanogenic rocks; 2) granitic dykes, and megacrystic gabbro dykes which cut Archean volcanogenic strata are lacking; and 3) the change from exclusively volcanogenic rocks in the Kaminak Group to exclusively siliciclastic rocks is abrupt and signifies a dramatic change in depositional regime. Three main units are defined. As described below, individually and collectively these units bear strong resemblance to lower Hurwitz Group strata better preserved elsewhere (see Aspler and Chiarenzelli, 1997).

The lowest unit (unit PHN) consists of massive, parallel-stratified and locally cross trough-stratified subarkose to quartz arenite, local quartz-pebble conglomerate and rare semi-pelite. The maximum thickness of this unit is ca. 600 m, but locally only a few metres are preserved because of fault cut-out adjacent to basement. This unit, considered equivalent to the Noomut Formation (Aspler and Chiarenzelli, 1996 b), signifies fluvial sedimentation during initial stages of Hurwitz Basin subsidence.

The middle unit (units PHPm; PHPp PHPm ± p) defines a thick (up to 1000 m) section consisting predominantly of cobble-boulder conglomerates (see Figure 5 *in* Aspler et al., 2000). These conglomerates are typically massive and thickly-bedded, but locally define channels and graded sheets, and contain parallel and trough cross-stratified wedges and sheets of subarkose and arkose. Clasts (up to 1 m in diameter) are generally subrounded to well rounded and are self-supporting in a coarse arkosic matrix. Monomictic granite-clast conglomerate (unit PHPm) and polymictic conglomerate (unit PHPp) locally define discrete mappable sub-units. The monomictic conglomerates consist almost exclusively of different types of granitic clasts (fine- to coarse-grained, locally pegmatitic) with rare amphibolite and gabbroic fragments, whereas the polymictic conglomerates contain a diverse suite including granitic, quartzite, chert, felsic volcanic and mafic volcanic clasts. Locally, sections of monomictic conglomerate contain polymictic conglomerate sheets (unit PHpm ± p). Significantly, the clasts lack a pre-existing tectonic fabric (see Structure below). Discontinuous zones of epidote alteration occur within the granite-clast conglomerate. The appearance of stratified conglomerates and immature arenites above a section of relatively mature arenites containing quartz pebble conglomerates (Noomut Formation) in the Mackenzie-Victory lakes area is one of the features that characterize the Padlei Formation (Bell, 1970 a) in other parts of Hurwitz Basin, although local rhythmites containing cold-climate and/or glacial indicators are lacking. Similar to Padlei deposits elsewhere, the stratified conglomerates and arkoses are interpreted to be periglacial fluvial deposits filling paleovalleys incised into Archean basement (see Aspler and Chiarenzelli, 1997), although the thickness and lateral continuity of these strata, and an abundance of soft-sediment deformation structures, could also imply fault-generated relief during sedimentation.

The upper unit (unit PHKm) is ca. 1000 m thick and consists of grey (locally white) subarkose to quartz arenite that contains beds of quartz pebble conglomerate. Primary sedimentary structures are generally obscured by a penetrative cleavage, but local parallel and trough cross-stratified heavy mineral layers are preserved. Some of the subarkose to quartz arenite beds contain kyanite. Beds with quartz-chert pebbles, either as isolated clasts or concentrated in m-scale framework-intact beds, occur sporadically throughout the unit. One ca. 100 m-thick horizon, containing thickly bedded (20 cm to 10 m) sheets of framework-intact quartz pebble conglomerate (unit PHKmqpc) proved to be a useful marker. The upper unit is virtually identical to parts of the Maguse Member (Kinga Formation; Bell, 1970 a) exposed elsewhere in Hurwitz Basin. It is interpreted to represent sedimentation on an extensive alluvial plain in a wet paleoclimate. The paucity of coarse-grained detritus and restriction of clast types to durable lithologies are indicators of low topographic relief and a long residence time for chemical weathering and abrasion before final sedimentation. Kyanite likely resulted from metamorphism of aluminous phyllosilicates found elsewhere in the Maguse Member and considered the products of tropical weathering (Bell, 1970 b; Young, 1973).

Lamprophyre dykes (unit PDcif)

At one locality between Mackenzie Lake and Victory Lake, an east-trending undeformed and unmetamorphosed lamprophyre dyke cuts penetratively foliated Hurwitz Group polymictic conglomerate and sandstone. Presumably part of the Christopher Island swarm, the dyke is significant because it demonstrates deformation and metamorphism in the area was pre-Christopher Island Formation magmatism, currently estimated at: 1850 +30/-10 Ma (U-Pb zircon, Tella et al. 1985); 1825 ± 12 Ma (^{40}Ar/^{39}Ar hornblende, Roddick and Miller 1994) and 1832 ± 28 Ma (Pb/Pb isochron, apatite, MacRae et al. 1996).

Post-tectonic granites (unit Pg)

In the southwestern part of the map area, a non-foliated fluorite/tourmaline-bearing granite pluton (and associated satellite dykes) cuts penetratively deformed Hurwitz Group, likely one of the post-tectonic granitic blooms within the western Churchill Province defined by Peterson and van Breemen (1999; ca. 1.83 Ga Hudson suite; ca. 1.76 Ga Nueltin suite).

STRUCTURE

South of Mackenzie Lake, basement and Hurwitz Group define a northeast-trending synclinorium that tapers to the southwest between two basement-cover faults. On the western side of the synclinorium, a high-angle intrabasement fault juxtaposes granitic rocks against the Kaminak Group. Near the "Marce prospect", the granitic rocks are structurally above a relatively thick Kaminak Group section (cross-section B-B'), whereas to the northeast they are structurally beneath, and the Kaminak Group is cut out against a high angle basement-cover fault (axial projection A-A'). The dip of this basement-cover fault also changes through the vertical along strike, resulting in basement-over-cover juxtaposition in the south, and cover-over-basement relationships in the north. This fault is near the Noomut Formation-basement contact in the south (cross-section B-B'), but cuts up-section northward and eliminates the Noomut Formation near axial projection A-A'. In the interior of the synclinorium, tight to isoclinal folds in Hurwitz Group strata display steeply-dipping axial surfaces and penetrative planar fabrics and shallowly-plunging hinge lines and stretching lineations. In the south, near the "Marce prospect", the synclinorium comprises a narrow southeast-vergent syncline caught between two faults (cross-section B-B'). To the northeast, the synclinorium broadens markedly and exposes higher stratigraphic levels as a basement-cover fault splay cuts upsection and is folded together with the Hurwitz Group. Rocks on the isthmus between Mackenzie and Victory lakes are separated from the southern synclinorium by a northwest-trending cross fault adjacent to which relatively low-strain Hurwitz Group rocks are folded. Farther east, at the "Victory prospect", highly strained Archean granitic and Kaminak Group rocks are faulted above the Hurwitz Group, and all three map units define a south-vergent overturned package.

We interpret the post-Hurwitz Group structures in the Mackenzie-Victory lakes area to represent an extreme example of a style of deformation found elsewhere in the Hearne domain, in which complex structures arise from space restrictions in the cores of major basement-cover infolds. Deformation is inferred to have occurred pre- ca.1.83 Ga because an undeformed and unmetamorphosed lamprophyre dyke cuts structures in the Hurwitz Group, and post-ca. 2.45 Ga, because Kaminak dykes contain a penetrative fabric (see above). Archean basement rocks adjacent to the Hurwitz Group generally bear a penetrative fabric. Despite this, basement clasts within voluminous Hurwitz Group conglomerates lack a pre-depositional tectonic fabric. Hence we conclude that, in contrast to the Kaminak Lake area to the southeast (Hanmer et al., 1998) structures in the Mackenzie-Victory lakes area reflect intense Paleoproterozoic deformation, and that the effects of Archean strain are not obvious.

BASE METAL MASSIVE SULPHIDE PROSPECTS

Base metal massive sulphides hosted by Kaminak Group volcanogenic rocks have recently been discovered by Comaplex Minerals Corp. on their Victory Lake property. Values reported below are from Armitage (unpublished data, Comaplex Minerals Corp. 1998, 1999). At the "west zone" of the "Victoria prospect " massive and stringer pyrite, sphalerite, chalcopyrite and galena extend for a strike length of ca. 450 metres. They are hosted by silicified and quartz-veined amphibole-garnet schists (up to 25 m thick) thought to be metamorphic equivalents of hydrothermally altered (chloritic and silicic) mafic to intermediate volcanic rocks. Averaged chip samples from trenching across a 4 metre thick lens of massive mineralization assayed: 6.77% Zn; 0.2% Cu; 0.2% Pb; 24 g/t Ag and 0.054 g/t Au. Diamond drilling tested the down-dip extension of this mineralization; samples from one drill hole yielded: 8.28% Zn; 0.38% Cu; and 17.48 g/t Ag over an interval of 5.12 metres. Stringer to disseminated chalocopyrite has assayed as high as 0.37 % Cu over 7.6 metres. The "main zone" of the Victoria prospect is a 1000 metre long alteration horizon containing massive and stringer pyrite, sphalerite and galena in felsic to intermediate volcaniclastic strata. Metre-scale zones of strongly pyritic muscovite-quatrz ± andalusite ± staurolite ± gahnite are interpreted to have been derived from metamorphism of tuffaceous beds that previously underwent intense sericite hydrothermal alteration. Samples from a massive sulphide lens yielded up to 19.1% Zn, 3.5% Pb, and 240 g/t Ag; those from stringer mineralization yielded up to 0.92% Zn, 0.35% Pb, and 64 g/t Ag. At the "Marce prospect" southwest of Mackenzie Lake, surface samples from sulphide zones hosted by mafic to intermediate volcanic rocks averaged 9.6% Zn, 1.5% Cu, and 259g/t Ag. Gold assayed as high as 7.2 g/t. The geological and mineralogical characteristics of base metal mineralization in the Mackenzie-Victory lakes area are typical of volcanic massive sulphide deposits. The Marce and Victoria prospects may represent a single horizon that was disrupted by Archean plutonism and Paleoproterozoic deformation.

REFERENCES

Aspler, L.B., and Chiarenzelli, J.R.
1996a: Stratigraphy, sedimentology and physical volcanology of the Ennadai-Rankin greenstone belt, Northwest Territories, Canada: Late Archean paleogeography of the Hearne Province and tectonic implications; Precambrian Research, v. 77, p. 59–89.
1996b: Relationship between the Montgomery Lake and Hurwitz groups, and stratigraphic revision of the lower Hurwitz Group, District of Keewatin; Canadian Journal of Earth Sciences, v. 33, p. 1243–1255.
1997: Initiation of ca. 2.45-2.1 Ga intracratonic basin sedimentation of the Hurwitz Group, Keewatin Hinterland, Northwest Territories, Canada. Precambrian Research, v. 81, p. 265–297.

Aspler, L.B., Armitage, A.E., Ryan, J.J., Hauseux, M., Surmacz, S., and Harvey, B.J.A.
2000: Precambrian Geology, Victory and Mackenzie lakes, Nunavut Territory and significance of 'Mackenzie Lake metasediments', Paleoproterozoic Hurwitz Group. *In* Current Research 2000-C10, Geological Survey of Canada, 10p.

Bell, R.T.
1968: Preliminary notes on the Proterozoic Hurwitz Group, Tavani (55K) and Kaminak Lake (55L) areas, District of Keewatin; Geological Survey of Canada, Paper 68-36, 17p.
1970a: Preliminary notes on the Hurwitz Group, Padlei map area, Northwest Territories; Geological Survey of Canada Paper 69-52, 13p.
1970b: The Hurwitz Group- a prototype for deposition on metastable cratons; *in* Symposium on Basins and Geosynclines of the Canadian Shield; A.J. Baer (ed.); Geological Survey of Canada Paper 70-40, p.159–169.
1971: Geology of Henik lakes (east half) and Ferguson Lake (east half) map-areas, District of Keewatin; Geological Survey of Canada Paper 70-61, 31p.

Hanmer, S., Rainbird, R. H., Sandeman, H. A. I., Peterson, T. D. and Ryan, J. J.
1998: Field contributions to thematic studies related to the Kaminak greenstone belt, Kivalliq Region, Northwest Territories; *in* Current Research 1998-C, Geological Survey of Canada, p. 77–84.

Heaman, L.M.
1994: 2.45 Ga global mafic magmatism: Earth's oldest superplume ? *in* Abstracts of the Eighth International Conference on Geochronology, Cosmochronology and Isotope Geology, M.A. Lauphere, G.B. Dalrymple, B.D. Turrin (ed.); United States Geological Survey Circular 1107, p.132.

Davidson, A.
1970: Precambrian geology, Kaminak Lake map-area, District of Keewatin; Geological Survey of Canada Paper 69-51, 27 p.

MacRae, N.N., Armitage, A.E., Miller, A.R., Roddick, J.C., Jones, A.L., and Mudry, M.P.
1996: The diamondiferous Akluilak lamprophyre dyke, Gibson Lake area, N.W.T., *in* LeCheminant, A.N., Richardson, D.G., DiLabio, R.N.W., and Richardson, K.A., eds., Searching for diamonds in Canada, Geological Survey of Canada Open File 3228, p. 101–107.

Peterson, T.D., and van Breemen, O.
1999: Review and progress report of Proterozoic granitoid rocks of the western Churchill Province, Northwest Territories (Nunavut); *in* Current Research 1999-C, Geological Survey of Canada, p. 119–128.

Roddick, J.C., and Miller, A.R.
1994: An ^{40}Ar - ^{39}Ar age from the REE-enriched Enekatcha ultrapotassic intrusive suite and implications for timing of ultrapotassic magmatism in the central Churchill Province, Northwest Territories. *in* Current Research 1994-F, Geological Survey of Canada, p. 69–74.

Tella, S., Heywood, W.W., and Loveridge, W.D.
1985. A U-Pb age from a quartz syenite intrusion, Amer Lake, District of Keewatin; a part of the Churchill structural province. Geological Survey of Canada Paper, 85-1B, p. 367–370.

Young, G.M.
1973: Tillites and aluminous quartzites as possible time markers for Middle Precambrian (Aphebian) rocks of North America; *in* Huronian Stratigraphy and Sedimentation G.M. Young (ed); Geological Association of Canada Special Publication 12, p. 97–127.

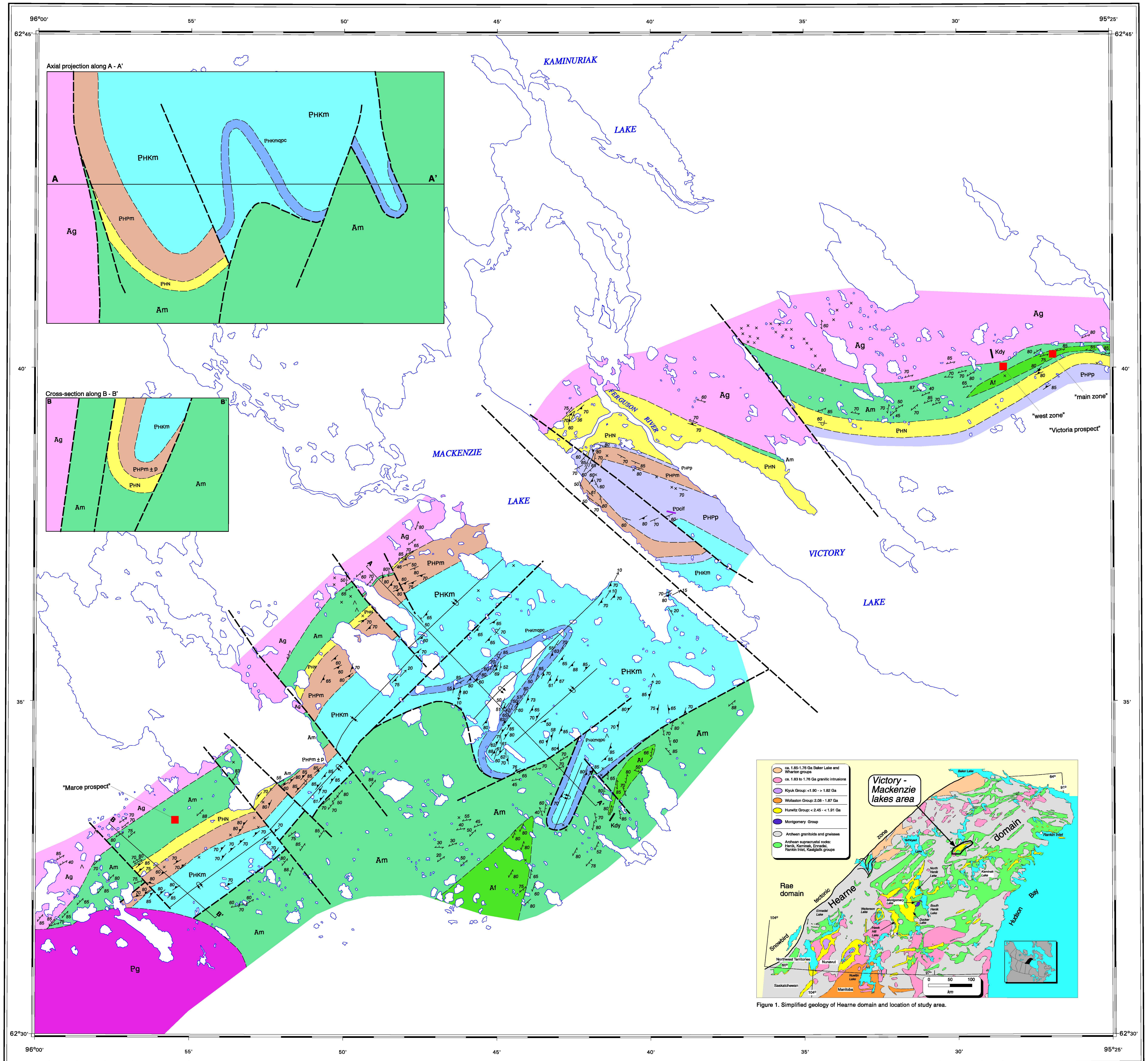

Figure 1. Simplified geology of Hearne domain and location of study area.

LEGEND

PALEOPROTEROZOIC

Unit	Description
Pg	*Non-foliated flourite and tourmaline-bearing granite*
PDcif	*Unmetamorphosed, non-foliated lamprophyre dyke*

- - - *intrusive contact* - - -

HURWITZ GROUP

Unit	Description
PHKm / PHKmqpc	*KINGA FORMATION: Maguse Member: Grey and white subarkose to quartz arenite. Local black parallel- and cross-stratified heavy mineral bands.* PHKmqpc: *Framework-intact quartz-pebble conglomerate containing clasts of well rounded spherical white quartz, blue and grey chert in sheets 20 cm to 10 m thick*
PHPp / PHPm	*PADLEI FORMATION: Massive cobble-boulder conglomerate; local channels, graded sheets; subarkose with parallel and trough cross stratification.* PHPp*: polymictic clast suite (granitic, mafic and felsic volcanic, quartzite, chert);* PHPm*: monomictic conglomerate with different types of granitic clasts;* PHPm ± p*: monomictic conglomerate with polymictic interbeds*
PHN	*NOOMUT FORMATION: Parallel-stratified subarkose to quartz arenite, local quartz-pebble conglomerate, semipelite*

- - - *unconformity* - - -

Unit	Description
Kdy	*Kaminak dykes. Northeast- and northwest- trending, well foliated gabbro dykes; with feldspar megacrysts*

- - - *intrusive contact* - - -

ARCHEAN

Unit	Description
Ag	*Well-foliated granodiorite, granite, diorite*

- - - *intrusive contact* - - -

KAMINAK GROUP

Unit	Description
Af	*Felsic to intermediate flows; tuffs; local mafic volcanic layers*
Am	*Mafic flows, locally pillowed; local felsic volcanic layers. Metre-scale tuffaceous sandstones, siltstones; local pelite*

Geological boundary (approximate)
Fault (approximate)
Axial trace fold (syncline)
Axial trace fold (anticline, syncline overturned)
Outcrop
Frost heave; probable subjacent outcrop
Bedding (inclined, overturned, tops unknown) 67 45 76
Bedding from pillow lavas (overturned) 34
Foliation (Hurwitz Group) (inclined) 65
Foliation (Kaminak Group and related plutonic rocks; likely in part Paleoproterozoic) (inclined, vertical) 65
Minor fold (azimuth and plunge) 30
Stretching lineation (azimuth and plunge) 25
Base metal prospect
Axial projection line A A'
Cross-section line B B'

Geology by L.B. Aspler, A.E. Armitage, M. Hauseux, S. Surmacz and J.J. Ryan

Geological compilation by L.B. Aspler, 2000

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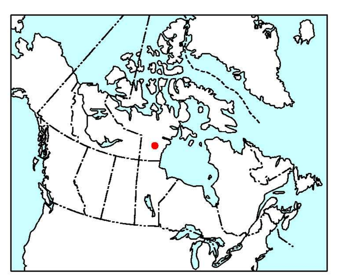
Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital base map supplied by the Author modified from data compiled by Geomatics Canada

Magnetic declination 2000, 0° 36' W, increasing 6.4' annually



LOCATION MAP

EGS 2000-13

OPEN FILE 3752

GEOLOGY

VICTORY AND MACKENZIE LAKES

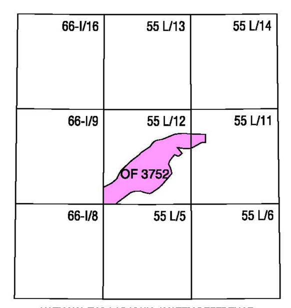
NUNAVUT

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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