DESCRIPTIVE NOTES

#### Kaminak greenstone belt The Kaminak greenstone belt is a segment of the ca. 500 km long "Ennadai-Rankin greenstone belt". The latter extends from Pistol Bay on the Hudson Bay coast to northern Saskatchewan (Miller and Tella, 1995; Aspler and Chiarenzelli, 1996). In the Kaminak Lake area, the Kaminak Group was defined as an assemblage of volcanic rocks, flanked to the north by clastic sedimentary rocks (Davidson, 1970a).

the Kaminak greenstone belt will be presented in another publication (Goff and Kerswill, in prep.)

In the present study, field determination of the compositions of volcanic and volcaniclastic rocks was based on colour and phenocryst content. At low metamorphic grade (chlorite-albite), black to dark green rocks ± plagioclase phenocrysts were called mafic, grey-green to grey rocks ± plagioclase and/or hornblende phenocrysts were termed intermediate, and light grev, cream to white rocks + potassium feldspar and/or quartz phenocrysts were mapped as felsic. However, locally pervasive silicification, or the growth of metamorphic minerals, make such field determinations difficult. Segments of distinct lithological associations, described below, can be traced over tens of kilometres along the relative age of lithological packages. Three U-Pb zircon ages (2697 ±1.4, 2692 ±1, 2682 ±3 Ma) have been obtained from felsic volcanic rocks from Spi Lake to Quartzite Lake (Mortensen and Thorpe, 1987; Patterson and Heaman, 1990). No basement to the Kaminak Group has been identified.

#### KAMINAK GROUP Mafic to intermediate volcanic rocks

Homogeneous, massive mafic flows (Amm) are fine grained, dark green and generally featureless, except for local, small plagioclase phenocrysts, and minor interflow siltstones. The interiors of thicker flows (>5 m) tend to be coarser than the margins, and can be confused with microgabbro sills. Pillowed flows (Amp) occur throughout the map area. locally forming homoclinal panels up to 4 km thick. Undifferentiated volcanic rocks (Amu) represent fine grained homogeneous rocks of uncertain origin, but may include massive and locally pillowed flows, as well as thinly banded rocks

DYKES which may represent epiclastic rocks or tuffs. However, in at least some cases, the presence of strain gradients indi-

## Intermediate to mafic volcanic rocks

Massive intermediate flows (Aim) are commonly interlayered with intermediate pillow lavas (Aip). Large volumes of intermediate volcanic breccia, conglomerate and arenite (Aiv) occur throughout the study area, particularly between Heninga and Turquetil lakes, south of Kaminak Lake, and at Quartzite Lake. The volcanic arenites are composed of variable proportions of small (<5 mm) fragments of feldspar crystals set in a fine grained, grey-green intermediate natrix. The conglomerates and breccias are composed of mafic to felsic volcanic rock fragments, locally with diorite, tonalite, quartz arenite and jasper clasts, set in a fine grained, grey-green intermediate matrix; locally the matrix is volcanic arenite. Lack of obvious bedding, the coarse grain size and overall textural immaturity of the conglomerate, combined with recognition of local source-rock types in the principal clast populations, suggest that some of these rocks were derived from nearby volcanoes of variable composition, and deposited as sedimentary gravity flows. It was not possible to unequivocally differentiate epiclastic from pyroclastic rocks.

#### Map-scale units of felsic volcanic rocks (Af) are well developed between Kaminak and Quartzite lakes. Banded, quartz- and K-feldspar-phyric rhyolites form autoclastic breccias along the northwestern margin of a 10 km by 5 km quartz-feldspar porphyry body (Ap), interpreted as a large felsic dome. The dome is mantled by a carapace of felsic preccias and fine grained quartz-phyric rhyolite. The former comprise angular rhyolite fragments, 2-20 cm in diameter,

Felsic volcanic rocks

set in a matrix of similar composition. The latter are fine grained, homogeneous layers, some times with feldspar phenocrysts, which are commonly difficult to identify as either flows or sediments. The felsic volcanic rocks are overlain by coarse volcaniclastic rocks, interpreted as locally reworked flows and pyroclastic detritus.

## Clastic sedimentary rocks

A distinct and mappable facies of clastic sedimentary rock (As) occurs around Kaminak and Quartzite lakes. North and south of Kaminak Lake this unit is characterised by normally graded, lithic arenite-siltstone rhythmites with average bed thickness of 20-30 cm. This map unit is particularly well exposed along the west side of a peninsula on the northeast side of Quartzite Lake, where it occurs in a continuous section more than 500m thick. The section youngs to the north and comprises texturally mature polymictic conglomerate overlain by coarse, bedded sandstones, massive sandstone and graded sandstone/siltstone rhythmites. These rocks are in fault contact with banded iron formation (see below) and quartz-feldspar porphyry; however, locally derived volcanic clasts in the conglomerate suggest an unconformable relationship with underlying Kaminak Group rocks, as suggested by Davidson (1970a). Preliminary analysis of the lithofacies and their associations suggest a submarine to alluvial fan origin for most of the coarse grained section. Finer grained siltstone/sandstone lithofacies are interpreted as distally equivalent turbidites. This map unit overlies felsic to ntermediate volcanic flows and breccias (Aiv) on the west side of Quartzite Lake and on northern Kaminak Lake and e appears to be uppermost in the Kaminak Group. Very coarse breccias, interpreted as proximal equivalents to the rocks just described, occur between Quartzite and Kaminak lakes.

arenite/siltstone (As) within thick sequences of massive to pillowed mafic to intermediate volcanic rocks. BIF consists of hickly laminated to thinly bedded magnetite, pigmentary hematite and grey chert, interlayered with thin to thick beds of grey-green volcanic arenite. The distribution of these rocks is clearly defined by pronounced linear anomalies in the the foliation and cleavage in the Spi and Hurwitz Groups; however they should not be confused with the older foliation regional aeromagnetic field (Geological Survey of Canada, 1987). However, outcrops are small and sparse. Oxide layers exhibit very thin, rhythmic, parallel lamination, with no tractional sedimentary structures, attesting to deposition in quiet water. In the northern part of Kaminak Lake, opposite the Kam deposit, Fe-carbonate interlayers occur with the oxide layers, chert and possible felsic tuff. North of Tootyak Lake, iron oxide is interbedded with 10-40 cm thick, normally graded beds of felsic lithic arenite. Some beds contain 5-50 cm rip-ups of iron oxide rhythmite, confirming their origin as gravity flows. Other potential indicators of slope instability include syn-sedimentary folds and clastic dykes. The iron formations display many attributes of the Algoma type (Gross, 1966), deposited in a quiet water basinal setting, below storm wave base (>100m). Intercalated felsic volcaniclastic sediments, tuffs and magmatic dykes are interpreted to indicate proximity to an active volcanic arc. Pyrite and/or pyrrhotite are locally abundant in iron-formation.

#### PLUTONIC ROCKS The central part of Kaminak Lake is underlain by at least four texturally distinct units of diorite (Ad): (i) medium- to fine-

grained, equigranular, hornblende leucodiorite, (ii) plagioclase-phyric to megacrystic diorite, (iii) hornblende oikocrystic < 3 cm) diorite, and (iv) intimately admixed components of all three. They are collectively called the central Kaminak probably syn-volcanic biotite tonalite, but more typically they are themselves cross-cut by silicic granitoids. The diorites marked by sericite aggregates and elongate chlorite grains is everywhere steeply pitching to vertically plunging. The are also cross-cut by intermediate dikes with chilled margins, apparently similar in composition to parts of the Kaminak sericite alteration is localised by initial fracturing, and subsequently deformed by limited dextral shear. East of Henings Group. These observations suggest that at least some of the diorites are synvolcanic. Southeast of Kaminak Lake, the Kaminak pluton ranges in composition from granodiorite to gabbro, but is predomition, and finally sericitisation accompanied by transpressive dextral shearing and quartz veining (Hanmer et al., 1998c).

nantly medium-grained, hornblende-biotite granodiorite (Agd) to tonalite. The pluton has a disruptive, net-vein contact along its northeastern margin, where it incorporates rafts and blocks of volcanic rocks of the Kaminak Group. In cor rast, its western margin is characterized by hornfelsed, highly-strained, banded metavolcanic rocks. There, variably deformed veins emanating from the pluton suggest that the wallrock was deformed as a consequence of the pluton emplacement. To the south and east, the Kaminak pluton intrudes slightly older, probably comagmatic, quartz diorite (Aqd), diorite (Ad), magnetite-bearing diorite (Admt), and rare gabbro (Agb). North of Kaminak Lake, the Ferguson olution is similarly diverse in composition, ranging from rare gabbro through diorite and quartz diorite, to predominantly onalite (At) and locally granodiorite. The pluton is extensively altered and plutonic textures are poorly preserved. East of Carr Lake, the Carr pluton ranges from diorite to granite (Ag), but is predominantly a homogeneous, mediumgrained, biotite-hornblende granodiorite. Diffuse, gradational contacts, mechanical incorporation of potassium feldspar nd quartz phenocrysts from tonalite into diorite, and hornblende reaction coronas around incorporated quartz grains,

series of margin-parallel, schlieren zones alternating with clean tonalite and granodiorite that, over a distance of ca. 4 North of Heninga Lake, large plutons of medium grained, equigranular biotite granite (Ag) contain inclusions of mafic

as a distinctive gneissic aspect (Agn). A large body of massive, megacrystic granite (Amg) is poorly exposed south-

and east of Kaminak Lake, and new mapping in adjacent areas to the south and west. The Carr-Kaminak-Quartzite polymictic conglomerate and trough cross-bedded arenites (Old Boot Formation). The breccia is composed of angular lakes map is a compilation of new data and interpretations from the 1997 mapping, and the above cited 1:50 000 scale to semi-rounded clasts of tonalite in a matrix of weathered tonalite debris that preserves the original texture of the tonalite, and is interpreted as a *paleogrus*s. The tonalite pebble conglomerate contains rare clasts of foliated mafic arc with high exploration potential. Group and associated plutonic rocks within the map area are presented elsewhere (Irwin, 1995, 1996; Relf 1995; volcanic rock. The sedimentary rocks are separated from well foliated mafic volcanic rocks that contain scattered, 1-2 Hanmer et al., 1998b, 1998c). Descriptions of the extensive Quaternary surficial deposits (Q) will be presented in cm plagioclase phenocrysts by a surface showing up to 1 m of paleotopographic relief which appears to be an another publication (McMartin, in prep.). The principal mineral occurrences are located on the maps and useful infor-unconformity. Foliations in the volcanic and sedimentary rocks are mutually parallel, and broadly concordant with their mation on these occurrences is summarized on the accompanying table. More information on the metal endowment of contact. Lithologically, the volcanic rocks correspond to the Spi Lake Formation (Patterson, 1991), but structurally the appear to share the same foliation as the adjacent Kaminak Group volcanic rocks (Av). It remains to be determined Aspler, L.B. and Chiarenzelli, J.R. whether the unconformity occurs within the Spi Group, or between the Spi and Kaminak groups. The lithological association and stratigraphic setting of the Spi Group resemble those of Temiskaming-type deposits of the Superior

produced by primary chemical and physical weathering of a granodiorite protolith is preserved. The sericite-quartz

schist along strike to the northeast is considered to represent the deformed equivalent of the regolith.

#### HURWITZ GROUP

In the map area, the Hurwitz Group (Pu; see Bell, 1971; Davidson, 1970a; Aspler and Chiarenzelli, 1997a) comprises the Padlei, Kinga and Ameto formations. The Padlei Formation (Pp) comprises a basal micaceous arenite conformably overlain by quartz-pebble and polymictic conglomerate, capped by a well-foliated argillite. The Kinga Formation of formably overlies the Padlei Formation, and comprises a lower Maguse (Pkm) Member and an upper White Rock (Pkw) Member. The Maguse Member is a light-purple to maroon arenite with minor beds of conglomerate and siltstone, with millimetre-scale jasper and quartz clasts, and centimetre-scale hematite nodules near the base. The Maguse Member grades upwards into supermature, massive, white, quartz arenite of the White Rock Member, with locally well preserved ripples and minor heavy mineral bands. The White Rock Member is overlain by the Ameto Formation which includes, from oldest to youngest, pink stromatolitic dolostone beds with black mudstone to siltstone interbeds (Pad), pillowed to massive mafic volcanic rocks (Pav) and gabbro (Pag). Panels of black slate derived from argillite and siltstone are locally preserved (Paa). A magnetite-rich chlorite schist (Pos), 10 to 100 m wide, cuts the lower part of the Kinga Formation. Where not strongly sheared, it appears to be derived from a plagioclase-phyric diabase dyke. An erosional unconformity between the Hurwitz Group and its underlying basement is exposed northeast of Carr Lake. The contact typically places the Maguse Member of the Kinga Formation above granitoid rocks or Kaminak 1971: Geology of Henik Lakes (east-half) and Ferguson Lake (east-half) map-areas, District of Keewatin; Geological Group volcanic rocks. In places, the interface is recognizable as a narrow sericite-quartz schist, foliated sub-parallel to the unconformity. However, in an embayment along the contact, the rocks are less strained and a possible rego

Four sets of dykes are recognised in the field area. They include the locally porphyritic north-northeast trending cates that the banded rocks are highly deformed pillowed flows. All three mafic to intermediate volcanic map units may Kaminak dyke swarm (Pkd; ca. 2.45 Ga; Heaman, 1994), cut by variably oriented phlogopite-phyric minette dykes contain sheets of fine grained, apparently synvolcanic, gabbro. Thin, laterally discontinuous siliceous beds occur epi-(Pmd) and rare east-southeast striking mafic dykes which are comparable with the Tulemalu dyke swarm (Ptd; ca. 2.19 sodically throughout the volcanic sequences. They comprise white to light grey, featureless horizons, rarely exceeding Ga; Tella et al., 1997). Other dykes include a single example of the northwest-trending Mackenzie dyke swarm (Pmk 2-3 m in thickness. In the field it is difficult to determine whether these rocks are quartzose epiclastic rocks, silicified tuffs, ca. 1.27 Ga; LeCheminant and Heaman, 1989) northeast of Quartzite Lake, and numerous, variably oriented undifferentiated dykes (Pud). The latter includes dykes of intermediate composition, apparently similar in composition to some of the volcanic rocks of the Kaminak Group. With the exception of the Kaminak and Mackenzie examples, the width of most dykes does not exceed several metres.

#### STRUCTURE AND METAMORPHISM

Within the Kaminak Group, compositional layering varies from cm-scale banding to packages of homogeneous pillow lavas. Most outcrop scale lithological contacts are interpreted as bedding  $(S_0)$ , or the margins of bedding-parallel sills Smaller scale banding, for example in mafic to intermediate rocks of uncertain parentage, may either be primary or

Hanmer, S., Sandeman, H.A., Rainbird, R.H., Peterson, T.D., Ryan, J.J. and Goff, S.P. ctonometamorphic in origin. Most rocks of the Kaminak Group exhibit a variably developed, layer-parallel foliation. The foliation is axial planar to rare, small scale (< 50 cm) intrafolial folds of layering. Although it could represent a composite tectonic fabric, this early foliation is referred to as S<sub>1</sub>. The strike of S<sub>1</sub> and S<sub>0</sub> varies from 045-135°, with steep to vertical dips. A steeply pitching extension lineation is regionally developed on S<sub>1</sub>, but its intensity is variable. Although the lineation is best developed in sheared zones of sericite alteration (Hanmer et al., 1998c), this association is not

Hanmer, S., Peterson, T.D., Sandeman, H.A., Rainbird, R.H. and Ryan, J.J. exclusive. For the most part,  $S_1$  is developed in lower greenschist facies chlorite-albite  $\pm$  sericite mineral assemblages. ocally, hornblende, garnet, staurolite, cordierite and clinopyroxene occur in close proximity to the principal plutonic bodies, and appear to be the product of contact metamorphism. Garnet is locally wrapped around by  $S_1$ , and hornblende is an S<sub>1</sub> foliation-forming mineral. Isograds are discontinuous, but are consistently oriented hot-side facing the major plutons. S1 also tends to be concordant to major tonalite and granodiorite plutons. North of Heninga Lake, there Hanmer, S., Rainbird, R. H., Sandeman, H.A., Peterson, T.D. and Ryan, J.J. is a spatial coincidence between the hornblende isograd and the three dimensional deflection of  $S_1$  around major granite plutons. A similar pattern at Snug Lake suggests that there is a buried pluton beneath the lake. Taken together, these observations suggest that the major tonalite, granodiorite and granite plutons are synkinematic. The S<sub>1</sub> foliation is locally deformed by structures which, with few exceptions, are only developed at a small scale ( < 50

cm). Isolated, asymmetrical folds, and oblique crenulation cleavage parallel to their axial planes, are heterogeneously Heaman, L.M. distributed, but not necessarily together. These structures are referred to as F<sub>2</sub> and S<sub>2</sub>, but their lateral discontinuity, and 1994: 2.45 Ga global mafic magmatism: Earth's oldest superplume?; in 8th International Conference on the rare occurrence of demonstrable S<sub>3</sub> foliation, caution against rigid correlation. Most folds are steeply plunging, and A distinct lithological association with relatively high proportions of felsic vs intermediate to mafic materials (1:2 - 1:3) coaxial with the extension lineation. Very locally, moderately plunging kink folds are seen to deform the lineation. Most occurs from Spi Lake to Tootyak Lake, and in a number of areas along the northern side of Kaminak Lake between Carr importantly, the development of the steeply plunging/pitching lineation is independent of the presence of macroscopic and Quartzite lakes. In general, the intermediate to mafic rocks range from pillow lavas, massive flows, and gabbro sills folding. These observations suggest that, in general, the steep extension lineation is an L<sub>1</sub> structure, contemporaneous o volcanic breccias and arenites. Interspersed within them are 5 m to 1 km thick horizons of felsic volcanic rocks similar with the development of S<sub>1</sub>. to Af. This "bimodal" assemblage (Av) is associated with abundant magnetite-chert-carbonate banded iron formations

The discontinuous preservation of the Kaminak Group stratigraphy makes it difficult to map major folds. Nonetheless,

1994: Mineral occurrences and preliminary geology of the Kaminak-Carr Lakes area, District of Keewatin (parts of southwest of the Kam deposit, central Kaminak Lake, and magnetite-hematite-chert facies iron formation northwest of the presence of younging reversals in pillowed flows and turbidites in the Quartzite-Snug lakes area suggests that the 55 L/3, 4, 5 and 6); NWT Geological Mapping Division, Map EGS 1994-03, scale 1:50, 000. lly folded on a wavelength of several kilometres. However, the relative age of these structures emains unconstrained. East of Heninga Lake, the thick homoclinal package of southeast-facing pillowed flows, flanked

on either side by intermediate volcaniclastic rocks and massive flows, demonstrates the absence of folding. Thus, the degree to which the Kaminak Group is extensively isoclinally folded, either by F<sub>1</sub> or post-S<sub>1</sub> structures, remains Paleoproterozoic Kaminak dykes cross-cut deformation structures in the Kaminak Group, thereby establishing that regional deformation and metamorphism in the Kaminak Group occurred in the late Archean. The granite pluton (Amg outheast of Snug Lake cross-cuts S₁ in the amphibolitic wallrocks and, when dated, will further constrain the timin leformation. The Hurwitz Group is preserved in a synclinorium, and deformed by generally upright, subhorizontal fo though overturned limbs are locally present. An upright axial planar cleavage is developed in volcanic and pelitic sedimentary lithologies. In addition to that reported here, other segments of intact unconformity at the base of the furwitz Group occur along strike to the northeast and southwest, beyond the map area (Park and Ralser, 1992; Aspler and Chiarenzelli, 1997b). The Carr Lake unconformity pins the Hurwitz Group in this middle section of its regional outcrop extent, thereby eliminating the possibility of significant Paleoproterozoic displacements between basement and cover. Localised deformation adjacent to the Hurwitz Group likely indicates strain incompatibility or partitioning at the

# quartz veining adjacent to the Hurwitz Group at Kinga Lake, are the best examples of Paleoproterozoic reworking of the Banded iron formation (BIF) occurs southwest of Kaminak Lake, where it is associated with normally graded volcanic The presence of foliated mafic volcanic clasts suggests that deformation of the Spi Group is younger than that in the

Kaminak Group. However, the deformation fabric in the Spi Group is discordant to that in the Hurwitz Group, and thereby appears to be older than the Hurwitz Group itself. For simplicity, the  $S_1$  symbol has been employed to represent

## Volcanic and volcaniclastic rocks of the Kaminak Group appear to be extensively altered, particularly along the north side of Kaminak Lake and around Quartzite Lake. Alteration around Spi Lake may be less extensive, and west of

urquetil Lake it appears to be focused in a fault zone. The local aspects of the alteration comprise variable components of silicification, carbonatisation, sericitisation, chloritization and sulphidation. Silicification is common in volcaniclastic conglomerates and breccias, but also occurs in massive and pillowed intermediate flows. Carbonatisation appears to be more localised than silicification. For example, southeast of Quartzite Lake, a 30-40 m thick sequence of boulder to granule conglomerates, overlain by trough cross-bedded lithic arenite was extensively replaced by recessive, brown-weathering ankeritic dolomite, most likely during diagenesis. Similar, carbonate-altered lithic arenites occur in the northwest corner of Kaminak Lake, and northwest of Tootyak Lake. In other cases, carbonate replacement in cleaved or massive volcanic and volcaniclastic rocks occurred by infiltration along a network of penetrative fractures. Progressive replacement can be traced into massive, featureless, fine grained brown diorite suite. Locally, these diorite units appear to both intrude and grade into adjacent hypabyssal and extrusive units carbonate, with a few isolated volcanic relics. Sericitisation may occur as concordant zones of well cleaved, steeply of the Kaminak Group. They commonly contain abundant centimetre- to metre-scale xenoliths of locally derived supracrustal rocks. These include mafic to silicic volcanic and sedimentary rocks that have been deformed into foliated localised in narrow, regularly spaced (5-10 cm), foliation-parallel bands. Within such sericite bands, a penetrative schlieren, lending a gneissose appearance to the diorite. Rarely, the diorites cross-cut a medium to coarse-grained, sericite-quartz foliation makes a uniform, anticlockwise angle (10-15°) with the band boundaries. An extension lineation

Lake, the complete alteration sequence appears to include early silicification, followed by formation of S<sub>1</sub>, carbonatisa-

There are no producing or past producing mines in the mapped areas, but exploration potential can be considered

high. Although it is commonly difficult to assign deposit types to occurrences, all three polymetallic occurrences appear

## MINERAL OCCURRENCES

The principal mineral occurrences of the Spi-Kaminak-Quartzite lakes area and the Heninga-Kogtok area of the Patterson, J.G. and Heaman, L.M. Kaminak greenstone belt, as compiled from a variety of public sources, are listed in Table 1 and plotted on the accompanying 1:125 000 scale maps. Only those occurrences with reported reserves or those that have been drilled were selected from an evolving database that includes information on more than 180 occurrences in the Kaminak greenstone belt. Much of this mineral occurrence information is available in NORMIN.DB, DIAND's comprehensive relational database of mineral showings in the NWT. Four principal types of occurrences have been recognized based on metal endowment. Those containing Zn and/or Pb (generally at concentrations of greater than 500 ppm), but lacking significant Au are designated as base metal are indicative of magma co-mingling/mixing relationships. On the northern and southern margins of the pluton, veins occurrences; those containing significant Au (generally at concentrations of greater than 500 ppb), but lacking Zn and dykes of granitoid intrude the country rock, although the northern contact has subsequently been faulted. Tonalite and/or Pb are designated as gold occurrences, those containing significant Au as well as Zn and/or Pb are designated. on the western shore of Carr Lake may be equivalent to the Carr pluton. The eastern margin of the pluton comprises a as polymetallic occurrences, and those containing uranium are designated as uranium occurrences. Ag and Cu are present in numerous examples of the gold, base metal and polymetallic types, but their presence is not diagnostic of any particular type. This classification scheme is empirical rather than genetic, but has genetic implications (see below).

#### material, similar to the mafic volcanic rocks of the Kaminak Group (Amu), as well as rafts of dioritic gneiss. The granite to be largely synvolcanic massive sulphide and/or feeder zone accumulations (VMS-style). Four of the base metal is mildly foliated to isotropic. West of the Kogtok River, granite with abundant semipelitic metasedimentary inclusions occurrences are examples of VMS-style mineralization; two of the base metal occurrences are classified as vein-related east of Snug Lake. It forms a magnetic high in the regional potential field (Geological Survey of Canada, 1987) from structurally controlled and linked to quartz-bearing veins. The presence of strongly deformed veins and alteration zones which its extent and shape have been inferred. Smaller bodies of similar granite occur northeast of Carr Lake. in some gold occurrences, combined with both "early" and "late" stages of carbonate alteration associated with nu-East of Southern Lake, gabbro is pervasively injected by quartz diorite, tonalite and granite, forming a megabreccia merous gold, base metal and polymetallic occurrences, are consistent with a multi-stage hypothesis for gold concentration. The uranium occurrences are classified as paleoplacers.

The Spi Group (Asp; Patterson, 1991) is confined to a six kilometre long, north-northeast trending belt, north of Spi

The discontinuous nature of map units in the metal-rich Kaminak Group does not allow elaboration of a robust Lake. It is essentially composed of steeply dipping, mildly foliated, tonalite breccia and tonalite pebble conglomerate, stratigraphy based upon field observation alone. Nevertheless, the abundance of intermediate to felsic extrusive lithologies, and the high proportion of volcaniclastic rocks, much of which may represent subaqueous reworking of material eroded from subaerial volcanoes, suggests that the Kaminak Group contains the remains of a calc-alkaline magmatic

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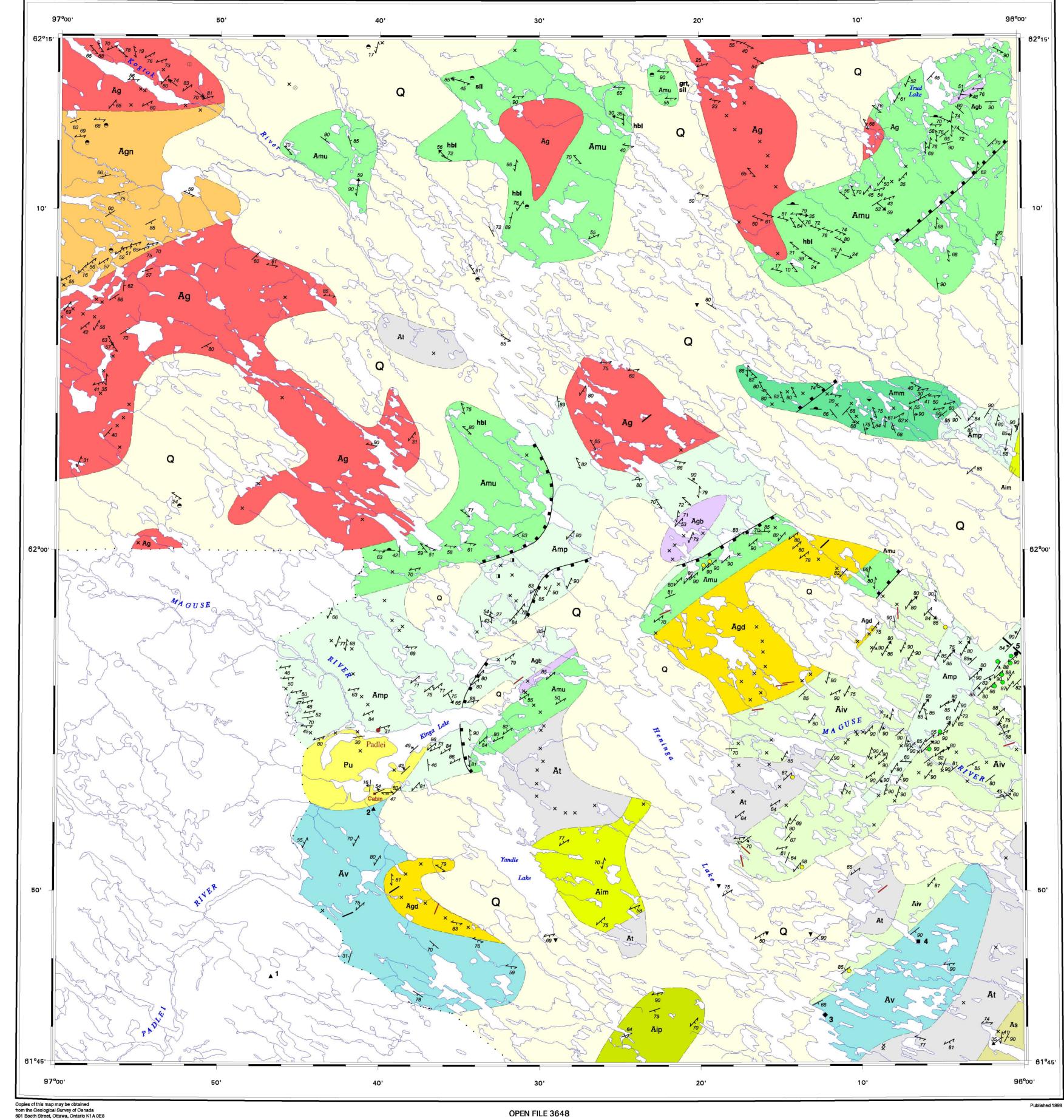
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# **HENINGA LAKE - KOGTOK RIVER AREA, KIVALLIQ REGION** DISTRICT OF KEEWATIN NORTHWEST TERRITORIES

Scale 1:125 000 - Échelle 1/125 000 Universal Transverse Mercator Projection Projection transverse universelle de Mercator <sup>©</sup>Her Majesty the Queen in Right of Canada, 1998 <sup>©</sup>Sa Majesté la Reine du chef du Canada, 1998

Geological compilation by S. Hanmer, 1998 Digital cartography by R.L. Allard, Geoscience Information Division Electrostatic plot produced by the Geoscience Information Division Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada Digital base map assembled and modified by the Geoscience Information Division from digital bases provided by Geomatics Canada Mean magnetic declination 1998, 1° 51'E, decreasing 8.1' annually. Readings vary from 0° 47'E in the NE corner to 2° 54'E in the SW corner of the map Coordinated through the auspices of the Western Churchill NATMAP Project

Geology by S. Hanmer, H.A. Sandeman, R.H. Rainbird, T.D. Peterson, and J.J. Ryan, 1997

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDE TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

# LEGEND

			LEGEND				
Note: This legend is common to Open File 3648 and 3649. Not all units or symbols will appear on each map.	Ар	Quartz/feldspar porphyry	Lithological contact		Bedding or layering, overturned	67 🖈	obro
QUATERNARY	Ad	Diorite	Fault, undifferentiated		S <sub>2</sub> foliation		ic volcanic rocks
PROTEROZOIC HURWITZ GROUP (Pp-Pu)	Admt	   Diorite, magnetite-bearing	Overturned synform (Proterozoic)	<del>*</del> <del>*</del> <del>*</del> * * * * * * * * * * * * * *	F <sub>1</sub> fold axis	, 26 Band	ded iron formation
Pu Undifferentiated	At	   Tonalite	Antiform (Archean)	٧	F <sub>1</sub> , minor fold axis, z-asymmetry	79 Urar	d occurrence, with id number
Pcs Magnetite-chlorite schist	Am	Monzonite	Hornblende isograd		F <sub>2</sub> , minor fold axis, z-asymmetry	27	metallic occurrence, with id number
Pag  AMETO FORMATION: gabbro, minor volcanic rocks			Kaminak dyke		Crenulation lineation		Minerals
PAA AMETO FORMATION: argillite and siltstone	Amg	Monzogranite, microcline megacrysts	Minette dyke		Quartz-carbonate veins	•	Hornblende
PAV  AMETO FORMATION: pillowed and massive volcanic flows	Aqd	Quartz monzodiorite	Limit of mapping		Granite		Sillimanite sil  Cordierite crd
PAd AMETO FORMATION: dolomite	Amp	Mafic/intermediate volcanic pillow flows	Bedding or layering, top unknown	73. /	Tonalite		
PKW  KINGA FORMATION: Whiterock Member, quartz arenite	Amm	Mafic/intermediate volcanic flows					
KINGA FORMATION: Maguse Member,	Amu	Undifferentiated mafic-intermediate volcanic rocks					
PADLEI FORMATION: polymictic conglomerate, quartz pebble conglomerate	Amu'	Undifferentiated mafic-intermediate volcanic rocks, banded or schistose		68° 120°	103° 95° 103° 83° 68°		
and argillite  ARCHEAN	Amp'	Mafic-intermediate pillowed volcanic rocks, banded or schistose	64	SLA	RAE		
Asp SPI GROUP: breccia, conglomerate and arenite	Aip	Intermediate/mafic volcanic pillow flows		SLA	STZ	Baker Lake	
<b>Agb</b> Gabbro	Aim	Intermediate/mafic volcanic flows	66° 120°	200 km	HEARNE		Rankin Inlet
Agbx Agmatitic and migmatitic gabbro	Aiv	Intermediate/mafic volcaniclastic rocks		56°	7	Map are	ea .
Agd Granodiorite	Av	Mixed volcanic rocks, including felsic component			103*	Arvi	iat HUDSON Bay
Ag Granite	Af	Felsic volcanic rocks					
Agn Granitic gneiss with metasedimentary rock inclusions	Ās	Clastic sedimentary rocks	of t	igure 1. Schematic f the Rae and Hear rindow are represer	location of the map area represented by this set of map rne domains, separated by the Snowbird tectonic zone ( nted in green.	s. The Western Chur STZ). Greenstone be	rchill Province is composed olt rocks in the enlargement

TABLE 1. SUMMARY INFORMATION ON THE PRINCIPAL MINERAL OCCURRENCES WITHIN THE AREA COVERED BY THIS SET OF MAPS.										
ID NUMBER	NAME	ALTERNATE NAME	STATUS	COMMODITIES	DEPTYPE	DESCRIPTION	NOTABLE ASSAYS, ETC.	NORMIN.DB#	CANMINDEX#	REFERENCE
1	Wolks Lake	DEN Claims	drilled prospect	U	Paleoplacer	py & uraninite/pitchblende disseminations in quartz-pebble conglomerate; 5 diamond drill holes (ddh)	2430 ppb Au on "Grid C" (DIAND AR082737)		00933700	DIAND AR019955; locations "e" & "f" in GSC Paper 69-52, Fig.3
2	Мас Вау	KIM & TEQUILA Claims	drilled prospect	U, Ag	Paleoplacer	radioactive layers (2 km long) in polymictic conglomerate with py matrix; 8 ddh			00933400	DIAND AR019958
3	Heninga Lake: Central Zone		reserves	Zn, Cu, Ag, Au	VMS	sulphide disseminations & layers in felsic to intermediate volcaniclastic rocks; 3 ore zones: Central, West & East - East is high grade	5.5 Mt of 9.0% Zn, 1.3% Cu, 68.6 g/t Ag & 1.03 g/t Au (Northern Miner 25/03/1982)	065HNE0001	00159400	DIAND MIR 1979, NWT EGS-1983-9, pp. 89-91
4	MAG	E tip of Mag Lake	drilled prospect	Zn, Cu, Pb, Ag	VMS	sulphide disseminations & layers in silicified & sericite-altered felsic volcaniclastic rocks	31% Zn, 2.5% Cu, 135.0 g/t Ag & 0.255 g/t Au (DIAND AR083169)			065HNE0010,01048900, DIAND AR083285
5	False Hook Lake	NE of "SPI 16" showing"	drilled prospect	Au	Vein gold	quartz veins in sheared quartz-carbonate-altered volcanic rocks	8.9 g/t Au; 1 ddh gave insignificant gold (DIAND AR083309)			DIAND AR083177
6	Hook Lake	SPI 7 claim, W of JOYCE 1	drilled prospect	Au	Vein gold	quartz-carbonate veins in sheared iron carbonate-altered mafic volcanic rocks	10.36 g/t Au; ddh: 3.78 g/t Au over 3.7 m (DIAND AR083309)			DIAND AR082775
7	Turquetil Lake: Discovery	JOYCE 1 claim	reserves	Au	Vein gold	quartz-carbonate veins in sheared iron carbonate-altered mafic volcanic rocks	0.5 Mt of 6.31 g/t Au (>60 ddh) (Noble Peak Resources Ltd. Annual Report 1994)		01088600	DIAND AR082822
8	Spi Lake	DEE Claims	drilled prospect	Zn, Cu, Pb, Au, Ag	VMS	sulphide pods and stringers in silicified & sericite-altered felsic to intermediate volcaniclastic rocks; two mineralized zones: Southern & Northern	ddh: 4.25% Zn & 0.1% Cu, 23.31 g/t Ag & 0.857 g/t Au over 4.27 m	055LSW0133	00533200	DIAND NWT MIR 1973 EGS 1976-9, pp. 18-20
9	Unnamed	SE of Arrowhead Lake	drilled prospect	Zn, Cu, Ag, Au	VMS	sulphide disseminations & layers at contact between chlorite and carbonate-altered dacite and andesite flows	ddh: 6.60% Zn, 0.31% Cu, 4.98 g/t Ag & 2.18 g/t Au over 1.5 m	055LSW0142		DIAND AR061294
10	Unnamed	S of Arrowhead Lake	drilled prospect	Cu, Ag	Vein	quartz-cbt veins in hornblende-basalt and diabase; ddh cut po-py stringers in rhyolite breccia (nb. ddh 300m NE tested py-po in argillite with 0.3% Zn)	channel sample: 0.03% Cu & 2.74 g/t Ag over 1.5 m	055LSW0141		DIAND AR061294
11	Unnamed	NE of Arrowhead Lake	drilled prospect	Zn, Cu	VMS	EM anomaly; ddh: po stringers in rhyolite breccia above fault contact with andesite	ddh: 0.12% Zn & 0.02% Cu over 1.5 m	055LSW0144		DIAND AR061294
12	VG Prospect	KAM Claims	drilled prospect	Au	Vein gold	quartz veins in sericite-altered felsic volcaniclastic rocks at sheared contact with chert-pyrrhotite-magnetite iron-formation	709.7 g/t Au			DIAND AR082938
13	Mule	Elbow Lake	drilled prospect	Zn, Cu, Fe	VMS	chert-pyrrhotite-magnetite iron-formation in felsic to intermediate volcaniclastic rocks		055LSW0255	01089200	DIAND AR082938
14	Unnamed		drilled prospect	Cu	VMS	sulphide disseminations in felsic tuff: diamond drill hole on nearby EM anomaly intersected disseminated pyrite and pyrrhotite		055LSE0029		DIAND AR080438
15	MAC Gold Zone		drilled prospect	Au	Vein gold	quartz veins with prominent sulphide halos in sheared chlorite & carbonate- altered mafic volcanic rocks near a contact with sericite schist	ddh:13.989 g/t Au over 3.40 m	055LSE0080		DIAND AR082891
16	Unnamed		drilled prospect	Au	Vein gold	quartz veins in sheared, sericitized & quartz-carbonate-altered felsic volcaniclastic rocks	22.29 g/t Au	055LSE0060		DIAND NWT MIR 1988-89, p.55
17	LAD Zone		drilled prospect	Cu	Vein	quartz veins in carbonate and sericite-altered shear zone along contact between mafic and felsic volcaniclastic rocks		055LSE0057	00354100	DIAND AR017007
18	Kaminak Lake NE- 2 (PETER)		drilled prospect	Au	Vein gold	quartz-carbonate veins in talc-sericite schist		055LSE0257	01089400	NMI No. 502628 or 055L07AU001; GSC Map 1216A
19	Cache Zone		reserves	Au	Vein gold	quartz veins and quartz-iron carbonate veins in sheared, sericitized & iron carbonate- altered felsic volcaniclastic rocks near contact with a quartz-feldspar porphyry plug	0.364 Mt of 9.26 g/t Au (13 ddh)	055LSE0056		DIAND AR082888
Note: ID num	ote: ID numbers 1 to 5 are located on Open File 3648 and ID numbers 6 to 19 are located on Open File 3649									



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