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NATMAP CARTNAT
Canada's National Topographic Mapping Program
Le Programme national de cartographie géotechnique du Canada

DESCRIPTIVE NOTES

INTRODUCTION

This map is one of a set of two 1:125 000 scale colour Open File maps (Hermige Lake - Kogvik River area, Hornaer Lake - Kivalliq River area) published by the Geological Survey of Canada as a contribution to the Canada-Nunavut Geoscience Office (CNGO) and the results of bedrock mapping by the Geological Survey of Canada and the Government of the Northwest Territories in parts of the Kaminak Lake (NTS 55 J), Hornik Lakes (65 H) and Ferguson Lake (55 K) map areas. The CNGO is a joint initiative of the Government of Canada and the Government of Nunavut. Base maps at 1:250 000 scale by Geodraft (1978), (1979) and BAE (1971). 1:50 000 by Hydat et al. (1982), Brown (1982, 1986, 1987) and Rolf (1990), and 1:30 000 by Laporte et al. (1981). Fieldwork by the Geological Survey of Canada in 1996 and 1997 was carried out by 1:50 000 scale mapping in the Kaminak Lake area, 1:100 000 scale mapping in the west and east of Kaminak Lake, and reconnaissance mapping in adjacent areas to the south and west. The Carr-Kaminak-Quartzite lakes map is a compilation of new data and interpretations from the 1996 mapping, and the above-cited 1:50 000 scale maps. The Hornaer - Kivalliq River map is a compilation of new data and interpretations from the 1997 mapping, and Geological Survey and associated Ukaniorto cooks within the map area are presented elsewhere (Aspler, 1995, 1996; Rafi 1995; Hanmer et al., 1996b, 1996c). Descriptions of the extensive Quaternary surficial deposits (Q) will be presented in separate publications. Mineral and diamond exploration assessment reports filed with DIAND have been used as an information these occurrences is summarized on the accompanying table. More information on the metal endowment of the Kaminak greenstone belt will be presented in another publication (Eott and Kerswill, in prep.).

Kaminak greenstone belt

The Kaminak greenstone belt is a segment of the ca. 500 km long "Ennadai-Rankin greenstone belt". The latter extends from West Bay on the Hudson Bay coast to northern Saskatchewan (Miller and Tella, 1995; Aspler and Chiarenzelli, 1998). In the Kaminak Lake area, the Kaminak Group was defined as an assemblage of volcanic rocks, which is bounded by granitoid rocks and unconformably overlain by clastic rocks.

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, are mafic to intermediate volcanic rocks, whereas light grey to pink rocks with quartz phenocrysts are intermediate and felsic ones, present in white rocks, a protessor Mihalynuk and/or quartz phenocrysts were mapped as felsic. However, locally pervasive silicification, or the growth of metamorphic minerals, make such field determinations difficult or impossible. Most of the rocks in the Kaminak greenstone belt have been metamorphosed to greenschist facies, but are invariably truncated by large plutonic and intrusive bodies. The highly discontinuous map pattern obscures the relative age of lithological packages. Three U/Pb zircon ages (2681 ± 1.4, 2682 ± 1, 2682 ± 3 Ma) have been obtained from felsic volcanic rocks in the Kaminak greenstone belt (Mortensen and Thorpe, 1987; Patterson and Heaman, 1989). No basement to the Kaminak Group has been identified.

KAMINAK GROUP

Mafic to intermediate volcanic rocks

Massive mafic volcanic rocks (Am) are commonly interlayered with intermediate pillow lavas (Aap). Large volumes of intermediate volcanic rocks (Aav) are present in the Kaminak Lake area, in the Hornik Lakes area, in the Ferguson Lake area and Turquoiti Lakes, south of Kaminak Lake, and at Quartzite Lake. The volcanic sequences are composed of variable proportions of small (< 5 m) fragments of feldspar crystals set in a fine grained, grey-green intermediate matrix. Locally, the rocks are crowded porphyritic andesites (Aap). Rare, thin (< 1 m) interbeds of mafic tuff, lithic tuffite, quartz arenite and jasper (Bjd), 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, and the presence of angular fragments of the underlying lithologies in the conglomerate, are features which in many cases 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.

Felsic volcanic rocks

Massive and pillowed felsic volcanic rocks (Af) are well developed between Kaminak and Quartzite lakes. Banded, quartz- and feldspar-porphyritic rhyolite form subsidiary breccias along the northwestern margin of a 10 km by 5 km quartz±feldspar porphyry body (Apq), interpreted as a large felsic dome. The dome is manifest by a complex of felsic flows, breccias and intrusive rocks, which is surrounded by a carapace of felsic volcaniclastic rocks, which are in turn set in a matrix of similar composition. The latter are the largest, 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.

Mixed volcanic rocks

A distinct lithological association with relatively high proportions of felsic cs intermediate to mafic matrixes (1.2 - 1.3) occurs from Sp Lake to Turquiti Lake, and in a number of areas along the northern side of Kaminak Lake between Carr Lake and Quartzite Lake. The association is characterized by a mixture of felsic, intermediate and mafic clasts in volcaniclastic breccias and arenites, interspersed within them and 0.1-to 1.1 km thick horizons of felsic volcanic rocks similar to Af. The "immixite" assemblage (Aax) is associated with abundant magnetite-chemical/clastic banded iron formations (Fe), and with fine- deposits, central Kaminak Lake, and magnetite/hematite/chert fesies iron formation northeast of Turquiti Lake.

Clastic sedimentary rocks

A distinct and mappable fesies of clastic sedimentary rock (As) occurs around Kaminak and Quartzite lakes, North and south of Kaminak Lake this unit is characterized by normally graded, 5thin) semi-laminations rhythmites with averaged bed thickness of 1 to 5 cm. The rhythmites are commonly interbedded with 1 to 5 m thick beds of mafic tuff and lapilli tuff. South of Quartzite Lake, where it occurs in a continuous section more than 2000 m thick. The section young to the north and comprises texturally mature polymictic conglomerate overlain by coarse- bedded sandstones, massive sandstone and conglomerate, and finally by thick, fine- to medium- grained, well- bedded quartz arenite. Clasts in conglomerate are quartz±feldspar porphyry, however, locally derived volcanic clasts in the conglomerates suggest an unconformable relationship with underlying Kaminak Group rocks, as suggested by Davidson (1979a). Preliminary analysis of the sedimentary structures in the quartz arenite indicates a dominant paleoflow to the northeast. Similar rocks south of the granitoid plutons/batholiths at Ferguson Lake are interpreted as distally equivalent subfacies. This map unit overlies felsic to intermediate volcanic flows and breccias (Aav) on the west side of Quartzite Lake and on northern Kaminak Lake and Turquiti Lake, and is in turn overlain by mafic flows (Am). The contact relationships between these rocks and the felsic rocks just described, between Quartzite and Kaminak lakes.

Iron formation

Banded iron formation (BIF) occurs southwest of Kaminak Lake, where it is associated with normally graded volcanic conglomerate (Agd) and felsic volcanic rocks (Af) and northeast of Turquiti Lake, where it is associated with felsic tuff and thickly laminated to thinly bedded magnetite, pyrgmerites hematite and gyrgy chert, interbedded with thin to thick beds of grey-green volcanic arenite. The distribution of these rocks is clearly defined by pronounced linear anomalies in the aeromagnetic data (GSC Map 1216A, 1217A, 1218A, 1219A). The iron formation is commonly oxide facies, but locally has layers sorted very thin, rhythmic, parallel lamination, with no traditional sedimentary structures, allowing to deposition in quiet water. In the northern part of Kaminak Lake, opposite the Kam deposit, Fecantonate interbeds occur with the iron formation. Similar rocks at Turquiti Lake, 10 km to the southeast, are also associated with felsic volcanic rocks. Drill intersections of these rocks (DIAND assessment files) show that the iron formation is commonly 5-60 m thick, but may be thicker. Some contain 5-60 cm layers of iron oxide rhythmite, confirming their origin as gravity flows. Other potential indicators of abyss instability include syn-sedimentary folds and dioritic dyke/s. The iron formation is commonly magnetic, and is locally associated with pyrite, pyrrhotite, and minor chalcopyrite. Drill intersections below storm wave base (> 100m). Intercalated felsic volcaniclastic sediments, tuffs and magnetic layers 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-feldspar diorite; (ii) plagioclase-porphyritic to megaporphyritic diorite, (iii) hornblende crowcks (< 3 cm) diorite, and (iv) intimately admixed components of all three. They are collectively called the central Kaminak Lake pluton. The pluton is the largest intrusive body in the area and is interpreted to be comagmatic with the volcanic rocks of the Kaminak Group. They commonly contain abundant xenoliths of metavolcanic rocks, up to several tens of metres across. These include mafic to felsic volcanic and sedimentary rocks that have been deformed into foliated amphibolite. Locally, the xenoliths are so abundant that the diorite is a breccia. Some of the xenoliths are rounded, probably somethatare bottle bralites, but more typically they are irregularly shaped, suggesting brittle fracturing of country rock. They are also intrusive by intermediate dikes with chilled margins, apparently similar in composition to parts of the Kaminak Group volcanic rocks, which are interpreted to be feeders to the volcanic rocks.

Southwest of Kaminak Lake, the Kaminak pluton ranges in composition from granodiorite to gabbro, but is predominantly medium-grained, hornblende-biotite granodiorite (Agd) to tonalite. The pluton has a disruptive, relevant contact with the Kaminak Group volcanic rocks, which are commonly altered to hornfels for a few hundred metres. Along the northeastern margin is characterized by hornblende, hyphyllonized, banded metadiabasic rocks. These, variably deformed veins emanating from the pluton suggest that the wallrock was deformed as a consequence of the pluton intrusion. Small bodies of granodiorite (Agd), diorite (Ad), gabbro (Ag), and quartz monzonite (Aqd), quartz diorite (Aqd), diorite (Ad), magnetite/ilmenite gabbro (Agm), and very gabbro (Agb) North of Kaminak Lake, the Ferguson pluton is similarly diverse in composition, ranging from two gabbros through diorite and quartz diorite, to predominantly granodiorite and tonalite. Most of the rocks are medium- to coarse-grained, equigranular and hornblende-bearing.

East of Carr Lake, the Carr pluton ranges from diorite to granite (Ag), but is predominantly a homogeneous, medium-grained, biotite±hornblende granodiorite. Diffuse, gravitational contacts, mechanical incorporation of potassium feldspar megacrysts from the granodiorite into the diorite, and the presence of abundant hornblende-rich mafic enclaves in the granodiorite are indicative of magma mixing/mingling relationships. On the northern and southern margins of the pluton, veins and dykes of granitoid intrude the country rock, although the northern contact has subsequently been faulted. Tonalite (At) is the most abundant rock type in the Aberdeen Lake pluton, which is a large, composite intrusion that consists of a series of magmaticallt, kilometer zones alternating with dioritic bodies and granodiorite that, over a distance of 10 km, pass into the central Kaminak dioritic suite.

North of Hermige Lake, large plutons of medium grained, equigranular biotite granite (Ag) contain inclusions of mafic material similar to the mafic volcanic rocks of the Kaminak Group (Amu), as well as sets of dioritic gneiss. The granite is mildly foliated to isotropic. West of the Knight River, granite with abundant xenoliths metasedimentary inclusions (Agx) is interpreted to be anatectic. The Aberdeen Lake pluton intrudes the Kaminak Group and Quartzite Lake rocks east of Snug Lake. It forms a magnetic high in the regional potential field (Geological Survey of Canada, 1987), from which its extent and shape have been inferred. Smaller bodies of similar granite occur northeast of Carr Lake.

East of Southern Lake, gabbro is perviasively injected by quartz diorite, tonalite and granite, forming a megabreccia or agmatite (Agm).

SPI LAKE GROUP

The Spi Group (Asp; Patterson, 1991) is confined to a six kilometre long, north-northwest trending belt, north of Spi Lake, where it is in fault contact with the Kaminak Group. The Spi Group is dominated by mafic to intermediate, pillowed volcanic conglomerate and rough crossbedded arenites (Ab Boot Formation). The breccia is composed of angular to semirounded blocks of tonalite in a matrix of weathered tonalite debris that preserves the original texture of the tonalite. The tonalite clasts are identical to the Aberdeen Lake pluton, which intrudes the Kaminak Group volcanic rocks. The sedimentary rocks are separated from well-foliated mafic volcanic rocks that contain scattered, 1-2 cm plagioclase phenocrysts by a surface showing up to 1- n of paleotopographic relief which appears to be an angular unconformity. The mafic volcanic rocks are interpreted to be part of the Kaminak Group (Amu). Where in contact, Lithologically, the volcanic rocks correspond to the Spi Lake Formation (Patterson, 1991), but structurally they appear to share the same foliation as the adjacent Kaminak Group volcanic rocks (Aa). It remains to be determined whether the contact is depositional or tectonic. Patterson (1991) has described the Spi Group in detail, including its composition and stratigraphic setting of the Spi Group resemble those of Tertiaberrnglian deposits of the Superior Province.

HUMMEZ GROUP

The map area the Hurvill Group (Pe, see Rafi, 1991; Davidson, 1970a; Aspler and Chiarenzelli, 1997a) comprises the Pacific Kings and Kines formations. The Pacific Formation (Pp) comprises a basal resistance arenite conformably overlain by quartzwackestone and pulsmictic conglomerate, capped by a well-foliated pebble. The Kinga Formation (conformably overlies the Pacific Formation and is subdivided into the Mayuse Member (Pkm) and the Kinga Member. The Mayuse Member is lightcrystal to marone arenite with minor beds of conglomerate and siltstone, with millimetre-scale pepar and quartz dasts, and centimetre-scale hematite nodules near the base. The Mayuse Member is overlain by the Kinga Member, which is dominated by mafic to intermediate, pillowed and massive lava flows, rubble and minor heavy mineral bands. The White Rock Member is overlain by the Kinkry Formation which includes, from oldest to youngest, pink stromatolitic dolomitone beds with black mudstone to siltstone interbeds (Pwd), pillowed to massive basalt flows (Pwa), and a thick succession of fine- to coarse-grained, buff to pink, quartz arenite (Pwq). The preserved (Pwp), A magnetitefe'r chlorite schist (Pwg, 1.5 to 100 m wide, cuts the lower part of the Kinga Formation, Where not strongly sheared, it appears to be derived from a plagioclase±pyroxic diabase dyke.

Aspler and Chiarenzelli (1997a) suggest that the Hurvill Group was deposited in a rift-related northeast of Carr Lake. The contact typically dipbove the Mayuse Member of the Kinga Formation above granitoid rocks or Kaminak Group volcanic rocks. In places, the interface e recognizable as a narrow semicleavyard schist, foliated subparallel to the regional foliation in the adjacent rocks. Aspler and Chiarenzelli (1997a) suggest that the schist may have been produced by primary chemical and physical weathering of a granitoidone protolith is preserved. The semicleavyard schist along strike to the northeast is considered to represent the deformed equivalent of the regolith.

DYKES

Four sets of dykes are recognized in the field area. They include the locally porphyritic norite±mottled trending Kaminak dyke swarm (Pdk; ca. 2.45 Ga; Heaman, 1994), cut by variably oriented plagioclase±phyric minette dykes (Pmd) and rare easmunbased strong mafic dykes which are comparable with the Tulemalik dyke swarm (Pdt; ca. 2.19 Ga; LeCheminant and Heaman, 1989). Kaminak dykes are cut by a swarm of northeast-trending diabase dykes (ca. 1.27 Ga; LeCheminant and Heaman, 1989) northeast of Quartzite Lake, and numerous, variably oriented proterozoic dykes (Pxd). The latter includes dykes of intermediate composition, apparently similar in composition to some of the Hurvill Group volcanic rocks. Dykes of all ages, with the exception of the Kaminak and Mackenzie swarms, the width of most dykes does not exceed several metres.

STRUCTURE AND METAMORPHISM

Within the Kaminak Group, composite/interbedding veering from sh-scale banding to packages of homogeneous pillow lavas. Where the two are interbedded, the pillowed flows are commonly thinner than the massive flows (Aspler et al., 1996). Smaller scale banding, for example in mafic to intermediate rocks at Lynnshen package, may either be primary or tectonometamorphic in origin. Most rocks of the Kaminak Group exhibit a variably developed, layer-parallel foliation, which is defined by the alignment of mafic minerals, flattened pillows, and, locally, by the alignment of elongate composite xenoliths. This early foliation is referred to as S_1. The strike of S_1 varies from 004-25°, with steep to vertical dips. It steeply pitching extension lineation is regionally developed on S_1 foliation surfaces. This lineation is a spatial coincidence between the hornblende isograd and the three dimensional deflection of S_1 around major plunge is also observed in the Kaminak Group rocks at Quartzite Lake, where the hornblende isograd is deflected around a doubly plunging synform. Regional fold the map comprises the Kaminak and granite plutons are synformal.

The S_1 foliation is locally deformed by structures which, with few exceptions, are only developed at a small scale (< 50 cm). Isolated, asymmetrical folds, and millipe cmmillation cleavage parallel to their axial planes, are heterogeneously distributed, but not necessarily together. These structures are interpreted as F_2 and S_2, but their lateral discontinuity, and the fact that they are commonly restricted to one rock type, suggests that they are not regional in extent. S_2 is commonly associated with the extensional lineation. Very locally, moderately plunging mm folds are seen to deform the foliation. Most importantly, the development of the steeply plunging pitching lineation is independent of the presence of macroscopic folds. This relationship suggests that the lineation is the result of a single, three dimensional deflection is left L_1 structure, interpreted with the development of S_2.

The discontinuous preservation of the Kaminak Group stratigraphy makes it difficult to map major folds. Nonetheless, the distribution of the Kaminak Group and the Spi Group suggests that the Kaminak Group is a synform, and that the Kaminak Group is locally folded on a wavelength of several kilometres. However, the relative age of these structures remains unconstrained. East of Hermige Lake, the thick homoclinal package of southwesterly-dipping pillowed flows, flanked by massive flows and conglomerate, is interpreted to be the overturned limb of a northeast-trending synform. The sense and degree to which the Kaminak Group is extensionally modified, either by F_2 or post-S_2 structures, remains unresolved.

The Kaminak greenschist. Kaminak dykes crosscut deformation structures in the Kaminak Group, thereby establishing their regional deformation and metamorphism in the Kaminak Group occurred in the late Archean. The granite pluton Aberdeen Lake, southeast of Snug Lake crosscuts S_1 in the amphibolitic wallrocks and, when dated, will further constrain the timing of S_1. Kaminak Group rocks are unconformably overlain by the Paleoproterozoic Hurvill Group, which was deposited in a through overturned limbs are locally present. An upright post-plutonic 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 Hurvill Group have been described by Davidson (1970a), Aspler and Chiarenzelli (1997a), Rafi (1991), and Aspler and Chiarenzelli, (1997b). The Carr Lake unconformity plus the Hurvill Group in this middle section of its regional outcrop extent, thereby eliminating the possibility of significant Paleoproterozoic displacements between basement and cover rocks. Aspler and Chiarenzelli (1997a) suggest that the Hurvill Group was deposited in a northeast-trending rift. Paleocurrent data, Paleoproterozoic shortening, Proterozoic alteration and narrow, semicircular shear zones developed in the Ferguson pluton north of the Hurvill Group, and similar alteration associated with extensive