GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

LEGEND

PALAEOZOIC AND/OR PROTEROZOIC

ORDOVICIAN? AND/OR EARLIER

6 — *Dolomite, sandstone, shale; minor arkose;* **6a**, *dolomite;* **6b**, *sandstone;* **6c**, *shale*

ARCHAEAN OR PROTEROZOIC

5 — *Diabase, gabbro*

4 — *Coarsely porphyritic granite*

3 — *Granite and allied rocks;* **3a**, *quartz monzonite, hornblende granite; minor granodiorite, quartz diorite;* **3b**, *very coarse-grained granite, porphyritic in part*

2 — *Quartz-feldspar porphyry, feldspar porphyry; in part may be younger than* **3**

1 — *Metamorphosed sedimentary or igneous rock, commonly with added granitic material;* **1a**, *mainly quartzite, quartz-mica schist;* **1b**, *mainly chloritic schists and gneisses derived from intermediate to basic rocks of volcanic or intrusive origin; minor hornfels*

Geological boundary (defined, approximate or assumed)
Bedding (horizontal or inclined less than 5 degrees)
Schistosity, gneissosity (inclined)
Fault, shear zone (defined, assumed)
Glacial striae (direction of ice movement known)
Esker
Quartz vein or stockwork
Breccia, crushed rock, mylonite m
Mineral occurrence (Pyrite, py; Uranium, U) U

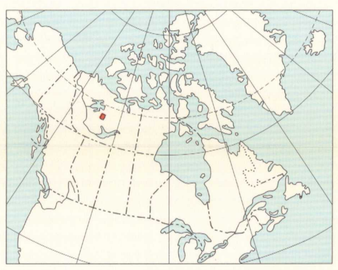
Geology by J. A. Fraser, 1956

Geological cartography by the Geological Survey of Canada, 1966

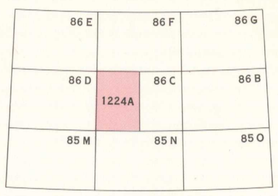
Trail or portage P
Cabin
Intermittent stream
Rapid, falls R F
Marsh
Sand and gravel
Contours (interval 100 feet) 1000
Height in feet above mean sea-level 725

Base-map compiled and drawn by the Army Survey Establishment, R.C.E., 1959-61

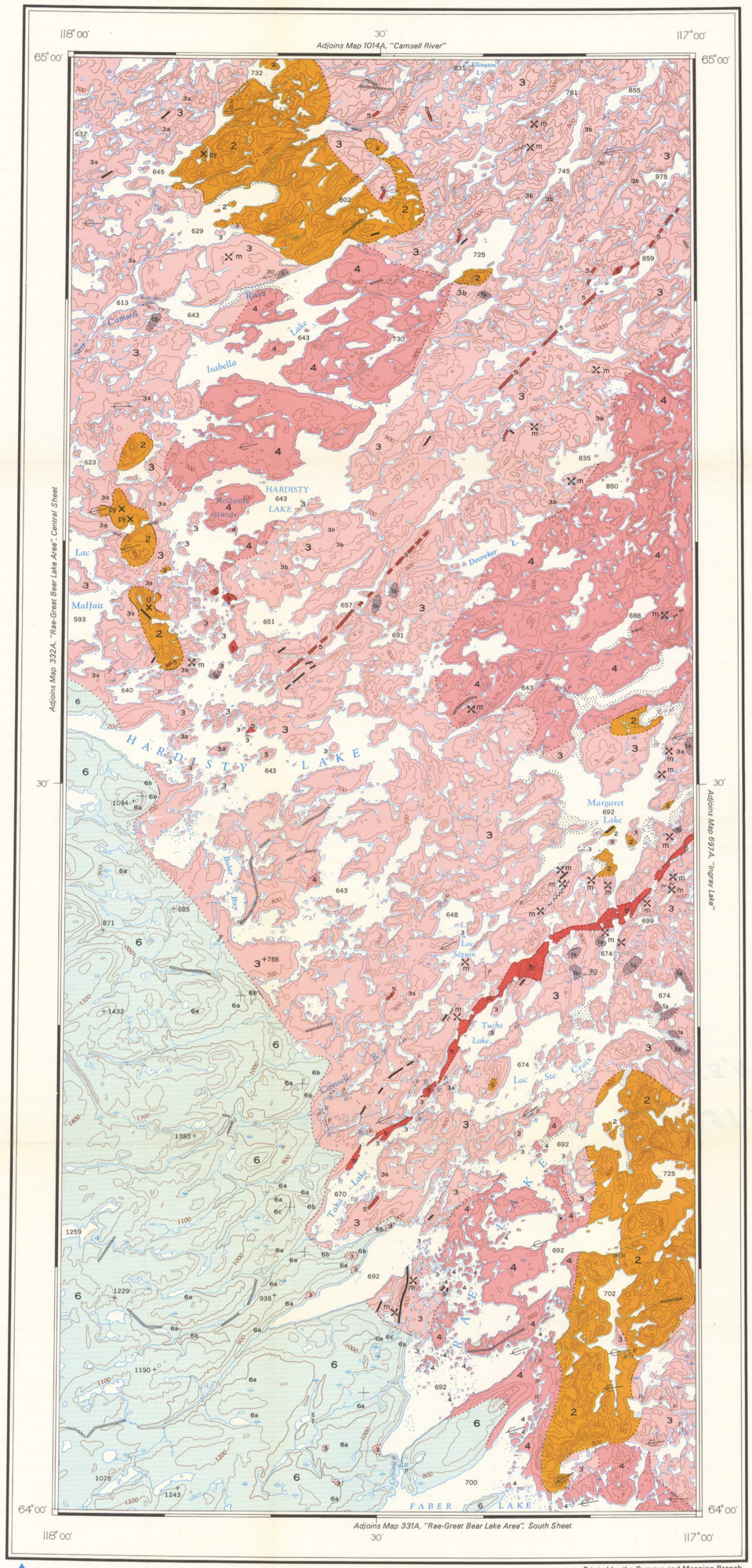
Mean magnetic declination, 36° 39′ East, decreasing 8.3′ annually. Readings vary 35° 42′ in the SE corner to 37° 30′ in the NW corner of the map-area



INDEX MAP



N. T. S. REFERENCE



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1867 | 1967

Printed by the Surveys and Mapping Branch
Copies of this map may be obtained from the Director, Geological Survey of Canada, Ottawa

MAP 1224A

GEOLOGY

HARDISTY LAKE

(West Half)

DISTRICT OF MACKENZIE

Scale 1:253,440
1 inch to 4 miles

Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres

DESCRIPTIVE NOTES

Much of the geology of the southern and western parts of the map-area has been described by Kidd[1]. In general, topographic relief is controlled by the character of the underlying bedrock. It is greatest in regions underlain by feldspar porphyry (2) where steep-sided hills and ridges rise to 600 feet above adjacent waterways. Prominent hills and ridges are also formed by large quartz veins and stock-works, and, in the southwest corner of the map-area, by isolated cliffs of almost flat lying strata flanked by broad slopes. Areas underlain by granitic rocks are commonly of low relief but may be rugged in detail.

Glacial ice moving westward has scoured and striated bedrock surfaces and has left behind eskers and deposits of boulders and till. Layers of clay in the drift, which locally attain a thickness of 20 feet, and abandoned beaches at elevations up to 360 feet above Hardisty Lake are evidence of widespread flooding following glaciation. Bedrock in the southwestern part of the map-area is poorly exposed; elsewhere, outcrops are abundant. Drift-covered areas are well wooded with spruce, jack pine, birch, and tamarack.

Relatively small bodies of sediments and mafic rocks that have been metamorphosed and partly granitized (1) are the oldest rocks exposed. The sediments (1a) comprise mainly light grey to greenish, cherty or fine-grained bedded quartzite that consists of 70 per cent well-sized subangular quartz grains, 15 per cent chlorite, 10 per cent muscovite, and 5 per cent biotite. With a higher mica content, the quartzite grades into mica-quartz schist. Rocks characterized by a high chlorite content (1b), but which may also contain biotite or hornblende and various amounts of quartz and feldspar, are dark green, fine to medium grained, and massive or foliated. Some of the coarse-grained varieties have been derived from dioritic rocks; the finer-grained rocks are probably mainly of volcanic origin but may include some metamorphosed equivalents of argillaceous sediments.

The composition of the porphyries (2), based on the larger determinable grains, ranges from dacite to quartz latite. Pale white, grey, or light greenish euhedral phenocrysts of oligoclase or andesine, 1/16 to 1/8 inch long, and in some cases 1/4 inch long, constitutes 25 per cent of the porphyry. Phenocrysts of untwinned potassic feldspar and microperthite up to 1/8 inch long generally make up less than 10 per cent. Quartz phenocrysts are smaller and less abundant than those of feldspar; half of the porphyry specimens examined by microscope contained less than 1 per cent quartz as phenocrysts. The groundmass of the porphyry is pink and fine grained or reddish brown to black and aphanitic. The dark phase weathers to grey or greenish grey. The pink phase appears to be more characteristic of marginal zones of the porphyry bodies and of some of the smaller bodies, such as that on the north arm of Margaret Lake; the darker phase forms the main mass of the larger bodies and is particularly common underlying the higher ridges. No clear-cut relationship between the two types of porphyry has been discovered and contacts between them have not been observed. Whether these rocks are extrusive or intrusive is not known. Fragmental and rare pillow structures suggest a volcanic origin for the grey feldspar porphyry (2) north of Isabella Lake. Dykes of pink or reddish quartz-feldspar porphyry (2) containing 1/4 inch phenocrysts of quartz and feldspar in approximately equal amounts intrude quartz monzonite (3a) near Lac Malfait. The quartz monzonite, in turn, intrudes grey feldspar porphyry (2). Pink feldspar porphyry (2) at the north end of Margaret Lake is separated from porphyritic granite (4) by sharp, undulating contacts, but the relative ages could not be determined.

Map-unit 3 includes at least three distinct varieties of granitic rocks which, because of their irregular distribution and the gradational nature of their mutual contacts, could not be mapped separately. All are massive and some are porphyritic. Much of the granite is pink and medium grained, comprising up to 35 per cent quartz, 50 per cent microcline and microperthite, and 30 per cent oligoclase. Biotite or chlorite, in some cases with hornblende, generally constitutes not more than 5 per cent of the granite. Granite (3) northeast of Faber Lake is also of this kind but is characterized by microperthite associated with orthoclase rather than with microcline. This granite grades into pink feldspar porphyry (2) through a contact zone in which small exposures of both rocks alternate. Hornblende is a common constituent of the granite and quartz monzonite (3a), which are best exposed west of Hardisty Lake and west and northwest of Isabella Lake. This rock, which grades in some places into granodiorite and quartz diorite, is light pink to salmon-pink or buff, weathering pale grey to cream-white, and consists of 5 to 20 per cent quartz, 20 to 50 per cent microcline and microperthite, 25 to 40 per cent andesine or oligoclase, with up to 10 per cent hornblende, biotite or chlorite, and minor epidote. The plagioclase is a distinctive waxy yellowish green and weathers dark grey or chalky-white. Grains exhibit a blocky form in which zone boundaries may be apparent. Rounded inclusions from a few inches to more than a foot in diameter, similar in lithology to the feldspar porphyry (2), occur in the quartz monzonite (3a) and are increasingly abundant approaching contacts with porphyry bodies (2). Quartz monzonite (3a) east of Hardisty Lake grades into massive, very coarse-grained, pink granite (3b) that is similar in appearance and composition to the coarsely porphyritic granite (4) except that in the latter, feldspar crystals are larger and more numerous. The granite (3b) may be a marginal phase of the coarsely porphyritic granite (4) into which it grades. Masses of reddish or pinkish fine-grained granite, which may be more than 30 feet in diameter, occur throughout much of the medium-grained or coarse-grained granite (3). Some of these are slightly porphyritic, containing blocky feldspar phenocrysts up to 1/8 inch in diameter. Contacts with the surrounding granite are sharp or gradational but the relative ages are obscure. Granite (3) adjacent to shear zones or faults is commonly chloritic. Prominent topographic lineaments that pass south through Margaret Lake and southwest through Margaret and Seguin Lakes and are bordered by chloritic granite, may be the loci of such shears or faults.

The coarsely porphyritic granite (4) consists of pink or, more rarely, grey phenocrysts of microperthitic microcline in a medium- to coarse-grained matrix of quartz, potassic feldspar, oligoclase, and chlorite or biotite. The phenocrysts, which in most places constitute 50 to 80 per cent of the rock, are in blocky subhedra or euhedra that appear on outcrop surfaces as randomly oriented rectangular forms from 1/2 inch to 2 inches long. Porphyritic granite in marginal zones adjacent to non-porphyritic granite commonly contains less than 20 per cent phenocrysts in a reddish, fine- to medium-grained, cataclastic matrix. Border phases may also contain pearl-grey ovoids of potassic feldspar instead of the common pink variety. Porphyritic granite (4) at Rae Lake here and there carries rare, small xenoliths of medium-grained and fine-grained granite and, in one exposure, was observed to intrude fine-grained red granite (3). At Faber Lake and elsewhere, porphyritic granite (4), with a decrease in the size and number of phenocrysts, grades into massive granite (3).

Dykes of pink, fine-grained, equigranular aplite, ranging in width from a few inches to more than 10 feet, are found in the granitic rocks (3), in the porphyries (2), and in the coarsely porphyritic granite (4), but are most common in the hornblende granite and quartz monzonite (3a) west of Hardisty Lake. Contacts are generally sharp and straight but may, in some cases, be irregular. A typical dyke comprises 30 per cent quartz, 60 per cent microline and microperthite, 10 per cent oligoclase, and traces of chlorite.

There is no reason to believe that the several kinds of granitic rocks (3, 4), despite differences in composition and texture, are widely different in age. On the contrary, they are probably all genetically related; each is massive or porphyritic, and at one place or another is gradational into the others. Moreover, the feldspar porphyry or quartz-feldspar porphyry (2) is known to be in part older and in part younger than the quartz monzonite (3a). If these porphyries are genetically related they may be roughly equivalent in age to the granite (3).

Brown-weathering dykes of diabase (5) intrude all other rocks except quartz veins and the flat-lying sediments (6) exposed in the southwestern part of the map-area. Most of the dykes are less than 100 feet wide; those shown are dyke swarms or dykes more than 50 feet wide. The prominent dyke that extends northeast from Taka Lake dips 35° SE.; most, however, are steeply inclined. A representative dyke consists of about 35 per cent augite and hornblende, 50 per cent labradorite, 5 per cent or more magnetite, with minor epidote, chlorite, and biotite, and up to 5 per cent quartz and feldspar in granophyric intergrowths. Small bodies of lamprophyric rock on central Hardisty Lake, probably derived from diabase or gabbro, are black, medium grained, and massive, with 35 per cent hornblende and chlorite, 30 per cent biotite, 30 per cent andesine, 5 per cent quartz, and minor potassic feldspar, apatite, magnetite, and epidote.

Quartz veins cut diabase (5) and older rocks (1-4). Those mapped are between 50 and 100 feet wide and are steeply inclined. Some of the large veins exhibit a crude alignment but, in such cases, appear to be discontinuous along strike. The central part of a vein is typically massive, white or pinkish quartz; along the margins, partial replacement of the walls by silica has produced quartz stock-works and vein breccias that are transitional into relatively fresh country rock. Many veinlets from 1/2 to 1 inch wide have well-developed comb structure commonly coated by specular hematite. At least two ages of quartz can be inferred from vein intersections.

The youngest rocks (6) are flat-lying to gently dipping strata of dolomite, sandstone, and shale, exposed in a series of scarps that face east and rise in elevation to the west. They represent a total thickness of about 400 feet; (this estimate is based largely on elevational differences between outcrops as bedrock in this region is poorly exposed). Impure arkosic sandstone at Rae Lake lies unconformably on deeply weathered granite and is overlain by red sandstone that grades upward into white or light grey, fine-grained sandstone consisting chiefly of uniformly sized and rounded quartz grains in beds from 1 inch to 4 inches thick. The total thickness of the sandstone is probably not more than 100 feet. Stratigraphically above the sandstone is dark grey, thin- to thick-bedded dolomite that weathers dark reddish brown. Light grey dolomite near the top of the section is thick bedded and very fine grained. It contains 15 per cent quartz and feldspar and carries casts of salt crystals. This is interbedded with 20 feet of light green or grey, thin-bedded, fissile shale. Fossils were not found in the dolomite although similar strata mapped by Lord[2] to the southeast yielded fossils of Ordovician age. Contacts between the dolomite and sandstone were not observed. The sandstone may, therefore, be Palaeozoic or Proterozoic.

On the UR group of claims west of Hardisty Lake[3] pitchblende is exposed in pits and trenches that follow the strike of a quartz stock-work intruding feldspar porphyry (2) near its contact with quartz monzonite (3a). The stock-work has a strike length of more than 1,500 feet. Steeply dipping fractures in the vein are filled with hematite and, in a few places, are coated with films of pitchblende. Chlorite alteration is common in the vein walls. Elsewhere, shear zones in feldspar porphyry (2) may contain finely disseminated pyrite. One such zone north of Lac Malfait can be traced by discontinuous outcrops for more than 2,000 feet.

[1] Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, Northwest Territories; Geol. Surv., Canada, Mem. 187 (1936).
[2] Lord, C. S.: Snare River and Ingray Lake map-areas, Northwest Territories, Geol. Surv., Canada, Mem. 235, p. 37 (1942).
[3] Lang, A. H.: Canadian Deposits of Uranium and Thorium; Geol. Surv., Canada, Econ. Geol. Ser. No. 16 p. 59 (1952).