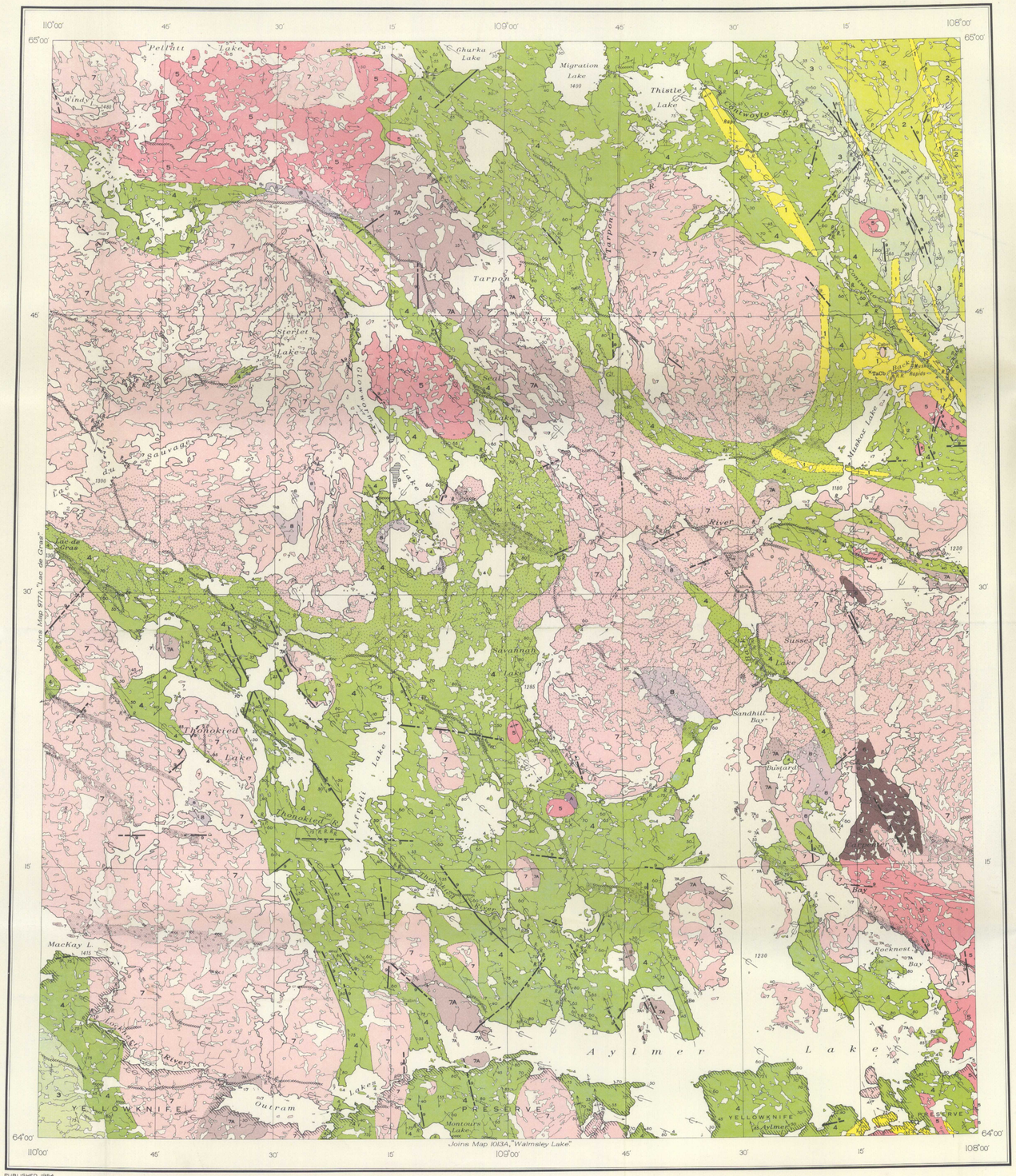
CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

GEOLOGICAL SERIES

SHEET 76C



LEGEND

PROTEROZOIC

- 9 — Diabase, quartz diabase, gabbro
- 7 7A — Granite, quartz monzonite; pegmatite **7A**. Mainly pegmatite, minor granite and quartz monzonite
- 5 6 — **5**. Biotite-hornblende quartz diorite **6**. Quartz diorite with 25 to 75 per cent granite, quartz monzonite, and pegmatite
- 8 — Granite, quartz monzonite, quartz diorite, and pegmatite with 25 to 75 per cent schist and gneiss

ARCHÆAN

- 3 4 — YELLOWKNIFE GROUP (1-4) **3**. Greywacke, slate, arkosic sandstone, phyllite **4**. Nodular quartz-biotite schist and arkosic quartzite; derived from 3
- 2 — Rhyolite, dacite, tuff and agglomerate; minor greywacke and slate
- 1 — Basalt and tuff

- A — Pyroxenite (younger than 4 and probably older than 9; age relative to 5 and 7 uncertain)

Area of heavy glacial drift
Pleistocene drainage route
Bedding (inclined, vertical, overturned; dip unknown)
Bedding (direction of dip known, upper side of bed unknown)
Schistosity (inclined, vertical, dip unknown)
Anticlinal axis (arrow indicates direction of plunge)
Synclinal axis (arrow indicates direction of plunge)
Glacial striæ
Drumlin (and direction of ice-movement)
Esker
Mineral occurrence

MINERAL SYMBOLS

Beryl	Be
Spodumene	Li
Tantalite-columbite	TaCb

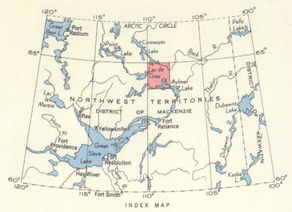
Geology by C. S. Lord, 1948, and F. Q. Barnes, 1949
Descriptive notes by F. Q. Barnes, 1952

Portage
Survey monument
Preserve boundary
Lake and stream (position approximate)
Fall and rapid
Glacier
Marsh
Reef or small island
Sand or gravel
Height in feet above mean sea-level (approximate) 1230

Base-map compiled by the Topographical Survey, 1942, from air photographs taken in July, 1938, by the Royal Canadian Air Force. Cartography by the Geological Cartography Division, 1953

Air photographs covering this map-area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

Approximate magnetic declination, 34°30' East



DESCRIPTIVE NOTES

The map-area is in the barrens 210 miles northeast of Yellowknife and 95 miles north of the east arm of Great Slave Lake. The elevation of the lakes varies from about 1,500 feet in the northwest corner to about 1,100 feet in the Back River drainage system at the east boundary of the area. Local relief may be as much as 250 feet above the surrounding lakes, but is commonly not more than 50 feet.

In general, the volcanic rocks show the greatest relief, as well instanced by the belt that extends southeast from Thistle Lake. The acidic volcanic rocks in the northeast corner of the area rise sharply along the sedimentary-volcanic contact to an elevation of more than 100 feet, and this part of the area is characterized by extremely rugged topography, with high, knobby hills and precipitous cliffs. Areas of granitic rocks stand next in relief, and those underlain by sedimentary strata are least rugged. The latter underlie most of the relatively flat areas, though even there rock slabs may be frost-heaved along bedding or schistosity planes to heights of from 1 foot to 10 feet. The metamorphosed sedimentary rocks (4) are more resistant to erosion than the unmetamorphosed greywackes (3). The diabase dykes and plugs (9) are commonly found in draws and depressions, but a few form discontinuous walls 50 to 70 feet high.

Drainage is controlled by a divide that extends diagonally across the map-area from the south side of Hardy Lake in the northwest to Sandhill Bay, Aylmer Lake, on the east. North of the divide the drainage is by way of Contwoyto and Back Rivers to Bathurst Inlet on the Arctic coast. Water to the south of the divide flows by way of Aylmer Lake and the Lockhart River system to the east arm of Great Slave Lake.

Most of the map-area supports only a tundra growth of mosses, lichens, and various low shrubs and grasses. A few stunted black spruce trees were noted near Outram Lakes and the west end of Aylmer Lake. Here and there, in sheltered spots and along stream and river channels, are patches of ground birch, willow, and alder, which rarely exceed 2 to 3 feet in height, but where conditions are favourable may reach 8 to 10 feet. Although these might provide emergency fuel, prospectors should carry gasoline or other liquid fuel for heating and cooking. The principal fauna of the area are ptarmigan, caribou, wolves, foxes (predominantly white), Arctic hares, marten, ground squirrels, wolverines, and lemmings, although the occasional grizzly bear and musk-ox are seen. Numerous caribou may be encountered during the late summer. In 1946, caribou were first observed on July 26, but in 1949, when flies were especially troublesome, they had come south in only small numbers by August 18.

Glacial drift covers about 80 per cent of the land area. It consists mostly of till, and commonly gives an indication of the bedrock. Many erratics have a diameter of as much as 15 feet. A thick belt of glacial debris crosses the area parallel with the watershed, from the north end of Carpenter Bay, Aylmer Lake, to Lac du Sauvage. This drift-belt conceals most of the bedrock along its course, and is typified by rounded hills about 150 feet high and ¼ to ½ mile long. Glacial erosion has rounded, polished, and grooved the bedrock. The ice moved southwesterly, and later, west and northwesterly. Glacial striæ of the earlier ice-movement are preserved along the more protected sides of outcrops, whereas later striæ predominate over most of the rock surface. Esker ridges, some 150 feet high, parallel the later ice-movement. Drumlins and drumlinoid features are common, and are oriented southwest in the northeast corner and west in the southwest corner of the map-area. Elsewhere the drumlins are rounded or irregular.

Well-scoured outcrops, eskers, and scattered sand and gravel deposits interspersed with numerous small rounded lakes mark the Pleistocene drainage routes. Good examples of these routes extend northwesterly from the eastern boundary of the map-area at latitude 64°15' through the head of Carpenter Bay, and westerly to the north side of MacKay Lake. Another ancient drainage route, within the drift-belt mentioned above, extended northwesterly just west of the north end of Savannah Lake; the old river channel is still preserved, and at places is 50 feet deep, 100 feet wide, and filled with water-smoothed boulders. Relict lakes associated with this system show beaches at at least one higher level.

Wherever age relations could be determined, it was found that the volcanic rocks and associated tuffs were the oldest members of the Yellowknife group. The age of the acidic (2) with respect to the basic (1) volcanic members is not known, although they are in part contemporaneous. Minor acidic porphyry flows are intercalated with the Yellowknife sedimentary rocks (3, 4) in the northeast section of the map-area. A few beds of greywacke material are also intercalated with the acidic volcanic rocks. So far as could be ascertained, both flows and sedimentary strata are conformable.

The meta-volcanic rocks of basaltic composition (1) are fine- to medium-grained, chloritized and recrystallized lavas. Pillows and ropy lava structures, as well as amygdules and vesicles, are well preserved within some of the flows. Most of the lavas are completely recrystallized to shiny black amphibolites, which only rarely show orientation of the fresh hornblende needles and become hornblende schists. In thin section these amphibolites vary slightly in their mineral composition. Magnetite, commonly titaniferous, forms 1 to 7 per cent of the rock; fresh, green hornblende comprises 80 to 90 per cent; and a fine mosaic of quartz and plagioclase (andesine-labradorite) fills the interstices in the mat of hornblende needles, and forms from 5 to 20 percent. Some of the volcanic rocks are green, chloritized lavas, of which 70 per cent consists of a mixture of chlorite, hornblende, epidote, and clinozoisite; 25 per cent is a fine-grained quartz-plagioclase mosaic; and about 5 per cent is magnetite. Some of the outcrops are carbonatized and garnetiferous. Thinly bedded, intercalated tuffs characterize the basalts on the south side of Aylmer Lake, and appear to have predominated in the later stages of volcanic activity.

Acidic volcanic rocks (2), consisting of rhyolites, rhyo-dacites, and dacites, outcrop in the northeast corner of the map-area. Texturally they vary from compact devitrified glasses, with conchoidal fracture, to medium-grained equigranular and porphyritic rocks; phenocrysts are quartz, feldspar, and hornblende. The rocks are of various colours—pink, green, buff, white, grey, and black. Flow lines and flow contacts were seen, and, here and there, small vesicles and round pillows, but little structural information could be obtained from them. The rhyolitic flows are commonly massive and featureless. Most of the lavas are felsic, but some carry a low percentage of dark minerals. In thin section, the rhyolites show quartz phenocrysts and a composite groundmass of sericite, chlorite, magnetite, quartz, and feldspar. Small veinlets of quartz and calcite may be present; the calcite veinlets formed later than those of quartz. Some of the dacitic flows carry hornblende and andesine phenocrysts. Other mineral constituents are chlorite, epidote, clinozoisite, sericite, tremolite, magnetite, sphene, apatite, and a fine-grained mosaic of quartz and feldspar. Considerable flow breccia, tuff, and agglomerate are interstratified with the flows, and the agglomeratic fragments resemble the lavas. These fragmental zones are generally porous, and thereby facilitated carbonatization and sulphide deposition. The close of volcanism is marked, on the west side of the acidic volcanic belt, by an assemblage of interstratified greywackes, tuffs, and porphyritic flows.

The Yellowknife sedimentary rocks (3, 4) are particularly well represented in this map-area. They comprise well-bedded greywackes, slates, and arkosic sandstones. Bedding is easily discernible in the unmetamorphosed rocks (3), and particularly so on water-washed shoreline outcrops. The greywacke beds vary in thickness from 1 inch to 2 feet, and commonly show a gradation from a sandy base to a slaty top. They consist of quartz and feldspar grains about 1 mm. in diameter embedded in a fine-grained matrix of quartz, feldspar, and chlorite. The slate beds are dark and not more than 2 inches thick. The arkosic sandstones consist of quartz, feldspar, and a little chlorite; they form massive, featureless beds as much as 5 or 6 feet thick. The sedimentary rocks show pronounced metamorphic effects from neighbouring granitic intrusions. The sandstones become quartzites, and may contain small indistinct, and impure andalusite metacrysts. Towards the granitic contacts, the greywackes and slates show progressive metamorphism from phyllites to nodular quartz-biotite schists, the nodules being more concentrated in the slates and slaty tops of the greywacke beds. The metacrysts, or nodules, consist of violet andalusite, chiastolite, and cordierite, and increase in size and purity with the degree of metamorphism. Metacrysts, varying from impure mineral aggregates ¼ inch in length to pure violet andalusite prisms more than 2 feet long, are well displayed along the shores of Aylmer Lake. They lie in a matrix of granular quartz and feldspar grains and biotite flakes. Sillimanite is another important constituent found here and there in the schists throughout the area.

Quartz diorite (5) is the oldest intrusive rock cutting the Yellowknife group. It occurs throughout the map-area in small stocks, and as part of a composite batholith on the east side of the area. It is a medium to coarse-grained, holocrystalline, mesocratic rock, of weathered appearance, and consists mainly of grey and pink feldspar, quartz, biotite (commonly in small clusters), hornblende, and epidote. Near contacts with the metasedimentary rocks (4) the quartz diorite contains shadowy inclusions of sedimentary material. In thin section, the abundant feldspar is plagioclase, oligoclase-andesine in composition. Hornblende and greenish brown primary biotite alter to epidote and chlorite. Quartz, apatite, and sphene comprise the rest of the rock. Two varieties of sphene characterize the quartz diorite; one is clear and colourless, and is an alteration product of the biotite; the other is a primary, euhedral, accessory, dark brown mineral. The percentage of mafic constituents varies from 10 to 35 per cent. A few biotite-hornblende lamprophyre dykes were observed to cut the quartz diorite, but are also older than the granite and quartz monzonite (7). In the composite batholith on the east side of the map-area, outcrops consisting of 25 to 75 per cent quartz diorite (5) and the remainder of granite, quartz monzonite, and pegmatite have been mapped separately (65).

Granite and quartz monzonite, with associated pegmatite dykes, form a major map-unit (7) in the map-area. They are granular rocks consisting of microcline, honey-coloured quartz, plagioclase, apatite (which is discernible in hand specimens), biotite, muscovite, and minor hornblende and epidote. As a result of variations in mineral composition from place to place, the intrusions consist of muscovite, muscovite-biotite, biotite, and biotite-hornblende granites and quartz monzonites. The hornblende-biotite phase, with minor epidote, is restricted in extent, but outcrops northeast of Savannah Lake. All phases are gradational one into the other, in spite of which the granite and quartz monzonite remain uniform over large areas, being in general medium grained, equigranular, and leucocratic. They are rarely coarse grained, although phenocrysts of plagioclase in a medium-grained matrix are not uncommon. In thin section, plagioclase feldspar varies from almost pure albite to oligoclase-andesine. Microcline is present in appreciable amounts. Muscovite occurs as a primary constituent and as an alteration product of microcline, and may itself be altered to sillimanite. Reddish brown biotite, with a network of included rutile needles, shows alteration to chlorite, epidote, and hematite. Apatite, sphene, and zircon are minor accessory minerals. The mafic constituents comprise 2 to 10 per cent of the rock.

The quartz diorite (5) is distinguished from the granite and quartz monzonite (7) by: its higher content of mafic minerals, generally 25 per cent as against 5 per cent; its deficiency of microcline feldspar; and the presence of hornblende and epidote as important mafic constituents. Regardless of these mineralogical differences both rock types are probably genetically related. Such a view is supported by: variations within the granite and quartz monzonite that produce a hornblendic phase characteristic of the quartz diorite; the fact that the quartz diorite intrusions south of Aylmer Lake in the southeast corner of the map-area contain a little microcline feldspar, generally characteristic of only the granite and quartz monzonite; the occurrence of the more basic phases of the granite and quartz monzonite in the southeastern part of the map-area where the quartz diorite is also found; and the lack of known granites related to the quartz diorite and older than 7, or of sediments intermediate in age between the quartz diorite and 7, thereby further suggesting that the batholithiic rocks of the map-area belong to a single period of intrusion.

The pegmatites intruding the sedimentary rocks (3, 4) and the quartz diorite are extremely numerous. Although they are in sharp contact with the sedimentary beds and quartz diorite their contacts with the granite and quartz monzonite (7) are gradational, suggesting that they are related to them in origin. Areas within which the pegmatites form the bulk of the bedrock have been mapped separately (7A). The pegmatites consist mainly of microcline, plagioclase, quartz, muscovite, and biotite, but also contain many rare-element minerals, among which tourmaline, beryl, spodumene, lazulite, and tantalite-columbite were recognized.

Contacts between the granitic and meta-sedimentary rocks are generally concordant, but in many places the two rock types are intimately mixed. Small bands of sedimentary rocks, as for example those north of Sandhill Bay, Aylmer Lake, become diluted along their strike with granitic and pegmatitic material, and eventually only ***schlieren*** are evidence of their former presence. These sediment-granite complexes (8) represent paragneisses, injection gneisses, and mixtures of granitic rocks with from 25 to 75 per cent sedimentary schist.

Dykes of medium- to fine-grained, dark green, brown weathering diabase and gabbro (9) are the youngest rocks recognized. They are nearly vertical, and outcrop in trough-like depressions more commonly than in ridges. Many are between 100 and 250 feet in width, and most of those mapped exceed 50 feet. Most of the dykes strike north 10 to 40 degrees west, but a few strike northeasterly and east. Two large irregular bodies of gabbro occur on an island in, and on the shores of, Glowworm Lake. The mafic minerals comprise 45 to 65 per cent of the rock, of which 10 to 100 per cent is monoclinic pyroxene, depending upon the extent of deuteric alteration. Reaction rims about the pyroxene consist of hornblende, biotiite, and chlorite. The plagioclase is about labradorite in composition, and quartz, commonly as much as 10 per cent of the rock, forms myrmekitic intergrowths with the feldspar. Magnetite, ilmenite, and sphene are significant accessory minerals.

The pyroxenite (A) south of Savannah Lake is a medium-grained, black, magnetic rock, about 85 per cent of which consists of dark green pyroxene and 10 per cent of amphibole.

Folding of the Yellowknife strata was accompanied by the intrusion of quartz diorite (5) and granite and quartz monzonite (7). The folds strike north and plunge strongly in that direction in the southern part of the map-area around Aylmer Lake. The Yellowknife sedimentary rocks are isoclinally and intricately folded, and the folds are commonly overturned. Bedding is well displayed within the greywackes (3), but may be partly or completely obliterated in their metamorphosed equivalents (4).

Little prospecting has been done in the map-area, and no commercial mineral deposits have been found. In other areas, however, gold deposits genetically related to granitic rocks very similar to those in this map-area occur in quartz veins in nodular Yellowknife strata. It is, therefore, not unreasonable to suppose that gold occurs here. Quartz veins are fairly common in the sedimentary rocks (4), particularly along the shores of Aylmer Lake. Most of the veins parallel the bedding and cleavage and contain a little chalky white feldspar and mica. On the east side of the map-area, within the volcanic rocks, are numerous and extensive gossan zones that contain oxidized sulphides. Most of these zones occur in the vicinity of Muskox Rapids and along the contact of the acidic volcanic rocks (2) with the greywackes (3). Assay reports on two samples from these zones show traces of gold and a little silver. The many pegmatite dykes should be carefully scrutinized for minerals containing such elements as beryllium, lithium, tantalum, and tin. Spodumene (a lithium-bearing mineral) has been found in three dykes and beryl in one. The tantalite-columbite occurrence west of Muskox Rapids has a low uranium content.

PUBLISHED, 1954

MAP 1031A

AYLMER LAKE

DISTRICT OF MACKENZIE
NORTHWEST TERRITORIES

Scale: One Inch to Four Miles = 1/253,440

Miles
4 3 2 1 0 4 8 12

1031A
GEOLOGICAL SURVEY
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