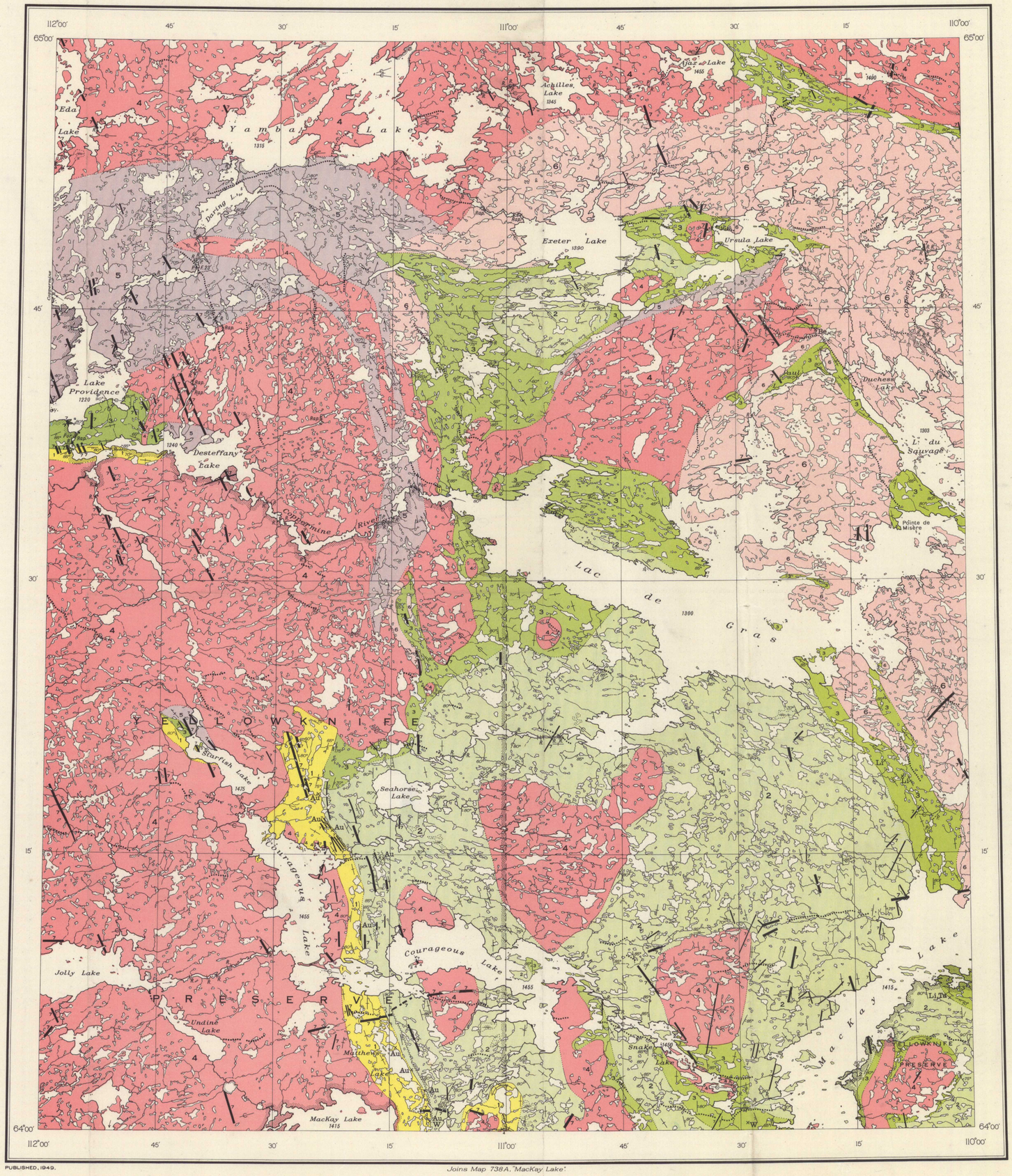
CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES, FORESTS AND SCIENTIFIC SERVICES BRANCH

GEOLOGICAL SURVEY OF CANADA



LEGEND

PROTEROZOIC

- 7 — Diabase, gabbro
- 6 — Muscovite–biotite granite, pegmatite
- 5 — Injection gneiss: sedimentary schist (3) injected and assimilated by intrusive rocks (4)
- 4 — Biotite granite, biotite–hornblende granodiorite, and allied rocks

ARCHÆAN

YELLOWKNIFE GROUP (1–3)

- 2 3 — 2. Greywacke, slate, phyllite; 3. Nodular quartz–mica schist derived from 2
- 1 — Basalt, andesite, dacite, rhyolite; basic intrusive rocks; tuff and agglomerate

Bedding (inclined, vertical, overturned, dip unknown)

Bedding (direction of dip known, upper side of bed unknown)

Foliation (inclined, vertical, dip unknown)

Fault or shear zone

Glacial striæ

Mineral occurrence

SYMBOLS FOR METALS

Gold	Au
Tungsten	W
Lithium	Li
Tantalum	Ta
Beryllium	Be

Geology by R. E. Folinsbee, 1946, 1947.

Portage

Cabin

Survey monument

Boundary of Yellowknife Preserve

Lake and stream (position approximate)

Fall and rapid

Marsh

Sand or gravel

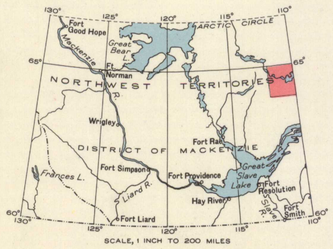
Glacier

Esker

Height in feet above mean sea-level (approximate) 1415

Base-map compiled by the Topographical Survey, 1941, from aerial photographs taken by the Royal Canadian Air Force in July, 1938. Cartography by the Geological Mapping Division, 1948.

Approximate magnetic declination, 35° 45' East.



PUBLISHED, 1949.

MAP 977A

LAC DE GRAS

DISTRICT OF MACKENZIE

NORTHWEST TERRITORIES

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

Miles

DESCRIPTIVE NOTES

The map-area is an upland of Precambrian rocks with an elevation of 1,200 to 1,600 feet above sea-level. The northern half encompasses the headwaters of Coppermine River. The southern half drains into Great Slave Lake by way of MacKay Lake and Lockhart River. The topography reflects the character of the underlying bedrock. The broad sedimentary belt lying between Lac de Gras and MacKay Lake is a featureless plain with very gentle gradients. West of this plain volcanic rocks outcrop as strongly defined north-trending ridges that rise as much as 200 feet above local lake levels. In the southeast part of the map-area, granitic rocks outcrop in moderate relief, characterized by rolling hills rarely more than 50 feet high. North and west of a line through Exeter and Jolly Lakes the topography is rugged, featured by granite cliffs and linear drift-filled depressions. The map-area lies within the barren lands. Stunted spruce grow in the western third of the area, and there is a grove of 20-foot, 300-year old, black spruce near the cabin at the north end of Courageous Lake. The rest of the area supports only tundra growth, including scattered patches of willow, alder, and ground birch.

Glacial erosion has rounded, grooved, and polished the bedrock. Contours of the rock outcrops and early glacial striae indicate that the ice-sheet moved west. As the ice thinned, the underlying Coppermine-Lockhart drainage divide caused the ice-cap to separate into two lobes. Trunk and tributary fluvioglacial esker ridges of sand and gravel parallel the late glacial striae and outline these two ice-drainage basins. The trunk eskers rise as much as 80 feet above lake level, and in places are 500 feet wide. Tributary eskers are smaller and more discontinuous; they average 20 feet in height and 100 feet in width. The drainage centre of the southern ice-lobe passes through Snake Lake, the southern part of Courageous Lake, and south of Jolly Lake. The centre line of the northern lobe runs through Duchess Lake, Exeter Lake, and between Yamba and Daring Lakes. Glacial drift in the lower part of the basins, and in the interlobate morainal area along the drainage divide, is extremely thick. Late advance of the glacier moulded the drift into drumlin-like boulder clay hills. Most of the map-area is covered with only a thin mantle of ground moraine boulders and boulder clay, and rock outcrops are plentiful. In the plains area of stratified sedimentary rocks, blocks of slate and schist have been frost elevated along bedding planes and now project 3 to 15 feet above the drift mantle. Post-Glacial lakes have drowned many of the drumlins, and wave action has breached the eskers and distributed their sand and gravel in long spits, bars, and hooks. On Yamba Lake, thorium-rich monazite, from the disintegrated injection gneiss (4), in the esker sands, has been concentrated into a slightly radioactive beach placer.

The Yellowknife group comprises a thick assemblage of volcanic rocks (1) succeeded by lavas and sediments passing into a sedimentary series (2). The oldest volcanic rocks, such as those of the Courageous Lake and Lake Providence greenstone belts, are predominantly dark green to black weathering basalts and andesites. Ropy, and squeezed and flattened pillow structures may be observed on weathered surfaces of the lavas, particularly where carbonate-quartz stringers replace pillow borders. Carbonate-chlorite schists occur in a narrow belt east of the north arm of Courageous Lake, but elsewhere the volcanic rocks have been recrystallized to shiny black schists, consisting of fine needles of hornblende in a matrix of quartz and basic plagioclase. Coarse-grained, massive, hornblende-plagioclase rocks occur as dykes and as sill-like sheets in the fine-grained flow rocks. They are probably intrusive, and in part may be post-Yellowknife. Three or four discontinuous bands of rhyolite and tuff, 10 to 50 feet thick, occur in the oldest flows. They are white weathering and commonly fractured, mineralized, and iron stained. Fresh surfaces of the rhyolite show abundant quartz phenocrysts, averaging ¼ inch in diameter in a dense groundmass. Towards the close of vulcanism, white to light green weathering rhyolite and dacite were extruded, and are locally interbedded with a garnetiferous andesite, tuffaceous agglomerates, and the slates and greywackes (2) of the Yellowknife group. These silicic volcanic rocks are well exposed around Matthews Lake. The agglomerate consists of squeezed and flattened fragments of rhyolite porphyry in an arkosic groundmass. The older sediments of the Yellowknife group were highly aluminous, thin-bedded black shales, with a few arkosic bands, 3 to 10 feet thick, that might be altered feldspar porphyry sills. The shales have been metamorphosed to slate, and the arkose to a hard, white weathering rock or to a crumbly weathering sericite-carbonate schist. Higher in the sedimentary series (farther from the volcanic contacts), thick-bedded greywackes or impure quartzites predominate. Gradation from a coarse, grey weathering greywacke to a fine, dark weathering slate is characteristic of the individual beds. Structural determinations based on grain gradation and pillow outline, indicate the essential conformity of the sedimentary and volcanic series.

Granitic rocks (5, 6) are everywhere intrusive into the Yellowknife group. They are responsible for the formation of injection gneiss (4), and for the thermal and hydrothermal metamorphism of the intruded rocks. Gold deposits are probably genetically related to the granite intrusions. The Yellowknife group was folded at the time of granite intrusion —the volcanic rocks into simple, steeply dipping structures, and the weaker sediments into a series of isoclinal folds. Axial planes of the folds parallel the slaty cleavage. The injection gneiss (4), best developed in the broad belt around Lake Providence, is a brown weathering, gneissic rock, formed by the *lit-par-lit* injection of granite magma into sedimentary schists. The resulting rock is variable in composition, consisting of about 40 per cent oligoclase feldspar, 30 per cent quartz, 20 per cent biotite, with accessory blue cordierite, white fibrous sillimanite, black graphite, and traces of radioactive zircon and, omazite. The injection gneiss is cut by dykes and sills of massive granite (5).

The granitic rocks in the western and southern parts of the area are biotite and biotite-hornblende granites and granodiorites (5), which, in border phases and in small stocks, grade into hornblende-quartz diorites. Related quartz-feldspar porphyries occur in the marginal intruded rocks. This group of intrusions contains up to 50 per cent oligoclase feldspar and 10 to 15 per cent each of microcline feldspar, quartz, biotite mica, and hornblende. Near the centre of the smaller stocks the rock is a light weathering, fine-grained, massive granite, containing 30 per cent quartz and 10 per cent biotite; at the margins the rock is commonly gneissoid or flow banded, and contains 10 per cent quartz and 20 to 30 per cent biotite and hornblende.

A muscovite-biotite granite (6), with satellitic muscovite-tourmaline pegmatites, probably intrudes the older granitic rocks as well as the Yellowknife group, and may be of Proterozoic age. The granite is coarse grained, containing 30 per cent smoky quartz, 60 per cent white to cream-coloured orthoclase and albite feldspar, and 10 per cent mica, mostly a light amber muscovite; blue-green apatite is a characteristic accessory mineral. Certain phases of this pegmatitic granite show a prominent, north-trending primary foliation, outlined by the parallel arrangement of the mica plates. Marginal to the main arcuate granite mass are tourmaline-muscovite pegmatites; some contain 10 per cent of the lithium silicate mineral spodumene. Traces of tantalite were found in one dyke near MacKay Lake, and a few small crystals of white beryl occur in a dyke north of Paul Lake. Near granite bodies the volcanic rocks were recrystallized to hornblende schists. The sedimentary rocks were metamorphosed to quartz-mica schists (3), and have developed ovoid knots or nodules of aluminous silicate minerals: cordierite, andalusite (with chiastolite cross), garnet, staurolite, and sillimanite were recognized. Some of the nodules have been hydrothermally altered to sericite. The belt of thermally metamorphosed sedimentary rocks is particularly wide around the muscovite granite (6).

Diabase and gabbro dykes (7) are the youngest rocks in the area and intrude all others. A prominent swarm of northwest-trending diabase dykes occupies a belt 20 miles wide that extends through Courageous Lake and Lake Providence, and includes a zone of gold occurrences. A less well defined set of dykes trends north 60 to 80 degrees east. The largest dykes are 200 to 300 feet wide, and others 100 feet in width are common. The dykes weather reddish brown, and are composed of equal parts of labradorite feldspar and pyroxene with accessory magnetite and quartz. Hornblende, biotite, and zoisite are common alteration products. Most of the dykes are diabasic in texture, with interlocking ⅛ inch laths of feldspar in a groundmass of augite. A few green weathering diabase-gabbro dykes are porphyritic, with scattered large crystals of feldspar altered to white zoisite. These green weathering dykes may be early Precambrian in age, and in part appear to be feeder dykes to the hornblende-plagioclase sills in the volcanic rocks.

Gold occurs in quartz veins in shear zones localized at the contact of the strong volcanic rocks with the weak sedimentary slates and greywackes of the Yellowknife group. A contrast in rock strength favours the formation of fractures that may become mineralized. Gold-bearing veins occur in garnetiferous bands in the basic volcanic rocks, at the volcanic-sedimentary contact, and in the sedimentary rocks, particularly where arkosic grits or porphyritic intrusive sills occur in the weak slates. All known gold occurrences lie along or near the eastern contact of the Courageous Lake greenstone belt. Crossing the contact zone, two east-trending diabase dykes are apparently displaced 1,400 feet to the left by vertical faults. Gold mineralization is of a high temperature type, as indicated by the presence of abundant crystals of arsenopyrite and needles of tourmaline in the wall-rocks, and minor amounts of arsenopyrite, tourmaline, scheelite, and pyrrhotite in the quartz-carbonate veins. Most of the prospects display visible gold in a dark blue-grey to smoky quartz, and more rarely in a white sugary quartz. The most favourable areas for further prospecting are believed to lie along the main belt of structural weakness extending from Matthews Lake through Lake Providence, especially in those areas where a sedimentary-volcanic contact offers a difference in rock strength favourable to fracturing.