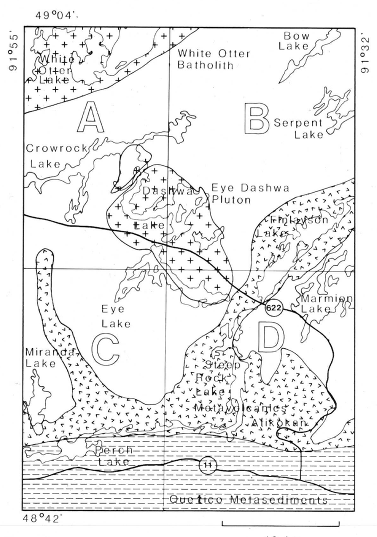
GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES

GEOLOGY OF THE ATIKOKAN AREA

Map sheet **B**



Legend

- 6c Granite
- 6b Granodiorite
- 6a Syenite, diorite
- 5 Diorite, hornblendite
- 4 Gabbro
- 3c Arkose, lahar
- 3b Wacke, argillite, conglomerate
- 3a Limestone, dolomite, chert
- 2c Intermediate to felsic flows, tuffs and breccias
- 2b Intermediate lava flows
- 2a Mafic lava flows and tuffs (ash)
- 1e Mafic tonalite gneiss
- 1d Tonalite gneiss
- 1c Mafic tonalite, quartz diorite
- 1b Tonalite (post volcanic)
- 1a Tonalite (pre volcanic)

Symbols

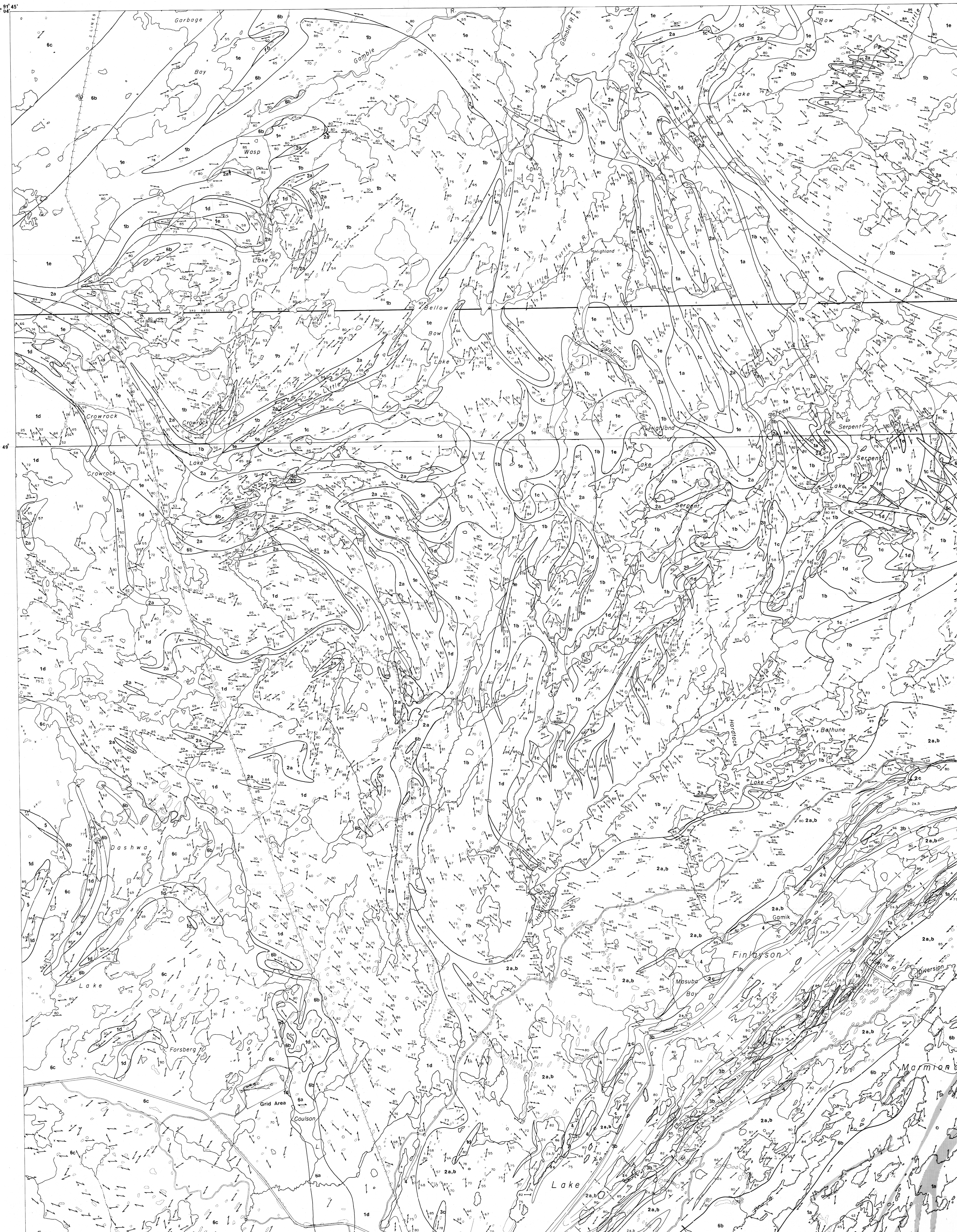
Cultural, geographical

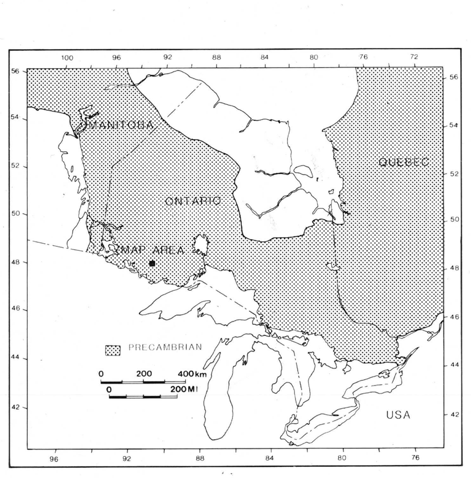
- Road
- Track
- Railway
- Electric transmission line
- Marsh
- Rapids, falls
- Dam
- Buildings
- Bridge
- Gravel, sand pit
- Borehole
- Shaft

Geological

- Rock outcrop
- Foliation or gneissocity defined primarily by alignment and long axes of mafic mineral grains (with dip)
- Foliation or gneissocity defined primarily by alignment and long axes of felsic mineral grains (with dip)
- Elongation and top of pillows (with dip)
- Bedding with dip, top unknown, top known
- Geological contact
- Lineation with plunge
- Minor fold with plunge
- Syncline
- Anticline
- Fault zone
- Mineral isograd

0 1 2 km
Scale





Geology by Denver Stone, Choudari Kamineni, Bill Shanks, Mike Jackson and assistants. Atomic Energy of Canada Limited 1984.
Cartography by Robert Buchanan.

Notes

Location:

The map area includes approximately 1100 square kilometres of gently rolling and wooded terrain with abundant lakes near the town of Atikokan, about 245 km west of Thunder Bay, Ontario. Highway 11 and the C.N.R. cross southern parts of the map area and Highway 622 extends northwesterly from Atikokan. The highways and a network of logging roads can be used to access most of the area.

General Geology:

Bedrock within the map area is Archean in age and encompasses parts of two major subprovinces in the Superior structural province. Clastic metasediments of the Quetico subprovince (unit 3b) are abundant south of 48° 45'. The Wabigoon subprovince, north of 48° 45', contains large oval masses of felsic plutonic rocks separated by metavolcanic belts.

Oldest rocks in the map area appear to be the mafic tonalite (1c) that occurs as xenoliths within tonalite (1a) in the Marmion Lake area. Radiometric dating of zircons indicates that the Marmion tonalite crystallized about 2.99 Ga (Don Davis, Royal Ontario Museum, personal communications). Supracrustal rocks of the Steep Rock Lake Group lie unconformably above the Marmion tonalite (Smyth,1891; Jolliffe, 1955). The basal member of the group is an arkosic conglomerate (3b(cgl)), which occurrs intermittently at the contact with the Marmion tonalite. The conglomerate is overlain by a carbonate member (3a) composed of bedded limestone and dolomite and contains the hematitic ore zone of the Steep Rock and Caland iron mines. Fossil stromatolites are identified in the limestone (Walcott, 1912; Wilks and Nisbet, 1985).

Mafic lappilli tuffs (2a(ash)) overlie the carbonate unit, followed by thick successions of pillowed mafic flows and intermediate to felsic flows, tuffs and breccias (2a,2b,2c). Gabbroic dikes and sills (4) transect the metavolcanic rocks and tonalitic basement. Small units of clastic metasediments (3b,3c) occur intermittently throughout the volcanic belt and appear to generally postdate volcanic extrusives.

Narrow lenses of amphibolite (2a) throughout the gneissic terrain in northeastern parts of the area are metamorphosed mafic lavas that flowed beyond the present boundaries of the metavolcanic belts. The amphibolites are spatially associated with mafic tonalite gneiss (1e). The mafic gneiss is strongly banded with abrupt variations in grain size, texture and composition of the rock between bands. Individual bands of the gneiss may be classified as tonalite, mafic tonalite (greater than 15% biotite) or amphibolite. Unit 1e may contain remnants of supracrustal rocks that were metamorphosed and assimilated by tonalite.

The metavolcanics were intruded by tonalite (1b), which tends to occur in distinct, spherical masses such as at Wasp Lake and Bow Lake. The tonalite can be transitional to tonalite gneiss (1d), one of the most abundant rock types in the map area. The tonalite gneiss is generally composed of two or three phases of leucocratic tonalite arranged in thin, discontinuous bands. Youngest rocks in the region are granite and granodiorite, such as the large, spherical, Eye-Dashwa granite pluton at the centre of the map area and numerous smaller plutons and dikes that are pervasive in the gneisses. Potassium - argon radiometric age determinations indicate that the Eye-Dashwa pluton cooled below the blocking temperature of hornblende about 2.65 Ga ago (Kamineni and Stone, 1983).

Structural Geology:

The stratigraphic "up" direction, or younging direction, can be obtained from pillow shapes in lava flows and from graded beds in clastic metasediments, provided the intensity of deformation and alteration is low. These local indicators, plus a general knowledge of the stratigraphic succession, can be used to define folds within the supracrustal rocks. Accordingly, numerous synclinal and anticlinal axes are positioned in the Finlayson Lake area, as indicated on the 1:20,000 scale maps. Reversals in younging directions are common within metasediments of the Quetico belt, but the exact locations of fold axes are not known everywhere, due to lack of marker units. Pillow lavas consistently young eastward for a distance of about 5 km within a triangular area at Steep Rock Lake. These pillow lavas and intervening gabbroic sills may be a section through a lava cone.

A network of fault zones that transects the Marmion tonalite and basal conglomerate, carbonate and ash units of the Steep Rock Lake belt could not be identified within the younger lavas, tuffs and sediments. The faulting may have occurred during the main phases of volcanism and apparently ceased as volcanism waned. Fault rocks within the tonalite are altered and friable, and show evidence of cataclastic deformation and variable, oblique displacement.

A diffuse zone of protomylonite extends southeast from Nevison Lake to Harold Lake along the contact of the metavolcanic belt. The stretching lineation within the protomylonite tends to be vertical and may have been generated during emplacement of the tonalite adjacent to the metavolcanic belt.

Younging directions indicate that a syncline must occurr along most of the boundary between the Wabigoon subprovince and the Quetico metasedimentary subprovince. Rocks are generally schistose at the boundary, perhaps due to tight folding, but little evidence could be found of a major fault zone (Quetico fault) as interpreted by Shklanka (1972) and Fumerton (1981).

Fractures and small faults are abundant in all rocks of the region. The Eye - Dashwa granite pluton contains a penetrative network of fractures that were sealed by several generations of mineral fillings in the Archean (Stone and Kamineni, 1982). Many of these fractures have subsequently been reopened within a few hundred metres of surface.

Economic Geology:

Approximately 75 million tonnes of iron ore were shipped from the Steep Rock and Caland open pit iron mines between 1944 and 1979. Numerous gold prospects occur in the area, the most noteable of which are the Harold prospect and the Elizabeth prospect near Modred Lake. These and other mineral occurrences in the area are discussed by Shklanka (1972), Fenwick (1976) and Wilkinson (1982).

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