MANITOBA

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT

MINERAL RESOURCES DIVISION

GEOLOGICAL SURVEY

REPORT OF FIELD ACTIVITIES 1976

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INTRODUCTION

In 1976 the Geological Survey conducted a number of projects the scope of which ranged from regional 1:100 000 mapping in the Munroe-Tadoule area, through detailed stratigraphic studies in the Lynn Lake region, to more conventional 1:50 000 mapping projects in the McCallum and Saw Lake areas. The continuing program in Southeastern Manitoba saw completion of initial coverage to the Winnipeg River and will result in 1978 in a 1:250 000 compilation for this region.

Mapping, that in previous years had extended west from the Greenstones Project on God's, Knee and Oxford Lakes to Utik, Bear, and High Hill Lakes, this year extended into the Pikwitonei "region" and highlighted important relationships that could radically alter earlier interpretations of this geological province.

Investigations were also initiated in the Thompson belt and on Crying and Little Assean Lake, studies that will eventually provide much needed data on the relationships of the boundary between the Churchill and Superior Provinces. The distribution of arkosic and greywacke gneisses in the Churchill Province was further delineated as part of a regional compilation which covered both the Paskwachi Bay-Melvin Lakes and the Macheewin-Waskaiowaka regions. Sections on Leftrook and Harding Lakes penetrated higher into the arkosic gneisses of the Sickle Group that had previously been recorded, and provided new data in the on-going delineation of the contact and transitional relationships between the Sickle Group and Burntwood River Supergroup.

In west and southwestern Manitoba four separate stratigraphically oriented core hole programs provided valuable new sections from the Stonewall, Narrows, Dawson Bay and Winnipegosis areas. Several shorter stratigraphic projects were conducted in the Hill Island, Denbeigh Point and Kawinaw and Katimik Lakes areas.

September, 1976

W.D. McRitchie
Director, Geological Services

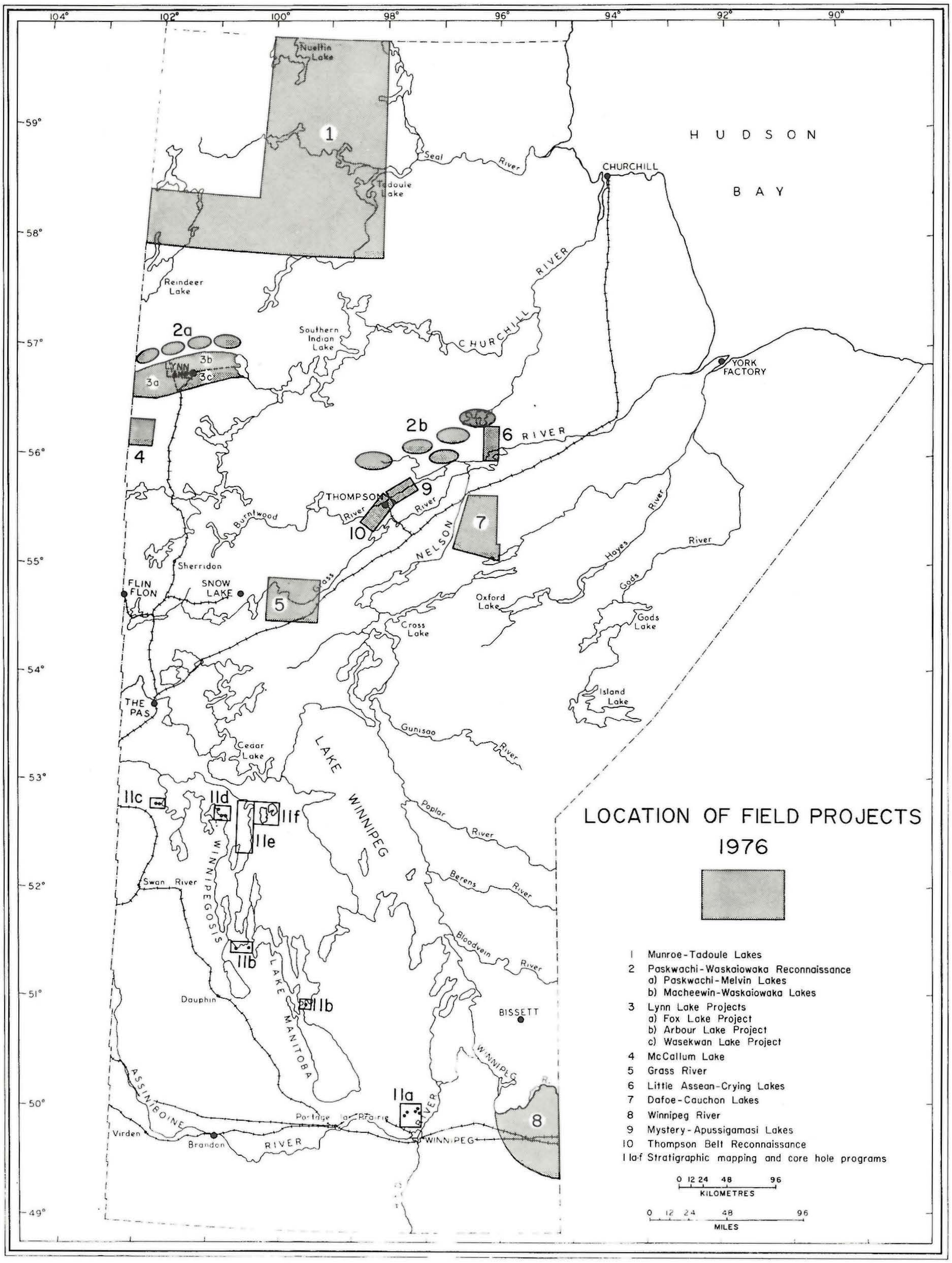

Figure GS1. Location of Field Projects.

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GEOLOGY OF THE MUNROE-TADOULE LAKES AREA

(64-J; 64-0)

By D.C.P. Schledewitz

An area of 10,000 square miles lying between latitude 58° and 60° and between longitude 98° and 100° was mapped during the summer of 1976. The main part of the mapping was carried out on a scale of 1:100 000 with more detailed mapping at 1:50 000 in the Stony Lake, Tadoule Lake and the north Seal River area. The main results of the mapping are:

i) a suggested correlation of rock types from the Stony-Munroe Lake area with rocks of the Kasmere Project to the west;

ii) a more detailed breakdown of existing map units as defined on the Geological Survey of Canada maps (GSC maps 30-1962; 35-1936) at a scale of 1:250 000.

The map-area is one of extensive glacial drift and debris cover with 1% outcrop. Some areas such as the eastern half of the North Seal River have over 2% while other areas such as the southerly quarter of the map-area have less than 0.5% outcrop with the extreme south being low sand plains and swamp, barren of even boulder fields.

Boulder examination for approximate lithologic boundaries appears reliable in most areas of drift cover. However, rock types which bear a close relationship to each other but weather differently add to the difficulties of mapping on the basis of boulder examination. An example is given by the white quartz monzonite (10) and pelitic gneiss (4). In areas of drift cover where both these rocks are expected to occur, up to 90% of the boulders remaining may be the white quartz monzonite. However, the ratio of white quartz monzonite to pelitic gneiss may also be much lower than this.

Preliminary interpretation

In the map-area a sequence of Precambrian early Aphebian migmatites, paragneisses and metasedimentary supracrustal rocks (units 4 to 9) overlies an Archean basement complex. The Archean rocks are best exposed in the northeast quadrant of the map-area and comprise hypersthene quartz monzonite (1) and grey gneisses (2). The latter are in part retrograde hypersthene quartz monzonite and in part gneisses of quartz monzonite and granodiorite composition. The supracrustal and Archean basement rocks have been intruded by porphyritic granodiorite (11) quartz monzonite (13) and gabbro (15). The white quartz monzonite (11) occurs as stocks, sills and granitic **lit** within the pelitic gneiss (4) and the semi-pelite (4a). Exposures of the white quartz monzonite are predominant in the west and northwest region of the map-area (Figure GS1-1).

The presence of possible late Aphebian metasedimentary rocks equivalent to the Hurwitz Group is suggested by the occurrence of a metasedimentary cross-bedded, matrix supported pebble and cobble conglomerate (15) of possible fluvial origin. The presence of quartzite, gneissic and white quartz monzonite (10) clasts and apparent low degree of recrystallization suggest an unconformity between the conglomerate and the underlying cordierite-muscovite biotite schist (9). The youngest rocks in the area are considered to be the porphyritic quartz monzonite (16) and the fluorite-bearing quartz monzonite (17). Pegmatites (10a) and (13b) form small abundant sills in the southern part of the quartz monzonite (13). However, these pegmatites may represent more than one age of pegmatite intrusion.

The similarity and continuity of the lithological sequence from more pelitic through calc-silicate-bearing and sporadic albite-pyroxene rocks to terrestial meta-arkose, for both the Kasmere project area and the Stony-Munroe Lakes area, suggest a similar time period and environment of deposition.

Crustal instability or fluctuations of sea level within the basin are indicated by the reversals in the sedimentary patterns. An example near Askey Lake comprises pelitic gneiss overlain by a massive quartzite which is in turn overlain by a calc-silicate carbonate sequence. In other areas such as the Munroe Lake synformal structure, which extends into the Kasmere area, the sequence indicates continued emergence. The regressive cycle passes from pelitic gneiss through calc-silicate rocks, quartzite and finally meta-arkose.

The stratigraphic sequence in the Tadoule Lake area indicates a more stable region with a preponderance of quartzite, followed by slow subsidence. The presence of impure quartzite, in part cross-bedded, as a basal unit overlain by a cordierite-biotite muscovite schist indicates a transgressive cycle. A matrix supported cobble and pebble conglomerate unconformably (?) overlies the schist. The matrix is greywacke to siltstone suggesting a fluvial origin. To the west of Tadoule Lake (45 kms) the basal quartzite is overlain by a calc-silicate marble sequence. This in turn is overlain by a semi-pelite. Just north of this sequence, at Wilkie Lake, a semi-pelite, which can possibly be correlated with the basal quartzite, is overlain by a calc-silicate marble sequence. This in turn is overlain by a semi-pelite. The overall pattern of sedimentation for the map-area suggests a shallow epineritic sea or possibly a miogeo-syncline.

Metamorphism

The character and degree of metamorphism which has effected the metasedimentary cover and granitoid basement increases in intensity from the southeast to the northwest. The regional migmatization, and recrystallization is lowest in the southeastern part of the map-area in the Tadoule Lake region. Here the metasedimentary schists and quartzite display primary layering and sporadic cross-bedding, although transposition of layering is significant and in many places has erased primary features. The association of cordierite as distinct grey inclusion-filled porphyroblasts; sillimanite as fibrous bundles in the matrix; primary muscovite and biotite indicates high temperature low pressure conditions of the Abukuma type amphibolite sub-facies. Granitic **lit** comprise up to 5% of the rock.

Cordierite occurs as lenticular porphyroblasts or as blue aggregates in the white quartz monzonite (10); sillimanite and less commonly garnet occur within the pelitic gneiss (4) and semi-pelitic gneiss (4) throughout the rest of the map-area. There is an increase in the degree of the gneissic character of the meta-sedimentary rocks from the southeast to the northwest corner of the map-area. In the Nueltin Lake area the pelitic gneiss contains 40 to 60 per cent white granitic **lit** producing in places a veined gneiss.

The metamorphic textures and structures in certain areas indicate reorientation of this regional trend of increasing grade of metamorphism to the northwest and west. Large-scale shear zones appear to act as loci for intrusions of sills and **lit** of white quartz monzonite (10) and white pegmatite (10a). Attendant with this is a coarsening of the grain size of minerals such as biotite and a greater differentiation of the leucocratic and melanocratic mineral constituents. One such zone appears to extend in a northeasterly direction from Fergus River in the southwest of the map-area for a distance of 80 kms to Bain Lake. In this zone primary layering is preserved only as small isolated remnants in areas of transposed layering. Biotite is coarse-grained in the mafic-rich layers of the gneisses,and cordierite-sillimanite complexes form lenticles and flattened porphyroblasts. White pegmatite with cordierite and/or tourmaline and white quartz monzonite are common as sills and stocks. Here rocks generally form predominant ridges and knolls.

Areas of more intense recrystallization are related to localized higher than normal temperature gradients, and to a greater degree of deformation in zones of the metasediments infolded into the quartz monzonite (13) during its intrusion. Examples are found near Overby Lake northwest of Stony Lake and on the north Seal River where it flows through Stony Lake. Flattening and shearing is evidenced by extreme boudinage of individual calc-silicate rock layers within the biotite psammitic gneiss (5) on Stony Lake with individual boudins being separated by tens of feet. This deformation has produced transposition of layering in the tightly folded sequence of rocks, coarsening of the biotite grain size and flattening of feldspar and cordierite porphyroblasts. These zones also contain abundant sills of white quartz monzonite (10) and white pegmatite (10b). Pink muscovite-bearing pegmatites (13b) which are possibly related to the intrusive quartz monzonite (13) are also present. Other pegmatites may be younger in age.

Structure

The sequence of regional deformation in the map-area appears to have been:

i) early folding about east-west axial planes;

ii) folding and/or shearing about northeast axial planes;

iii) deformation related to intrusion of large bodies of quartz monzonite (13);

iv) faulting with major faults trending north and northwest.

An example of the early regional folding is a synformal structure extending northwest from Munroe Lake to the south end of Nueltin Lake. This structure appears to be continuous

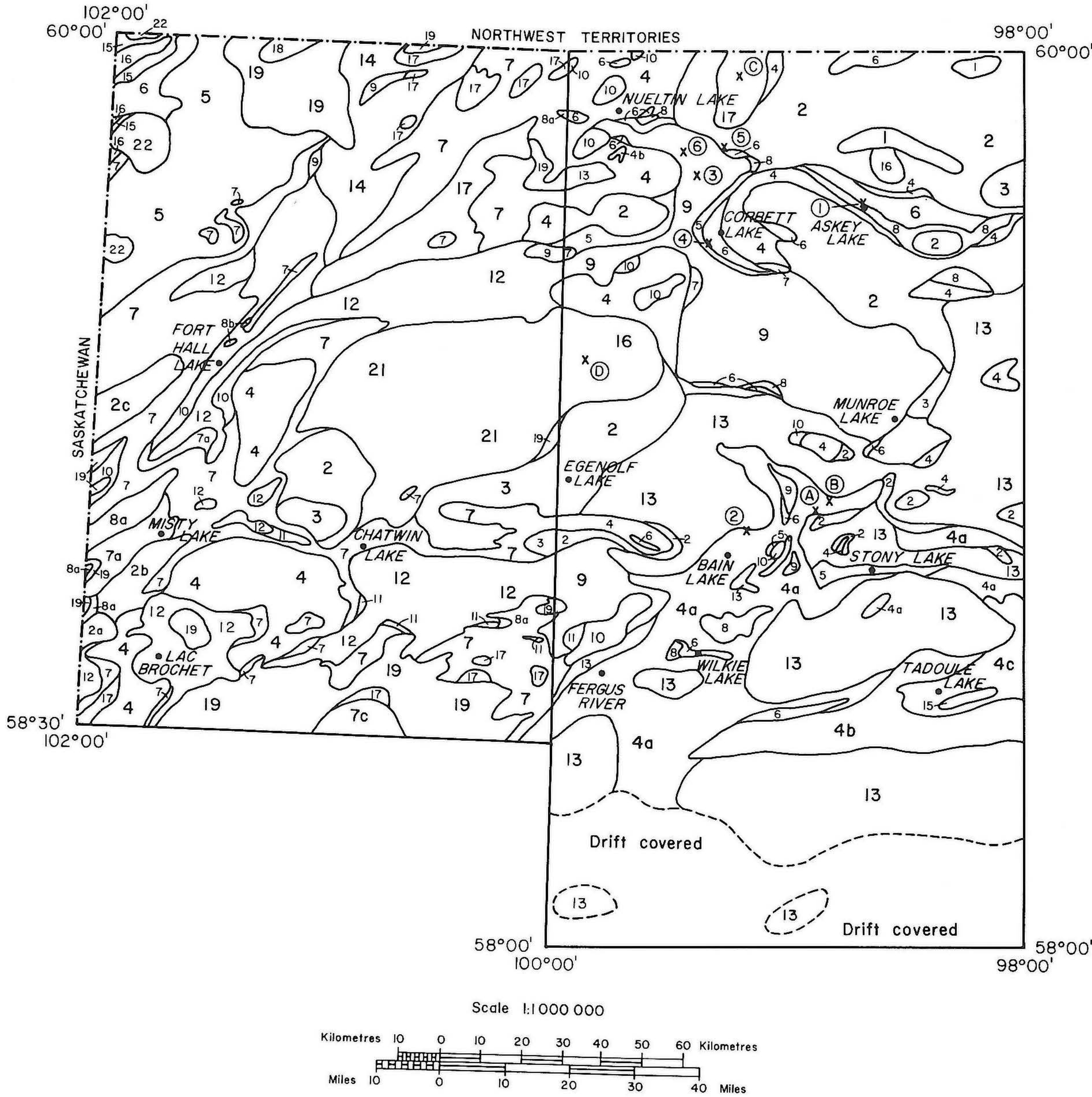

Figure GS1-1. General geology of the Kasmere Lake — Stony — Munroe Lake area.

LEGEND

(To Figure GS1-1)

*Map units too small to appear on the scale of Figure GS1-1 but that do appear in maps (1976S-1, 2)

KASMERE MAP-AREA

22 Fluorite-bearing quartz monzonite

20 Porphyritic quartz monzonite

Hurwitz Group

16 Meta-dolomite

15 Argillite

14 Metagreywacke, meta-siltstone

19 Pink leuco-granite to quartz monzonite

17 White granite to quartz monzonite

Aphebian

12 Meta-arkose

11 Conglomerate

9 Albite pyroxene rock

8b Marble

8a Calc-silicate rock

10 Psammitic biotite gneiss

7 Pelitic biotite gneiss

7a Porphyroblastic biotite gneiss

Archean

4 Foliated quartz monzonite

3 Foliated alaskite

2c Hypersthene-quartz monzonite

STONY — MUNROE LAKES MAP-AREA

17 Fluorite-bearing quartz monzonite

16 Porphyritic quartz monzonite

Hurwitz Group

15 Matrix supported meta-conglomerate with siltstone, greywacke matrix

Pre-Hurwitz Intrusive Rocks

*14 Gabbro and altered ultrabasic rocks

13 Quartz monzonite in part foliated

*13a Alaskite

*13b Pink pegmatite

*12 Amphibolite

11 Porphyritic granodiorite

10 White quartz monzonite

10a White pegmatite

Aphebian

9 Meta-arkose in part migmatized

8 Quartzite, feldspathic quartzite with sporadic calc-silicate lenses

7 Albite pyroxene rock

6 Calc-silicate rock with sporadic marble layers

5 Biotite psammitic gneiss with calc-silicate rock lenses

4 Pelitic to semi-pelitic biotite gneiss

4a Semi-pelitic gneiss in pure quartzite

4b Impure quartzite, biotite lamellae

4c Sillimanite-cordierite-muscovite-biotite quartz schist

Archean

3 Migmatite-granodiorite

2 Grey gneiss with minor amphibolite

1 Hypersthene quartz monzonite

NOTE: The following rock types are shown in Figure GS1-1 for the Kasmere map-area but up to the present time no equivalent units in the Stony — Munroe Lake area were proposed:

21 Quartz feldspar porphyry

18 Migmatite

13 Amphibolite

7d Augen gneiss

7b Hypersthene paragneiss

5a Amphibolite

4a Aplitic quartz monzonite

2b Hypersthene trondhjemite

2a Hypersthene quartz diorite

1 Hypersthene gneiss

into the Kasmere Lake project area extending all the way to Fort Hall Lake. This arcuate synclinorium may have had its trend in part altered by the intrusion of the late porphyritic quartz monzonite (16). In the southern half of the map-area from Tadoule to Wilkie Lake, tightly folded upright east-west fold can be traced up to the Fergus River area where they abut against a northeast trending shear zone. Lying to the west of this shear zone is a large synformal structure in the area of Nicklin Lake. This structure is cored by the meta-arkose (9) as in the Munroe Lake structure to the north. The synform extends westward from Nicklin Lake to Chatwin Lake in the Kasmere project area.

The best examples of cross-folding about later northeast trending axial planes occur in the area at the south end of Nueltin Lake. Here large-scale folds defined by pelitic gneiss (4) and quartzite beds (100 metres thick) are folded about steeply dipping northeasterly striking axial planes. These folds lie at a high oblique angle to the regional folds indicated by the major lithostratigraphic boundary of the meta-arkose (9) and pelitic gneiss (4). The high degree of migmatization and recrystallization within the meta-arkose (9) at the southeast end of Nueltin Lake may be related to this crossfolding. Smaller-scale evidence of this later northeast crossfold trend occurs on an island at the east end of Stony Lake where the North Seal River flows out of Stony Lake. Here westerly trending tightly folded minor folds, with amplitudes of ten feet, defined by primary layering in an impure quartzite, are refolded about steeply dipping northeast striking axial planes.

As previously mentioned a northeast trending shear zone extends from Fergus River through Bain Lake to the North Seal River where it is truncated by a later northwest to northerly trending faults. This episode of faulting appears to be the final phase in the deformational history of the area.

Mineralization

A number of gossan zones were observed in the map-area; these were observed in the:

i) calc-silicate zone (6);

ii) semi-pelite (4a);

iii) albite-pyroxene rock;

iv) gabbro and altered gabbro (14).

Locations of samples from these zones are shown on Figure GS1-1. More precise locations are given on the maps of the area at 1:200 000. The mineralization and associations are described in Table GS1-2.

During the course of mapping scintillometer readings using the TV-1 scintillometer were taken at most stations. The readings were taken on the T2 spectral band, which registers uranium and thorium, and using the 10x sensitivity scale. Background values for most of the rock types in the map area are listed in the table of formation, Table GS1-1. Four anomalously radioactive areas were identified during the course of mapping. These points (A, B, C, D) are indicated on Figure GS1-1 but their precise locations are shown on the preliminary maps.

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Davison, W. L.

1962: Tadoule Lake, Manitoba; Geol. Surv. Can.; Map 30-1962.

1963: Munroe Lake, Manitoba; Geol. Surv. Can.; Map 35-1963.

Weber, W., Schledewitz, D. C. P., Lamb, C. F. and Thomas, K. A.

1975: Geology of the Kasmere Lake-Whiskey Jack Lake (North Half) Area; Man. Mineral Resources Div., Publ. 74-2.

TABLE GS1-1

Table of Formations

MAP UNIT	ROCK-TYPE	DESCRIPTION
17	Fluorite-bearing quartz monzonite	Pink porphyritic to coarse grained - biotite (5%) - feldspar (65%) - quartz grey - purple fluorite interstitial
16	Porphyritic quartz monzonite	Layered (igneous) pink rock - biotite (3-5%) - phenocrysts from 1 to 3 cms - (60% - 65%) quartz dark grey (35%)
15	Metaconglomerate to siltstone	Grey cross-bedded to laminated greywacke to siltstone matrix with isolated cobbles and pebble layers. Clasts range from well rounded to angular. Clast compositions range from quartzite to gneiss. Clasts and coarse clastic layers are widely spaced
14	Gabbro	Black - hornblende (30%) - plagioclase (60%) - dark to white foliated to massive
13	Quartz monzonite	Pink to buff coarse to medium grained - magnetite (1%) - biotite (3-5%) - feldspar (70%) - quartz (25%) - foliated aligned quartz lenses and biotite
13a	Alaskite	Pale pink massive medium grained biotite (3%) - magnetite (1%) fine-grained disseminated quartz (15%)
13b	Pink pegmatite	Pink to deep pink feldspar ± muscovite ± tourmaline ± magnetite
12	Amphibolite	Foliated salt and pepper medium grained equigranular to coarse grained hornblende (70% - plagioclase (30%) ± quartz
11	Porphyritic granodiorite	Grey weathering biotite (8%) - feldspar pale pink and buff - quartz (10%) coarse-grained to porphyritic phenocrysts 1 cm in size
10	White quartz monzonite	Massive white weathering biotite (3%) - feldspar - quartz (25%) - ± blue cordierite ± garnet
10a	White pegmatite	White to brilliant white pegmatites white feldspar - quartz (25%) - ± black tourmaline ± muscovite ± cordierite ± garnet
9	Meta-arkose	Pale pink to grey or interlayered pale pink and grey layers - feldspar (70%) - quartz (30%) - sporadic green spots or layers of diopside also present, white granitic lit of feldspar and quartz
8	Quartzite	Dense glassy quartzite - quartz (90%) - biotite (1%) - sporadic sheeted sericite and sillimanite white quartzite feldspar 10-15% ± lenses of pale pink arkose and pale green diopside - ± epidote lenses
7	Albite pyroxene rock	Pale pink to grey dense albite (90%) - green to black disseminated pyroxene or as anastomosing veins
6	Calc-silicate rock	Layered sequence of pronounced differential weathering and colour banding comprising pale green diopside layers; dense grey biotite (8%) - feldspar 75% - quartz (10%)
5	Biotite psammitic gneiss	Grey dense to schistose biotite (10%) - feldspar (70%) - quartz (20%) ± amphibole ± feldspar porphyroblasts ± tourmaline - pale green to buff calc-silicate layers
4	Pelitic to semi-pelitic biotite gneiss	Grey - ± garnet ± sillimanite ± grey blue cordierite - biotite (15%) - feldspar (50%) - quartz (25%), layers with white plagioclase (80%) - quartz (20%)
4a	Semi-pelitic gneiss and impure quartzite	Buff grey - cordierite (grey blue) porphyroblasts - biotite (10%) - feldspar (25%) - quartz (60%) with dense grey sporadic interlayers
4b	Impure quartzite	Buff to white weathering - grey on fresh - biotite (3%) - feldspar (5%) - sporadic feldspar porphyroblasts - quartz - biotite partings 1 mm thick spaced 1 cm to several metres apart
4c	Sillimanite-cordierite-muscovite-biotite quartz schist	Sillimanite - cordierite porphyroblasts (5%) - muscovite fine-grained (5%) - biotite medium to fine-grained (15% - 20%) - feldspar (10%) - quartz (60%)
3	Granodioritic migmatite	Grey biotite (5%) - hornblende (2%) - feldspar-quartz layers and buff plagioclase (70%) - quartz layers
2	Grey gneiss	Buff to grey biotite (3%) - feldspar-quartz ± magnetite layers and pink quartz monzonite layers and sills
1	Hypersthene-quartz monzonite	Honey brown to pale green feldspar; folded with femic lenses comprising biotite, hypersthene ± hornblende

TABLE GS1-2

OCCURRENCE	MINERALIZATION SUSPECTED	ASSAY or ANALYSIS in PPM	SCINTILLOMETER READING CPM (counts per minute)	ROCK-TYPE, GEOLOGIC SETTING and RADIO ACTIVITY (Ur & Th) BACKGROUND	LOCATION (long. and lat.)
1	Cu, Zn, Pb	Cu - 75 ppm		Calc-silicate and marble, (6) gossan zone has shallow pit dug; 80 CPM	Askey Lake - 98° 41'; 59° 40'
2	Cu, Zn, Mo	Cu - trace Mo - nil Zn - result pending		Semi-pelitic gneiss (4a) on southwest flank of alaskite dome; 100 CPM	3 kms northeast of Bain Lake - 99° 11'; 58° 56'
3	Cu, Zn, Pb	Cu - pending Zn - pending Pb - pending		Quartzite, feldspathic with calc-silicate lenses; 80 CPM	Southeast end of Nueltin Lake - 99° 76'; 54° 24'
4	Cu, Zn, Pb	Cu - pending Zn - pending Pb - pending		Calc-silicate (6) well layered sequence; 80 CPM	Corbett Lake - 99° 22'; 59° 36'
5	Cu, Ni visible pyrrhotite chalcopyrite	Cu - pending Ni - pending		Gabbro (14) large sill or dyke (isolated exposure) in part schistose cut by quartz veins; 35 CPM	Southeast end of Nueltin Lake - 99° 29'; 59° 47'
6	Cu, Ni	Cu - pending		Gabbro (14) small sill 10 feet thick in foliated quartz monzonitic gneiss; 35 CPM	Southeast end of Nueltin Lake - 99° 21'; 59° 46'
A	Ur		500-700	Pale pink to white pegmatite (10) biotite 8% (180 CPM)	Stony Lake - 98° 53'; 59°
B	Ur		500	White quartz monzonite (10) and white pegmatite (10b) (180 CPM)	Stony Lake, North Seal River - 98° 54'; 58° 59'
C	Ur		650	Fluorite-bearing quartz monzonite (17) (150 CPM)	25 km east of Nueltin Lake - 99° 15'; 59° 57'
D	Ur		350	Porphyritic quartz monzonite (16) (150 CPM)	25 km north of Egenolf Lake - 99° 53'; 59° 18'

PASKWACHI — WASKAIOWAKA REGIONAL COMPILATION

By W. D. McRitchie

Following the initial work in the Kisseynew metasedimentary gneiss belt (McRitchie, et al., in preparation) it was realized that many of the major metasedimentary units are of regional extent. This was coupled with the discovery that the distribution of the two main groups, namely the meta-greywacke and meta-arkosic groups can be inferred and delineated with a high degree of confidence from their aeromagnetic signatures.

The developing synthesis of the area led to a critical appraisal of the structural or stratigraphic relationships of the Sickle arkosic group and the Burntwood River greywacke Supergroup and the conclusion that a conformable transition predominates (McRitchie, 1975; Baldwin, 1974; Zwanzig, 1975; Lenton, 1975). The nature of the transitional lithologies varies from locality to locality throughout the extent of the contact zone which is exposed in and around a series of ellipsoidal and linear belts and outliers from Saskatchewan over 200 kms east to Mynarski and Threepoint Lakes.

In 1976 a regional reconnaissance was undertaken as an initial step towards identifying:

(1) the extent to which the available airborne magnetic maps could be used to identify the distribution of the arkosic and greywacke groups:
   a) North of Lynn Lake, from Paskwachi Bay to Melvin Lake.
   b) East and north from Mynarski Lake to Waskaiowaka Lake and Kettle Rapids on the Nelson River.

(2) the areal extent of and variation in the greywacke and arkosic groups and the character and extent of the transitional contact lithologies.

The findings are presented in three sections, the first dealing with the Paskwachi-Melvin Lake region; the second with the Macheewin-Waskaiowaka region and the third, specific aspects of the transitional lithologies observed on Leftrook and Harding Lakes.

A concluding section reports the findings of a reconnaissance traverse on Outlaw Bay, Granville Lake, conducted as a preliminary to work on the Eden Lake map sheet.

1. Paskwachi — Melvin Lakes: (Figure GS2-1)

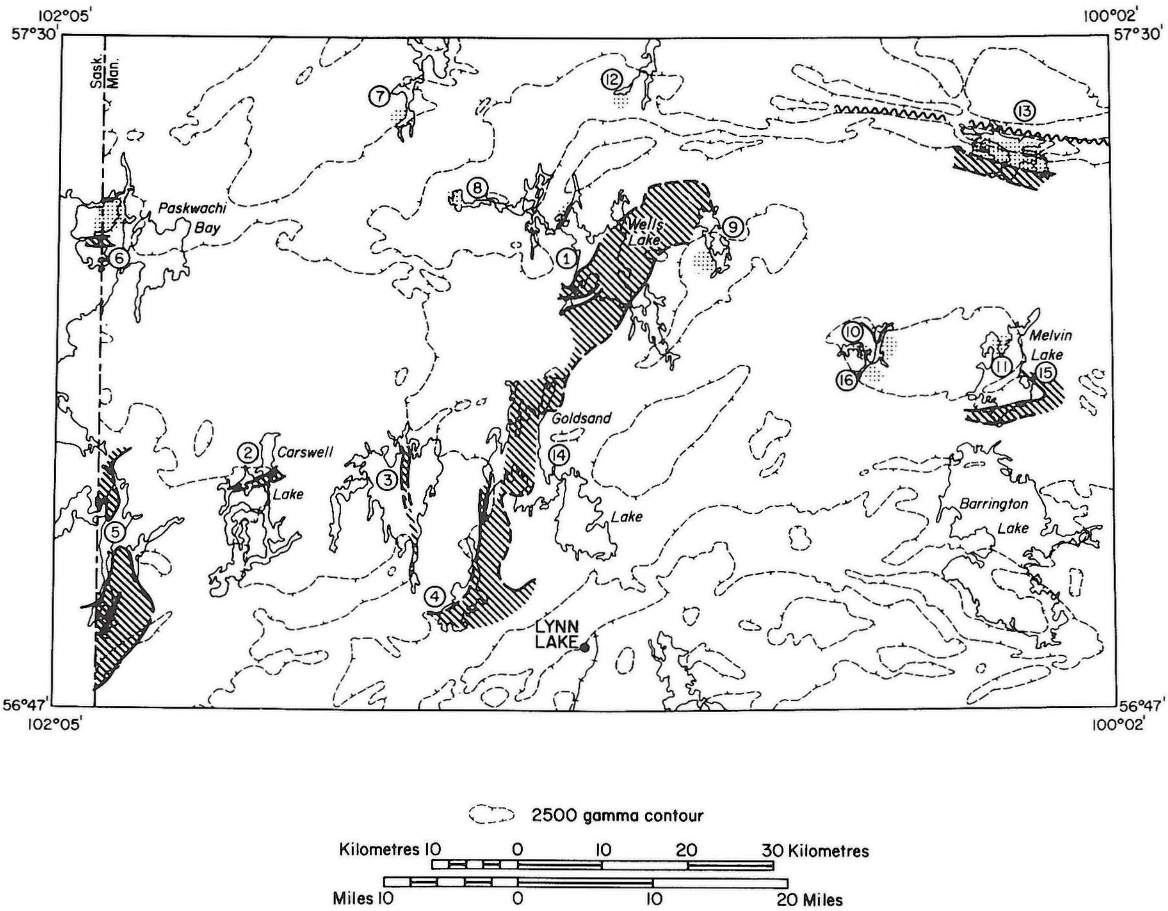
Shoreline investigations were conducted on all major lakes in the area. Specific attention was paid to regions where the airborne magnetic maps indicated levels lower than 2700 gammas, higher than 2700 gammas, and high relief possible contact zones in the interval 2500 to 3000 gammas.

Meta-greywacke gneisses with associated commonly dominant granitic intrusions were recorded on Wells (1), Carswell (2), Vandekerckhove (3), Zed (4), (Gilbert, this report) and Melvin (11) Lakes, Paskwachi Bay (6), LeClair Lake (13), Goldsand Lake (14) and Whitesand Bay (5) on Reindeer Lake. The greywackes strongly resemble the typical Burntwood type in both their range and association of compositions. They differ markedly however in their much lower garnet content and apparent absence of cordierite presumably an indication of lower Fe and Mg contents. Arkosic gneisses with associated magnetic signatures >2700 gammas were recorded on Wells Lake (1), Paskwachi Bay (6), Carlson Lake (7), Paskwachi River (8), "Seahorse" (9), "Dino" (10), Melvin Lake (11), LeClair Lake (13) and west of Brisebois Lake (12). The shoreline on Paskwachi Bay reveals a conformable section which comprises:

Arkosic gneisses with minor quartz rich arenites, quartzite, garnet amphibolite.
Mineralized zone with Cu and Zn sulphides in diopside rich gabbro-ultrabasic lenses.
Hornblende bearing arkosic gneisses.
Amphibolites with basal fragmental (metavolcanic?) marker unit.
Greywacke metatexites: garnet bearing.

A previously unrecorded thin conglomeratic (basal?) phase of the arkosic gneisses was recorded on top of a high outcrop on the south shore of "Dino" Lake. An almost identical conglomerate unit, also previously unrecorded, was discovered in the SE bay of Melvin Lake directly adjacent to and structurally underlying well bedded greywacke gneisses. The Melvin conglomerate comprises approximately 100 m of thin stretched pebble and cobble bearing beds, 5 - 20 cm thick, interlayered with medium grained hornblende bearing arkosic metasediment similar in character to that exposed near the centre of Melvin Lake, and on "Dino" Lake. The clasts comprise cream and light green coloured aphyric and fine-grained dacite to rhyolite and fine to medium grained metasediment with hornblende rich clasts common in some layers. One rounded granite clast, 35 x 18 cm in section, was recorded close to the contact with the greywacke unit. No reliable way-up criteria were observed.

On LeClair Lake a long linear belt of thinly layered hornblende and magnetite bearing arkosic gneiss is flanked to the south by well layered greywacke metatexites and gneisses and to the north by sporadically porphyritic quartz monzonite. A pronounced magnetic linear north of the lake correlates directly with a locally pseudo tachylitic, intensely sheared zone which is exposed in the northernmost bay. The linear forms a major structural element discernible on ERTS images and may be traced over 200 kms to the east.



Paskwachi — Melvin Lakes region; illustrates correlation between distribution of:

(a) arkose derived meta-texites and gneisses (dot screen) and magnetic signatures >2500 gammas, and

(b) greywacke derived meta-texites and gneisses (diagonal line screen) and magnetic signatures <2500 gammas.

Granites and granitoid rocks have not been shown on this map. Conglomeratic units were recorded at the inferred contacts of the arkosic and greywacke gneisses at localities 15 and 16.

1. Wells Lake
2. Carswell Lake
3. Vandekerckhove Lake
4. Zed Lake
5. Whitesand Bay
6. Paskwachi Bay
7. Carlson Lake
8. Paskwachi River (east of)
9. "Seahorse" Lake
10. "Dino" Lake
11. Melvin Lake
12. Brisebois Lake (west of)
13. LeClair Lake
14. Goldsand Lake

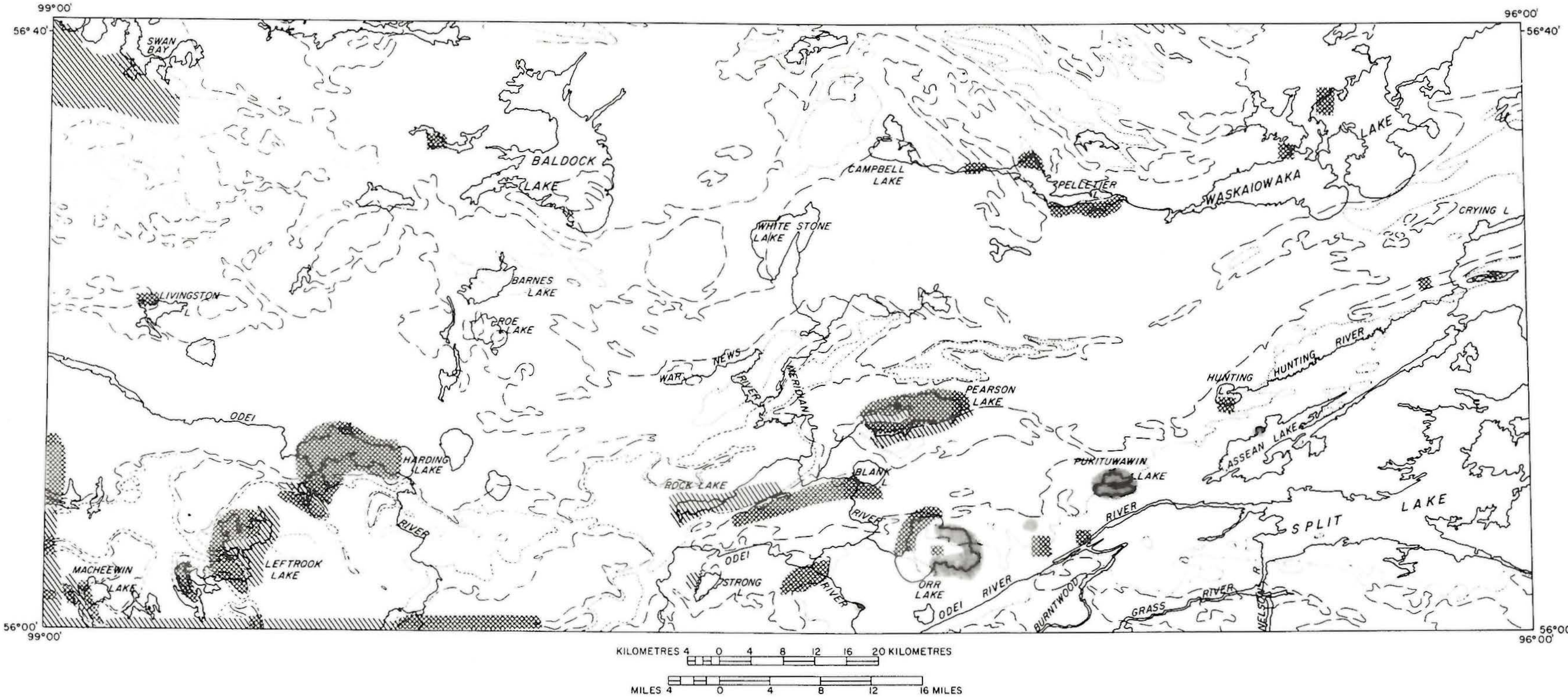
Figure GS2-1. Paskwachi Bay — Melvin Lake Region.

2. Macheewin — Waskaiowaka Region: (Figure GS2-2)

This part of the program was reduced in scope of coverage which was originally intended to provide data up to the Hudson Bay Paleozoic contact. That area, Waskaiowaka Lake to Weir River, has subsequently been rescheduled for 1977. The approach was similar to that adopted north of Lynn Lake where shoreline traverses and spot checks were undertaken for all areas greater and less than 2700 gammas and more detailed examinations were made over the 2500-3000 gamma interval where good lake side exposures provided sections through the transitional lithologies between the main meta-greywacke and meta-arkose groups.

A high degree of correlation between the magnetic signatures and main sedimentary groups was once again demonstrated. Pin point delineation of the arkose-greywacke contact was provided by the 2550 gamma contour in the Macheewin, Leftrook and Harding Lake areas and the 2700 gamma contour on Pearson Lake and east of Rock Lake. Elsewhere in the region high mag-high relief signatures served in a more general way to define areas of meta-arkose on Pelletier and Waskaiowaka Lakes. The typical "Burntwood type" psammitic and semipelitic garnet and cordierite bearing greywacke gneisses and metatexites occur on Rock Lake and occupy two narrow possibly fault bounded bands on Pearson Lake sandwiched between typical Sickle arkosic gneiss and metatexite with associated amphibolite. To the east no further exposures of the greywackes are found until those recorded by Haugh and Elphick (1968) on Moose (Stephens) Lake. The magnetic maps suggest a continuity may exist between these two areas. The narrowness of the belts on Pearson Lake also reflects the increasing transposition, tightness and intensity of folding as the Churchill Superior boundary is approached. South of Pearson Lake, on Blank and Orr, south to the Odei and Burntwood River, dirty, quartz rich arenites with interlayered amphibolites and lesser amounts of quartzite and arkosic gneisses are exposed over wide areas.

These quartz rich dirty arenites and associated rock types may represent a greatly increased section of the much sharper transitional quartzites and amphibolites that occur between the typical greywackes and arkosic units on Leftrook and Harding Lakes.



Distribution of arkosic gneisses (diagonal boxes),
greywacke gneisses (diagonal lines), and
hornblende-bearing quartzites and amphibolites (fine dot screen).

Note correlation with magnetic levels, contours at ....2500 gammas and
______.______.______.2700 gammas. Granitic units not indicated.

Figure GS2-2. Macheewin — Waskaiowaka Regions.

3. Leftrook and Harding Lakes: (Figure GS2-3 and GS2-4)

These lakes provide the last well exposed sections across the east end of the high magnetic-high relief ridge that extends from Rat Lake through Mynarksi Lake to Harding Lake. Further east the ridge breaks up into a series of lower relief small humps and then reforms into a large regional anomaly over Waskaiowaka Lake. Harding Lake lies abreast of the main highly magnetic ridge and provides a section (Table GS2-1) which ranges higher into the Sickle Group than any other section yet described.

That part of the Leftroof Lake sequence investigated to date (Table GS2-2) is limited to the lower half of the Harding section but provides considerable detail on the amphibolite and quartzite sequence that is not fully exposed on Harding Lake. Of special note is the appearance of a 50 cm massive sulphide horizon in host lithologies and a stratigraphic position very similar to those of prominent gossan zones on Rat, Granville, Russell and more specifically south of Kadeniuk Lake (Baldwin, 1974). The overall lithologic association of amphibolites, diopside rich units, quartzites and carbonates in this thick transitional group, between the gneissic greywacke and arkose proper, also resembles that mapped by Robertson (1953) on Batty Lake on the south side of the Burntwood Belt. In the latter region the Jungle, Bob and Wim, deposits are among the more prominent sulphide concentrations at or near to the contact between the greywacke and arkosic groups (Bailes, 1975).

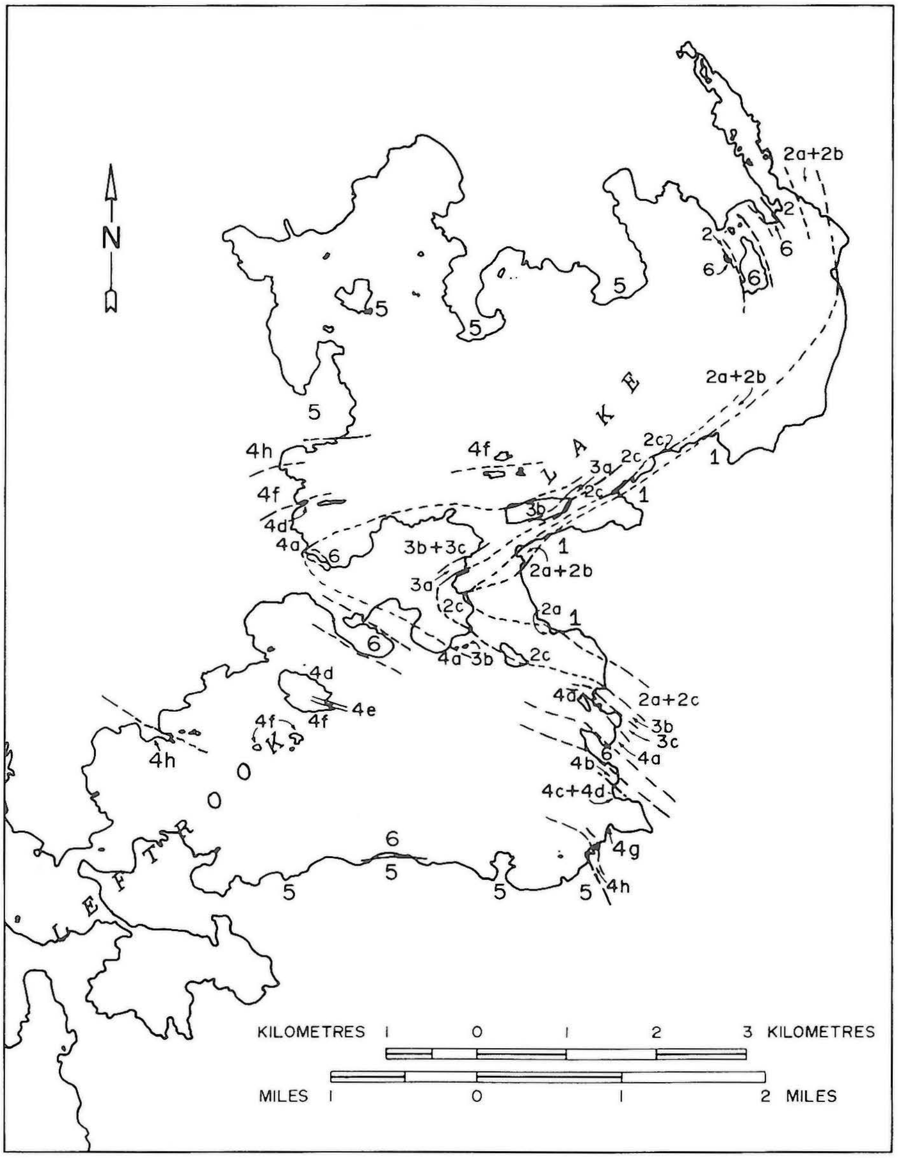


Figure GS2-3. Leftrook Lake (See Table GS2-1 for legend).

TABLE GS2-1

Leftrook Lake

(Section and Legend to Figure GS2-3)

6. Quartz monzonite.

5. Arkosic Gneiss: pink and white weathering variably layered quartz rich gneiss with minor quartzite; generally contains flattened sillimanite stringers, faserkiesel and potassium feldspar blasts with retrograde muscovite development. Knots mainly developed in south.

4. Amphibolite Suite:
   - (h) amphibolite, thinly layered with garnet bearing layers.
   - (g) diopside and grossular rich metasediment.
   - (f) amphibolitic metasediment, hornblende and magnetite bearing; calc silicate layers and delicate layering prominent near base.
   - (e) 10 m unit of interlayered psammitic and semipelitic greywacke gneiss with garnet and cordierite blasts, minor mobilizate.
   - (d) amphibolite, vague calc silicate lenses in weakly layered, foliated unit with minor diopside gneiss and garnet bearing layers.
   - (c) 50 cm thick massive sulphide zone with pyrrhotite, minor pyrite, trace chalcopyrite and magnetite; 40% quartz as disseminated angular aggregates.
   - (b) diopside gneiss and amphibolite, unit 20 m thick; layering discontinuous and lenticular 1 - 5 cm thick: minor carbonate veins, sulphides disseminated throughout, garnet near top of unit.
   - (a) amphibolite; massive homogeneous salt and pepper texture.

3. Quartzite and Amphibolite:
   - (c) amphibolite and interlayered feldspathic quartzite with sporadic carbonate and calc silicate rich layers.
   - (b) quartzite and dirty quartz arenite; thinly layered with minor biotite and magnetite, trace garnet, spotty pyrite; several thin meta-greywacke layers.
   - (a) meta-greywacke semipelitic homogeneous with abundant garnet.

2. Amphibolite (Marker):
   - (c) amphibolite interlayered with thin clean quartzites, 1 - 4 m units, delicate layering throughout.
   - (b) diopside gneiss - granofels.
   - (a) amphibolite, weakly layered, foliated, salt and pepper texture.

1. Greywacke Gneiss and Metatexite:

   grey sandy and psammitic with minor amphibolite pods and lenses.

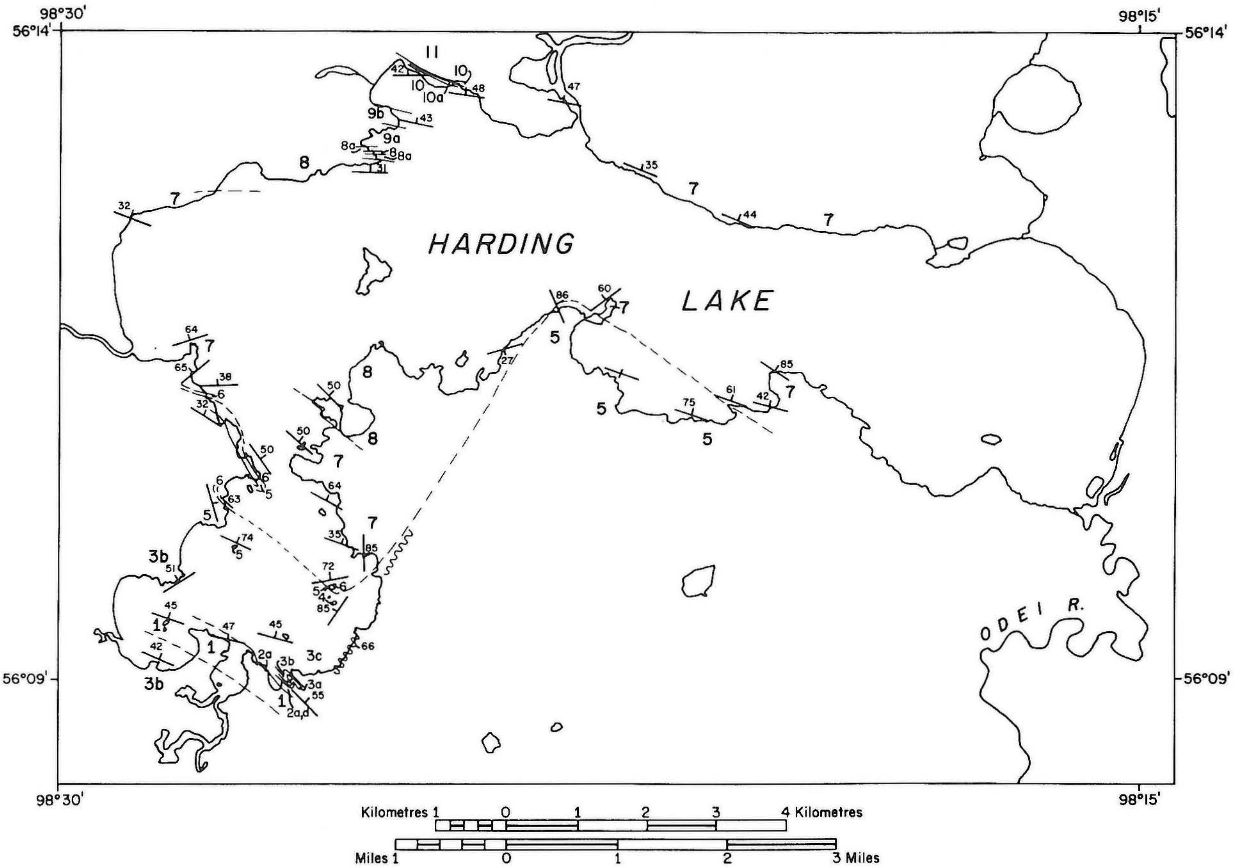


Figure GS2-4. Harding Lake (See Table GS2-2 for legend).

TABLE GS2-2

Harding Lake

(Section and Legend to Figure GS2-4)

11. Quartz Monzonite.

10. Muscovite Hornblende Plagioclase Gneiss: foliated homogeneous equigranular
    - (a) thinly layered unit of pink weathering sillimanite-bearing arkosic gneiss.

9. Arkosic Gneiss:
    - (b) laminite; delicately layered finely laminated and foliated light grey, silty phyllite and sandy arkosic gneiss, pink near base.
    - (a) arkosic gneiss; pink and buff weathering hornblende-bearing with 1 - 5 cm psammitic and semipelitic layers rich in potassium feldspar, minor sulphides.

8. Hornblende Plagioclase Gneiss and Metatexite:

    dark grey, dirty, foliated meta-greywacke derived psammitic and semipelitic gneiss and schist.
    - (a) buff weathering delicately layered hornblende and biotite-bearing sandy arkosic gneiss.

7. Hornblende-bearing Gneissic Arkosic Wacke:

buff weathering interlayered, homogeneous equigranular, foliated psammitic and semipelitic units (20 cm - 3 m thick), pervasive incipient feldspathic segregation and hornblende blastesis.

6. Grit and Matrix Conglomerate:

blue-grey weathering, epidote rich with local hornblende blastesis in quartz rich matrix of some layers; clasts angular to subrounded, 2 - 8 cm in section elongated and flattened in plane of foliation; clasts concentrated in alternating 10 cm - 2 m units, separated by finer grained metasediment; clasts concentrated at base of some layers as inferred from scour at base of 20 cm grit layer. Clast types vary from quartz, to metasediment to hornblende rich metasediment with compositional concentration in some layers. Unit thickness 20 metres.

5/4. Feldspathic Quartzite and Quartzite:

coarse grained, foliated, nodular pink and white weathering weakly layered units with concentrations of flattened muscovite rich faserkiesel (0.25 x 5 x 15 cm) and/or potassium feldspar blasts in some layers; minor magnetite; some layers more feldspathic with no faserkiesel; isolated outcrops of pure white, clean metaquartzite. Numerous gaps in section. Faserkiesel bearing units (Unit 5) at top of section.

3. Quartzite, Arkosic Gneiss and Meta-Greywacke:

(c) hornblende-bearing dirty quartzite with sporadic 1 - 3 cm epidote rich calc silicate layers.

(b) quartz rich arkosic metatexite thinly layered; contains local quartz rich gritty unit on SE shore; blue-grey dirty quartzite at base.

(a) greywacke gneiss; interlayered 20 cm units of buff weathering psammitic and semipelitic garnet rich greywacke gneiss with minor mobilizate.

2. Amphibolite:

(d) garnet rich hornblende diopside gneiss (1 metre thick).

(c) salt and pepper textured feldspar rich amphibolite.

(b) hornblende-diopside amphibolite: homogeneous equigranular with vague 1 - 3 m layering.

(a) amphibolite; delicately layered with 0 - 6 cm lenticular diopside granofels layers and transposed hornblende rich layers and hinges appearing as pseudo fragments.

1. Greywacke Gneiss and Metatexite:

relatively quartz rich with minor thin sills of pegmatoid mobilizate, thin calc silicate lenses, garnet throughout; slight separation into silty psammitic and semipelitic layers.

4. Outlaw Bay — Granville Lake: (Figure GS2-5)

A SW-NE traverse along this previously unmapped bay was undertaken to obtain preliminary data for the eventual mapping of the Eden Lake sheet. The southwestern bay contains a weakly mineralized (pyrite) homogeneous, equigranular, metadiorite sill which is probably related to the Stag Lake complex of Campbell (1972). The sill lies north of and is intruded into repeatedly S folded light grey, psammitic, hornblende bearing feldspathic metasediment.

The section for several thousand feet to the north comprises dominant quartz monzonite with common rafts of hornblende diorite, hornblende metasediment and typical Sickle hornblende and magnetite bearing arkosic gneiss.

A small island 8 kms up the channel comprises a 10 m wide zone of possible volcanic breccia with (5-30 cm) fragments of coarse grained hornblende andesite set in a slightly lighter hornblende bearing matrix. On the north side of the island the unit is much thinner (1 m) and is sandwiched between an irregularly layered coarse grained grit or lapilli ash with feldspar and quartz clasts up to 4 mm (some with subhedral crystals), and a finer grained laminated hornblende rich volcanogenic schist.

To the north a homogeneous equigranular dioritic unit similar to that observed at the southwest end of the bay separates the volcanogenic outcrop from a much thicker section containing fine grained strongly foliated laminated and lineated hornblende and biotite bearing metasediment, massive coarse grained gabbro and thinly laminated pink, green and white weathering possible dacitic fragmental tuff in which the original fragments have been highly flattened and drawn out. A thin andesitic tuff containing hornblende fragments up to 1 cm in size lies to the north in close association with a mineralized hornblende and quartz rich meta-iron formation/gossan.

The section is open to the north and will be completed in 1977. The metavolcanic units encountered in the bay lie directly on strike with a similar unit mapped by M. Steeves (1972) on the Churchill River to the east.

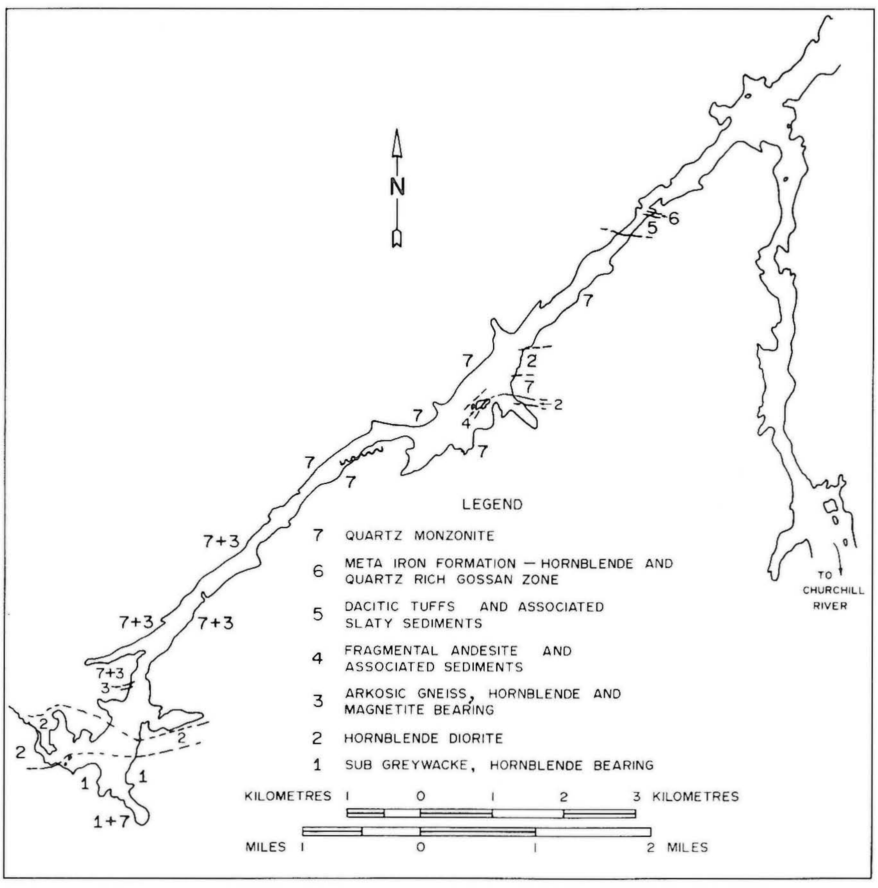


Figure GS2-5. Outlaw Bay; Granville Lake.

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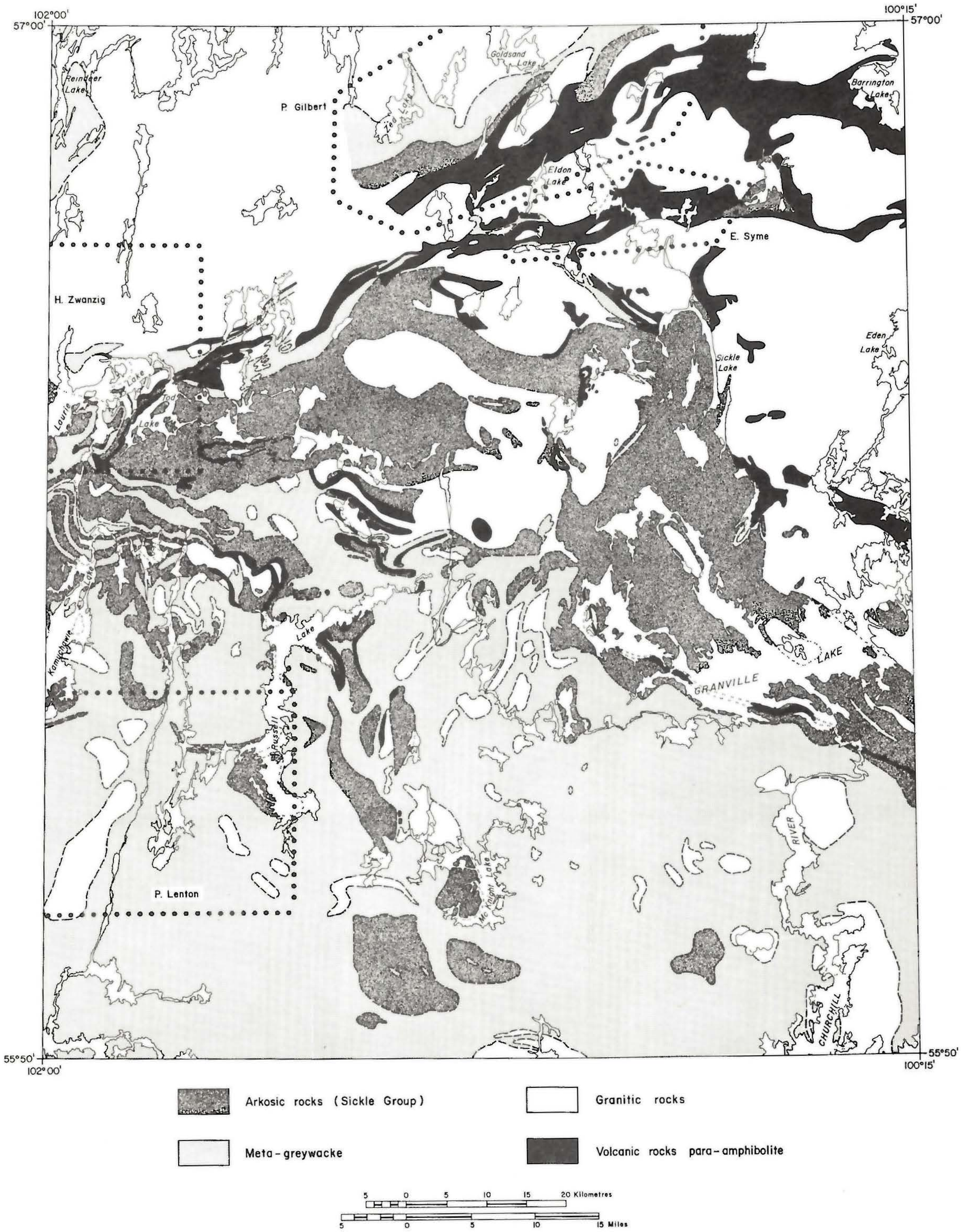

Figure GS3-1. General geology of the Lynn Lake area.

LYNN LAKE PROJECTS

By H. V. Zwanzig

Remapping of the Lynn Lake greenstone belt was undertaken by Gilbert, Syme and Zwanzig. The investigations are designed to establish the stratigraphic and structural framework of the volcanic belt and its relationship to the surrounding granite and gneiss. A relatively well preserved section of volcanic rocks outlines a pair of large folds in the Cockeram Lake area (64C/15), and a mixed succession of volcanic and sedimentary rocks at Lynn Lake (64C/14E). The transition between the greenstones and the Kisseynew sedimentary gneisses is well exposed at Laurie Lake (64C/12).

The 1:50 000 mapping program of the Kisseynew gneisses in the Burntwood River belt was brought to a conclusion with the mapping by P. Lenton of the McCallum Lake sheet (64C/4).

LAURIE LAKE AREA (Fox Lake Project)

(64C/12)

By H. V. Zwanzig

Mapping was conducted in the surroundings of Laurie Lake and Tod Lake, from the Saskatchewan border to Hatchet Lake (Figure GS3-1). South Bay was mapped exclusively by M. W. Thomas. The map of Milligan (1952) was extensively revised but fewer changes were made to the map of Stanton (1949). The data was compiled at a scale of 1:50 000 on a preliminary map. Maps of selected areas at a scale of 1:20 000 are in preparation.

Extensive descriptions are provided in preliminary form to hasten the distribution of field data. Conclusions are tentative, but the excellent exposures on Laurie Lake and Tod Lake permit detailed observations.

A few of the numerous mineral showings in the area may be assigned to favourable host strata but this work is in an early stage of preparation.

Stratigraphy

The stratigraphic succession at Laurie Lake consists of two major rock units which have been traced throughout the Kisseynew belt (McRitchie **et al.**, in preparation). The lowest part of the succession, the Burntwood River Supergroup, consists of Aphebian meta-greywacke overlain by metavolcanic rocks and para-amphibolite. A part of the succession is equivalent to the Wasekwan Group which underlies the volcanic terrain to the northeast. The upper part of the succession, the Sickle Group, consists of metamorphosed arkose, conglomerate, and impure standstone which conformably overlie the volcanic rocks.

Between Fox Mine and the south shore of Laurie Lake there are important stratigraphic changes that characterize a transition-zone between the Lynn Lake granite-greenstone belt and the Kisseynew sedimentary gneiss belt. They are illustrated in Figure GS4-1. There are no complete breaks between these belts and the metavolcanic rocks at Fox Mine can be traced southwest into a thin unit of amphibolite at the top of the Burntwood River Supergroup. The changes at the margin of the volcanic belt include:

1. a termination of most volcanic flows, locally at the steep bank margin;
2. thickening of the greywacke succession;
3. a transition from pillow flows to pillow breccia, hyaloclastic rocks and tuffs to mafic volcanic wackes;
4. thinning and termination of conglomerates in the Sickle Group;
5. a change from massive and disseminated sulphides to sparsely disseminated sulphides.

Structure

A granitic terrain occupies the northern part of the map-area, and two fold-complexes of sedimentary gneiss lie in the south. These three domains are separated by two narrow belts which contain mainly volcanic strata in a T-shaped structure.

The high-grade sedimentary gneisses and migmatites at Laurie Lake and Tod Lake occupy large sheet-like, isoclinal folds. These early structures are refolded into small dome-complexes which are cored by remobilized arkosic gneiss. Slivers of meta-greywacke and conglomerate in South Bay and of conglomerate along the Laurie River where it leaves Tod Lake are tentatively interpreted as domal culminations exposing the deepest structural level. The structures dive north under mainly volcanic and granitic rocks.

The granites in the north seem to be moderate-to high-level intrusions which structurally overlie some of the sedimentary gneisses. Some plutons are relatively fresh and have retained subophitic and porphyritic textures. Screens of greywacke and mafic tuff in quartz diorite along the northern arm of Laurie Lake are exceptionally well preserved. However, the chain of plutons along the northern part of Laurie Lake is folded and overturned to the south. Two of the bodies occupy late synforms such that the granites structurally overlie the sedimentary gneisses. Consequently, the gneisses form the floor or tilted margin of an eroded granitic terrain.

The narrow belts which contain most of the volcanic rocks separate the granites and the gneisses. They contain isoclinal folds and fault-bounded slices which are interpreted as thrust

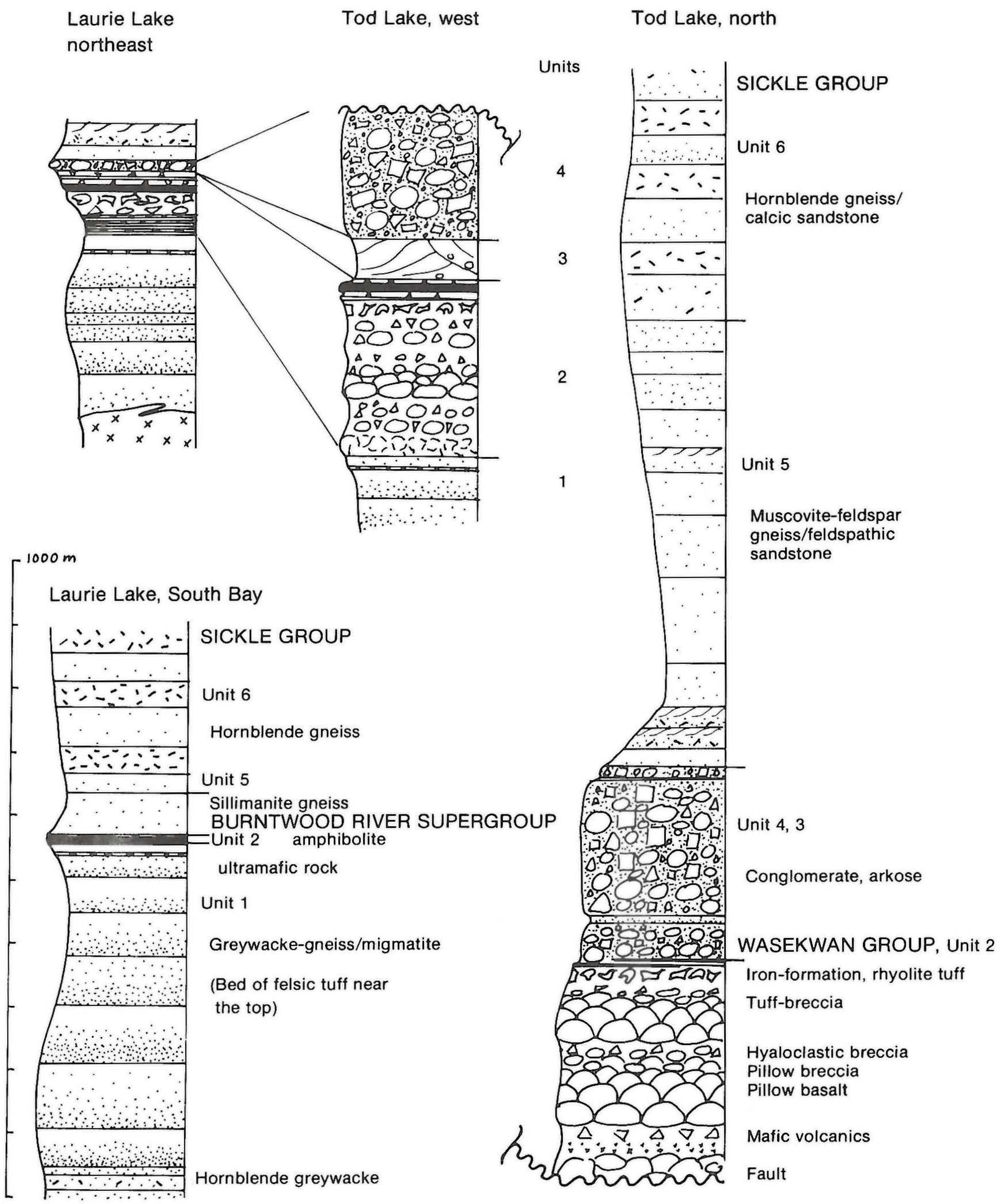

Figure GS4-1. Stratigraphy of the Laurie Lake area.

plates. The lithofacies changes that characterize the area take place along strike and between successive structures.

A well defined fault lies along the west shore of Tod Lake. It strikes northeast through Hatchet Lake towards Fox Mine. The fault contains Sickle arkose and conglomerate in the northwest wall, and volcanic rocks in the southeast wall. Both successions face southeast, and the southeast wall is interpreted as the over-riding plate. The fault was apparently bent and tilted during the emplacement of the gneissic complexes and during the intrusion of the northern granites. Folded mylonites on the west shore of Tod Lake support this conclusion. Several other faults can be inferred from stratigraphic relationships on Laurie Lake. They were refolded in the mantle of the gneissic rocks.

On Tod Lake the Sickle Group dips gently to the north but seems to contain four major repetitions. The structure is tentatively interpreted as a large domed recumbent fold. Consequently, the oval structure south of Eager Lake (Figure GS3-1) may contain volcanic strata found only at higher levels elsewhere. Other large horizontal folds may explain the presence of the volcanic and conglomerate facies outside the map area as far as the south tip of Russell Lake (McRitchie, 1975; Lenton, this report). The structures may help to outline areas of economic importance.

Metamorphism

Rocks in the core of the gneissic fold-complexes are moderately mobilized migmatites in the upper amphibolite facies. The structurally overlying rocks to the north are better preserved but sillimanite disappears only north of the Laurie River.

Muscovite is abundant in the Sickle Group on the north shore of Tod Lake and on the northeast shore of Laurie Lake. Farther south, sillimanite appears as intergrowths with muscovite in conspicuous faserkiesel. In South Bay, muscovite is rare and faserkiesel consist largely of feldspar intergrown with sillimanite. The first faserkiesel are spherical porphyroblastic overgrowths on a folded foliation with thin folded granitic veins. They grow after the onset of anatexis, but with the breakdown of muscovites they change from glassy, grey, egg-shaped bodies to creamy white, flattened knots, rich in sillimanite and feldspar. At the highest grade, faserkiesel are generally paper-thin and are folded with the foliation. In the sillimanite-garnet-cordierite-bearing gneiss which is restricted to the southwestern part of the area, faserkiesel are absent. At this stage, arkosic and argillaceous rocks contain over 50% granitoid material.

Mineral Deposits

Special field studies of mineral-showings were not made but most of the work is aimed at assigning a stratigraphic position to the known showings. This work is not completed but there are several obvious associations. These include:

1. pyrrhotite, pyrite and minor chalcopyrite in intermediate volcanic rocks and overlying mafic tuff and wackes beneath the main basaltic section;
2. iron sulphides, minor cherty iron formation with gold on Laurie Lake at the top of the main basaltic section;
3. minor sulphides in gabbro and diorite in the intrusive complex on the east shore of Laurie Lake;
4. minor iron sulphides and chalcopyrite in Sickle conglomerate;
5. minor malachite, and southwest of Tod Lake minor bornite in the lower part of Sickle arenite.

Appendix of Map Units

Map units which have been traced throughout the Kisseynew belt were originally defined within the migmatitic terrain (McRitchie **et al.**, in preparation). These units have been traced into rocks which contain no granitic material and which show sedimentary structures in the Laurie Lake area. Litho-facies changes at the margin of the Lynn Lake greenstone belt provide important data for correlations. Excellent shore exposures show the various facies.

Preliminary descriptions of the units are given to aid the mapping programs in the greenstone belt and in the sedimentary gneisses.

Unit 1 — Meta-greywacke (Burntwood River Supergroup)

Meta-greywacke and greywacke-migmatite form a unit which is 600 m thick after intensive deformation in fold limbs southwest of South Bay. However, only a 300 m section of the slightly lower-grade gneisses is preserved on the northeast shore of Laurie Lake.

The lower-grade rock is a fine-grained biotite gneiss, commonly with garnet porphyroblasts at the base of the exposed section and sillimanite knots at the top. Graphite is a minor constituent. Beds are 5 to 50 cm thick after structural flattening. The wackes seem to be proximal turbidites. Beds generally start with a graded (Bouma A) division and many have a laminated (B) division but higher divisions are rare. This information has been interpreted mainly from compositional variations but clastic textures are locally preserved.

The upper 100 to 200 m of the lower-grade section contain 5 cm beds of white-weathering feldspathic wacke with thin mudstone interbeds. Tourmaline is locally abundant. Soft-sediment deformation is evident at the base of the coarse-grained beds. A thin bed of dacitic tuff is an important marker unit near the top of the greywacke.

The higher-grade section in the south has a basal unit of 300 m of well layered medium-grey gneiss with beds of granite-veined pelite containing abundant biotite ± garnet and very local sillimanite. Lenses of calc-silicate rock are common. Near the base of the unit is a distinctive fine-grained meta-greywacke comprising 5 cm beds of hornblende-bearing gneiss.

The upper 100 to 300 m of the higher-grade section are coarse-grained garnet-sillimanite-cordierite-graphite gneiss ± tourmaline interlayered with lesser amounts of fine-grained gneiss. More than half the rock is granitoid material. This unit is tentatively correlated with the turbidites in the north. The lower part of the unit may be equivalent to fine-grained hornblende-bearing metasediments which are only poorly exposed north of Laurie Lake.

Unit 2 — Metavolcanic Rocks, Volcanic Wacke, Amphibolite (Burntwood River Supergroup, Wasekwan Group)

The metavolcanic rocks overlie the meta-greywacke conformably. Basaltic pillow flows and pillow breccia predominate in the northeast and water-laid tuffs and volcanic wackes predominate in the southwest. Dacitic rocks are largely restricted to an area around an intrusive complex on the east shore of Laurie Lake. They appear to lie near the base of the volcanic section.

The main basaltic unit is repeated across the fault between Laurie Lake and Tod Lake. The unit extends northeast towards Fox Mine. It is about 300 m thick but it is highly attenuated by deformation and was probably over 1000 m thick upon deposition. Individual flow units in the northeast are commonly 3 to 10 m thick. Some units start with pillows which are about 1 m long on outcrop but 3 to 5 m down plunge. Pillows are overlain by smaller, variably sized pillows and pillow breccia. About 15% of the rock is commonly hyaloclastite, recrystallized to coarse amphibolite with hornblende, feldspar ± garnet and epidote. The breccias consist of ellipsoidal and irregular fragments which are up to 50 cm long. Flow units are commonly overlain by an irregular breccia or tuff that weathers patchy or banded, light and dark grey. Silicic alterations may occur at the top, but patches of material rich in epidote occur in the breccias and the pillows. Massive flows are locally important. Amygdales are relatively abundant. Apparently, the breccias formed by steam explosions in fairly shallow water.

South, along the steep western shore of Tod Lake, there is a transition from basaltic pillow flows and breccias to breccias and tuff; and to interlayered greywacke, tuff and breccia. The sedimentary rocks include beds of garnetiferous meta-greywacke up to 1 m thick, and thinner, argillaceous beds with muscovite-sillimanite faserkiesel.

A distal facies of the basaltic rocks overlies the main greywacke on Laurie Lake. Along the east shore, the section is restricted to 50 - 100 m of mafic water-laid tuff, wacke and breccia with only 5 m of pillow breccia near the top. The bedded tuffs are prominent at the base of the section. They consist of 5 cm graded with mafic and felsic clasts up to 8 mm. These beds alternate with fine-grained wacke.

Unit 2 is generally very thin in the higher-grade gneissic terrain. West towards Saskatchewan the bedded-tuff facies is well developed but southwest of Tod Lake and in the Kamuchawie Lake map-area (Zwanzig and Wielezynski, 1975) there are lenses of basalt near Murray Lake. In the transition between metavolcanic and amphibolitic gneiss on Laurie Lake, pillow breccias with epidote alterations are apparently transformed into medium-grained hornblende amphibolite with streaks and lenses of gneiss rich in diopside.

At the base of the basaltic section there are medium grey, intermediate tuffs or flows and breccias which are only poorly exposed between Hatchet Lake and the Laurie River.

A unit of mafic and intermediate tuff lies along the east shore of Laurie Lake. It appears to underlie the basaltic rocks and may form a distal, clastic facies of the lower part of unit 2 but the section is complicated by strike faults. The intermediate rocks can be traced in a radius of 4 km around a small complex of plutonic breccia and quartz diorite which is centered on U.T.M. 328500E and 6275500N. Intrusive breccia, tuff and sedimentary units appear to occupy a stratigraphic position at the base of unit 2 but much of the rock lies in a fault silver on top of 50 m of Sickle meta-arkose. At the base are thick beds of homogeneous greywacke with much calc-silicate rock. Basaltic and dacitic dykes intrude the folded and faulted sedimentary rocks. The greywacke is overlain by bedded tuff and crystal tuff. Thin beds of conglomerate and breccia occur locally. The tuffs contain up to 15 mm phenocrysts of hornblende (after pyroxene?) and feldspar. There are scattered mafic and felsic lapilli. Large amygdales filled with quartz or feldspar are also present.

The intrusive quartz diorite and diorite are characterized by large quantities of small oval inclusions. Highly complex plutonic breccias with multiple dyke injections occur in the core, and tectonic (?) breccias with associated ultramafic rocks in the periphery of the intrusions. The main quartz diorite phase includes blocks of the Sickle Group and does not fit the position at the base of the basaltic section. More detailed work is required.

Near the top of unit 2 are 2 to 10 m of highly distinctive breccia composed of 60% mafic crystal tuff and 40% light-grey-weathering fragments with dark cores. Locally, the fragments form discontinuous layers of laminated sedimentary rock or tuff. Generally, fragments are less than 20 cm long and they are irregular or contorted. The tuff-breccia is one of the marker units that consistently underlies the Sickle conglomerate and indicates that there is no significant angular unconformity at the base of the Sickle Group.

In most of the area the tuff-breccia is overlain by thin bodies of ultramafic rocks. These include a differentiated sill but there may be flows or tuffs.

Another marker at the top of the volcanic rocks is a 5 cm to 15 m layer of distinctive white-weathering rhyolite tuff. The rock is highly recrystallized but its origin can be inferred from its field relationship; it extends for tens of kilometres. Locally there are several layers.

The tuff, the breccia and the ultramafic marker units overlie both the flow facies and the condensed, mainly sedimentary facies of unit 2. Consequently, accurate correlations are possible near the top of the section: the various facies were apparently deposited at the same time.

Unit 3 — Meta-arkose (Sickle Group)

Along the peninsula between Laurie Lake and Tod Lake 50 m of pink-weathering meta-arkose lie at the base of the Sickle Group, conformably on the marker unit of tuff-breccia or on pods of ultramafic rock. The meta-arkose is coarse-grained and rich in feldspar or quartz in the lower part. Locally it has festoon cross-bedding, 20 to 50 cm thick. Rounded quartz pebbles are scattered at the base. The upper part of the unit is rich in muscovite and the bedding is thick to massive. It was probably a feldspathic wacke.

The unit is discontinuous but apparently it extends northeast to Fox Mine and west to the middle of Laurie Lake. It is apparently a moderately sorted shallow-water deposit but there is no evidence for erosion at its base.

Unit 4 — Conglomerate (Sickle Group)

The meta-arkose is overlain by about 200 m of conglomerate truncated at the top by the fault along the shore of Tod Lake. The deposit is rich in felsic and mafic volcanic pebbles with fewer pebbles of meta-sediments, quartz and granite. Streaks of epidote and hematite alteration make the rock highly distinctive. An important feature is the presence of weathering rinds on certain pebbles and boulders throughout the area. Some granite clasts are almost completely replaced by epidote and hematite.

In the southeastern fault sliver, meta-conglomerate overlies unit 2 directly. There are 3 cm of cherty iron formation and thin units of porphyroblastic garnet and sillimanite gneiss just at the base of the conglomerate. The iron formation can probably be traced northeast along the regional magnetic anomaly. It also occurs on Laurie Lake at the same stratigraphic position as thick beds of chert on the abandoned Caimito gold property. On Tod Lake, the thin iron formation is overlain by 30 m of clast-supported conglomerate. It contains unsorted, angular and rounded felsic, quartz and sedimentary clasts up to 15 cm long. Weathering rinds occur on a few of the pebbles. The unit fines upward into 25 m of meta-arkose which is rich in muscovite at the top and pebbly at the base. On the steep, west shore of Tod Lake, impure arenite occurs in 30 cm graded beds with conglomerate at the base and laminated muscovite phyllite at the top.

A second unit of meta-conglomerate overlies the thin unit of meta-arkose. It is typically a homogeneous, grey-weathering rock, containing hornblende, epidote or diopside, hematite and magnetite. Pebbles comprise volcanic and sedimentary rocks including chert and iron formation. The clasts are angular but a few boulders of granite are round. Epidote and hematite form conspicuous alterations.

The condensed volcanic section on Laurie Lake is overlain by an equally condensed section of conglomerate. The basal arkose is 2 m thick but contains the same scattered pebbles of quartz and pink felsic volcanics as the 50 m of arkose to the east. The overlying epidote-smeared conglomerate is 15 m thick. It contains angular and rounded sedimentary, felsic volcanic and granitic cobbles. The unit grades rapidly from fine at the base to cobbly just above the base, and then slowly fines upward and becomes rich in muscovite. The upper 3 m consist of pebbly arkose in which 50% of the clasts are granite. Interbeds of meta-arkose have a graded base and a ripple-laminated top. Calc-silicate minerals form thin replacement layers.

Conglomerates in the high-grade gneissic terrain on Laurie Lake resemble the main (upper) conglomerate at Tod Lake but epidote is replaced by diopside and muscovite by biotite. The rocks exhibit pronounced stretching and are now a streaky plagioclase-hornblende-biotite gneiss. Dark-grey pebbles of quartz and altered granitoid (felsic volcanic?) clasts can still be recognized. Stringers of white granite replace some of the felsic material. The conglomerate is only a few metres thick and it pinches out towards the southwest.

Unit 5 — Feldspathic Sandstone, Sillimanite Gneiss (Sickle Group)

On the north half of Tod Lake conglomerate is overlain by 700 m of feldspathic gneiss derived from impure sandstone-mudstone. The rock weathers pale grey or buff. It is rich in muscovite or at higher grade sillimanite. Hematite or magnetite is always present.

Varieties rich in muscovite contain quartz and feldspar grains which are less than 0.3 mm in diameter. White mica is locally porphyroblastic and up to 0.5 mm long. These rocks are massive to thin-bedded. Graded divisions are up to 10 cm thick. Ripple-laminated divisions are slightly thinner. Very fine-grained felsic beds have pale-red and buff parallel laminations.

Varieties rich in quartz and feldspar occur near the top of the unit. They are coarser grained and locally contain scattered pebbles. On the south shore of Tod Lake the unit is correlated with pink-weathering meta-arkose in which festoon cross-beds 20 to 30 cm thick are preserved. Along the Laurie River the top of the unit has distinctive pink and grey weathering laminations.

Throughout the rest of the map-area the feldspathic sandstone is recrystallized into pink, faserkiesel-bearing gneiss. This rock is similar to the knotted arkose of Zwanzig and Wielezynski (1975).

In the migmatitic terrain on Laurie Lake sillimanite gneiss lies directly on the amphibolite of unit 2. The high-grade rock contains coarse, pink, granitic veins which replace the primary structure. The unit is only 10 to 100 m thick where it overlies amphibolite, but there are several belts up to 300 m thick which occupy the limbs of isoclinal folds or a higher stratigraphic level.

Unit 6 — Calcic Sandstone, Hornblende Gneiss

Hornblende-bearing paragneiss overlies the muscovite or sillimanite-rich rock. The facing is indicated in eight or ten localities with graded bedding or cross-bedding on Tod Lake and on one locality in South Bay. However, the stratigraphic position of the equivalent rock is different at Kamuchawie Lake (Zwanzig and Wielezynski, 1976) and at Russell Lake (Lenton, this report). It is possible that there are major thrust faults in the section or that the tops on Tod Lake were improperly interpreted.

The unit is 200 to 300 m thick in the limbs of isoclinal folds at Tod Lake and Laurie Lake. It is relatively well preserved on Tod Lake where the lower part consists of 20 to 100 cm massive pink beds of fine-grained feldspathic sandstone. The top of the beds are generally laminated pink and buff. The beds are separated by 2 to 3 cm of hornblende-and epidote-rich layers. At the higher grade, diopside replaces epidote. On several outcrops the hornblende-bearing layers contain mafic and felsic clasts up to 2 cm long. Small-scale cross-bedding occurs at the base of the unit in South Bay.

Along the Laurie River east of Tod Lake there is a thin unit of intraformational conglomerate and breccia. Clasts are unsorted but never larger than 2 cm.

The upper part of the unit consists of 2 to 3 cm layers with green hornblende ± epidote ± diopside alternating regularly with pink-weathering fine-grained layers. Graded bedding is apparent from a small upward increase in mica in some of the pink layers. Apparently, the sandstone was deposited below wave base in deeper water than the arkose at the base of the Sickle Group. The layers of hornblende-bearing rock probably formed from sandstone with a carbonate cement. In one graded unit the calc-silicate minerals appear several centimetres above the base of the bed.

In the higher-grade rocks in South Bay unit 6 is a distinctive pink and green-weathering gneiss. It has alternating layers of hornblende-diopside-rich/poor rock, 2 to 4 cm thick. However, thicker beds occur in the lower part of the unit, and at the base hornblende is absent.

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LYNN LAKE AREA
(Arbour Lake)

(Parts of 64C/14E and 15W)

By H. Paul Gilbert

Introduction

Mapping was carried out at a scale of ½ mile = 1 inch in the Lynn Lake area (64C/14E) and in the area to the northeast (64C/15W). Attention was directed largely to the volcano-sedimentary sequence in the area between Ralph Lake and Eldon Lake. Details of the granitic rocks in the Motriuk Lake, Eldon Lake and Berge Lake areas, and the geology of the area southeast of Arbour Lake and east of Hughes River are taken largely from previous publications (Milligan, 1960; Emslie & Moore, 1961). The southern part of the Lynn Lake area is based partly on the work of Emslie and Moore.

Previous mapping outlined a northeasterly trending (northern) belt of volcanic and sedimentary rocks in the north, and an easterly trending (southern) belt in the south, with a synclinal axis passing through Eldon Lake between the two belts (Allan, 1946; Emslie & Moore, 1961). The axial zone of the Eldon Lake syncline is occupied by granitoid rocks and the Fraser Lake gabbro (Preliminary Map 1976L-2).

Northern Belt

Structure

The northern belt was interpreted by Emslie and Moore as a southward facing monoclinal structure although the original work of Allan had identified an anticlinal axis extending southwestward from Berge Lake to Motriuk Lake. The present mapping has identified an anticlinal axis immediately south of Margaret and Sheila Lakes, trending northeastwards to West Lynn Lake. The anticline cannot be traced northeast of West Lynn Lake; top directions in this area indicate a northwesterly-facing monoclinal structure. The West Lynn Lake anticline is defined by northwesterly top directions in fine-grained metasediments at Margaret and Sheila Lake (grading, cross-bedding, and slump structures), southeasterly-facing directions defined by pillow basalt at Frances Lake and the attitude of the Lynn Lake gabbro, which displays south-facing primary layering (Emslie & Moore, 1961).

Stratigraphy

The oldest rocks in the northern belt comprise a mixed volcanic suite (subdivision A, table GS5-1) consisting of coarse pyroclastics and mafic to felsic volcanic flows in the vicinity of Lynn Lake town; these rocks laterally grade into finer pyroclastics and flows in the area to the southwest (between Margaret and Frances Lakes). Northeast of Lynn Lake, the volcanics grade laterally into a sequence of mafic to intermediate flows, tuff, lapilli tuff, and minor quartz-feldspar porphyry. Pyroclastic breccia decreases in abundance and coarseness to the northeast. At Lynn Lake town, the breccia is polymictic, consisting predominantly of felsic to intermediate clasts in an intermediate to mafic crystal tuff matrix. The largest clasts (porphyritic dacite) are boulders up to 1.3 m x 40 cm. The breccias are intimately interlayered with tuffs anf lapilli tuffs, and locally intercalated with porphyritic felsic and intermediate flows. The sequence in the fold-core southwest of Lynn Lake consists of interlayered felsic and intermediate tuff and lapilli tuff, quartz-feldspar porphyry, and fine-grained basaltic sills and flows with rare pillows. The maximum thickness of the mixed volcanic suite is approximately 1400 m in the vicinity of Lynn Lake town; this thickness decreases to approximately 375 m south of Margaret Lake (assuming an anticlinal structure in that area). The stratigraphic sequence away from the West Lynn Lake anticline is not consistent on opposite sides of the hinge line, and it is uncertain whether the fold is confined to the volcanic unit or defines the major structure of the northern belt. Southeast of the fold, the sequence consists of quartz-feldspar porphyry (up to approximately 2400 m thick) which apparently lenses out northeastwards in the vicinity of Keewatin River. The upper part of the porphyry is locally flow-brecciated, and contains intercalated conglomerate, arkosic wacke, and minor greywacke, pyroclastic breccia, mafic tuff, basalt and garnetiferous schist; these rocks are intruded by tonalitic to quartz monzonitic rocks at their southern margin. Northwest of the fold the mixed volcanic suite (A) is overlain by approximately 700 m of metasedimentary rocks (B). These consist largely of very fine-grained arkose wacke, siltstone, hornblendic greywacke, and conglomerate containing sedimentary and volcanic fragments. The metasedimentary suite contains minor intrusive and extrusive basaltic interlayers. Within the sedimentary suite a distinct garnetiferous zone (up to approximately 150 m thick) may be traced for at least 4 km. Garnetiferous rocks include amphibolite, metasediments, and mafic tuffs, and the zone is locally characterized by pyrite/pyrrhotite mineralization, a carbonated shear zone, and gabbroic sills. The zone is locally associated with a magnetic anomaly. East of Eric Lake, The metasedimentary suite consists predominantly of siltstone with minor greywacke and mafic tuff.

The metasedimentary suite at Margaret and Sheila Lakes is overlain by approximately 2500 m of predominantly mafic to intermediate flows (subdivision C, table GS5-1). Felsic (dacitic?) flows are subordinate, except in an 800 m wide zone intersecting the southern extremity of Ralph Lake. The extrusive suite is largely porphyritic (with plagioclase and locally hornblende) and commonly characterized by irregular zones of quartz amygdales. Oligomictic flow-breccia, and porphyritic and aphyric flows are intimately interlayered. The flow-breccias are locally polymictic, with mafic and felsic, epidotized fragments. A few mafic flows are pillowed. Subordinate intermediate lapilli tuff and siltstone are interlayered with the flows. Minor gabbro and quartz-feldspar porphyry intrusives are common in the extrusive suite.

Northeast of Ralph Lake, approximately 425 m of predominantly mafic tuff and crystal tuff (subdivision D, Table GS5-1) overlie the extrusive volcanic suite (C). The tuffs are well bedded, and intercalated with mafic flows and minor pyroclastic breccia, greywacke and rare magnetiferous siltstone. A northwestward-facing top direction is indicated by graded bedding and rare scoured surfaces. The tuffs are the youngest volcanic rocks in the northern belt.

Northeast of Lynn Lake, the predominantly extrusive suite (C) and overlying mafic tuffs and flows (D) may be mapped in the area between Dot Lake and Arbour Lake. Flow-breccias (C) are locally characterized by quartz amygdales and polymictic assemblages of clasts as at Ralph Lake. North and northeast of Arbour Lake, mafic to intermediate flows and flow-breccias with minor mafic intrusives are predominant; porphyritic dacite and dacitic breccia interlayers occur south and east of Tulune Lake.

The predominantly volcanic sequence of the northern belt, which was assigned to the Wasekewan Series by Allan, is apparently overlain by conglomerate of uncertain age (Figure GS3-1). The conglomerate (subdivision E, Table GS5-1) is polymictic, with a wide variety of clasts in the area west of Ralph Lake. Unsorted pebbles, cobbles and sporadic boulders include the following (in order of abundance): felsic volcanic and/or arkosic wacke, intermediate aphyric and porphyritic volcanic, amphibolite, epidotized volcanic (?), fine-grained and medium-grained quartz diorite, quartz, and rare magnetiferous chert. Northeast of Berge Lake the conglomerate also contains greywacke clasts, but granitoid types are generally absent and the clasts are less varied; alteration has locally produced pink and yellow (feldspathic/epidotic) irregular zones, and fine-grained mafic dykes are common in this area. South of Zed Lake the conglomerate is extensively intruded by quartz diorite or granodiorite. Iron formation (up to 80 m thick) immediately underlies the conglomerate west of Berge Lake. The conglomerate extends for at least 45 km from south of Zed Lake to the area southeast of Dunsheath Lake. The conglomerate is flanked to the northwest by intermediate greywacke and minor siltstone, with rare argillitic interlayers. The approximate width of the conglomerate unit is 2650 m, and that of the greywacke suite is 5000 m. The extent of structural repetition in the conglomerate and greywacke is unknown; minor folds in the greywacke indicate at least 2 fold phases, and the foliation of the conglomerate is locally folded. The conglomerate-greywacke sequence was assigned to the Sickle Series by Allan (1948) but interpreted by Emslie and Moore (1961) as part of the Wasekwan Series. The following observations indicate that the conglomerate overlies the volcano-sedimentary Wasekwan Group and is of Sickle age:

(a) at Barbara Lake mafic tuffs immediately southeast of the conglomerate face northwest;
(b) the mafic tuff unit is apparently truncated by the conglomerate in the area southwest of Barbara Lake (Preliminary Map 1976L-2);
(c) the lithology of the conglomerate is similar to that of the Sickle conglomerate (Fawley, 1949);
(d) the Wasekewan Group rocks southeast of the conglomerate represent a probable source for the latter, in contrast to the monotonous greywacke-siltstone sequence northwest of the conglomerate.

The lithologies of the greywacke suite northwest of the Zed Lake-Dunsheath conglomerate are less typical of the Sickle Group than of the Wasekewan, where the latter is represented by metasedimentary rocks of the Burntwood River Supergroup (McRitchie, 1974). The greywacke suite may represent Wasekewan Group rocks which are transitional laterally across a synclinal fold, the core of which is occupied by the Zed Lake-Dunsheath Lake conglomerate.

Southern Belt

Structure

An easterly-trending anticlinal axis was mapped by Emslie and Moore from north of Nail Lake to McVeigh Lake. This structure is consistent with an apparent northward-facing direction between Ace Lake and Eldon Lake, interpreted on the basis of the stratigraphic sequence which is broadly similar to the Frances Lake—Ralph Lake section of the northern belt. A possible easterly trending fold axis through Franklin Lake is indicated by the distribution of lithologic units. This area was interpreted as anticlinal by Bateman (1945) but a synclinal structure, interpreted by Emslie and Moore (1961) is more likely.

Stratigraphy

The oldest rocks in the southern belt are porphyritic and aphyric basalt which outcrop in the core of the anticline in the Ace Lake—Nail Lake area (subdivision A, lower part, Table GS5-1). The flows contain plagioclase phenocrysts and hornblende pseudomorphs in the area northeast of Ace Lake. South of the basalt the sequence consists predominantly of interlayered mafic flows, tuff and crystal tuff with minor polymictic pyroclastic breccia, felsic tuff, and rare siltstone (subdivision A, upper part, Table GS5-1). South of the map-area, these rocks are succeeded by predominantly extrusive mafic volcanics, which may correlate with those north of the proposed syncline through Franklin Lake. A similar sequence in the Nail Lake area contains minor greywacke interlayers. Quartz-feldspar porphyry intrusives and probably extrusive rhyolite units up to 80 m thick occur close to the southern margin of the mafic volcanics, which are intruded by tonalite to the south. The thickness of the mafic volcanic suite (A) is approximately 1100 m, assuming a syncline-anticline structure. Feldspathic wacke and siltstone terminate just west of Franklin Lake in the core of the syncline.

A largely metasedimentary suite (subdivision B, Table GS5-1) occurs north of the mafic volcanics (A). The lower and upper contacts of the metasediments are interlayered with volcanic rocks (of subdivisions A and C, respectively) and the approximate thickness of the metasediments is 1000 m. The metasediments include arkosic wacke, intermediate greywacke, siltstone and conglomerate. Pebble-to cobble-conglomerate, which is best developed south of Fraser Lake, is largely comprised of aphyric and porphyritic felsic and intermediate volcanic clasts, with minor mafic volcanic and locally quartz and siltstone fragments. The matrix varies from hornblendic greywacke to siltstone. The metasediments are locally associated with minor quartz-feldspar porphyry and mafic tuff interlayers. Basalt is intimately intercalated with siltstone southwest of Fraser Lake. Minor mafic intrusives (locally with euhedral hornblende pseudomorphs) are common, especially at the base and top of the metasedimentary suite. Subdivision B in the southern belt is similar to the upper part of the quartz-feldspar porphyry unit of the northern belt (Table GS5-1), which may be stratigraphically equivalent.

A mafic volcanic suite (subdivision C, Table GS5-1) south of Fraser Lake consists predominantly of quartz-amygdaloidal porphyritic flows and flow-breccias similar to those at Ralph Lake, with pyroclastic breccia, subordinate mafic tuff, and rare arkosic wacke. The thickness of the mafic volcanic suite is uncertain owing to possible structural repetition indicated by the contact between volcanics (C) and metasediments (B) in the Fraser Lake area. The maximum thickness of the volcanics (C) is 1400 m, assuming a monoclinal sequence. The volcanic suite is laterally gradational eastwards to a sequence consisting of interlayered mafic to intermediate tuff and breccia, basalt, greywacke and siltstone; pyroclastic breccia is less coarse and metasediments more abundant than in the sequence south of Fraser Lake. Quartz-amygdaloidal flow-breccia occurs close to the northern and southern margins of this unit.

Stratigraphic Correlation

A tentative correlation of the major stratigraphic subdivisions is outlined in Table GS5-1.

The correlation implies the following north-south lateral gradations across the Eldon Lake syncline:

Subdivision C: loss of dacitic flows; increasing abundance of greywacke and siltstone towards Eldon Lake;
Subdivision B: loss of garnetiferous zone; appearance of quartz-feldspar porphyry;
Subdivision A: decreasing pyroclastic breccia, and loss of very coarse breccia; increasing proportion of extrusives and volcanics of mafic composition.

The apparent stratigraphic equivalence of the sequence from subdivision A to C in the northern and southern belts may be due to folding or faulting. Repetition of the sequence across a fold pair (West Lynn Lake anticline — Eldon Lake syncline) is more likely than major faulting for the following reasons:

(a) the contact between the mixed volcanic suite (A) and quartz-feldspar porphyry in the northern belt is interlayered and apparently conformable; no major faulting is evident;
(b) the northern and southern belts verge towards an apparent closure in the vicinity of Eileen Lake; although the stratigraphic subdivisions cannot be traced directly from the northern to the southern belt, continuity of the belts through the fold closure may reasonably be inferred.

Metamorphism

An Upper Greenschist to Lower Amphibolite regional metamorphic grade is established by the widespread occurrence of garnet and green hornblende porphyroblasts, and porphyroblasts, and plagioclase compositions reported by Emslie and Moore to range from oligoclase to andesine in the southern Lynn Lake area. Pseudomorphs after possible cordierite in the vicinity of Flag Lake, and altered staurolite immediately east of the Lynn Lake gabbro occur in arkosic wacke. These occurrences may be contact metamorphic products of local gabbroic or granitoid intrusives. Staurolite, cordierite, and andalusite southwest of Lynn Lake (close to the southwestern corner of Preliminary Map 1976L-2) may be products of regional metamorphism of higher grade in the southwestern extension of the southern belt (see Zwanzig, this paper). Rare garnet occurs in the conglomerate-greywacke-siltstone sequence at the northwestern margin of the northern belt. The fine-grained metasediments are more coarsely recrystallized towards the contact with the granitoid rocks of the Zed Lake—Goldsand Lake area; this feature is also characteristic of amphibolites at the southern margin of the southern belt towards the contact with tonalitic rocks to the south.

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TABLE GS5-1

Stratigraphic subdivision of units in the Lynn Lake area.

SUBDIVISION (stratigraphic sequence A to E)	NORTHERN BELT	THICKNESS (maximum, in metres)		SOUTHERN BELT
age uncertain	greywacke, minor siltstone; rare argillite	5000*		
E	polymictic pebble/cobble conglomerate with mainly volcanic clasts; locally metasedimentary and granitoid types	2650		
	iron formation	80		
D	mafic tuff, crystal tuff, basalt; minor pyroclastic breccia, greywacke, siltstone	425		
C	mafic to intermediate flows and flow breccia; minor felsic extrusives, pyroclastic breccia; rare siltstone	2500	1400*	at west: mafic flows, flow-breccia, pyroclastic breccia; minor mafic tuff, rare arkosic wacke at east: mafic to intermediate tuff and pyroclastic breccia, mafic flows and flow-breccia, greywacke and siltstone
B	arkosic wacke, siltstone, hornblendic greywacke, conglomerate; minor mafic flows, sills, tuff	700	1000	arkosic wacke, siltstone, greywacke, conglomerate; minor quartz-feldspar porphyry, mafic tuff, basalt
A	pyroclastic breccia, tuff mafic to felsic extrusives; minor quartz-feldspar porphyry	1400	1100	upper part: mafic flows, tuff, crystal tuff; minor pyroclastic breccia, felsic tuff, greywacke, siltstone; lower part: porphyritic and aphyric basalt; minor tuff
age uncertain	quartz-feldspar porphyry; associated with arkosic wacke, conglomerate and minor greywacke, pyroclastic breccia, mafic tuff and basalt in upper part	2400		

* Actual thickness unknown, probable structural repetition

GEOLOGY OF THE SOUTHERN LYNN LAKE GREENSTONE BELT

(Parts of 64C/14 and 15)

By Eric C. Syme

Introduction

The belt of mainly metavolcanic rocks south of Lynn Lake was mapped at a scale of 1:20 000 to provide updated information on both lithology and structure. Preliminary maps of the area are compiled at a scale of 1:50 000. The 24 km by 3.5 — 6 km area is part of one of several greenstone belts, separated by granitic plutons, that occur in the vicinity of Lynn Lake.

General Geology

Mafic flows dominate in the thick central portions of the belt between Wasekwan and Cartwright Lakes (Figure GS6-1). Felsic volcanic rocks are almost entirely restricted to the eastern part of the area (west of Hughes Lake), and sediments occur chiefly in the west (Eldon Lake, north end of Wasekwan Lake).

The geology of all or portions of the map area has been previously published in the reports of Bateman (1945), Allan (1948), Emslie and Moore (1961), and Milligan (1960).

Rock Types

Table GS6-1 is a composite stratigraphic section intended only to show the lithologies present in the southern belt and their approximate relative ages.

Most of the units are discontinuous or lensoid in nature; consequently, the entire section is not developed at any one locality within the belt.

Basalt

The oldest unit comprises a sequence of pillowed and massive basalt flows, most of which are amygdaloidal. A maximum thickness of approximately 3600 m of flows occurs north of Moses Lake.

Pillows are generally only weakly deformed, have epidotized interiors, and are often 2 m or more in maximum dimension. Shapes are irregular and tops are usually difficult or impossible to determine with absolute certainty. Reliable tops determined in the area north of Moses Lake face south, opposite to those reported by Milligan (1960). In the thick portions of the basaltic pile chert occurs in the interstices between pillows, and (rarely) as rafts or blocks within pillows.

The massive basalt flows are characterized by amygdaloidal zones, and by yellowish epidotized fragments up to 1 m in size dispersed throughout the unaltered basalt. These massive basalt breccias probably derived from autobrecciation of flows.

Interbeds of pillow breccia, blocky flows, layered mafic tuff, fine-grained sediments, and volcanogenic pebble conglomerate comprise less than 10% of the basalt unit.

Andesite

In the western part of the area basalt is overlain by porphyritic andesite. The unit attains a maximum exposed thickness of 1300 m at McVeigh Lake, and pinches out south of Cockeram Lake. The rock has a consistent, distinctive appearance with hornblende phenocrysts (30 — 40%, 2 mm to 1 cm) and feldspar phenocrysts (30%, 1 mm) in a fine-grained grey-green groundmass. Fragmental varieties are most common, with porphyritic, lensoid fragments up to 10 cm in section set in a crystal tuff matrix of very similar composition. Some layers are well bedded crystal (hornblende) and lapilli tuffs, and a minority are amygdaloidal flows. The hornblende andesite is interlayered on a scale of several metres with massive basalt flows and layered mafic tuffs. A thin unit of basalt flows and, locally, mafic to intermediate crystal and lapilli tuffs overlie the andesite.

Sediments

Fine-grained clastic metasedimentary rocks attain their maximum thickness of 400 m in in the area south of Eldon Lake, but the beds are cut off by granite north of McVeigh Lake and are thus not traceable for more than 4 km to the east. A lens of sediments also occurs between

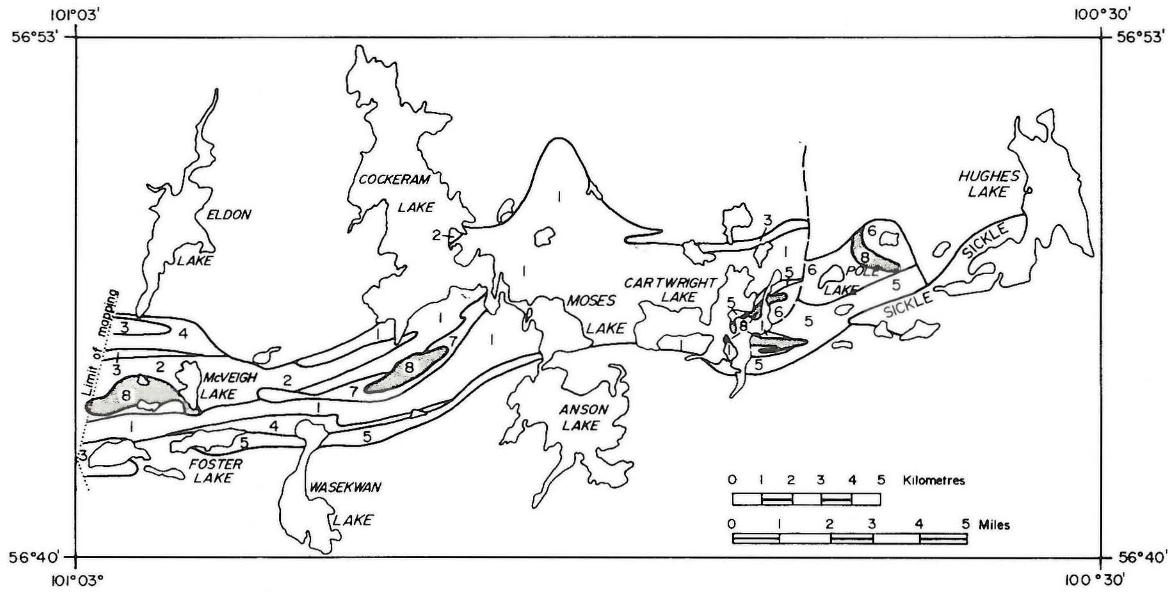

Figure GS6-1. Generalized geological map of the southern Lynn Lake metavolcanic belt between Eldon and Hughes Lakes. Unit numbers refer to Table GS6-1.

TABLE GS6-1 — LITHOLOGIES

UNIT	MAXIMUM THICKNESS (m)	
8		Granite, tonalite, quartz diorite, diorite. Intrusive Contact
7		Gabbro Intrusive Contact
6	1000	Felsic flows and crystal tuffs; quartz-feldspar porphyry, intermediate flows and tuffs, rhyolite breccia.
5	300 - 800	Intermediate and felsic tuffs; interlayered sediments and flows.
4	400	Clastic metasediments: siltstone, wackes, conglomerate.
3	500	Basalt flows, mafic tuffs, intermediate tuff.
2	1300	Hornblende-porphyritic andesite: breccia, tuff, flows; interlayered with basalt flows and mafic tuff.
1	3600	Basalt: pillowed and massive flows; interlayers of pillow breccia, blocky flows, mafic tuff, sediments, pebble conglomerate.

NOTE: This is a composite section. Individual units may not be extensive.

Foster and Wasekwan Lakes, where a maximum thickness of 300 m is established. This unit is lost in an area of no exposure west of Anson Lake. The metasedimentary rocks are predominantly micaceous siltstones and quartz wackes: fine-grained, buff coloured, quartz-biotite-feldspar and hornblende-bearing rocks in which primary structures are generally lacking. Most are thinly bedded (millimetres to several centimetres).

Tuffs and Sediments

A 300 m thick unit comprising intermediate and felsic tuffs and minor interlayered sediments and flows forms much of the southern margin of the belt. Intense shearing has destroyed most of the primary textures, but many of the rocks appear to be thickly bedded (greater than 1 m) feldspar and quartz crystal tuffs.

West of Hughes Lake, approximately 800 m of tuffs, sediments, and minor intermediate to felsic flows underlie a dominantly felsic unit. The tuffs include a variety of buff-weathering, massive and bedded feldspar and quartz crystal tuffs (commonly with a few small lithic fragments), lapilli tuffs with abundant small felsic lapilli in a matrix of feldspar crystals, and finely bedded siliceous tuffs. Interlayered with the tuffs are finely bedded or laminated slates and siltstones, and amygdaloidal, light green to buff weathering intermediate and felsic flows.

Felsic Volcanic Rocks

The felsic volcanic rocks west of Hughes Lake include porphyritic and aphyric flows, crystal tuffs, and one 100 m thick band of breccia.

Most of the flows appear to be dacitic in composition. They can be pillowed or massive, and are often amygdaloidal. The rocks weather light green to light grey-green, and may contain phenocrysts of feldspar, quartz, and hornblende. Siliceous, light grey-green to cream coloured amygdaloidal rhyolite flows are also present.

The crystal tuffs are massive or bedded on a scale of several centimetres. They often contain small felsic lapilli, and lack the ovoid quartz-feldspar-amphibole-filled amygdales common in the felsic flows.

A band of rhyolite breccia has been traced for 1900 m in the Pole Lake area. It is on the whole rather poorly sorted, but is characterized by abundant angular fragments up to 20 cm in diameter at the base, grading to 5 mm - 2 cm fragments at the top. The clast-supported breccia has a matrix of white granular carbonate.

Metamorphism

The rocks are metamorphosed to the middle greenschist facies in the east, and the metamorphic grade increases gradationally to lower amphibolite in the west, where garnet appears in the metasedimentary rocks. Primary structures in the metavolcanic rocks are often well preserved.

Structure

The main structure in the belt is an east-west trending anticline, the eastern extension of a fold mapped to McVeigh Lake by Emslie and Moore (1960). The fold axis extends as far east as near the small lake north of Cartwright Lake, where it is cut off by granite. Schistosity and primary layering are parallel and the limbs have identical dips, so the fold is interpreted as being isoclinal. The anticline is cored by pillowed and massive basalt north of Moses Lake and by hornblende andesite at McVeigh Lake. The axial regions of the fold have been intruded by lensoid tonalite plutons, one of which (south of Cockeram Lake) is mantled by medium grained gabbro. Twenty reliable pillow basalt top determinations clearly outline the fold.

Three south-west facing tops in the nose of the greenstone belt north of Moses Lake suggest that a synclinal axis lies to the north of the established anticlinal axis.

In the Cartwright Lake-Hughes Lake area a northeast-southwest trending synclinal axis is proposed, base on 5 top determinations, bedding attitudes, and the symmetric distribution of some felsic rock units. The fold is asymmetric and probably plunges to the northeast. Foliation and primary layering are not parallel in the nose of the fold, but it is not clear whether all foliations in the area are axial-planar to the fold. The exact relationship between the folded Wasekwan and Sickle strata in the Hughes Lake area remains as yet unresolved.

A major zone of shearing and crenulation occurs along the southern margin of the greenstone belt and in adjacent granites. This zone is probably the westward extension of a mylonite zone found south of Hughes Lake (Zwanzig, 1974).

Economic Geology

Few conductors were located in the southern belt by the 1976 INPUT survey flown over the Lynn Lake area. Of the conductors which were located, most lie within the sedimentary unit. Pyrite-pyrrhotite mineralization, most often associated with very fine-grained graphitic/argillaceous sediments, was observed in test pits and gossan zones in that unit.

Hornblende andesite occasionally contains trace to 1% disseminated pyrite and chalcopyrite, and trace amounts of pyrrhotite and chalcopyrite were noted in some of the felsic volcanic rocks.

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GEOLOGY OF THE McCALLUM LAKE AREA

(64C/4)

By P. G. Lenton and H. D. M. Cameron

General Geology

Work in the McCallum Lake area was carried out with two objectives: to complete the coverage of the previously unmapped area, and to expand the detail of the reconnaissance mapping on Russell Lake (McRitchie, 1975). The rocks consist predominantly of Aphebian metasedimentary gneisses and migmatites of the Kisseynew gneissic belt, intruded by a variety of granitic rocks (Figure GS7-1).

Rock Description

Greywacke Group

Much of the area comprises biotite gneisses and migmatites of the Burntwood River Supergroup. These grey to brown gneisses, derived from greywacke turbidites, are composed of plagioclase-quartz-biotite-graphite ± garnet ± cordierite ± sillimanite ± muscovite. Metamorphic layering is generally well developed, although primary bedding is often recognizable when the degree of remobilization is low. Sedimentary tops can be recognized, but only on exceptional exposures.

There is no systematic variation in the meta-greywackes that can be mapped, but some generalizations can be made. In the vicinity of arkosic bodies, the meta-greywacke is generally psammitic and contains numerous boudins and layers of calc-silicate rock and hornblende-biotite-plagioclase amphibolite. Deeper in the succession amphibolites are less common and the rock is generally more pelitic although calc-silicate rock is still abundant. The most pelitic sediments, rich in garnet, sillimanite, muscovite and cordierite, are exposed on McCallum Lake and west of Runner Lake.

The degree of remobilization in the area is highly variable, ranging from essentially unmobilized meta-greywackes on the south shore of McCallum Lake, to scattered areas of diatexite with up to 80% granitic fraction.

A discontinuous layer of mixed mafic and ultramafic rocks occurs within the meta-greywacke succession. The thickness of this layer ranges from 10 m to 100 m. While gabbroic and dioritic rocks are most common, pyroxene-bearing ultramafic rocks and fragmental andesitic rocks also occur.

Amphibolite Group

The top of the meta-greywacke section is marked by the characteristic "marker" amphibolite. Normally, this consists of 0 to 50 m of thinly layered hornblende-plagioclase-diopside-quartz ± garnet ± sphene ± sulphides para-amphibolite. The main body of Sickle type rocks of Russell Lake shows an anomalous amphibolite horizon.

The boundary of the body is delineated by the normal layered para-amphibolite. However, within the structure, a second layer of amphibolite occurs that is much more massive. Layers are 30 to 100 cm thick, and on some exceptional exposures resemble pillowed basic volcanic rocks. Within this unit are several discontinuous pods and lenses of enstatite-bearing hornblende peridotite. While this massive amphibolite differs from the para-amphibolite, it occurs at the same stratigraphic horizon suggesting they represent proximal and distal facies of a volcanic amphibolite occupying opposing limbs of a major fold structure.

Thin layers of carbonate, meta-iron formation and greyish-white protoquartzite occur within the layered amphibolite.

Sickle Group

Locally, the basal unit of the Sickle Group is a polymictic meta-conglomerate; the conglomerate is only recognized within the body of arkose on Russell Lake in association with the massive volcanic derived amphibolite; the conglomerate never exceeds 40 m in thickness and is usually thinner. Conglomerate was never recognized on the outside margins of the body, in association with the apparently more distal para-amphibolite facies.

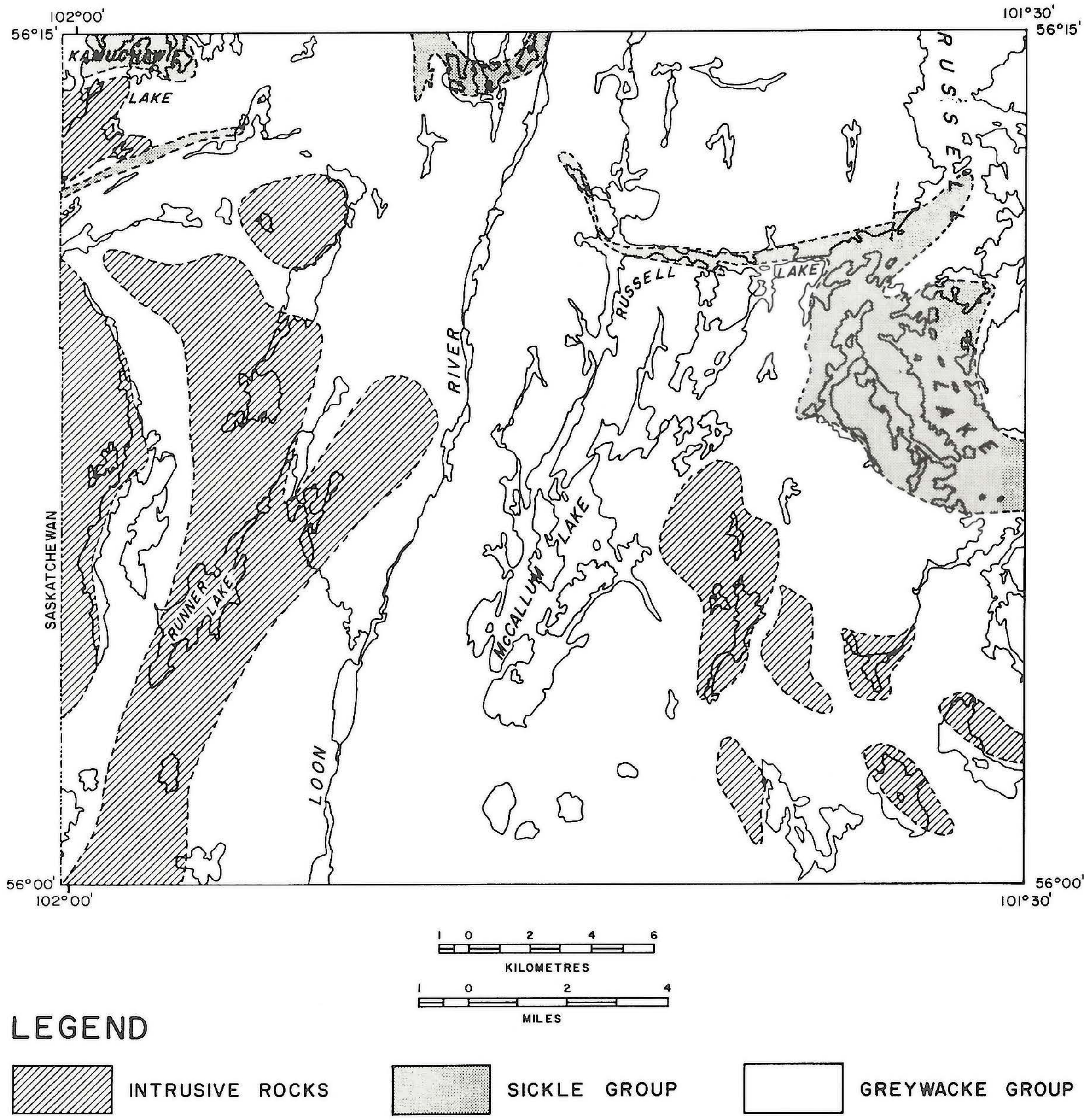

Figure GS7-1. General geology of the McCallum Lake area.

The clasts have been recrystallized and stretched, but are commonly recognizable, comprising granitic cobbles, quartz pebbles and fine-grained mafic and felsic clasts probably derived from volcanic rocks. The matrix appears to be hornblende rich arkosic wacke.

A pink to white hornblende rich gneiss occurs stratigraphically above the conglomerates, and in the distal facies at an equivalent horizon to the conglomerate. The gneiss is generally rich in magnetite and epidote, and is probably derived from a carbonate rich arkosic wacke. It contains numerous boudins and layers of calc-silicate rocks and hornblende-biotite amphibolite. Local variations of this unit are quartz rich with traces of garnet and sillimanite, and little or no hornblende.

The hornblende rich gneiss grades rapidly into a biotite gneiss derived from a feldspathic greywacke. Mineralogically simple, it consists of quartz, feldspar, biotite and magnetite. Primary layering is often recognizable as alternations of 30 cm psammite and semipelite beds.

Sedimentary tops determinations are rare. A variant of this unit exposed on Russell Lake is a delicately layered biotite gneiss with the psammite-semipelite alternation at a 1 to 3 cm scale.

The youngest unit of the Sickle group is a distinctive pink weathering knotted sillimanite gneiss derived from an arkosic wacke. The characteristic feature of this unit is the abundance of sillimanite, either as coatings on foliation planes, or more commonly as quartz-sillimanite-magnetite faserkiesel up to 30 cm long. Generally lineated, the knots can be as long as 1 m in the direction of stretching. The sillimanite gneiss often contains boudins or discontinuous layers of hornblende-biotite-plagioclase amphibolite up to 6 metres in thickness.

Plutonic Rocks

Numerous granitic intrusions are present throughout the area, but the main intrusive terrain is in the west, north of Runner Lake. This area of predominantly intrusive rocks registers as an aeromagnetic high, which can be attributed mainly to a homogeneous fine-grained pink magnetite-bearing biotite granite exposed along the western boundary of the area. A complex intrusive area centered around Runner Lake is comprised of gneissic tonalite, porphyritic hornblende and biotite granites, diatexites and pink pegmatites. Similar tonalitic and granitic rocks occur at Kamuchawie Lake and in the southeast corner of the map area. Pyroxene is normally found as a mafic mineral in this unit.

On the Loon River a small body of red fine-grained granite or syenogranite is exposed. The main intrusions east of the Loon River are a pink to white weakly layered quartz monzonite that intrudes the Sickle rocks on Russell Lake, and areas of biotite granite containing numerous inclusions of country rock.

Structure

Within the body of Sickle-"type" rock on Russell Lake it is possible to identify three periods of folding and two of faulting. Elsewhere in the area, although minor folds are numerous, delineation of major structures and trends is hampered by the lack of any marker horizons within the meta-greywacke suite.

The Sickle outlier on Russell Lake is a highly flattened tongue shaped structure plunging to the east at a shallow angle. Early overturned isoclinal folding has produced numerous structural repetitions of units. The youngest folds identified plunge to the north at moderate angles.

Economic Considerations

Occurrences of sulphide mineralization are mainly restricted to the various amphibolite units. Traces of iron sulphides and minor arsenopyrite are common throughout the amphibolites. Some minor traces of pyrite and chalcopyrite were noted as disseminations in the arkose above the "marker" amphibolite. One minor showing of chalcopyrite-malachite-bornite was noted in a granitic pegmatite on the south shore of Kamuchawie Lake.

Addendum

As part of the evaluation of the distribution of arkosic rocks in the Lynn Lake region (McRitchie, this report), a brief survey was made of the shoreline exposures of Trophy Lake (64C/2 west). Rocks previously mapped as greywacke derived paragneisses of the Burntwood River Supergroup are reinterpreted as Sickle-"type" arkosic rocks.

The stratigraphy mapped in this structure corresponds to that determined in neighbouring bodies.

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SAW LAKE AREA (Grass River Project)

(63J14 and part of 63J11)

By Alan H. Bailes

Introduction

A geological mapping program in the Saw Lake area was undertaken:

1) to provide 1:50 000 geological coverage of this previously unmapped area;
2) to determine the extent and nature of the eastern termination of the Flin Flon volcanic belt; and
3) to determine the relationship, if any, between rocks of the Flin Flon volcanic belt, the Kisseynew sedimentary gneiss belt and the Thompson nickel belt, which were all anticipated to crop out in this area.

A simplified geological map of the area is shown in Figure GS8-1. A preliminary 1:50 000 scale geological map (Bailes and Malyon, 1976) is available through the Manitoba Mineral Resources Division. Mapping of the Saw Lake area was conducted by conventional pace and compass traversing methods, augmented by helicopter access to reach otherwise inaccessible outcrops and areas of outcrops.

No prior published geological maps of the Saw Lake area exist. The area to the west has been mapped at 1 inch to 1 mile by Frarey (1948); the area to the east has been mapped at 1 inch to 3000 feet by Cranstone and Toogood (1969); and the area to the north has been mapped at 1 inch to 4 miles by Quinn (1954). The area to the south is unmapped, but mainly comprises Paleozoic cover rocks.

General Geology

The Saw Lake area is located in the Churchill geologic province, just to the northwest of the Superior geologic province and the Thompson nickel belt. Rocks of the Saw Lake area correlate to the west with Amisk and Missi Group rocks of the Flin Flon volcanic belt. To the north they correlate with rocks of the Kisseynew sedimentary gneiss belt.

Rocks of the Saw Lake area have been subdivided into four main groups (Figure GS8-1).

Volcanic rocks and derived orthogneisses;
Sedimentary rocks and derived paragneisses;
Granitoid gneisses of uncertain genesis; and
Intrusive rocks

Rb-Sr whole rock isochron studies of similar rocks in adjacent areas (Josse, 1974; Anderson, 1974; Cranstone and Turek, 1976) give late Aphebian ages. Rocks in the map-area are strongly recrystallized by middle to upper almandine-amphibolite facies regional metamorphism and are complexly deformed. In general, there is an increase of plutonism, metasomatism and grade of metamorphism towards the east and southeast in the map-area.

Pleistocene lacustrine clay and silt deposits, from Glacial Lake Agassiz, underlie the swampy terrain in the centre of the map-area (Figure GS8-1).

Description of Rock Units

Volcanic Rocks and Derived Orthogneisses

Volcanic rocks and derived orthogneisses occur in the western half of the map-area and correlate to the west with similar volcanic rocks, the latter considered by Frarey (1948) to be part of the Amisk Group of the Flin Flon volcanic belt.

Prominent exposures of mafic metavolcanic flows and derived orthogneisses (unit 1) outcrop on and south of Niblock Lake. They comprise massive, homogeneous, fine-grained mafic hornblende-plagioclase gneisses, which locally contain pillow structures. On the east shore of Niblock Lake the mafic metavolcanic flows are intercalated with metasedimentary rocks of unit 5 (Figure GS8-1).

Unit 1a comprises mafic heterogeneous metavolcanic breccias which outcrop southeast of Dion Lake. They are strongly recrystallized and characterized by large anhedral 1 cm diameter porphyroblasts of pyralspite garnet. Most fragments in unit 1a are mafic to intermediate in composition, with felsic fragments also present in small amounts.

Felsic metavolcanic flows and derived gneisses (unit 2) occur locally south of Niblock Lake as small lenses in the mafic metavolcanic rocks of unit 1. A highly vesiculated sequence

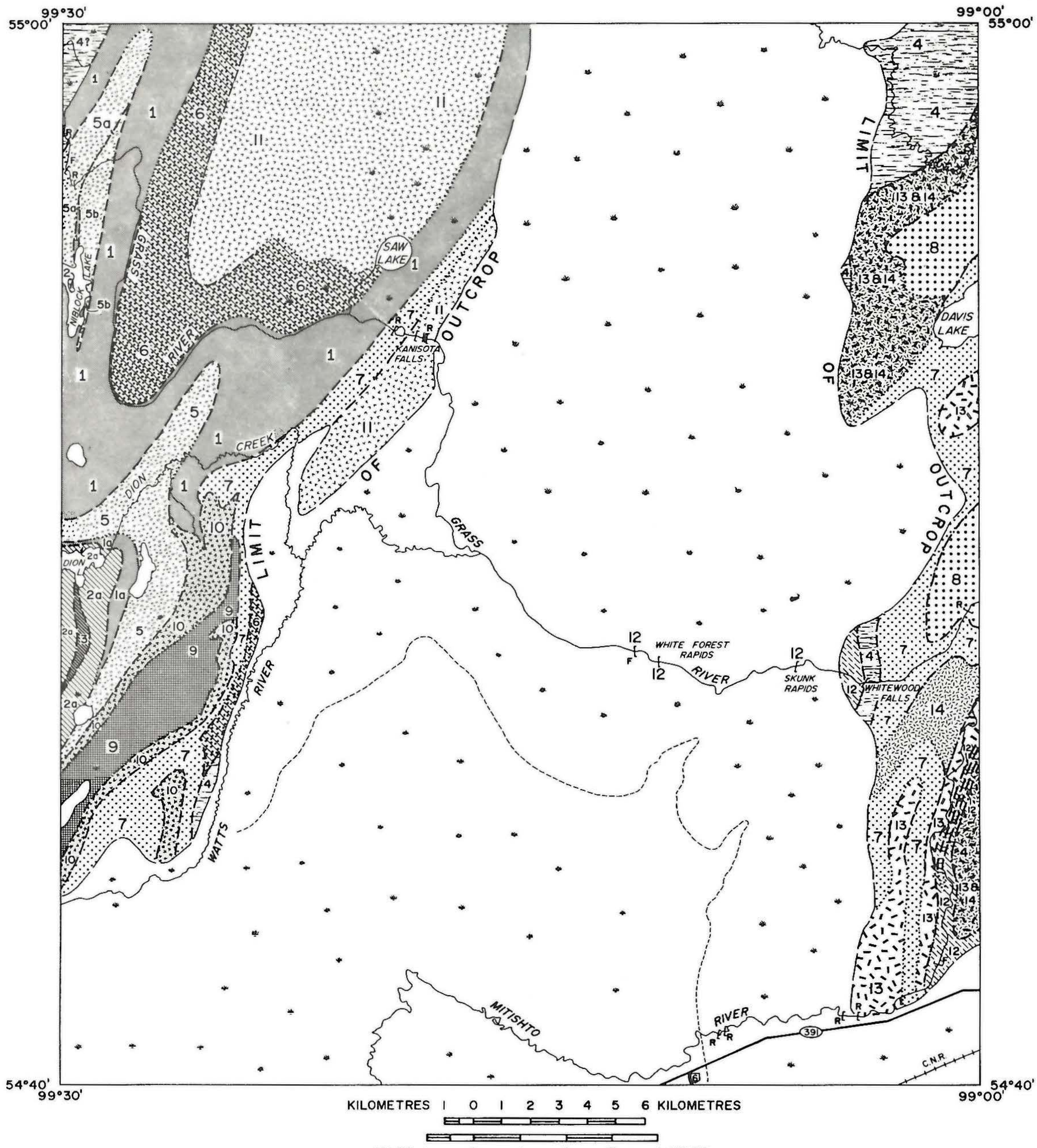

Figure GS8-1. General geology of the Saw Lake area.

LEGEND

QUATERNARY

SURFICIAL DEPOSITS

Sand and gravel, beach deposit of Glacial Lake Agassiz

PRECAMBRIAN (APHEBIAN)

INTRUSIVE ROCKS

14 Pink granite and pink pegmatitic granite

13 Pink gneissic microcline augen granite

12 White pegmatitic tonalite, commonly garnetiferous

11 Light pink to white gneissic granodiorite and tonalite

10 Pink gneissic granite

GRANITOID GNEISSES OF UNCERTAIN GENESIS

9 Granitoid intermediate to mafic plagioclase-hornblende-quartz gneiss

8 Microcline augen-bearing granitoid felsic quartz-feldspar-biotite-hornblende gneiss, gradational into rocks of units 7 and 13

7 Granitoid felsic quartz-feldspar-biotite gneiss, believed to be derived mainly from rocks of unit 5

SEDIMENTARY ROCKS AND DERIVED PARAGNEISSES

6 Siliceous gneiss, with minor horizons of mafic metavolcanic gneiss

5 Meta-arkose, meta-subgreywacke, meta-siltstone and local beds of conglomerate: 5a staurolitic meta-siltstone interlayered with non-staurolitic pebbly beds; 5b felsic quartz-feldspar-biotite paragneiss with conglomerate beds.

4 Lit-par-lit felsic to intermediate garnetiferous quartz-feldspar-biotite gneiss

3 Meta-carbonate and para-amphibolite

VOLCANIC ROCKS AND DERIVED ORTHOGNEISSES

2 Felsic metavolcanic flows; 2a felsic metavolcanic(?) quartz-feldspar-biotite gneiss

1 Mafic metavolcanic flows and derived gneisses; 1a mafic garnetiferous fragmental metavolcanic gneiss

of felsic volcanic flows outcrop prominently on the large island in Niblock Lake (Figure GS8-1). A thin sequence of laharic intermediate breccias, with large prominent fragments of felsic volcanic rocks, are well exposed on the west shore of Niblock Lake and may be genetically related to the felsic flows on the island.

Unit 2a comprises a thick sequence of felsic quartz-feldspar-biotite gneisses which outcrop south of Dion Lake. West of the map-area Frarey (1948) considers these rocks to be paragneisses. However a lack of bedding in the unit and the local occurrence of possible volcanic fragments indicate they may be derived from felsic volcanic rocks.

Sedimentary Rocks and Derived Paragneisses

Sedimentary rocks and derived paragneisses outcrop prominently in the western portion of the Saw Lake area. In the eastern half sedimentary gneisses were probably also widespread but they are no longer recognizable as metasedimentary due to strong recrystallization and widespread metasomatism.

Unit 3 comprises a narrow 50 to 150 m wide horizon of meta-carbonate and para-amphibolite. It varies from a white weathering calcite-diopside-plagioclase-sphene gneiss to a black weathering hornblende-plagioclase gneiss.

Unit 4 is a light to medium grey coloured **lit-par-lit** garnetiferous felsic to intermediate quartz-plagioclase-biotite gneiss which outcrops prominently in the northeast corner of the map-area. It is identical to Amisk Group paragneisses mapped previously by the author (Bailes, 1976) in the Guay-Wimapedi Lakes area. The latter rocks are considered to be derived by metamorphism and partial anatexis of an interbedded sequence of greywacke and shale.

Unit 5 comprises meta-arkose, meta-subgreywacke and meta-siltstone which contain numerous lenses and horizons of pebble conglomerate. On Niblock Lake unit 5 comprises a lower unit rich in staurolite-bearing meta-siltstones (unit 5a) and an overlying unit of non-staurolitic meta-sandstones (unit 5b). The latter rocks are prominently cross-bedded, with tops to the east. On Dion Lake rocks of unit 5 are dominantly meta-sandstones and are generally more strongly recrystallized than those on Niblock Lake. Pebble-bearing horizons in unit 5 are rich in felsic to mafic volcanic fragments and in quartz and quartzite pebbles. Rare pebbles of iron formation were noted. No pebbles of granitic rocks were observed. Rocks of unit 5 correlate to the west with Missi Group strata mapped by Frarey (1948).

Unit 6 consists of siliceous light grey to white paragneisses and protoquartzites. They outcrop north and east of the Grass River in the northwest corner of the map-area. They appear to overlie a thick sequence of mafic metavolcanic flows (unit 1) which, according to top criteria on Niblock Lake, overlie strata of unit 5. No equivalents to rocks of unit 6 have been previously described in the Flin Flon volcanic belt. It is possible that they may be a new rock formation, possibly younger than any previously identified in the Flin Flon belt.

Granitoid Gneisses of Uncertain Genesis

Granitoid gneisses of uncertain derivation are widespread in the east half and the southwest corner of the Saw Lake area. They are probably strongly recrystallized and metasomatized equivalents of the volcanic and sedimentary rocks previously described.

Unit 7 comprises granitoid felsic quartz-feldspar-biotite gneisses. Southeast of Dion Lake they are gradational into rocks of unit 5 and are believed to be derived from the latter. In the eastern half of the map-area they are generally more coarsely recrystallized and are strongly impregnated by and mixed with granitic rocks of unit 13 and 14. East of the map-area, Cranstone and Toogood (1969) lumped units 7, 8, 13 and 14 together because of their complex intermixing.

Unit 8 is a microcline augen-bearing granitoid quartz-feldspar-biotite-hornblende gneiss. It comprises white to grey gneisses, with 0.5 to 2 cm flesh coloured augen of microcline. It is characteristically magnetite-bearing and has a high aeromagnetic signature. Rocks of unit 8 are gradational into gneisses of unit 7 and are thought to be produced by potash metasomatism of the latter.

Unit 9 is a granitoid intermediate to mafic plagioclase-hornblende-quartz gneiss which outcrops southeast of Dion Lake. It is variable in composition and texture. Generally it consists of medium grained intermediate gneisses, but more mafic finer-grained gneisses, which resemble mafic metavolcanic rocks, occur locally.

Intrusive Rocks

The volcanic and sedimentary rocks of the Saw Lake are intruded by several bodies of felsic plutonic rocks (Figure GS8-1). All of them, except rocks of unit 14, are strongly foliated and deformed. Relative ages of the felsic plutonic rocks are unknown and their compositions are based on field estimates of their mineralogy.

Unit 10 is a fine to medium grained homogeneous bright salmon pink gneissic granite exposed in three stratiform bodies southeast of Dion Lake. It is magnetite-bearing and has a high aeromagnetic signature.

Unit 11 is a medium grained light pink to white gneissic granodiorite to tonalite exposed in the core of a large synformal structure northeast of Niblock Lake. It is a folded intrusion with strongly foliated margins and a more massive interior. On individual outcrops rocks of unit 11 are homogeneous, but regionally they exhibit subtle variation in composition and texture.

Unit 12 is a white, medium to coarse grained, commonly pegmatitic, gneissic tonalite which occurs as small bodies in and associated with migmatitic paragneisses of unit 4. It commonly comprises the **mobilizate** phase of the latter. One large body of unit 12, of undetermined size, outcrops in small isolated exposures along the shore of the Grass River, west of White Forest Rapids. A distinctive feature of rocks of unit 12 are large garnet porphyroblasts.

Unit 13 is a bright pink coarse grained gneissic microcline augen granite which outcrops in the east half of the map-area. It comprises discrete bodies and also occurs intermixed with pink granite and pink pegmatitic granite of unit 14. It is characteristically strongly foliated with the 1 to 2 cm augen of microcline flattened in the foliation. It is not known whether unit 13 is a true magmatic rock or whether it is the end product of potash metasomatism of the granitoid gneisses of unit 7.

Unit 14 comprises massive to weakly foliated pink granite and pink pegmatite granite which outcrops in the east half of the map-area. Rocks of unit 14 form both discrete bodies and occur complexly intermixed with rocks of unit 7, 8 and 13. They locally cross-cut and are considered to be younger than rocks of unit 13.

Metamorphism and Deformation

Rocks of the Saw Lake area are strongly recrystallized to middle and upper almandine-amphibolite facies assemblages, strongly metasomatized (in the east) and complexly deformed. Generally, the intensity of plutonism, metasomatism, metamorphism and deformation increases to the east and southeast.

One of the striking features of the Saw Lake area is the contrasting character of the metamorphism, plutonism and deformation relative to areas to the west. For example, to the west in the Snow Lake and File Lake areas: i) the regional metamorphic grade increases to the north; ii) plutonic rocks form discrete bodies with little or no widespread metasomatic effects; and iii) north northeast fold structures, where present, are generally broad open structures of only moderate significance. However, in the Saw Lake area: i) the least highly metamorphosed rocks occur in the northwest corner of the map-area; ii) plutonic rocks, particularly those in the east, are irregular bodies with widespread metasomatic effect; and iii) north northeast trending fold structures are tight, major and control the main tectonic fabric of rocks in the map-area.

It is the author's impression that a major late Aphebian orogenic event, accompanied by high grade metamorphism, widespread plutonism (and metasomatism) and strong north northeast folding occurred in the Churchill geologic province adjacent to its contact with the Superior geologic province; and that it is responsible for the abrupt change in tectonic regime in the Saw Lake area relative to areas to the west.

Surficial Deposits

Lacustrine varved clay and silt deposits of Glacial Lake Agassiz are common throughout the Saw Lake area. Many rock exposures are covered by a thin layer of the clay and silt. In addition, extensive deposits of the clay and silt underlie the topographically low and swampy terrain in the centre of the map-area (Figure GS8-1). In the central swampy area the Grass River generally flows between high banks of the clay and silt. Many of the latter deposits are described by Antevs (1931).

South of the Grass River a low sinuous ridge of sand occurs atop the lacustrine clays. South of the map-area Ringrose (1975) has termed it the Minago beach and interpreted it as a shoreline feature of Glacial Lake Agassiz. A C-14 date on a molluscan shell from the Minago beach suggest this shoreline is about 8000 years old (Ringrose, 1975).

Economic Geology

Mapping in the Saw Lake area indicates that the Flin Flon volcanic belt extends well into the western half of the map-area and, therefore, this area is a favourable terrain for the occurrence of massive copper-zinc volcanogenic sulphide deposits. Particularly promising areas for exploration for copper-zinc sulphide mineralization are the intermediate to felsic volcanic rocks on and south of Niblock Lake and the meta-carbonate unit, which may be volcanogenic, outcropping south of Dion Lake.

In the eastern half of the map-area no rocks or significant structures of economic interest were noted.

The Saw Lake area has been actively explored by many major mining companies, mainly for copper-zinc sulphide deposits in the west half and for nickel sulphide deposits in the east half. At present there is no active exploration in the Saw Lake area and only one small block of claims, held by Falconbridge Nickel Mines Limited, are in good standing.

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LITTLE ASSEAN LAKE — CRYING LAKE AREA

(64A/8 East Half)

By M. T. Corkery

Preliminary mapping in the Little Assean Lake — Crying Lake area, bounded by longitudes 96°00′ and 96°15′ and latitudes 56°16′ and 56°30′, was carried out in order to:

1) update previous mapping by Dawson (1939) and Gill (1951);
2) trace the possible extension of the Assean Lake fault zone (Haugh, 1965) to the east, and to determine whether this zone can be extended eastward into the fault zone at Gull Rapids (Haugh, 1968; Corkery, 1975);
3) define the nature of the rocks north and south of the major fault — the Superior-Churchill Province boundary.

Outcrops occur on Fox Lake and Little Assean Lake in the south, and on Crying Lake in the northern portion of the map-area. Bedrock exposure inland is minimal due to thick glacial drift.

The present mapping has extended the major zone of cataclasis in the Assean Lake area (Haugh, 1965) through Little Assean Lake and down the Assean River to the eastern boundary of the area mapped, and the associated airborne magnetic low can be followed eastward (Airborne Magnetic Map Sheets 2444G, 2467G, 2475G) to Gull Rapids as proposed by Corkery (1975).

General Geology

The distribution of the major rock units is shown on Figure GS9-1. The map-area has been divided into three sub-areas; this was necessary because it is impossible to correlate rock types from north to south across the northeast trending cataclastic zone. The first sub-area lies south of Little Assean Lake and the Assean River, the second is the northern portion of the area around Four Mile Lake and Crying Lake, and the third consists of the Little Assean Lake area.

I) South of Little Assean Lake

A large granite intrusion, which predates the cataclastic zone on Little Assean Lake, outcrops on Fox Lake. The northern boundary of the intrusion is interpreted to run down the centre and south shore of Little Assean Lake where it is fault bounded. This boundary correlates with the edge of an airborne magnetic low over the Fox Lake area (Airborne Magnetic Map Sheet 2444G).

II) Four Mile Lake — Crying Lake Area

Interlayered granitic, tonalitic, and hornblende gneisses (unit 4) outcrop as linear east-west trending belts within a dominantly granitic (unit 6) terrain in the Crying Lake area. Foliated granite is transitional into nebulitic granite gneisses and these grade into mixed tonalitic and hornblende gneisses. The core of the gneissic zones is dominated by hornblende gneiss.

Meta-conglomerate interlayered with meta-arenite outcrop on Four Mile Lake and to the west of the lake. The percentage of clasts in the meta-conglomerate is highly variable. The clasts, grey granite, pink granite, epidote, and chert, have been strongly elongated and form shallowly plunging rods. The matrix has a greywacke composition.

The most northerly outcrop of meta-conglomerate has been intruded by a younger magnetite-bearing granite (unit 6).

III) Little Assean Lake Area

A broad northeasterly trending zone of cataclastic rocks follows the topographic lineament of Little Assean Lake and the Assean River. Every shoreline exposure exhibits some degree of cataclasis. The intensity of cataclasis increases as the mylonite zone is approached.

The granite (unit 1) on Fox Lake contains a biotite foliation which is parallel to the major fault zone on Little Assean Lake. Under low intensity of cataclasis quartz grains are streaked out into very thin lenses, this is postdated by the development of blasts of potassium feldspar. As the process progresses a segregation into layers takes place producing a granite gneiss.

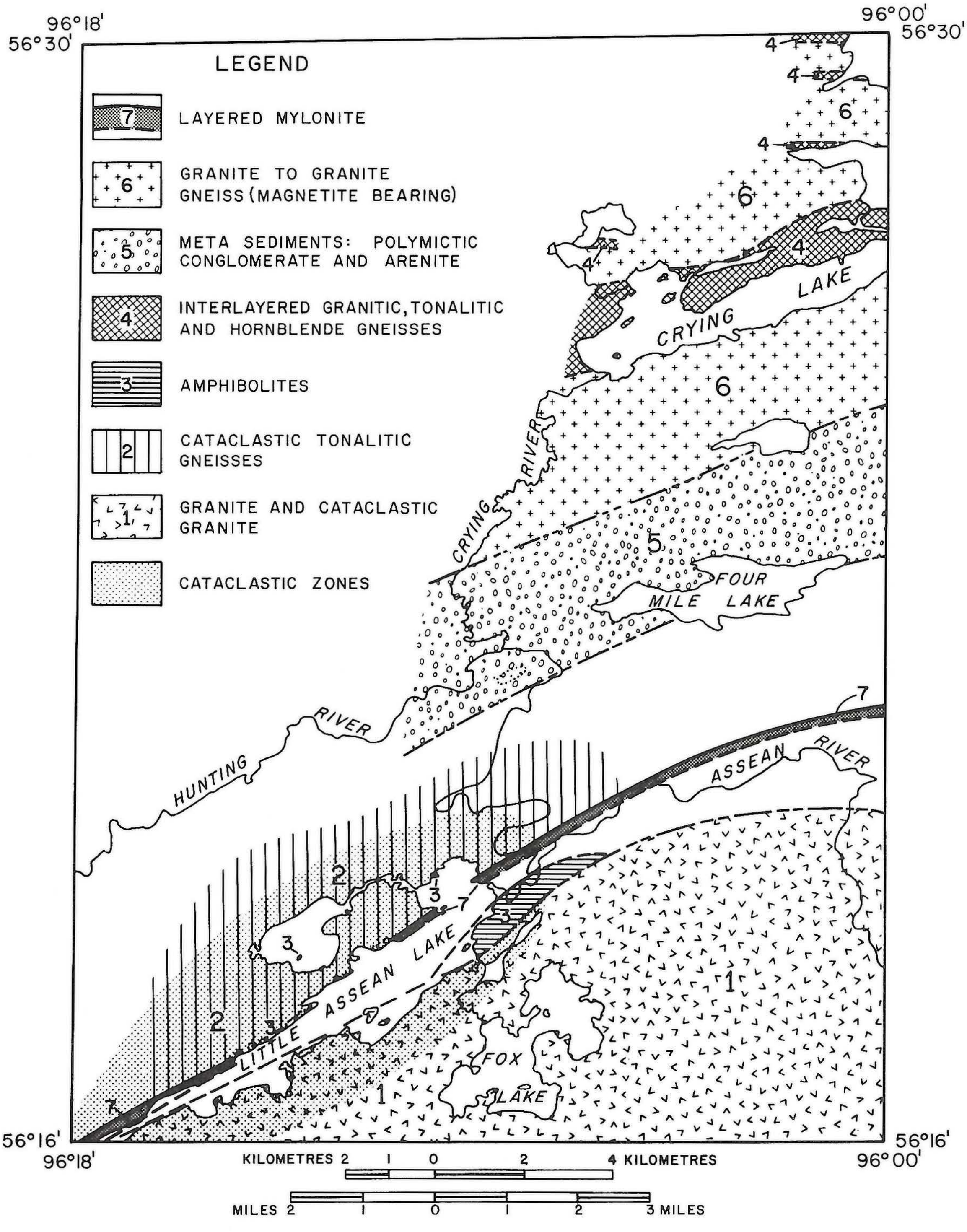

Figure GS9-1. Major geological units in the Little Assean Lake — Crying Lake area.

Within the mylonites (unit 7) severe crushing has obliterated the origin of the rocks. These mylonites are extremely fine-grained and are layered. The layering is defined by colour variations from red over white to black which is caused by mineralogical content and grain size variations. This layering has undergone folding and subsequent brecciation indicating a complicated history of deformation in this zone.

Layers and lenses of cataclastic amphibolite (unit 3) occur throughout the mylonite sequence, but only the larger bodies are represented on Figure GS9-1.

The existence of a major fault zone extending through Assean Lake, Little Assean Lake, and along the Assean River is, therefore, now well documented, but further field investigation in the Assean Lake, Waskaiowaka Lake area will be required to determine the relationship of the rocks north and south of the fault zone.

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CAUCHON, PARTRIDGE CROP AND APUSSIGAMASI LAKES AREA

(Parts of 63P, 7, 8, 9, 10, 11 and 13)

By W. Weber

During the 1976 field season areas east of the Thompson Nickel Belt were investigated. Cauchon Lake was mapped to study the contact the between the Superior Province and the "Pikwitonei Province", as proposed by C. K. Bell (1971).

Fieldwork at Partridge Crop and Apussigamasi Lakes was directed towards the relationship between the "Pikwitonei Province" and the "Wabowden Subprovince", a subdivision introduced also by C. K. Bell (1971).

The principal reason for mapping Apussigamasi Lake (and Mystery Lake, ref. Scoates, this volume) was to document the bedrock geology prior to the increase of water levels caused by the Churchill River diversion.

Cauchon Lake Area: (Figure GS10-1)

Mapping in the Cauchon Lake area in connection with previous work in the northwestern Superior Province, the Utik-Bear-High Hill Lake area (Weber, 1974, 1975) [and supplemented by reconnaissance surveys in Cross Lake and east of Thompson] raises serious doubts as to the evidence used by other workers to separate a "Pikwitonei Province" from the Superior Province, if the concept for structural provinces, as defined by Stockwell (1963) is applied. No structural break or disconformity appears to exist between the two "Provinces", in the Cauchon Lake area.* Lithologic units appear to be conformable with each other on both side of the contact; e.g. a zone of layered anorthosite, 0.5 to 1.5 km wide and traceable for over 25 km in the northern arm of Cauchon Lake is conformable to a narrow belt of metavolcanic rocks in the southern part of the lake and conformable with primary lithostratigraphic units in the Utik Lake greenstone belt, 30 km to the southeast (Weber, 1974).

The spectrum of rock compositions is not significantly different in the two "Provinces". Mafic and, to a lesser degree ultramafic rocks, form a significant and omnipresent part of the lithology in the Pikwitonei region. This appears to be true for the entire Pikwitonei "Province" based on reconnaissance surveys on Dafoe, Witchai, Pikwitonei, Partridge Crop, Natawahunan, and Apussigamasi Lakes. Previous descriptions, (Bell, 1971) neglected this aspect which, together with Bell's assumption that the Pikwitonei "Province" forms a basement to the Superior greenstone, must have misled anyone trying to evaluate the economic potential of this area. The term Pikwitonei "Province" is therefore dropped and replaced by Pikwitonei "region".

The grade of metamorphism appears to be the main difference between rocks in the Pikwitonei region and those to the south of it. But in this respect present observations indicate a transition, and not a break from hornblende granulite to upper amphibolite facies. The transition is complicated by retrogression, shear and possible fault zones, and late granitic activity which requires further study for a full understanding. Preliminary results indicate that the metamorphic gradient is oblique to the pre-metamorphic lithologies.

The most northerly typical Superior rocks consist of (metamorphically layered amphibolites (Figure GS10-1, Unit 1), intruded by sills of trondhjemite (unit 5) and tonalitic gneiss which may be related to a large tonalite pluton (unit 4) to the south. The amphibolites are similar to those along the northern margin of the Bear Lake greenstone belt (Weber, 1974), where they have been interpreted as, and are traceable into, pillowed meta-basalt. However, generally they show a more prominant metamorphic layering defined by plagioclase rich and plagioclase poor layers leading, e.g. to the metamorphic separation of lenses of coarse grained clinopyroxene bearing-diorite or leucogabbro mobilizates.

North of these amphibolites is a gneissic complex, informally termed the Cauchon Lake gneisses (units 6 a-d). These gneisses are of dioritic to tonalitic composition whereby the mafic mineral(s) are biotite ± hypersthene (clinopyroxene) or green hornblende depending on the degree of prograde and/or retrograde metamorphism. Narrow sill-like layers of more

*The Cross Lake unconformity, used by Bell (1971) as main evidence for an unconformity between the Pikwitonei and the Superior lies outside the granulite facies Pikwitonei region; the Cross Lake "basement granodiorite" does not show any lithological similarities with Pikwitonei rocks, but is similar to other greenstone belt-related plutons overlain by supracrustals, e.g. at Island Lake (Herd, 1976), Rice Lake (Weber, 1971). This unconformity is therefore not related to the Pikwitonei/Superior contact.

leucocratic tonalite, variable in abundance and with sharp or diffused boundaries, occur in the gneisses. They also contain foliated, and commonly layered, inclusions of gabbroic and dioritic composition with green hornblende, hypersthene, diopside, biotite or garnet, depending on metamorphic grade and composition. The size of these inclusions ranges from a few centimetres, to rafts several metres long, to mappable discontinuous layers up to several hundred metres wide and several kilometres long (unit 2). Small inclusions and larger rafts can be observed on every outcrop. The large rafts have a characteristic schollen structure which was formed by partial melting of the mafic material producing a leucotonalite to diorite melt containing biotite ± hypersthene, hornblende, and leaving the restite as schollen in the mobilizate. Ultramafic rocks occur as a mappable layer of pyroxene-hornblendite (unit 3) in the southern area of Cauchon Lake and as pyroxenite inclusions further south.

Late concordant and discordant coarse grained mobilizate also occurs in the dioritic to tonalitic gneisses. Locally, k-feldspar augen (c.f. unit 6d) or narrow concordant veins of pink leuco-granodiorite have formed in sheared and/or retrogressively metamorphosed rocks, possibly *in situ* through release of potassium from the antiperthitic plagioclase. In a few places pink straight-walled potassium feldspar-bearing pegmatites truncate the gneisses and represent the latest event. These outcrops usually also contain retrogressive amphibolite facies assemblages.

Layered anorthosite (unit 7) forms a layer in the northern part of Cauchon Lake. The layering is caused by mineralogical and grain size variations. Mineralogically, the rocks range from anorthosite over leucogabbro to melanocratic pyroxene amphibolite. Plagioclase shows the most distinctive grain size variation, ranging from ½ cm to 10 cm in anorthosite and leucogabbro. The largest phenocrysts are commonly recrystallized into a mosaic of 2 - 5 mm grains. Along its margins the anorthosite is intercalated with white/grey layered tonalitic gneisses.

Schollen-enderbite (unit 8) is exposed north of the anorthosite. The enderbite is medium to coarse grained, foliated, homogeneous or nebulitic and contains everywhere abundant schollen (rafts) of mafic and, less abundantly ultramafic inclusions. This enderbite is on the one hand intrusive into tonalitic gneisses along the northern margins of the anorthosite and into mafic rocks nearby. On the other hand, the Cauchon Lake gneisses appear to be in many places gradational into the enderbite.

Several dykes of the Molson swarm are exposed (Weber, 1976). The largest is shown on Figure GS10-1 (unit 9).

Partridge Crop Lake

Fieldwork at Partridge Crop Lake indicated that east-west striking hornblende-granulite facies rocks of the Pikwitonei region grade structurally and mineralogically into amphibolite facies gneisses of C. K. Bell's (1971) "Wabowden subprovince". The gradation takes place over a width of approximately 10 km. The western margin of this gradation is occupied by a late (possibly Hudsonian) granodiorite. Patterson (1963) indicated this transition correctly.*

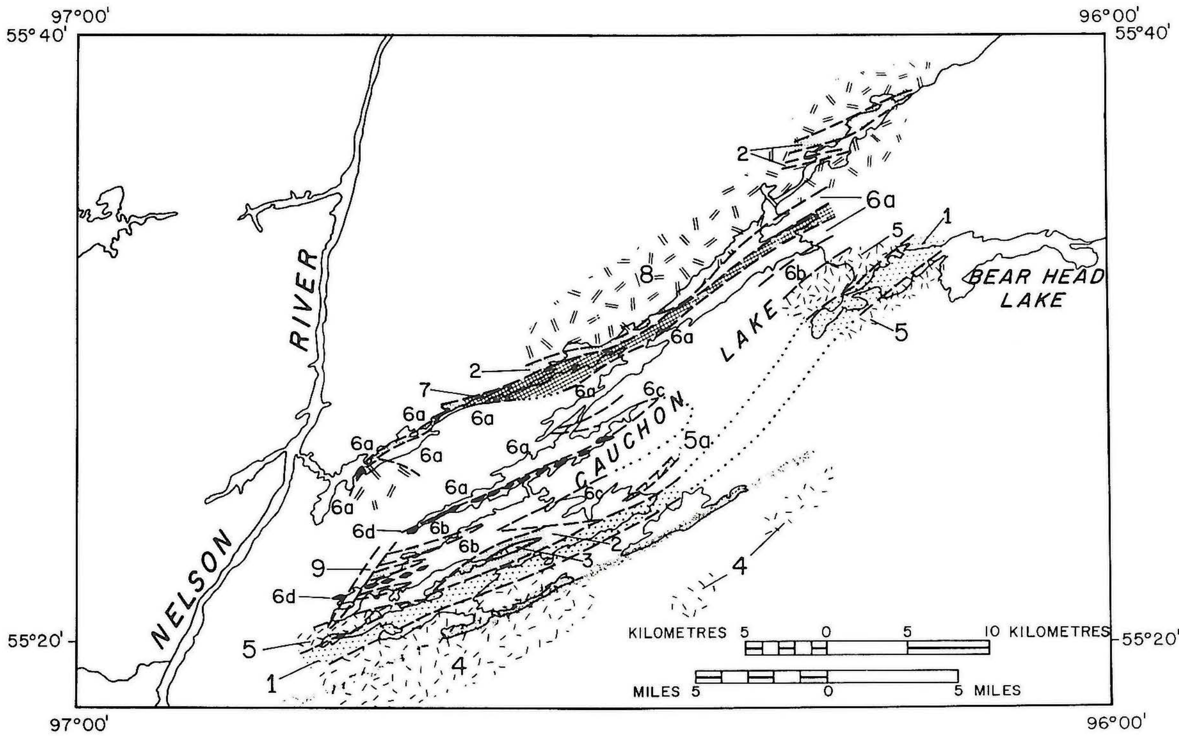
The transition takes place in the following manner:

the east striking gneisses in the eastern part of the transition zone become folded with axial planes of minor folds striking 10° - 20°. This folding appears to become more intense towards the late granodiorite, and the strike of the gneisses there approaches a NE to NNE direction. Several mafic dykes and younger granodiorite dykes, related to the later granodiorite run in the same direction. Coincident with the folding the gneisses have undergone partial recrystallization under amphibolite facies conditions. Relicts of the granulite facies are best preserved in layers of ultramafic rocks. These hornblendites containing variable amounts of pyroxene, garnet, magnetite, are interlayered with mafic amphibolite-plagioclase ± pyroxene garnet rocks. Mafic and ultramafic material are more abundant than in the Cauchon Lake area.

Apussigamasi Lake

Shoreline exposures along the Burntwood River, including Apussigamasi Lake, were mapped from the seaplane base at Thompson to 12 km before the first rapids (Scoates and Weber, 1976).

*Because of this transition, the term "subprovince" is not justified. Nor is it necessary, since the geology can be better dealt with by using lithological descriptions.



---···· Geological boundary (approximate, assumed).

Zone of intense cataclasis.

Figure GS10-1. Geology of the Cauchon Lake area.

LEGEND
to Figure GS10-1

9 Mafic dykes

8 Schollen-enderbite, locally nebulitic

7 Layered anorthosite

6 Cauchon Lake gneisses

- 6a granulite facies gneisses: enderbite and hypersthene-bearing dioritic gneiss with abundant mafic rafts.
- 6b derived from 6a, partly downgraded to amphibolite facies gneiss.
- 6c layered tonalitic gneiss with mafic rocks.
- 6d Augen gneiss, derived from 6b.

5 Trondhjemite

- 5a Pegmatite

4 Tonalite

3 Pyroxene hornblendite

2 Mafic and minor intermediate pyroxene ± garnet-bearing rocks (Metavolcanics?)

1 Layered pyroxene-bearing amphibolites (probably meta-basalt).

Layered tonalitic-amphibolitic gneisses with mafic and ultramafic inclusions (equivalent to unit 7 in Quirke et al., 1970) show a similar relationship to rocks of the Pikwitonei region exposed on the south shore of the north western part of Apussigamasi Lake, as the transitional zone at Partridge Crop Lake to the rocks of the Pikwitonei region further east. In addition to the mafic and ultramafic material, so typical for the rocks of the Pikwitonei region, layered anorthosite forms part of the sequence, which supports the conclusion that the layered tonalitic-amphibolitic gneisses are genetically related to similar rocks in the Pikwitonei region, as also recently proposed by Cranstone and Turek (1976). The layered tonalitic-amphibolitic gneisses contain a mineralogy reflecting amphibolite facies conditions, but local pseudomorphs after pyroxene and other features suggest that the rocks have undergone granulite facies metamorphism earlier, a problem requiring further studies.

The contact between these gneisses and the granulite facies gneisses is rather sharp and marked by intense flattening of all geological elements (shearing) and intrusion of pegmatitic rocks. Associated with these pegmatites is an apparent silicification and formation of augen gneisses. Tectonic flattening, pegmatite intrusion and associated feldspar augen characterize also the western margin of these gneisses, where they are in contact with argillaceous sediments of the Thompson belt.

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THOMPSON NICKEL BELT GEOLOGICAL RECONNAISSANCE

By R. F. J. Scoates

Four weeks were spent examining outcrops in the Thompson Nickel Belt during the 1976 field season. A portion of this time was devoted to examining shoreline outcrops on Mystery Lake. Samples and structural data were collected prior to an increase of the lake level related to an expected increased flow on the Burntwood River. The results of this examination are incorporated in Preliminary Map 1976T-1. Rocks were also examined on Ospwagan, Paint, Setting, Clark and Conlin Lakes as well as in the Thompson and Pipe mines of International Nickel Mines Limited and the Manibridge Mine of Falconbridge Nickel Mines Limited.

Some of the problems to be examined in future investigations of the belt include:

1) the relationship of the intermediate and high grade gneissic rocks in the Nickel Belt with the intermediate and high grade gneisses of the Pikwitonei province to the east and the Kisseynew gneiss terrain to the west;
2) the stratigraphy and structure of the apparently younger metasedimentary rocks and the nature of their relationship with the gneissic rocks;
3) the stratigraphy and structure of the mafic metavolcanic suite including the quench textured metavolcanic rocks on Mystery and Ospwagan Lakes and the nature of their relationship with the metasedimentary rocks;
4) the nature and relative age of the suite of ultramafic (serpentinite and ultramafic amphibolite) rocks found associated with different host rocks in the belt;
5) the nature, relative age, and extent of the intermediate to acid plutonism in the belt; and
6) the identification of the number of periods of major cataclastic deformation within the belt.

The examination of areas necessary for establishing criteria by which the problems noted above can be solved will allow also for the critical evaluation of the nature of the Thompson Nickel Belt and its nickel sulphide ore deposits and the nature of the Churchill — Superior boundary in this part of the Canadian Shield.

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WEKUSKO LAKE AREA

(63J-12, 13, 14)

By J. J. Macek

Thirty-five locations were chosen for geological examination in the vicinity of Wekusko Lake and the Grass River (Figure GS12-1), to locate and sample possible outcrops of ultramafic bodies. The selection was made on the basis of the aeromagnetic anomalies and data from cancelled assessment files. Twenty-eight areas were visited during a three week field period. None of the ultramafics were found to outcrop but a variety of metavolcanic, metasedimentary and plutonic rocks were found. The most mafic rock observed was classified as gabbroic. It was noted that parts of the existing geological maps for the area need a critical review.

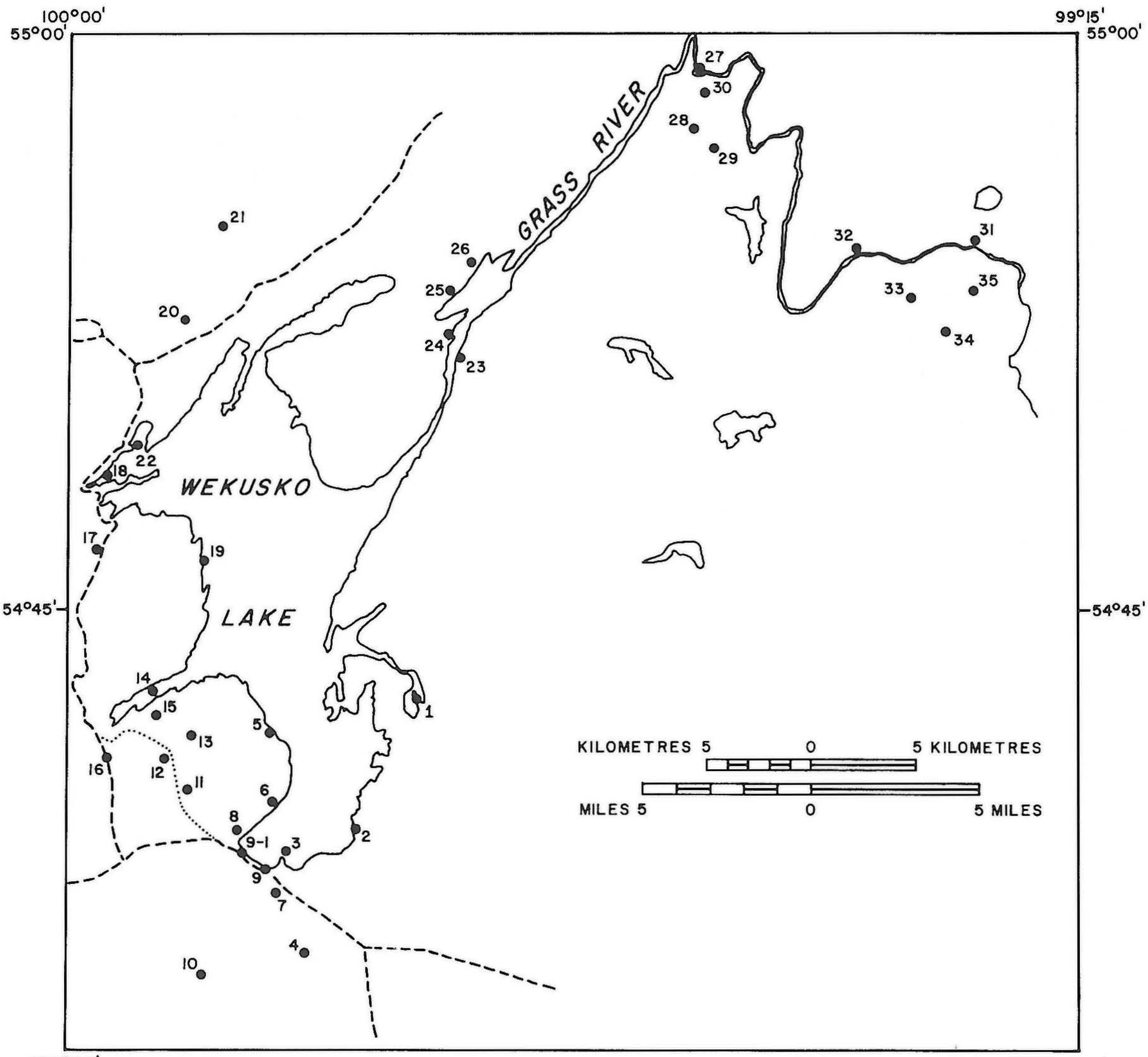

Figure GS12-1. Station location map, Wekusko Lake area.

SOUTHEASTERN MANITOBA

(Parts of 52E, 52L, 62I)

By D. Janes

During the 1976 field season, the author continued the mapping and correlation program conducted in 1974 and 1975 by C. F. Lamb in the southeastern Precambrian outcrop area of Manitoba. This region was divided into three areas by Lamb (1974).

Northern (north of PTH44 to the Winnipeg River)
Central (between PTH44 and the Trans-Canada Highway)
Southern (south of the Trans-Canada Highway to the U.S. border)

Mapping during the past field season was concentrated in the northern and central area. Helicopter traverses were made in one area where no other means of access was available. For the remaining areas, lakeshore and pace and compass traverses were done at half-mile intervals where outcrop justified them.

Mapping is complete in the southern area and 90% complete in central area. The northern area was covered by a series of sections and approximately 40% of this area remains to be mapped.

General Geology (Figures GS13-1, 2)

The consolidated rocks of the region are of Archean age and form part of the Superior Province of the Canadian Shield. The S.E. Manitoba region can be regarded as three east-west trending zones of relict epicrustal rocks, chiefly volcanic-sedimentary complexes, bordered on the north and south by migmatitic gneiss, which are partially composed of fragmented and resorbed relicts of the older edifice. These migmatite zones are gradational into, or have intrusive contacts with, granodiorite to quartz monzonite stocks to batholiths. Commonly, the youngest intrusive in the region appears to be a coarse, non-foliated, nearly pegmatitic granite.

Faults were mapped which cut all save the pegmatitic granites. The faults strike NNE and SSE and occur in the central and northern regions. In some instances, foliation within gneissic units appears to be dragged and units truncated by these faults, which may therefore represent reactivated basement faults.

Two simplified compilation maps are included with this report. They record the results of mapping, correlation and compilation studies by C. F. Lamb, the author and others and represent the best data available at the present time. A simplified table of formation is attached to the maps. This table represents lithological units only, since no correlation between the volcanic-sedimentary belts has been yet attempted. It is possible that several of the intrusive units are equivalent to those of the Lac du Bonnet batholith (McRitchie, 1971) but no correlations can be supported as yet.

Economic Geology

Since the fieldwork for 1976 was concentrated on the gneissic-batholithic terrain, little of economic interest was found. One occurrence of a beryl pegmatite to the south of Johnson Lake suggests that the migmatite zone (unit 8) to the south of the Winnipeg River may be a favourable zone for these pegmatites.

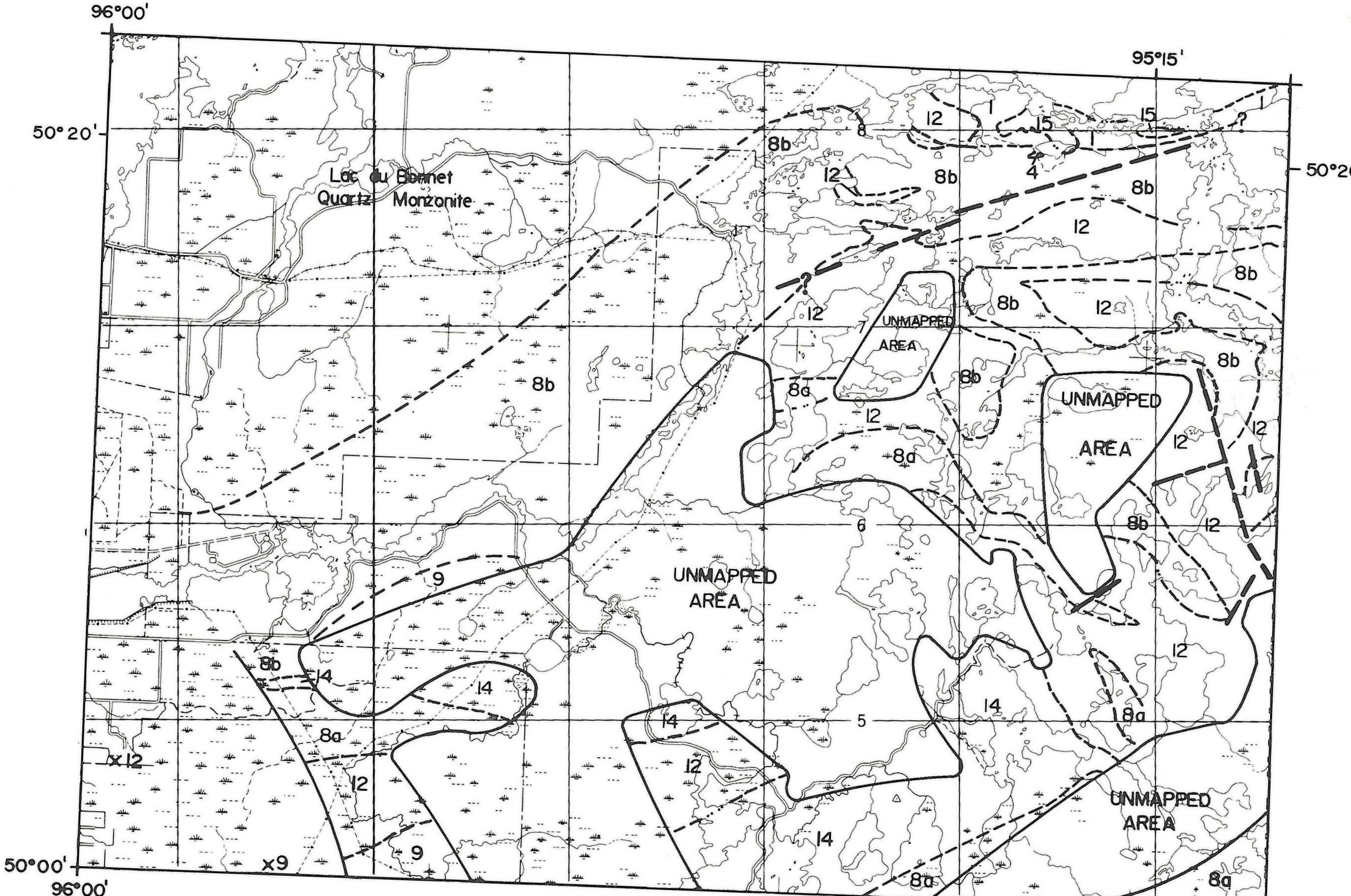

Figure GS13-2. Geology of the West Hawk Lake — Winnipeg River Region, northern area. (Legend as for Figure GS13-1)

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STRATIGRAPHIC MAPPING AND CORE HOLE PROGRAMS

By H. R. McCabe

Four separate stratigraphically-oriented core hole programs were undertaken in 1976 utilizing two diamond drill rigs. As in previous years, the "Winkie" drill was used for shallow stratigraphic core holes. A J.K.S. 300 rig, capable of drilling to 300 metres, was used for holes as deep as 135 metres. The "300" drill was acquired by Exploration Operations Branch in 1975, and during the initial break-in and familiarization period this year, it was decided to carry out test drilling in the southern part of the Province prior to commencing exploratory drilling in the more northerly areas. The southern test sites were chosen jointly by H. McCabe of the Geological Survey and B. Bannatyne of the Mineral Evaluation Branch so as to provide maximum information relating to structure, stratigraphy and industrial minerals. Drill results are summarized in Tables GS14-1 and GS14-2.

(a) Stonewall — Winnipeg Area:

Under the auspices of the Mineral Evaluation Branch, through B. Bannatyne, an evaluation of the bedrock quarry potential had been undertaken in 1975 for the area south and east of Stonewall, extending to the north perimeter highway. This evaluation was part of a*D.R.E.E./ Provincial Government joint program to study the aggregate resources of the Winnipeg region. The main purpose in outlining the potential quarry sites was to provide input for municipal planning to ensure optimum resource utilization.

The initial phase of the program included a reconnaissance hammer seismic survey by a consulting engineering firm. Seven (7) target areas were delineated where overburden thickness was estimated to be 3 metres or less. (An additional five (5) targets were outlined subsequently in an extension of the seismic survey.) It was decided that the above seismic targets would be optimum core hole locations, and five (5) locations were subsequently drilled (Table GS14-1). Two of the holes, one in the western group of targets, in the outcrop belt of the Stony Mountain Formation, and a second in the eastern group of targets, in the outcrop belt of the Red River Formation were taken to 45 metres specifically to test for two high-calcium limestone zones known to occur in some areas within the upper 45 metres of the Red River Formation. The expected zones were intersected at 37.8 — 39 metres in hole B-1B-76 (Upper Selkirk) and at 39 — 41 metres in hole B-1A-76 (Upper Fort Garry). Analyses have not yet been made of these intervals.

Results of the drilling more or less confirmed the results of the hammer seismic survey, although discrepancies are noted, and further reconciliation of results must be made. Time permitting, some of the remaining seismic targets may be checked later this fall.

(b) The Narrows — Winnipegosis Area:

Previous shallow drilling in this area had not been able to establish firm structural control for the base of the Devonian, which datum is required to determine estimates of reef thickness and structural relief. Stratigraphic information as to reef and especially inter-reef lithology was also sparse or lacking. Four locations were chosen to obtain the above data, using the J.K.S. 300 drill (Table GS14-2). The two holes in The Narrows area (M-1-76 and M-2-76) both had to be abandoned before reaching target depth. In both cases abandonment was caused by sand flowing into the well hole. The source of the sand is not known; it could have come from fractures in the carbonate bedrock or from sand-filled solution caves. The limited samples obtained of this sand consisted mainly of fine angular carbonate grains, as though derived from a disaggregated saccharoidal dolomite, but with a small admixture of fine quartz sand.

Hole M-1-76 obtained no new data, but hole M-2-76, located in a structurally low off-reef position penetrated 23 metres of Winnipegosis dolomite out of a total estimated thickness of 36.5 metres, including an uppermost 0.6 metre zone of micro-laminated dolomite believed correlative with the Upper Winnipegosis inter-reef facies. The calcareous Elm Point facies was not encountered although this facies could still occur below total depth of the hole.

In the Winnipegosis area, hole M-5-76 was drilled in a structurally low position, and as expected intersected a thin, 27.4 metre inter-reef sequence consisting of an upper 10.4 metre section of micro-laminated bituminous limestone and dolomite underlain by 17 metres of platform beds which consist primarily of Elm Point-type limestones locally exhibiting a

*Department of Regional Economic Expansion moderate degree of dolomitization. Hole M-6-76 was located on a structurally high reef-crest position, and intersected a total of 87.5 metres of variably fossiliferous Winnipegosis dolomite from which a strong flow of brackish artesian water was obtained. The structure and isopach data for holes M-5 and M-6 now permit a much more accurate interpretation of reef isopachs and structure contours in this area. These data will be incorporated into the report on Devonian Stratigraphy currently in preparation.

(c) Dawson Bay Area:

Locations for the two core holes in this area were chosen by the Exploration Operations Branch. One location was close to a domal outcrop indicative of local Winnipegosis reef development but both holes proved to be structurally low and intersected thin Winnipegosis sections of 24.1 and 33.2 metres. Both holes comprise an upper zone of bituminous laminates and an underlying platformal dolomite. A thick zone of collapse breccia in hole D-47-76-2, at the top of the Winnipegosis, is quite unusual. Structural data for the base of the Devonian obtained from these holes suggest slightly greater structural irregularity than previously envisaged for this area. In hole D-47-76-2 Devonian strata are overlain by Mesozoic sands and shales, probably as channel-fill deposits. This extends the known area of occurrence of Mesozoic strata.

(d) Lake Winnipegosis Area:

Three "Winkie" core holes were drilled at remote outcrop locations at the northern end of Lake Winnipegosis, to obtain additional data on Winnipegosis lithology, and more particularly to obtain structural data for the base of the Denovian (Ashern). The presence of Ashern beds immediately beneath the exposed Winnipegosis outcrop, at lake level, was confirmed at Devil Point (HM-1-76). Hole HM-3-76 was spotted on a large, newly located Winnipegosis outcrop at Grenon Point and intersected Ashern beds at a depth approximately 3 m below lake level. The indicated regional dip in this area, approximately 1 m per km, is considerably flatter than previously estimated.

Hole HM-2-76 was drilled to check a supposed outcrop near Rod Point Lake. A channel has been excavated by Fisheries Branch from Rod Point Lake to Lake Winnipegosis, as part of a fish rearing project. The entire excavation shows fine, white pure quartz sand below thin overburden. The sand appears to be underlain by red clay, and large Winnipegosis-type blocks are seen at the Lake Winnipegosis end of the excavation. It was thought that the Winnipegosis blocks indicated proximity to outcrop, but only 2.4 metres of porous Winnipegosis (?) type dolomite was recovered to a depth of 10.4 metres, at which point white unconsolidated sand was intersected, the same as exposed in the excavation. The sand, which forced abandonment of the hole, probably represents Mesozoic infill, either as fracture filling, karst infill, or channel fill on the pre-Mesozoic erosion surface. The 10.4 metre section of dolomite was badly broken and contained thin sand, clay and sandy dolomite intervals. It is unlikely that the dolomite represents *in situ* Winnipegosis, since drill core from the nearby Devil Point hole (HM-7-76) indicates that the base of the Winnipegosis should occur at a depth of less than 3 metres. Unless there is a local structural anomaly, this suggests that the Winnipegosis dolomite occurs as slump blocks, possibly on the edge of a karst channel. Occurrences such as this, point to the local complexity that can occur in an area generally considered to be relatively uniform stratigraphically.

In addition to the above core hole program, several short stratigraphic projects were completed.

(e) Hill Island, Roderick Point, Denbeigh Point Area:

The outcrops of Winnipegosis dolomite at Hill Island and Roderick Point, near the central part of Lake Winnipegosis, were examined and sampled. Time did not permit drilling at these locations this year, but both locations are suitable for drill sites. The clean flat-lying, thick-bedded dolomites indicate that these outcrops comprise part of the Lower Winnipegosis platform facies.

A recently exposed outcrop at the Denbeigh Point fish station exposes a pavement of dolomite beds of the Silurian Interlake Group (Cedar Lake Member). Some beds contain numerous chert nodules, in places comprising as much 30 percent of the rock. Loose chert fragments are also abundant in float. The chert is light grey to medium dark bluish grey, somewhat mottled and rarely banded, and is hard and dense. Similar chert float was noted at Devil

Point, indicating that the cherty zone occurs at or close to the Pre-Devonian erosion surface over a considerable area. To the writer's knowledge this is the only known Palaeozoic occurrence of hard dense chert (flint, rarely agate) in Manitoba. All other occurrence are of the relatively soft white earthy tripolitized variety of chert.

(f) Kawinaw — Katimik Lakes Area:

Shoreline mapping was carried out on Kawinaw and Katimik Lakes, two large lakes immediately south of Easterville Road (P.R. 327), approximately 20 miles southwest of Grand Rapids. Only one outcrop was located, at l.s.d. 2-12-45-15W, a small island near the centre of Kawinaw Lake, exposing 2 — 4 feet Interlake dolomite. Both lakes are extremely shallow over large areas, making approach to the shorelines difficult or impossible, so not all areas were checked. Much of the shore is bordered by prominent, high, steep-sided (ice-push?) ridges of angular blocks, in places rising 20 — 25 feet above lake level. The uniform dolomite lithology of the blocks suggests that Silurian strata may floor much of the lakes area.

Also of interest are several areas where (a) fine, clean sand beaches are present and (b) where 'clean' grey clay occurs beneath a thin boulder pavement, and has been exposed in ice-push grooves. Such occurrences are uncommon in this region and possibly reflect proximity to Mesozoic (?) channel-fill deposits, such as those apparently intersected in the Denby #2 mineral exploration core hole (4-32-46WPM), about 12 miles to the northwest.

TABLE GS14-1 — STONEWALL AREA CORE HOLE DATA. FORMATION TOPS.

				STONY MOUNTAIN FM.			RED RIVER FORMATION			TOTAL
							FORT GARRY			DEPTH
HOLE NO.	LOCATION	ELEVATION (Estimated, m)	OVERBURDEN (Metres)	GUNTON	PENITENT	GUNN	UPPER	LOWER	SELKIRK	(Metres)
B-1A-76	SE1-12-13-1 EPM	+245.4	4.0	4.0	14.0	20.7	38.1	-	-	48.2
B-1B-76	NW13-19-13-3 EPM	+234.7	2.4	-	-	-	2.4	18.0	37.5	43.6
B-1C-76	SW4-5-14-3 EPM	+234.7	3.0	-	-	-	3.0	13.7	-	14.3
B-1D-76	NW13-16-13-3 EPM	+234.7	6.7	-	-	-	6.7	10.7	-	13.4
B-1E-76	SW12-20-13-2 EPM	+246.9	4.3	4.3	-	-	-	-	-	14.3

TABLE GS14-2 — DEVONIAN CORE HOLE DATA

HOLE No./ AREA	LOCATION/ ELEVATION	FORMATION/ MEMBER	INTERVAL (Metres)	SUMMARY LITHOLOGY
HM-1-76 (Devil Point)	1-24-44-19 WPM + 262.4 m	Winnipegosis	0.3 - 9.1	Dolomite
		Ashern	9.1 - 12.5	Shale, red, dolomitic
HM-2-76 (Rod Point)	16-11-44-19 WPM + 254.5 m	Winnipegosis (?)	0.5 - 10.4	Dolomite, slump blocks (?)
		(Mesozoic)	10.4 - 11.6	Sand (cavity fill)
HM-3-76 (Grenon Point)	12-5-45-19 WPM + 266.7 m	Winnipegosis	0.5 - 17.1	Dolomite
		Ashern	17.1 - 22.6	Shale, green to red dolomitic
M-1-76 (Narrows E. Quarry)	16-15-24-10 WPM + 253.0 m	Winnipegosis	0.0 - 34.8	Dolomite
M-2-76 (Narrows E.)	SE7-13-24-10 WPM + 254.5 m	Dawson Bay — Lower	2.0 - 8.2	Limestone, buff, micritic, dense, grading to calcareous dolomite
		— Second Red	8.2 - 18.9	Shale, red, dolomitic
		Winnipegosis — Upper	18.9 - 19.6	Dolomite, finely laminated, fissile
		— Lower	19.6 - 42.1	Dolomite, buff, faintly mottled, variably porous and fossiliferous
M-5-76 (Meadow Portage)	SW10-22-30-16 WPM + 257.6 m	Souris River	0.0 - 8.8	Limestone and calcareous dolomite, yellow to buff, porous
		— First Red	8.8 - 18.9	Shale, red to grey interbeds, limestone, dolomite, breccia
		Dawson Bay — Upper	18.9 - 33.5	Dolomite medium brown, saccharoidal, thin limestone at top
		— Middle	33.5 - 44.5	Shale, red to grey, calcareous, fossiliferous
		— Lower	44.5 - 55.8	Limestone, buff to purplish, micritic, stylolitic, grading to argillaceous dolomite at base
		— Second Red	55.8 - 67.7	Shale, dolomitic, buff to red
		Winnipegosis — Upper	67.7 - 68.3	Limestone breccia (collapse)
			68.3 - 71.6	Limestone, laminated, bituminous, stylolitic
			71.6 - 78.6	Limestone, bituminous, banded and streaked
		— Lower	78.6 - 95.7	Limestone, mottled, variably dolomitic
		Ashern	95.7 - 102.4	Shale, red to buff, dolomitic, breccia interbeds
		Interlake	102.4 - 116.7	Dolomite, buff; 3.7 m red argillaceous at 106.7; 1.5 m red shale and pebble conglomerate at 112.2 (karst infill?)
M-6-76 (Paradise Beach)	13-21-30-17 WPM + 254.5 m	Dawson Bay — Lower	2.7 - 13.4	Limestone, buff to brown, micritic, fossiliferous at top, becoming bituminous and grading to bituminous dolomite at base
		— Second Red	13.4 - 24.4	Shale, red to buff, dolomitic, breccia zones
		Winnipegosis	24.4 - 25.0	Limestone, partly dolomitic, coarsely crystalline
			25.0 - 111.9	Dolomite, highly fossiliferous, stromatoporoidal in upper part, becoming finer grained variably fossiliferous towards base
		Ashern	111.9 - 117.0	Shale, grey to red, breccia fragments common towards base
		Interlake	117.0 - 122.5	Dolomite, buff, dense; 1.2 m red argillaceous bed at 119.2 and 0.3 m shale and breccia bed at 120.4
D-47-76-14 (Red Deer R.)	NC14-12-44-26 WPM + 870'	Overburden	0.0 - 25.0	Mud, clay, sandy clay, pebbles
		Souris River — First Red	25.0 - 34.7	Shale, dark grey to red, partly calcareous contorted and brecciated at base
		Dawson Bay — Upper	34.7 - 40.5	Limestone, buff, massive, stylolitic, coarsely crystalline to micro-crystalline
		— Middle	40.5 - 59.7	Shale, grey, calcareous, fossiliferous
		— Lower	59.7 - 65.8	Limestone, light grey, fossiliferous micrite, thin brecciated zones
		— Second Red	65.8 - 76.5	Shale, buff to red, pronounced breccia zone (polymict)
		Winnipegosis — Upper	76.5 - 89.6	Limestone and dolomite, laminated, bituminous
		— Lower	89.6 - 100.6	Dolomite, vuggy, massive to nodular, crinoidal fragments
		Ashern	100.6 - 107.6	Shale, grey to red, breccia fragments near base
		Interlake	107.6 - 135.9	Dolomite, buff, sublithographic to partly fine granular, several reddish, shaley interbeds
D-47-76-2 (Red Deer R.)	NW10-11-44-26 WPM + 870'	Mesozoic	12.8?- 20.7	Red Shale, siltstone, sandstone
		Souris River — First Red	20.7 - 25.3	Shale, mottled red, breccia
			25.3 - 30.5	Limestone grading to red shale and breccia
		Dawson Bay — Upper	30.5 - 37.2	Limestone, buff, stylolitic, in part coarsely crystalline
		— Middle	37.2 - 52.7	Shale, grey, calcareous fossiliferous
		— Lower	52.7 - 62.6	Limestone, buff, brachiopod biomicrite
		— Second Red	62.5 - 79.2	Red shale, breccia at top grading to polymict limestone - shale breccia
		Winnipegosis — Upper	79.2 - 81.4	Limestone breccia
			81.4 - 94.2	Dolomite and bituminous laminated dolomite
		— Lower	94.2 - 111.9	Dolomite, buff, granular, vuggy
		Ashern	111.9 - 119.5	Shale, red, dolomite
		Interlake	119.5 - 121.6	Dolomite

LIST OF PRELIMINARY MAPS

1976B-1	Saw Lake (63J-14 + 63J-11 N¼) by A. Bailes	1: 50 000	
1976F-1	Waugh (52E-11W) by D. Janes	1: 50 000	re-issue
1976F-2	McMunn (52E-12E) by D. Janes	1: 50 000	re-issue
1976F-3	Caddy Lake (52E-14W + part of 14E) by D. Janes	1: 50 000	re-issue
1976F-4	Whitemouth (52E-13E) by D. Janes	1: 50 000	re-issue
1976F-5	Crowduck Lake (52L-3W + part of 3E) by D. Janes	1: 50 000	
1976F-6	Pinawa (52L-4E) by D. Janes	1: 50 000	
1976F-7	Ryerson Lake (52L-6W + part of 6E) by D. Janes	1: 50 000	re-issue
1976F-8	Pointe du Bois (52L-5E) by D. Janes	1: 50 000	re-issue
1976L-1	Laurie Lake (64C-12) by H. V. Zwanzig	1: 50 000	
1976L-2	Lynn Lake (63C-14) (East Half) by H. P. Gilbert and E. Syme	1: 50 000	
1976L-3	Cockeram Lake (64C-15) by E. Syme and H. P. Gilbert	1: 50 000	
1976R-1	McCallum Lake (64C-4) by P. Lenton	1: 50 000	
1976R-2	McCallum Lake (part of 64C-4E) by P. Lenton	1: 20 000	(detail of Russell Lake)
1976S-1	Munroe Lake (640) by D. C. P. Schledewitz	1:200 000	
1976S-2	Tadoule Lake (64J) by D. C. P. Schledewitz	1:200 000	
1976T-1	Mystery Lake (63P-13) by W. Weber and R. F. J. Scoates	1: 50 000	
1976U-1	Prud'homme Lake (63P-7) by W. Weber	1: 50 000	
1976U-2	Goulet Lake (63P-8) (West Half) by W. Weber	1: 50 000	
1976U-3	Bear Head Lake (63P-9) (South Half) by W. Weber	1: 50 000	