MARGINAL NOTES

INTRODUCTION

These maps are part of a multi-year program to upgrade the Precambrian Geology maps of the central Uchi Subprovince. The present survey, at a scale of 1:50 000, has produced major revisions to previously published maps of the area and outlined structural features of significance for gold exploration as reported by Stott and Wallace (1984).

Throughout most of this area, the bedrock exposure is very poor inland from the lakes. Major drumlinoid ridges of fine sand trend northeastward and dominate the topography of the region. As a consequence, this survey is based on outcrop information from cross-sections through the belt along waterways and other bedrock "windows" between drumlinoid zones.

LOCATION AND ACCESS

The Muskegsagagen-Bancroft Lakes Area encompasses a major segment of the Meen-Dempster Lakes greenstone belt (Stott and Wallace 1984) and is situated southwest of Pickle Lake. The area is accessible by float or ski-equipped aircraft from Pickle Lake. Many lakes are shallow and not suitable for access by float-equipped aircraft. Portages have been cut by the survey crew to provide access between several lakes.

PREVIOUS WORK

Owing to the fact that the Muskegsagagen-Bancroft Lakes area is not on a major waterway but forms the axis of a local watershed, it had not been mapped until Karl Whitmore, a prospector from Red Lake, reported the existence of a greenstone belt north of Lake St. Joseph in 1933. Following this, W.D. Harding and assistants carried out the first geological survey (Harding 1935). In 1972, a reconnaissance survey encompassing a larger region was completed (Sage and Breaks 1982) and produced a geological compilation map of the Cat Lake-Pickle Lake area (Sage *et al.* 1976).

MINERAL EXPLORATION

Until recently, exploration in this area has been limited to some early sporadic gold prospecting and a few regional base-metal exploration programs, notably by Umex Incorporated and Cominco Limited.

Considerable exploration activity has occurred in the last several years near Pickle Lake. Recent drilling and other exploration work on the nearby Dona Lake property of Dome Exploration (Canada) Limited (Assessment Files Research Office, Ontario Geological Survey, Toronto) has further stimulated the already keen interest in ironstone-hosted gold in this region. In addition, exploration drilling for gold by Moss Resources Limited focussed on an ironstone unit south of Bancroft Lake (locally referred to as Ben Lake) (Assessment Files Research Office, Ontario Geological Survey, Toronto). As a consequence of this activity, the spring and summer of 1984 saw extensive staking and reconnaissance prospecting by several companies covering large parts of the survey area.

The most significant record of earlier gold prospecting is the work in 1963 by New Jersey Zinc Exploration Company Limited on gold-silver occurrences 3.2 km north of Muskegsagagen Lake. Trenching and diamond drilling were conducted, with the best assays from diamond drill core recording 0.32 ounce gold per ton (11 g per tonne) over 0.27 m in a pyritic quartz vein and 0.12 ounce silver per ton (4.1 g per tonne) over 0.58 m in a quartz-feldspar porphyry (Assessment Files Research Office, Ontario Geological Survey, Toronto).

Late in 1985, St. Joe Canada Incorporated made a significant gold discovery in the same area north of Muskegsagagen Lake that was earlier prospected by New Jersey Zinc Exploration Company Limited. St. Joe Canada Incorporated reported through the Northern Miner (March 24, 1986) that diamond drilling has defined a narrow quartz vein sheet associated with a mylonite zone and containing large tonnages grading more than 0.58 ounce gold per ton (20 g per tonne) across a mining width of 1.5 m. This has further stimulated a claim staking rush throughout the Meen-Dempster Lakes greenstone belt of which this map area is a part.

GENERAL GEOLOGY

Figure 1 summarizes the major stratigraphic and intrusive components of the Archean supracrustal belt from Meen Lake to Kasagiminnis Lake.

The belt can be subdivided into three volcanic cycles, each of which comprises massive to pillowed basalt capped by dacitic to locally rhyolitic pyroclastic rocks. On a regional scale, the stratigraphy youngs consistently to the south with local evidence of folding, notably on, and south of Meen Lake (Stott and LaRocque 1983a) and within the Billett Lake metasedimentary belt (Figure 1).

In the Meen Lake area west of this map area, previously interpreted fold patterns in the belt (Stott and LaRocque 1983a, 1983b) have been reinterpreted. The stratigraphy is now interpreted to be younging southward with only local folding - a syncline on the southern part of Meen Lake and tight folding along the southern margin of the belt. At present, regional stratigraphic correlations of the metasedimentary and felsic to intermediate metavolcanic rocks just north of the Southern Pluton (Stott and LaRocque 1983a) remain problematical.

The older cycle is referred to here as the Meen-Jacknife Lakes cycle and occupies the northern one-third to one-half of the belt from Meen Lake eastward to at least south of Wright Lake. Its easternmost extent has not been defined since the felsic pyroclastic rocks and metasediments at the top of the cycle tail out at Jacknife Lake. The stratigraphy swings northeastward, east of Graniteboss Lake, and the cycle is probably obliquely transected by the Dobie Lake Batholith near Kawinogans Lake.

This cycle is dominated by tholeiitic basalts with stratigraphically continuous marker units of magnetite-quartz ironstone, notably within the lowermost part of the cycle near the Dobie Lake Batholith. Minor intermediate to felsic pyroclastic rocks occur northeast of Muskegsagagen Lake, on and south of Kaminiskag Lake. The intermediate to felsic metavolcanics northeast of Muskegsagagen Lake may be part of a more continuous unit that correlates with the thin unit of felsic pyroclastic rocks observed on the north side of a small lake on Dobie River, just north of the felsic tuffs that define the top of the cycle (*see* Stott and LaRocque 1983b).

The top of the older cycle is marked by intermediate to felsic pyroclastic rocks with interlayered and overlying ironstone, clastic metasediments, and graphitic schist. The pyroclastic suite is now recognized to extend from Meen Lake to Jacknife Lake. It appears to thin out near Dobie River and eastward on Jacknife Lake. This assemblage of pyroclastic rocks is best observed on Meen Lake (west of the present map area), and locally south of Muskegsagagen Lake, and on Jacknife Lake.

A thick sequence of interbedded chemical and clastic metasediments is prominently displayed along the north shore of Jacknife Lake, immediately overlying a carbonatized felsic lapilli-tuff. The sequence includes ferriferous black chert, iron carbonate units, magnetitic, actinolitic, and locally pyritic ironstone, graphitic argillite, calcite-bearing quartz arenite, limestone, and an oolitic carbonate bed. Some thin carbonate beds possess finely laminated fabrics similar to those seen in documented stromatolites but the significance of this feature remains to be evaluated.

Diamond-drill logs for holes drilled southeast of Meen Lake in this sequence of pyroclastic and metasedimentary rocks were filed by Cominco Limited with the Assessment Files Research Office (Ontario Geological Survey, Toronto). These logs attest to the extensive development of sulphide facies ironstone, clastic metasediments, and pyritic and graphitic metasediments interbedded with the felsic to intermediate metavolcanics that cap this cycle.

Concentrations of coarse pyroclastic material occur on Meen Lake and south to southeast of Muskegsagagen Lake. Finer intermediate tuff beds characterize this stratigraphic package between these lakes and suggest that two volcanic centres may have been active in this cycle. One centre is in the vicinity of Meen Lake (Stott and LaRocque 1983a, 1983b) and the other is in the vicinity of Muskegsagagen-Kawashe Lakes. The thickest cross-sections of the cycle underlie the two volcanic centres.

The overlying volcanic cycle is referred to here as the Dempster Lake cycle. Its lowermost section is best exposed on the south shore of Jacknife Lake, which lies along the contact between the two cycles. On the south shore, weakly deformed pillowed basalts with well defined cusps confirm a southward younging direction to the stratigraphy. These pillowed basalts become markedly distorted southwest of Jacknife Lake and develop a strong cleavage. This deformational fabric defines the boundary of a major deformational zone (shear zone) that is described later in this summary.

Cross-sections through the Dempster Lake cycle suggest that pillowed basalts containing iron carbonate amygdules are predominant south of Jacknife Lake and north of Dempster Lake. Massive to pillowed basalts typify the section south and east of the Graniteboss Lake Stock.

The top of this cycle is marked by a suite of felsic to intermediate tuffs. These rocks extend beyond what is shown on previous maps (Sage *et al.* 1976); they extend from Kasagiminnis Lake, around the Knupp Lake Stock, southwestward through Dempster Lake, and south of the Graniteboss Lake Stock. The northwest extent of the felsic metavolcanics has not been determined due to the poor exposure around Billett Lake; however, felsic metavolcanics at the east end of Billett Lake may be correlative with this suite.

The uppermost suite on Dempster Lake is composed of fine-grained felsic to intermediate flows or ash-flow tuffs. On Whitmore Lake, where the stratigraphy appears to wrap partly around the Knupp Lake Stock, there is a complex sequence of wackes, derived from the volcanic edifice and interbedded with some intermediate tuffs. Farther east, in the north part of Caley Lake, intermediate lapilli-tuffs are prevalent. This suite appears to continue eastward beyond Kasagiminnis Lake. The coarsest pyroclastic rocks in this suite are found in the north part of Caley Lake.

The third volcanic cycle, the Bancroft Lake cycle, comprises poorly exposed basaltic flows overlain by intermediate pyroclastic deposits. These latter deposits are characterized by fine-grained, thinly bedded dacitic to andesitic tuff notably observed on the south half of Caley Lake and south of Bancroft Lake. The tuffaceous rocks become interbedded with volcaniclastic metasediments at the top of the sequence south of Bancroft Lake.

Wackes comprise a discontinuous unit along the southern margin of the belt and form large inclusions within the late tectonic Osnaburgh Pluton (Stott 1985). These metasediments are interpreted to be remnants of the previously more extensive Billett Lake metasedimentary belt that stretched obliquely and unconformably across the volcanic cycles.

Large metasedimentary inclusions range across the northern half of the Osnaburgh Pluton from Highway 599 to Teevin Lake. Much of the region southeast and northwest of Billett Lake is covered by overburden, with the best exposures occurring in the vicinity of Billett Lake and west of Teevin Lake.

Apart from the proximally-derived conglomerates of Billett Lake, most of the metasedimentary sequence appears to be composed of wackes with minor interbeds of aluminous mudstone.

South of Billett Lake, an antiformal "window" of basalts which underlie the conglomerates is exposed. In addition, diamond-drill logs (Assessment Files Research Office, Ontario Geological Survey, Toronto) suggest that the metasedimentary belt probably forms a relatively thin, folded mantle over the metavolcanics southeast of Billett Lake.

The volcanic belt has been intruded by a number of early and late granitoid and gabbroic plutons as shown in Figure 1. These intrusions have been assigned to a relative sequence within the regional supracrustal and tectonic history (Table 1).

Several of the gabbroic masses intrude the enveloping volcanic rocks discordantly. The gabbro body on Dempster Lake contains a narrow anorthosite phase on its northwest margin. This large body discordantly intrudes rocks of the Dempster Lake cycle. Its margins tend to conform with the enveloping stratigraphy, but it contains mafic volcanic and other supracrustal inclusions. The body also intrudes the Billett Lake metasedimentary belt, as indicated by the presence of sedimentary xenoliths, and thereby is recognized as a late intrusion in the supracrustal history. The south half of the body is characterized by high magnetic susceptibility, and is magnetite-rich near an unassimilated ironstone inclusion south of Dempster Lake.

The part of the gabbro body northeast of Dempster Lake on Kawinogans Lake is crossed by numerous northeast-trending shear zones that are related to the regional (D_1) deformation characterized by southwest-plunging stretching lineations (*see* Structural Geology). These zones are carbonatized and contain quartz-calcite pods and veins. The shear zones also locally contain pyritic gossan zones. The gabbro is generally semiconcordant with the surrounding metavolcanics.

Granitoid intrusions range widely in relative age. Two small stocks may represent subvolcanic intrusions in this belt. A quartz porphyry underlies the dacitic rocks on Meen Lake (outside the present map area). This small intrusion is on the north side of the eastern arm of the lake. The small Sky Lake quartz porphyry stock lies just east of Caley Lake. It appears to underlie dacitic-andesitic tuffs near the top of the Bancroft Lake cycle.

The Kawashe Lake Stock is an early, pre-tectonic trondhjemitic body enveloped by the Kawashe gabbro. Intruding the gabbro is a set of quartz porphyry and fine-grained trondhjemitic sills apparently related to the stock. This implies that the Kawashe gabbro is an older intrusion than the trondhjemitic stock. Some of the porphyry dikes are pyrite-and tourmaline-bearing.

Two intrusions were emplaced very late in the tectonic history of this region. The Graniteboss Lake and Knupp Lake Stocks consist of quartz porphyritic, K-feldspar megacrystic granodiorite. They possess primary strain fabrics and postdate the regional deformation recorded in the surrounding supracrustal rocks. The Knupp Lake Stock, as defined here, includes the formerly mapped Duffell Lake Stock (Sage *et al.* 1976).

The regional deformation in the western half of the belt is relatable to the emplacement of the large Dobie Lake Batholith to the north. This batholith is a syntectonic body. In contrast, the Southern Pluton, south of Meen Lake (Stott and LaRocque 1983a), and the Osnaburgh Pluton are both late tectonic intrusions. These have imposed limited contact-strain aureoles that overprint the pre-existing deformation in the adjacent greenstone belt. The crescent-shaped Osnaburgh Pluton (Stott 1985) appears to have been emplaced largely by magmatic stoping, since it produces a contact strain aureole that extends only 2 km northward within the greenstone belt.

The Kasagiminnis Lake Pluton and a pluton east of Kawinogans Lake, the Kawinogans Lake Pluton, are also interpreted to be late tectonic granodioritic intrusions that have primary fabrics and produced limited contact-strain effects upon the surrounding volcanic rocks.

STRUCTURAL GEOLOGY

In the generally homoclinal southward younging, volcanic stratigraphy of the Meen Lake-Kasagiminnis Lake section, the most notable structural features are two major ductile deformation zones (shear zones) shown in Figure 1. Both zones extend to the northwest and both display a dextral (right-handed) sense of shear. Movement in these zones was dominantly transcurrent and plunged southeastward.

One zone occurs along the northeastern contact between the Dobie Lake Batholith and the greenstone belt. The zone extends from north of Meen Lake southeastwards and diminishes north of Knupp Lake at the belt contact. The zone is interpreted to be continuous along the margin of the belt although only parts of the zone have been observed, as shown on the map. This shear zone varies from a narrow mylonite band north of Meen Lake to a more complex zone up to 700 m wide. The wider parts have been observed north of the eastern end of Meen Lake (Stott and LaRocque 1983a), north of Muskegsagagen Lake, and on Kawinogans Lake. The deformation affects the adjacent metavolcanics most notably in these areas. In the area north of Muskegsagagen Lake, local evidence of mylonitic rocks within the greenstone belt suggests that the shear zone is probably more complex, resembling a wrench fault system, with the principal zone lying mainly in the Dobie Lake Batholith, and a set of secondary shears transecting the northern part of the belt. Spatially associated with this zone is a conjugate set of narrow shear bands widely observed in the northern half of the belt and within the immediately adjacent part of the Dobie Lake Batholith. The bands are typically 5 to 15 cm wide. There is a consistent right-handed sense of transcurrent movement in the northwest-trending shears and a left-handed sense in the northeast-trending shears. These shear bands are most prominent north of Muskegsagagen Lake and in the vicinity of Wright Lake. As one proceeds southwards across the belt, the bands diminish to form thin shear fractures and cracks with slickensided surfaces that record the same conjugate sense of movement. This southward decrease in the ductility of conjugate shearing may reflect change down the thermal gradient away from the Dobie Lake Batholith.

The second major deformation zone is wider and lies to the south of Jacknife Lake. It appears to widen from northwest of Billett Lake towards the southeast, and crosses a major gabbro body north of Teevin Lake. The full extent of this deformation zone has not been defined. It ranges up to 1500 m wide and contains moderately to strongly deformed rocks that grade into discrete mylonite zones. Eastward, the deformation appears to diminish to form narrower zones north of Teevin Lake. Towards its margins in the east, where the deformation decreases, the zone is recognized only by a characteristic southeasterly-plunging mineral lineation which contrasts with the older, regional, northwesterly-plunging extension lineations in the rocks outside the zone.

These two deformation zones appear to be late formed, integral elements in the regional deformation pattern across the westernmost half of the belt from Meen Lake to the Graniteboss Lake Stock.

Regional mineral lineation patterns (Figure 2) were mapped in the Meen Lake area (Stott and LaRocque 1983a, 1983b) and this work was continued across the present survey area. The results show major progressive changes in lineation plunge azimuth along the length of the belt. The patterns have been studied for their relationships to the regional tectonic history, and as clues to the timing of deformation zones and granitoid intrusions.

The sequence of tectonic events (Table 1) is based on the spatial distribution of structural domains defined as areas with a consistent stretching direction in the strain fabric of the rocks. This tectonic stretching direction is identified by mineral lineations and the long axis of ellipsoidal shapes of varioles and amygdules plus clasts in pyroclastic and epiclastic rocks. Figure 2 is a sketch that summarizes the major structural domains in the greenstone belt. It includes observations from the Meen Lake area (Stott and LaRocque 1983a, 1983b), northwest of the present map area.

Table 1: The Sequence of Supracrustal and Tectonic Events, Meen Lake-Kasagiminnis Lake

Conjugate shear bands and fractures:
- in the northern one-third of the greenstone belt, notably north of Muskegsagagen Lake.
- probably late-stage compression during the D_4 deformation event

Right-handed transcurrent high strain shear zone (D_4 deformation event) - on the northeastern margin of the belt, interpreted to be related to a major late subhorizontal compression event that produced the major transcurrent faults across the Superior Province.

Late tectonic plutons with primary strain fabrics:
- eg: Southern Pluton, Knupp Lake Stock, Graniteboss Lake Stock, Kawinogans Lake Pluton, Kasagiminnis Lake Pluton.

The D_3 deformation event is a contact strain aureole imposed by a late to post tectonic pluton, such as the Southern Pluton, upon the adjacent greenstone belt.

Right-handed high strain shear zone (D_2 deformation) south of Jacknife Lake and the Graniteboss Lake Stock.

Regional deformation (D_2 domain with easterly plunging mineral and shape lineation) defining a contact strain aureole produced by the emplacement of the syntectonic Dobie Lake Batholith

Earlier regional D_1 deformation (preserved in the eastern half of the belt and south of the D_2 contact strain aureole) is characterized by westerly plunging mineral and shape lineations

Kawashe Lake Stock
- intruded the Kawashe gabbro.

Dempster Lake Gabbro
- intruded the Billett Lake sedimentary belt
- other discordant gabbro bodies probably emplaced at this stage.

Billett Lake Sedimentary Belt
- along the southern margin of the greenstone belt, locally discontinuous enclaves in the Lake St. Joseph Granitoid Complex (Stott 1985). The sedimentary belt is interpreted as unconformably overlying the adjacent volcanic cycles.

Unconformity

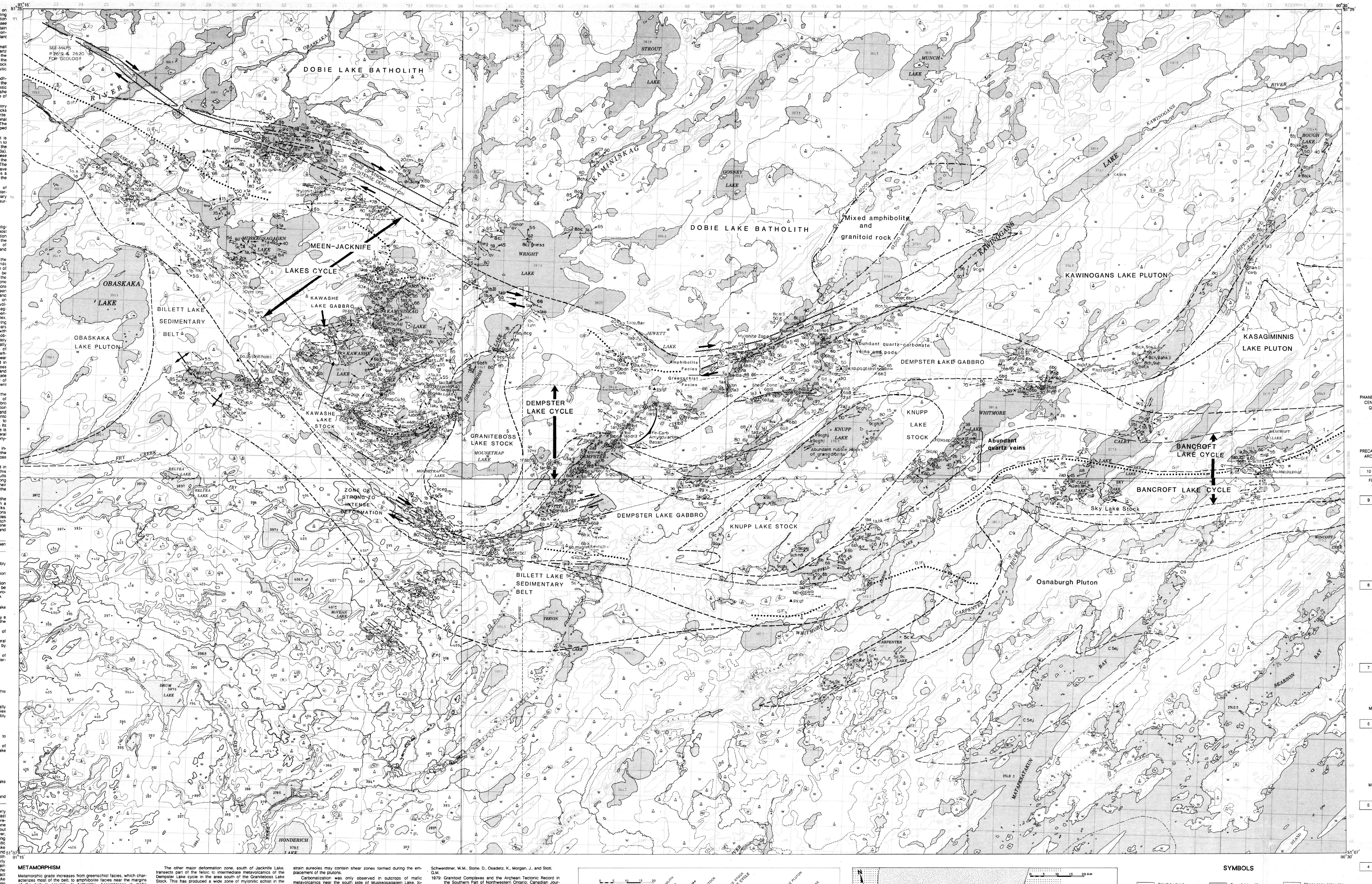
Four Volcanic Cycles:
Each cycle consists of tholeiitic basalts overlain by dacite to rhyolite pyroclastic rocks.
1) A partly preserved basaltic suite is interpreted as the base of the youngest volcanic cycle, observed from south of Duffell Lake to south of Bancroft Lake.
2) Bancroft Lake Volcanic Cycle.
3) Dempster Lake Volcanic Cycle
- includes Sky Lake quartz prophyry intrusion.
4) Meen-Jacknife Lakes Volcanic Cycle
- the oldest cycle with two volcanic centres: on Meen Lake and south of Muskegsagagen Lake.
- includes Meen Lake quartz porphyry intrusion.
- the pyroclastics at top of this cycle are overlain by and interbedded with epiclastic and chemical metasediments.

The oldest strain fabric observed is characterized by westerly plunging lineations on the plane of schistosity in rocks to the east and south of Graniteboss Lake Stock. This strain domain represents the earliest recognizable deformation (D_1) in the greenstone belt. Presumably this strain fabric at one time occurred throughout a much larger part of the greenstone belt farther west. However, the western half of the belt is now marked by easterly plunging lineations. This easterly plunging orientation is also characteristic of lineations in at least the southern part of the Dobie Lake Batholith. The batholith is weakly to non-metamorphosed and possesses strain fabrics that appear to be primary to the batholith emplacement. It is interpreted here that the domain of easterly plunging lineations in the greenstone belt is a wide contact strain aureole (designated as the D_2 strain domain) imposed by the Dobie Lake Batholith. Part of the southern margin of this contact strain aureole, south of Jacknife Lake and the Graniteboss Lake Stock, is defined by a wide, easterly plunging shear zone showing evidence of right-handed movement. The western extent of this D_2 shear zone has not been established but the shear zone appears to become narrower and may be represented by sheared rock observed at the eastern end of Billett Lake. The eastern end of this shear zone appears to splay out into the Dempster Lake Gabbro.

The Southern Pluton (Figure 1), which lies farther west, is part of a continuous mass of post-tectonic granodiorite that appears to postdate the Dobie Lake Batholith. This is evident from the contact strain aureole (containing northwesterly plunging lineations) in the greenstone belt along the northern margin of the Southern Pluton superimposed on the wider strain aureole (containing southeasterly-plunging lineations) imposed by the Dobie Lake Batholith. An analysis of lineation trends from Stott and LaRocque (1983a) defines this contact strain aureole (designated as the D_3 deformation event) as a progressive rotation of lineations from the southeasterly plunge across most of the belt in the Meen Lake area to a northwesterly plunge, close to the Southern Pluton, which parallels the orientation of primary lineations within this unmetamorphosed pluton. This post-tectonic mass of granodiorite which lies to the west and southwest of the Meen Lake area is therefore interpreted to postdate the Dobie Lake Batholith.

A right-handed transcurrent shear zone with a shallow southeastward-plunging shear direction, follows the length of the greenstone belt along its northeastern margin and lies mainly within the Dobie Lake Batholith but also affects the younger granodiorite mass to the northwest. Based on this observation, it is interpreted that this shear zone postdates the emplacement of both the Dobie Lake Batholith and the younger granodiorite terrain to the west. The shear zone is designated as a D_4 deformation event. This interpretation implies that this shear zone postdates the D_2 shear zone, observed south of the Graniteboss Lake Stock, that forms the southern boundary of the wide D_2 strain domain imposed by the Dobie Lake Batholith.

The D_4 shear zone along the northeastern margin of the belt therefore represents the last tectonic event in this region and may be part of a system of late Archean conjugate faults and shear zones across the Superior Province (Schwerdtner *et al.* 1979) with which many of the major gold deposits in Ontario are known to be associated (Colvine *et al.* 1984).



METAMORPHISM

Metamorphic grade increases from greenschist facies, which characterizes most of the belt, to amphibolite facies near the margins of the belt in proximity to batholiths. Assemblages in mafic metavolcanics typically comprise epidote-chlorite-actinolite but close to the Dobie Lake Batholith the rocks contain hornblende and plagioclase. This change in metamorphic grade is best seen on Kawinogans Lake.

The southern shear zone, south of the Graniteboss Lake Stock is characterized by the abundance of epidote, chlorite, zoisite, and notably carbonate within sheared felsic metavolcanics and gabbro. Plagioclase feldspars and quartz are recrystallized to polygonal subgrains and support textural evidence for a syn-metamorphic D_2 shearing event. This contrasts with the textures of the D_4 shear zone along the northeastern margin of the belt. There, quartz grains are extensively recrystallized with internal deformation bands and subgrains with highly serrated grain boundaries. Widespread textural evidence indicates that the internal strain is only partly relieved by subgrain formation. The mylonitic fabric is late and postdates the peak of metamorphism.

ECONOMIC GEOLOGY

There are few records of mineralization in this belt. Due to the poor exposure and the limited geological database available, relatively little exploration has been done in this area in the past. As a consequence, this supracrustal belt is one of the few remaining moderately accessible areas of high mineral potential within Ontario that has not been exhaustively explored.

The present reconnaissance survey has identified two major dextral shear zones. The northern mylonite zone is largely restricted to the margin of the belt but is associated with narrower shear zones within the belt. In addition, a conjugate set of shear bands is prominently developed in the northern third of the belt, notably in the Meen Lake-Wright Lake section. The major ironstone units are concentrated along the northern length of this belt, the overprint of shear zones in the vicinity of ironstone units provides an obvious target for prospectors seeking auriferous vein concentrations associated with deformed ironstone. Quartz veins were widely observed within these shear zones. Folding of ironstone, notably evident by the aeromagnetic expression of a unit north of Kaminiskag Lake, may also prove to be a factor controlling gold mineralization.

The other major deformation zone, south of Jacknife Lake, transects part of the felsic to intermediate metavolcanics of the Dempster Lake cycle in the area south of the Graniteboss Lake Stock. This has produced a wide zone of mylonitic schist in the felsic metavolcanics and a local abundance of folded *en echelon* quartz-tourmaline-filled fractures which should be examined.

These mineralized veins (gold: 800 ppb - grab sample; analysis by the Geoscience Laboratories, Ontario Geological Survey, Toronto) appear to be formed in *en echelon* tension fractures produced during late stage dextral movement within the D_2 shear zone.

Quartz, and quartz-carbonate±tourmaline veins are widely observed across this belt. The veins are parallel to the regional foliation and occur along narrow shear zones. Quartz-tourmaline veins are most notable on Jacknife Lake, Kaminiskag Lake, and in the vicinity of Dempster and Bancroft Lakes.

Quartz carbonate veins and pods are widely observed in the Dempster Lake Gabbro body and especially along northeast-trending D_1 shear zones observed within the northern part of body.

The recent gold discovery by St. Joe Canada Incorporated, north of Muskegsagagen Lake, comprises an auriferous quartz vein within a narrow, tabular mylonite zone in the volcanic rocks and is interpreted to have been emplaced during the D_4 shearing event along the northeastern margin of the belt. At least three separate gold mineralization events are therefore proposed for this belt:

1. a syn-D_1 hydrothermal gold mineralization within permeable, sheared rocks. This is exemplified south of Bancroft Lake where Moss Resources Limited has outlined sulphide-bearing silicification in sheared rock adjacent to ironstone.
2. a late-D_2 hydrothermal gold mineralization within the permeable D_2 shear zone; this shear zone forms the outer margin of the wide contact strain aureole imposed by the Dobie Lake Batholith; and
3. a hydrothermal gold mineralization in a vein within a narrow mylonite zone that probably forms a splay off the main D_4 shear zone along the northeastern margin of the belt.

These three structural events afford good exploration targets and it is anticipated that detailed examination will more fully define the major deformation zones and discover other related zones of permeable rock within the belt. It remains to be determined whether or not syn-D_3 gold mineralized zones occur within the D_3 contact strain aureoles adjacent to late- to post-tectonic granitoid plutons (eg. Southern Pluton, Figure 1). These contact strain aureoles may contain shear zones formed during the emplacement of the plutons.

Carbonatization was only observed in outcrops of mafic metavolcanics near the south side of Muskegsagagen Lake, locally farther west on the Obaskaka River, and within the felsic metavolcanics on the north shore of Jacknife Lake.

Syntectonic carbonatization may not be a significant exploration factor in this belt. Instead, sulphide-bearing silicification, such as that found south of Bancroft Lake, may be considered to have high gold potential.

Prospectors should, in view of the relatively poor exposure in this belt, focus their exploration for gold on the structurally more competent ironstones and especially the major shear zones along the northern and southern margins of the belt. Evidence of differential shearing along the margins of ironstone units and associated silicification of sheared host rocks south of Bancroft Lake suggests that similar features may occur in association with ironstone units in the western half of the belt where later (D_2, D_4) superimposed deformation events have been recorded.

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1984: Regional Stratigraphy and Structure of the Central Uchi Subprovince: Meen Lake-Kasagiminnis Lake and Pashkokogan Lake Sections; p.7-13 *in* Summary of Field Work, 1984, Ontario Geological Survey, edited by John Wood, Owen L. White, R.B. Barlow, and A.C. Colvine, Ontario Geological Survey, Miscellaneous Paper 119, 309p.

Streckeisen, A.
1976: To Each Plutonic Rock Its Proper Name; Earth-Science Reviews, Volume 12, p.1-33

The Northern Miner
1986: Volume 72, Number 2, p.1.

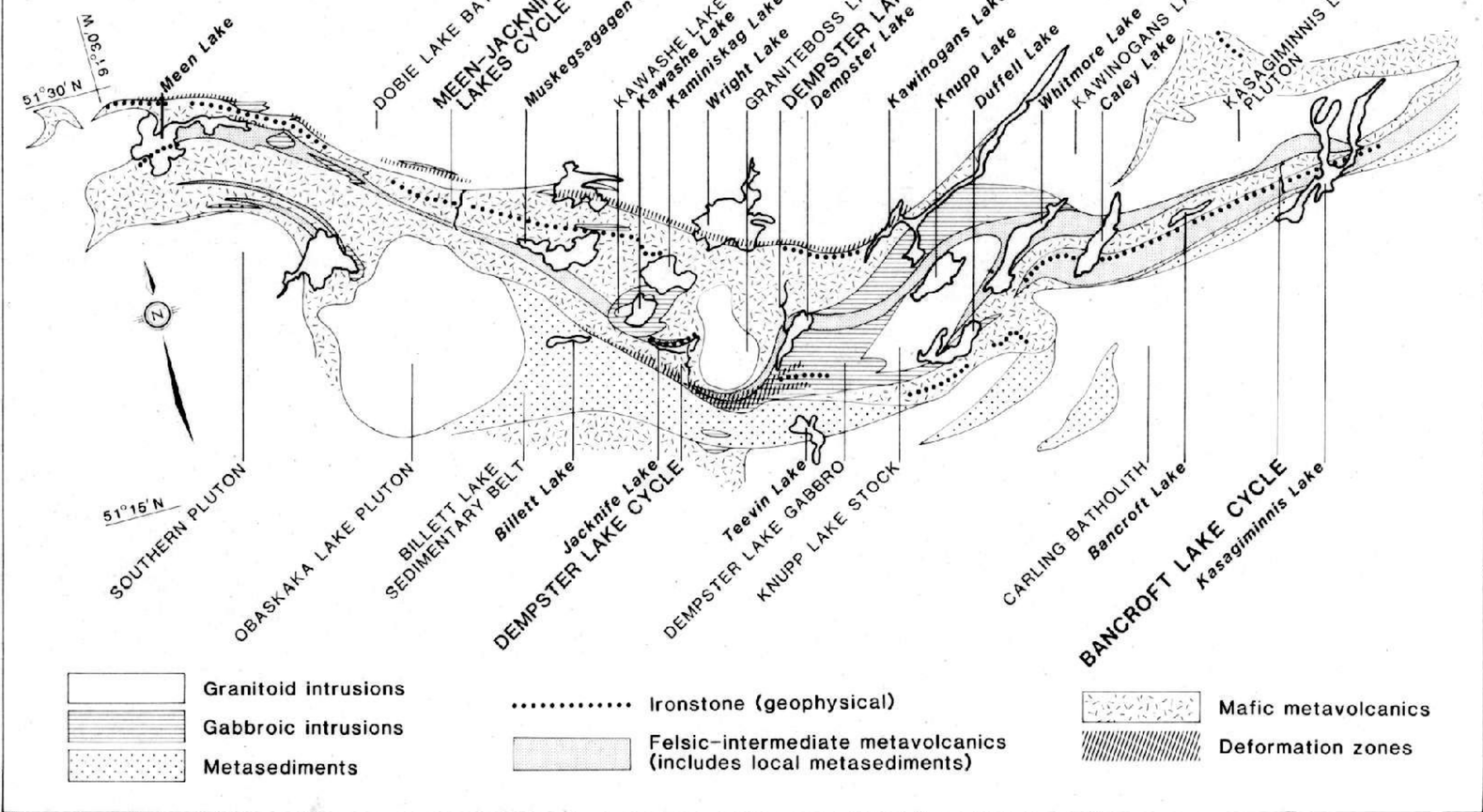


Figure 1- General Geology of the Meen Lake-Kasagiminnis Lake Area.

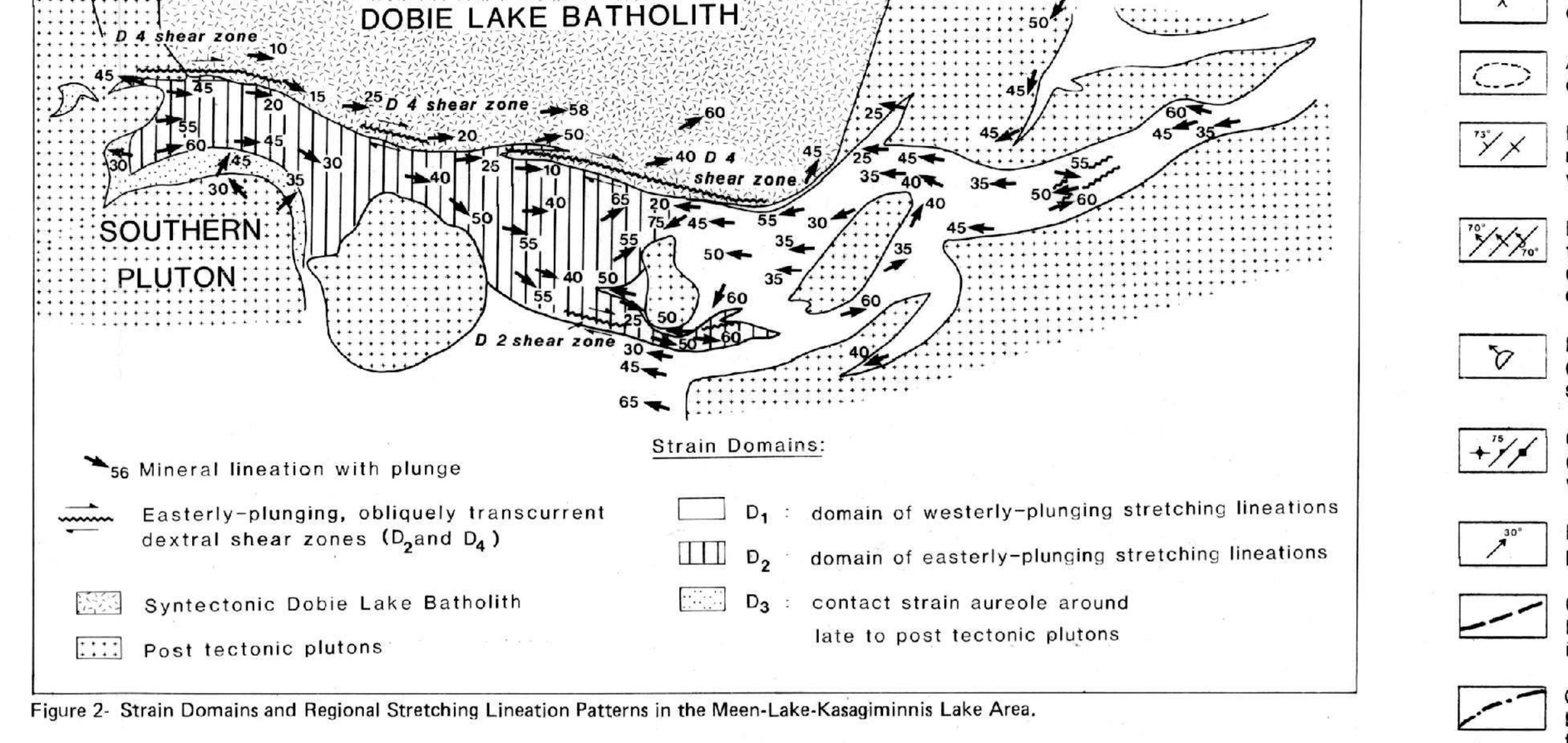


Figure 2- Strain Domains and Regional Stretching Lineation Patterns in the Meen-Lake-Kasagiminnis Lake Area.

Ministry of Northern Development and Mines
Ontario

Ontario Geological Survey
MAP P.3049
Geological Series—Preliminary Map

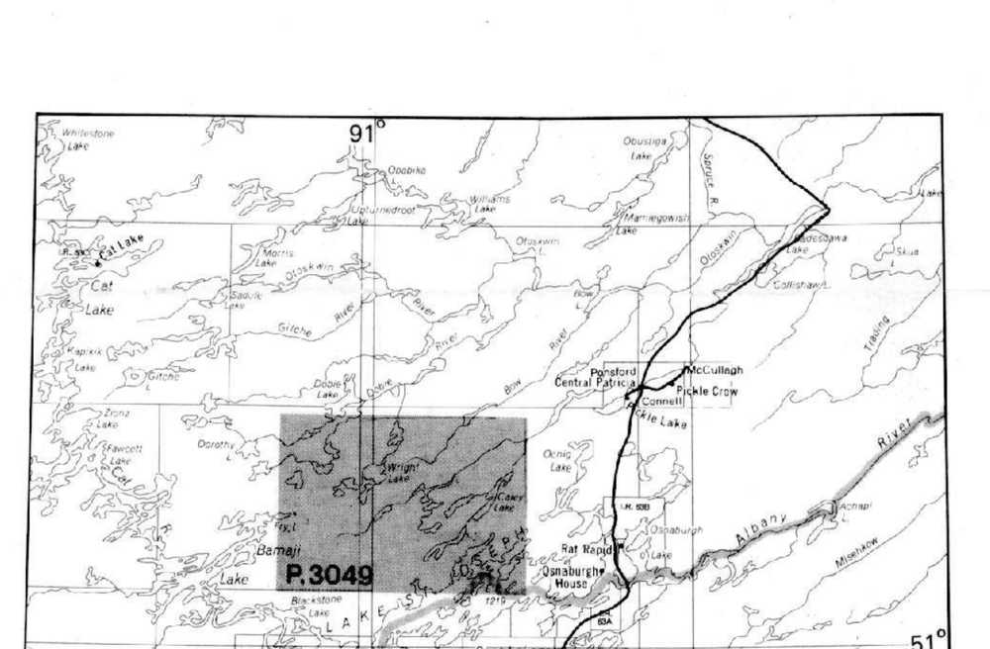
PRECAMBRIAN GEOLOGY

MUSKEGSAGAGEN BANCROFT LAKES AREA

DISTRICT OF KENORA (PATRICIA PORTION)

Scale 1:50 000
Metres 1000 0 1 Kilometre
Mile 1 0 1 Mile

NTS Reference: 52 O/2,3,6,7
ODM-GSC Aeromagnetic Maps: 920G, 903G, 912G, 913G
ODM Geological Compilation Map: 2218



LOCATION MAP
Scale: 1:1 548 000 or 1 inch to 25 miles

LEGEND[a,b]

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT
Stream, lake, and organic bog deposits

PLEISTOCENE
Eskers, outwash deposits, drumlinoids; glacial till

UNCONFORMITY

PRECAMBRIAN[c,d]
ARCHEAN
LAMPROPHYRE

10 — 10a Biotite-phyric (>10%) lamprophyric dike

FELSIC INTRUSIVE ROCKS[c]
UNMETAMORPHOSED LATE TO POST-TECTONIC GRANITIC ROCKS

9
- 9a Alkali feldspar granite
- 9b Monzogranite
- 9c Granodiorite
- 9d Tonalite
- 9e Granitic rock with biotite>amphibole
- 9f Granitic rock with biotite<amphibole
- 9g Granitic rock with biotite
- 9h Potassium feldspar-megacrystic granitic rock
- 9j Quartz-phyric granitic rock
- 9k Granitic dike or sill
- 9l Xenolith-bearing[d]

INTRUSIVE CONTACT

METAMORPHOSED PRE- TO SYNTECTONIC GRANITIC ROCKS

8
- 8a Alkali feldspar granite
- 8b Granodiorite
- 8c Tonalite
- 8d Trondhjemite
- 8e Quartz diorite
- 8f Granite pegmatite
- 8g Granitic rock with amphibole>biotite
- 8h Granitic rock with biotite>amphibole
- 8j Granitic rock with biotite
- 8k Potassium feldspar-megacrystic granitic rock
- 8l Plagioclase feldspar-phyric granitic rock
- 8m Quartz-phyric granitic rock
- 8n Granitic dike or sill

METAMORPHOSED FELSIC PORPHYRY INTRUSIVE ROCKS[e]

7
- 7a Quartz porphyry
- 7b Feldspar porphyry
- 7c Quartz-feldspar porphyry
- 7d Felsite, fine grained
- 7e Xenolith-bearing[d]

INTRUSIVE CONTACT

MAFIC INTRUSIVE ROCKS[c]
METAMORPHOSED MAFIC INTRUSIVE ROCKS

6
- 6a Diorite
- 6b Gabbro
- 6c Anorthosite
- 6d Leucocratic gabbro (colour index <30)
- 6e Pyroxenite, hornblendite
- 6f Quartz-bearing mafic intrusive rock
- 6g Plagioclase feldspar-phyric mafic intrusive rock
- 6h Mafic sill, dike
- 6j Xenolith-bearing[d]

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS
METASEDIMENTS
CLASTIC METASEDIMENTS

5
- 5a Quartzose arenite
- 5b Feldspathic arenite
- 5c Feldspathic wacke
- 5d Lithic wacke
- 5e Conglomerate (clast-supported, polymictic)
- 5f Conglomerate (matrix-supported, polymictic)
- 5g Mafic source-derived clastic material
- 5h Felsic source-derived clastic material
- 5j Mudstone (slate, argillite)

CHEMICAL METASEDIMENTS

4
- 4 Undifferentiated
- 4a Ferruginous chert
- 4b Metachert
- 4c Magnetite ironstone
- 4d Siderite ironstone
- 4e Limestone
- 4f Sulphide ironstone
- 4g Amphibole-rich ironstone

METAVOLCANICS
FELSIC METAVOLCANICS

3
- 3a Massive flow (may include fine-grained ash flow)
- 3b Flow top breccia, flow breccia
- 3c Tuff
- 3d Lapilli tuff
- 3e Crystal tuff

INTERMEDIATE METVOLCANICS

2
- 2a Massive flow (may include fine-grained ash flow)
- 2b Tuff
- 2c Lapilli tuff
- 2d Tuff-breccia
- 2f Lithic tuff
- 2g Monolithic pyroclastic rock
- 2h Heterolithic pyroclastic rock
- 2j Pyroclastic rock with fragments more mafic than matrix
- 2k Pyroclastic rock with fragments more felsic than matrix
- 2m Quartz-feldspar porphyry
- 2n Mafic phenocrysts-bearing rock
- 2o Sericitic rock
- 2p Epidote lenses (>5%) in pyroclastic rock
- 2q Volcaniclastic sediments (may include tuff and resedimented tuff)

MAFIC METAVOLCANICS

1
- 1a Massive flow
- 1b Pillowed flow
- 1c Pillow breccia
- 1d Amygdaloidal flow
- 1e Variolitic flow
- 1f Flow top breccia, flow breccia
- 1g Coarse-grained flow
- 1h Tuff
- 1k Mafic phenocrysts-bearing rock
- 1m Plagioclase feldspar-phyric rock
- 1n Strongly chloritized rock
- 1o Amphibolitized rock
- 1p Gneissic rock
- 1r Epidote lenses and layers (<5%)
- 1s Epidote lenses and layers (>5%).

Notes
a) This field legend is subject to changes pending results of subsequent laboratory investigation.
b) Age relationship of rocks coded 1 to 7 are varied.
c) Plutonic rock classification follows the IUGS Subcommission on the Systematics of Igneous Rocks (Streckeisen 1976).
d) Types of xenoliths are shown in ( ) in decreasing abundance where noted.
e) May be extrusive in part.

The letter "C" preceding a code refers to selected data compiled from previous maps of the Ontario Geological Survey in areas of poor outcrop exposure or areas not visited by the present mapping project.

The letter "G" preceding a code indicates that the interpretation is based on geophysical data.

Parentheses),)), and))) following a code refer to field estimates of intensity of rock deformation. A semi-quantitative scale of weak, moderate, strong, and intense deformation is used. Most greenstone belt outcrops show a "moderate" degree of deformation and are not labelled as such—"Weakly-deformed" rocks are indicated by ")"; "Strongly-deformed" rocks are indicated by "))"; "intensely-deformed" rocks (typically shear zones which include mylonitic rocks) are indicated by ")))".

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown; (inclined, vertical)
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned)
- Lava flow; top (arrow) from pillows shape and packing
- Gneissosity; (horizontal, inclined, vertical)
- Lineation with plunge
- Geological boundary, position interpreted
- Geological boundary, deduced from geophysics
- Jointing; (horizontal, inclined, vertical)
- Drag folds with plunge
- Anticline, syncline
- Lava flow; top in direction of arrow
- Foliation; (horizontal, inclined, vertical)
- Lineation with plunge
- Iron formation
- Veins; quartz, quartz-carbonate; quartz tourmaline
- Mineral lineation
- Second lineation
- Second foliation with second lineation
- Anticline (strike of axial plane)
- Z-fold, W-fold (showing plunge of fold axis)
- Strike and dip of axial plane of Z-fold, and trend and plunge of fold axis
- Shear zone (showing sense of movement - sinistral)
- Shear zone (showing sense of movement - sinistral, and downthrown side with orientation of mineral lineation)
- Fracture orientation: vertical; inclined showing downthrown side
- Fracture orientation: showing sense of movement
- Major shear zone showing sense of movement
- Esker
- Topographic contour
- Marsh, swamp (wooded)
- Spot elevation, precise: land, water
- Wooded area

ABBREVIATIONS

Ag	Silver
and	Andalusite
asp	Arsenopyrite
Au	Gold
bio	Biotite
carb	Carbonate, carbonatized
chl	Chlorite
cpy	Chalcopyrite
Cu	Copper
ep	Epidote
Fe-cb	Iron carbonate
gf	Graphite
gt	Garnet
If	Iron formation
mag	Magnetite
Ni	Nickel
po	Pyrrhotite
py	Pyrite
qc	Quartz-carbonate vein
qt	Quartz-tourmaline vein
qv	Quartz vein
S	Sulphide mineralization*
sil	Silicified; silicification
sp	Sphalerite
stau	Staurolite
tour	Tourmaline

* Where "S" symbol is not accompanied by a specific location symbol, the sulphide mineralization is compiled from the 1975 Cat Lake-Pickle Lake Preliminary Map P.808, and is located directly beneath the symbol.

⊗ Indicates a station visited during the course of 1984 mapping.

▲ Indicates a mineral occurrence compiled from the 1975 Cat Lake-Pickle Lake Preliminary Map P.808.

SOURCES OF INFORMATION

Base maps derived from National Topographic Series Sheets 52 O/2, 52 O/3, 52 O/6, and 52 O/7.

Cat Lake-Pickle Lake, Districts of Kenora and Thunder Bay; Ontario Geological Survey, Map 2218, Geological Compilation Series, 1975, by R.P. Sage, F.W. Breaks and assistants, scale 1:253 440 or 1 inch to 4 miles.

Assessment Files Research Office, Ontario Geological Survey, Toronto.

Geoscience Laboratories, Ontario Geological Survey, Toronto.

Magnetic declination is 0° 9.9'W.

Metric conversion factor: 1 foot = 0.3048 m

CREDITS

Geology by G.M. Stott and A.C. Wilson, 1984.

Issued 1986

Information from this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:

Stott, G.M., and Wilson, A.C.
1986: Precambrian Geology of the Muskegsagagen-Bancroft Lakes Area, District of Kenora (Patricia Portion); Ontario Geological Survey, Map P.3049, Geological Series-Preliminary Map, scale 1:50 000. Geology 1984.