# REPORT ON THE 1998
# LITHOGEOCHEMISTRY, GEOLOGICAL MAPPING AND STRUCTURAL ANALYSIS
# SEPARATION LAKE, ONTARIO (52 L/8 SW)
# SUMMER 1998

CLAIMS K 1178295, K 1178296, K 1178297, K 1178437, K 1162989, K 1162990, K 1162991, K 1178574, K 1178575, K 1178598, K 1178678, K 1178689, K 1178690, K 1178730, K 1178787, K 1149774, K 1149772, K 1149773, K 1149775, K 1149776, K 1178866, K 1178867, K 1220538, K 1220539, K 1220540, K 1220541, K 1220542, K 1166804, k 1220596

CLAIM SHEETS

| | | |
|---|---|---|
| | Treelined Lake | G-2651 |
| | Paterson Lake | G-2634 |
| | Stop Lake | G-2523 |
| | Snook Lake | G-2644 |



TANTALUM MINING CORPORATION OF CANADA LIMITED
P.O. BOX 200, LAC DU BONNET, MANITOBA, R0E 1A0 / (204) 884-2400



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MARCH 21st, 2000
BERNIC LAKE, MANITOBA

# TABLE OF CONTENTS



**List of Tables:**



**List of Figures:**



**Map Pocket Report:**

## INTRODUCTION

During of the summer of 1998, numerous field activities were carried out by the Tantalum Mining Corporation of Canada Limited (Tanco) in the Separation Lake region of northwest Ontario. This report focuses on the lithogeochemistry, geological mapping and structural investigations associated with the 1998 field season. Work was completed in order to provide insight into the potential of buried deposits of mineralized rare-element pegmatites.

N. Wiebe, one of the summer geological assistants, for purposes of an undergraduate thesis at the University of Saskatchewan, carried out comparison structural mapping of two pegmatitic granites. A consultant, Fernando de la Fuente, was brought to the property in the later part of the summer to examine the structural emplacement and controls of the exposed surface pegmatites.

Copies of N. Wiebe's and F. de la Fuente's reports are presented in the appendices.

All supervision and report writing has been carried out by the author of this report.

The expenditures for this program may be viewed in Appendix A (Program Expenditures for 1998 Lithogeochemistry, Geological Mapping and Structural Analysis).

## CLAIM GROUP

The Separation Lake property is under a joint venture agreement between Gossan Resources Limited (Gossan Resources) of Winnipeg, Manitoba and Tantalum Mining Corporation of Canada Limited (Tanco). At present, the property consists of 33 claims totaling 147 claim units (Table 1). All claims are held jointly with Tanco (operators) holding 50.1% and Gossan holding 49.9%.

The addresses and contact names for the holders of the claims are as follows:

Tantalum Mining Corporation of Canada Limited
PO Box 2000
Lac du Bonnet, Manitoba
R0E 1A0

Contact:
Peter Vanstone
Chief Geologist
(204) 884-2400 ext. 226

Gossan Resources Limited
52 Donald Street
Winnipeg, Manitoba
R3C 1L6

Contact:
Jim Campbell
President
(204) 943-1990

## LOCATION AND ACCESS

The property is situated approximately 75 kilometres north of Kenora, Ontario (Figure 1). The 33 claims are mainly situated north of the English River and to the northwest of Separation Lake (Figure 2).

| CLAIM LIST | | | | | | | |
|---|---|---|---|---|---|---|---|
| CLAIM | CLAIM SHEET | | | DATE | DATE | CLAIM | CLAIM |
| NUMBER | NUMBER | NAME | NTS NUMBER | STAKED | RECORDED | HECTRES | UNITS |
| K 1178866 | G-2651 | Treelined Lake | 52-L-8SW | 11-Jan-97 | 13-Jan-97 | 32 | 2 |
| K 1149772 | G-2651 | Treelined Lake | 52-L-8SW | 1-Sep-96 | 11-Sep-96 | 16 | 1 |
| K 1178867 | G-2651 | Treelined Lake | 52-L-8SW | 11-Jan-97 | 13-Jan-97 | 32 | 2 |
| K 1178575 | G-2651 | Treelined Lake | 52-L-8SW | 11-Jan-96 | 17-Jan-96 | 32 | 2 |
| K 1178574 | G-2651 | Treelined Lake | 52-L-8SW | 11-Jan-96 | 17-Jan-96 | 64 | 4 |
| K 1178787 | G-2651 | Treelined Lake | 52-L-8SW | 28-May-96 | 7-Jun-96 | 48 | 3 |
| K 1178730 | G-2634 | Paterson Lake | 52-L-7SE | 2-May-96 | 5-May-96 | 48 | 3 |
| K 1178295 | G-2651 | Treelined Lake | 52-L-8SW | 1-Jun-95 | 5-Jun-95 | 16 | 1 |
| K 1178296 | G-2634 | Paterson Lake | 52-L-7SE | 1-Jun-95 | 5-Jun-95 | 256 | 16 |
| K 1178690 | G-2651 | Treelined Lake | 52-L-8SW | 11-Apr-96 | 15-Apr-96 | 16 | 1 |
| K 1178598 | G-2651 | Treelined Lake | 52-L-8SW | 29-Mar-96 | 10-Apr-96 | 32 | 2 |
| K 1178689 | G-2651 | Treelined Lake | 52-L-8SW | 29-Mar-96 | 10-Apr-96 | 128 | 8 |
| K 1178678 | G-2634 | Paterson Lake | 52-L-7SE | 29-Mar-96 | 10-Apr-96 | 208 | 13 |
| K 1162991 | G-2634 | Paterson Lake | 52-L-7SE | 12-Dec-95 | 14-Dec-95 | 128 | 8 |
| K 1178297 | G-2634 | Paterson Lake | 52-L-7SE | 2-Jun-95 | 5-Jun-95 | 96 | 6 |
| K 1162990 | G-2634 | Paterson Lake | 52-L-7SE | 13-Dec-95 | 14-Dec-95 | 64 | 4 |
| K 1149773 | G-2634 | Paterson Lake | 52-L-7SE | 1-Sep-96 | 11-Sep-96 | 32 | 2 |
| K 1149776 | G-2634 | Paterson Lake | 52-L-7SE | 1-Sep-96 | 11-Sep-96 | 48 | 3 |
| K 1149775 | G-2634 | Paterson Lake | 52-L-7SE | 1-Sep-96 | 11-Sep-96 | 16 | 1 |
| K1162989 | G-2634 | Paterson Lake | 52-L-7SE | 13-Dec-95 | 14-Dec-95 | 96 | 6 |
| K 1178437 | G-2634 | Paterson Lake | 52-L-7SE | 22-Sep-95 | 29-Sep-95 | 192 | 12 |
| K 1149774 | G-2634 | Paterson Lake | 52-L-7SE | 27-Jul-96 | 7-Aug-96 | 96 | 6 |
| K 1220538 | G-2651 | Treelined Lake | 52-L-8SW | 3-Jun-97 | 2-Jul-97 | 48 | 3 |
| K 1220539 | G-2634 | Paterson Lake | 52-L-7SE | 4-Jun-97 | 2-Jul-97 | 48 | 3 |
| K 1220540 | G-2634 | Paterson Lake | 52-L-7SE | 10-Jun-97 | 2-Jul-97 | 48 | 3 |
| K 1220541 | G-2651 | Treelined Lake | 52-L-8SW | 5-Jun-97 | 2-Jul-97 | 64 | 4 |
| K 1220542 | G-2651 | Treelined Lake | 52-L-8SW | 5-Jun-97 | 2-Jul-97 | 48 | 3 |
| K 1220915 | G-2651 | Treelined Lake | 52-L-8SW | 9-Oct-99 | 29-Oct-99 | 16 | 1 |
| K 1220669 | G-2651 | Treelined Lake | 52-L-8SW | 9-Oct-99 | 29-Oct-99 | 160 | 10 |
| K 1133795 | G-2651 | Treelined Lake | 52-L-8SW | 9-Oct-99 | 29-Oct-99 | 32 | 2 |
| K 1166804 | G-2634 | Paterson Lake | 52-L-7SE | 5-Apr-98 | 1-May-98 | 16 | 1 |
| K 1220664 | G-2634 | Paterson Lake | 52-L-7SE | 2-Jul-99 | 16-Jul-99 | 16 | 1 |
| K 1220596 | G-2651 | Treelined Lake | 52-L-8SW | 20-May-98 | 10-Jun-98 | 32 | 2 |
| **Total Claims = 33** | | | | | **Totals** | **2,224** | **139** |

**Table 1: Claim List, Separation Lake Property**

Access to the area is via the English River Road, an all-weather gravel road. The English River Road turn-off is 24 kilometres north of the Trans-Canada Highway along Highway 566 to Reddit, Ontario. The property is dissected by a network of abandoned secondary clay and sand based logging and drill roads. The southern and central portions of the property are accessible by boat via the English River.

The physiography of the area is typical of the PreCambrian shield with most overburden consisting of tills and clay. Much of the area has experienced blow downs and consequently, in these areas, the forest consists of small pines, alders and poplars. Logging as also been carried out in the region. In isolated areas, mature spruce stands exist.

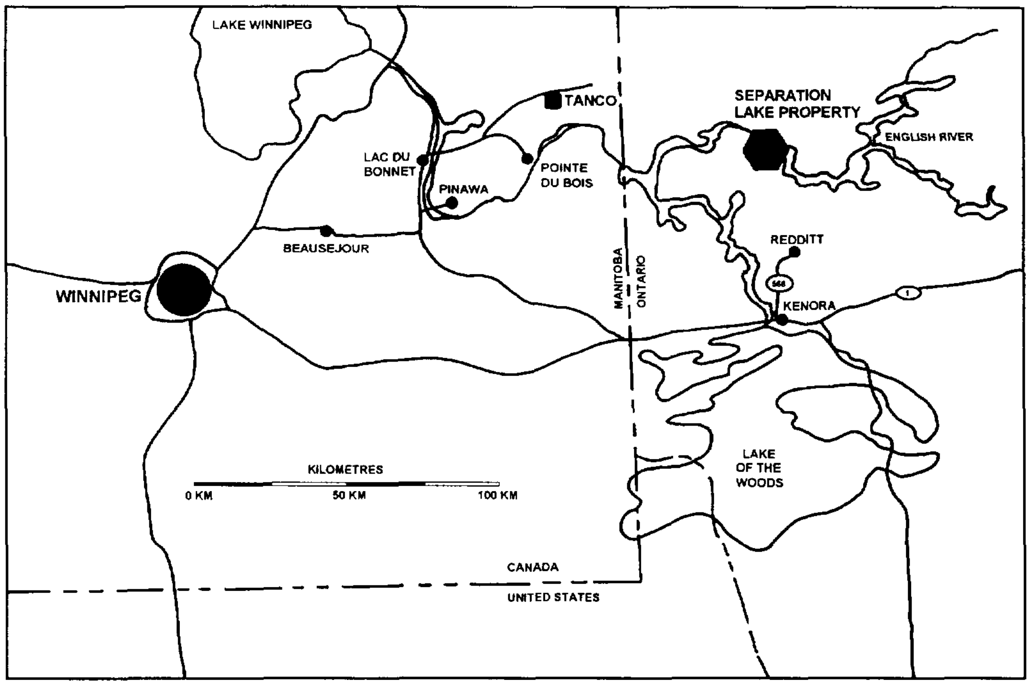


**FIGURE 1: Location Map of the Separation Lake Profect**

## PREVIOUS WORK

The area has a history of base and precious metals exploration with some work for uranium and iron. Since 1993, work by the Ontario government has increased interest in the rare-element pegmatite potential of the area.

Records of mineral exploration in the Umfreville-Separation Lake area date back to the mid-1930's. The first work in the area appears to be around Minaki, where work was conducted on the Minaki Pyrite Prospect on Vermillion Lake. Sporadic work for base metals was conducted near Redditt in 1956, by Stratmatt Limited and south of Patterson Lake in 1963, by the Canadian Nickel Company. Both programs consisted of diamond drilling.

The iron formations in the Separation Lake area were examined for their iron potential. W.S. Moore Company of Duluth conducted trenching and feasibility studies of the property in the period 1948-1955. Tombill Gold Mines and Glen Echo Mines Limited conducted work in 1957.

Results of these studies indicated that the iron mineralization has excellent concentration characteristic, but does not occur in sufficient widths to apply open pit mining methods (Breaks et al, 1975).

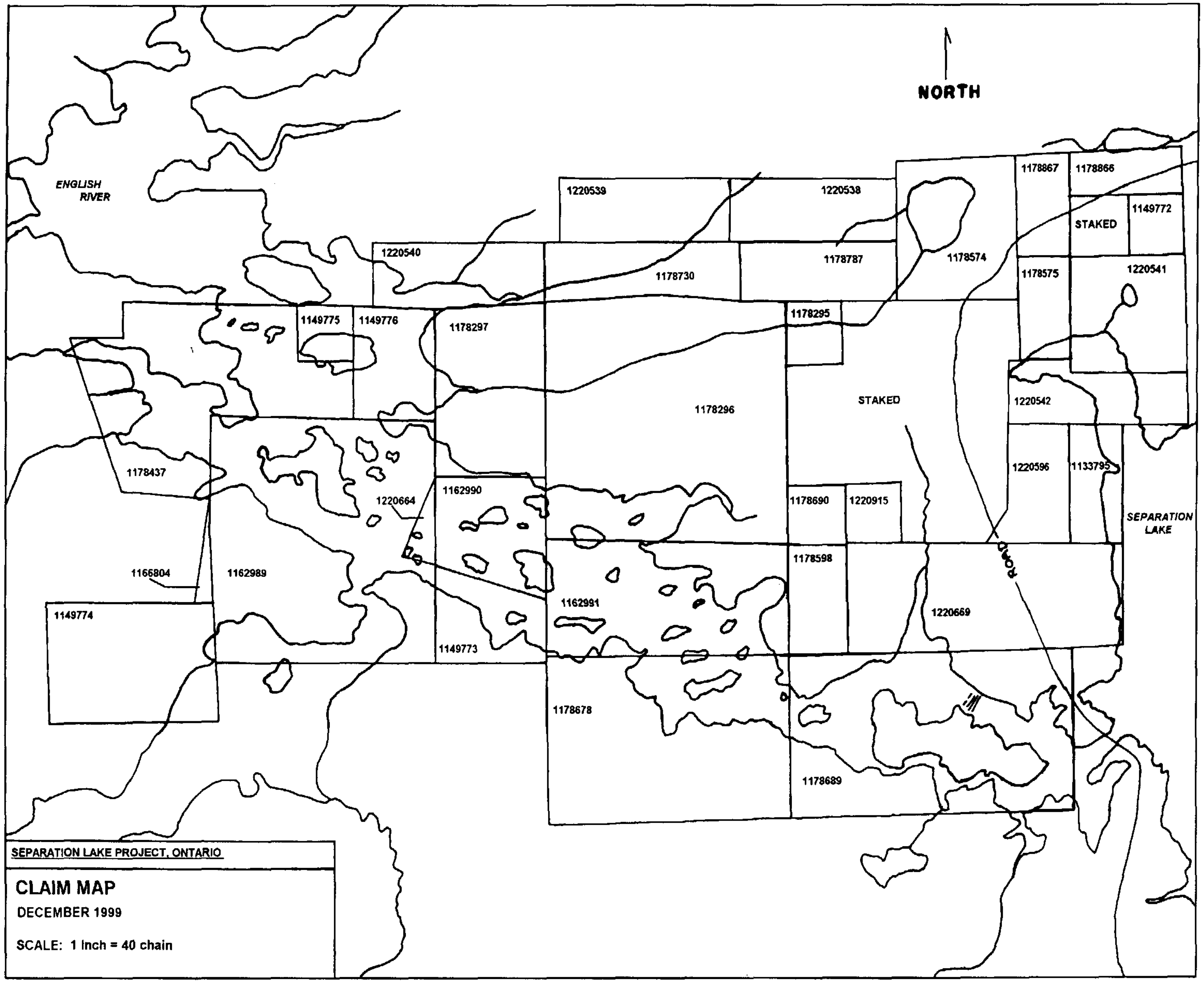


FIGURE 2: Separation Lake Claim Location Map

During the 1960's and into the 1970's, several companies explored in the region for uranium. Much of the work consisting of airborne scintillometer surveys with follow-up ground work. Some of the major work was carried out by Headvue Mines Limited (1967), Bralorne Resources Limited, and Can-Fer Mines Limited (1968-1971). These surveys encountered anomalous, but sporadic uranium mineralization associated with the pegmatites in the area (Breaks, et al, 1975). Selco Mining Corporation, Sherritt Gordon Mines and Champion Bear Resources have conducted extensive exploration work in the area with numerous programs of mapping, sampling, geophysics and drilling. The main focus was on base metals with some work being done on precious metals.

The most recent government geological map covering the region is Open File Map 241 (Blackburn, et al, 1994). The Ontario Geological Survey has recently carried out numerous detailed programs on the pegmatite field in the Separation Lake/English River area. Dr. F.W. Breaks of the Mineral Field Services Section, Ontario Geological Survey, has carried out most of the work. This work has spawned great interest in the Separation Rapids pegmatite field. Several companies and individuals are presently in the process of exploring the rare-element potential of the area. These companies include Champion Bear Resources, Avalon Ventures, Tanco, and Emerald Fields Resources Corporation.

From 1996 to 1998, Tanco completed several programs of geological mapping and lithogeochemical sampling over the entire claim area. The results for 1996 and 1997 have been filed for assessment. The results for the 1998 work are the topic of this report.

During the field seasons of 1998 and 1999, Tanco performed a B-horizon soil geochemistry program over a portion of the property. This work has been filed for assessment.

Tanco, to date, has completed two diamond drill programs in the area. In 1996, seven holes totaling 1872 feet (570.73 metres) were drilled to test the geological character of exposed pegmatites at depth with respect to mineralization, mineralogy and structure. The 1997 diamond drill program was a continuation of the 1996 diamond drill program, with emphasis placed on examining several other surface pegmatite exposures. This program consisted of ten holes totaling 2803 feet (854.35 metres). Both diamond drill reports have been filed for assessment.

## REGIONAL GEOLOGICAL SETTING

The Separation Lake property occurs almost completely in the Separation Lake Greenstone Belt (Blackburn and Young, 1992). It is part of a package of metavolcanic rocks which occur discontinuously along the boundary of the English River and Winnipeg River subprovinces of the Archean Superior Province (Figure 3). The belt constitutes the boundary zone between the high grade, metasedimentary-dominant English River Subprovince to the north and the granite-tonalite-dominant Winnipeg River Subprovince to the south (Breaks 1991; Breaks and Bond 1993; Beakhouse 1991).

It has been suggested that the Separation Lake greenstone belt may represent an extension of the 2.74 Ga Bird River metametavolcanic-metasedimentary belt to the west (Timmins et al, 1985). This belt is known to host other pegmatite fields such as the Greer Lake, Rush Lake and Bernic.

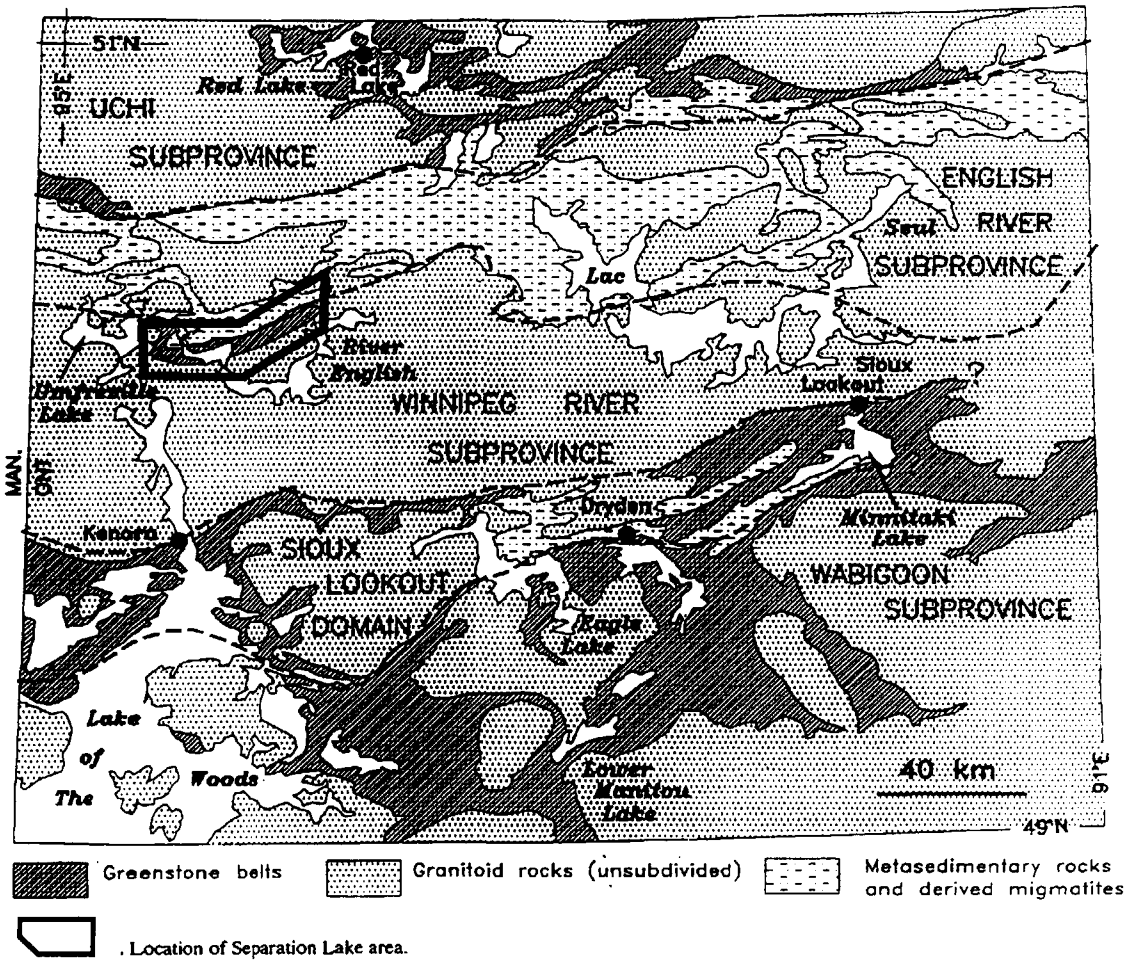


**Figure 3: Geological Location of Separation Lake Area (from Breaks, F.W. and Tindle, A.G., 1997)**

The pegmatite field at Separation Lake is seven kilometres long by three kilometres wide and trends in an east to west direction. It is hosted by supracrustal rocks (Blackburn et al., 1992; Blackburn and Young, 1992). The area is predominantly underlain by mafic metavolcanic units and associated gabbroic units. Felsic metavolcanic and metasedimentary rocks exist to the north of the property and pinch out to the east. Most rock units are strongly deformed and metamorphosed to at least lower amphibolite facies (Blackburn and Young, 1993).

F.W. Breaks (1993) has described the Separation Rapids pegmatite field as divisible into two clusters. These clusters have been divided into the eastern subgroup and the southwestern subgroup. The eastern subgroup has further been divided into three distinct zones, based on mineralogy in surface exposures of pegmatites. These are the interior beryl-columbite zone, cassiterite-beryl-petalite zone, and columbite-cassiterite-beryl zones. Occurrences of petalite, cassiterite and tantalum bearing minerals have been reported. The pegmatites in this area would belong to the complex type, petalite subtype of the rare-element pegmatite class of Cerny (Cerny, 1982).

## PROPERTY GEOLOGY

The Tanco/Gossan claim block lies within the Separation Lake greenstone belt. The areas mapped in the 1998 field program covered essentially the eastern and western margins of the property holdings. Following is a brief overall description of the local geology followed by a description of the encountered rock units. Of the rock units, only units 1, 7, and 8 (mafic metavolcanics, granite, and pegmatitic granite) were encountered in the 1998 field mapping program. A generalized geology map is presented in Figure 4.

### Local Geology

The predominant rock type in the area is a fine to medium grained, medium gray to black, well-foliated mafic metavolcanic, possibly of basaltic composition. This unit comprises most of the central portion of the claim group. Coarse grained, dark coloured gabbro has been mapped in the center of the mafic metavolcanic unit. It appears to indicate a folding pattern. As well, narrow bands of chemical metasedimentry iron formation occur throughout the region. These iron formation units tend to display a highly gossaned appearance.

The mafic metavolcanic unit is bounded to the north and to the south by regional granitoid complexes, both of which contain granitic gneissic and pegmatitic units. Well exposed to the north is the Treelined Lake Granite, which is part of the English River Subprovince. The granitic unit to the south is part of the Winnipeg River Subprovince.

To the north of the property a unit of a felsic composition is exposed. This unit is in fault contact with the Treelined Granite. As well, clastic metasedimentary units are exposed to the northeast of the claim group.

On the western flank of the property, the Separation Rapids Pluton is well exposed. The exposed area of the pluton, is 4 square kilometres. It has been described as a fertile, peraluminous S-type

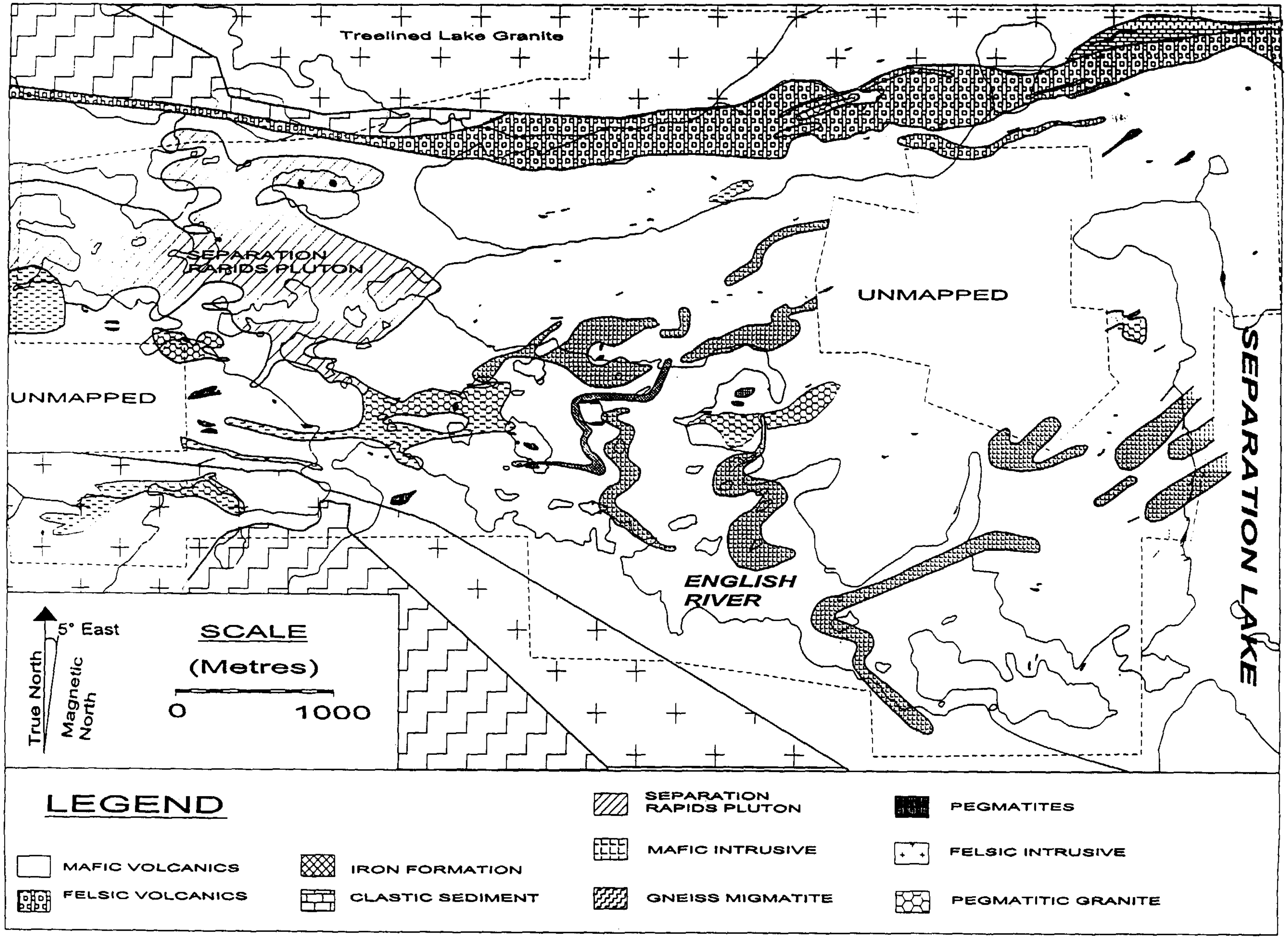


**Figure 4: General Geology of the Separation Lake Property, Ontario**

granite (Breaks, 1993). Within this unit there is widespread layering of pegmatitic leucogranite, sodic aplite, potassic pegmatite and coarse grained granitic units.

Numerous pegmatites are exposed on surface. They vary in size and dimensions, as well as complexity. The preferred orientation tends to be east to west, with many of the pegmatite bodies lying parallel to foliation.

The pegmatite field at Separation Lake is seven kilometres long by three kilometres wide and trends in an east to west direction. It is hosted by supracrustal rocks (Blackburn et al., 1992; Blackburn and Young, 1994). The area is predominantly underlain by mafic metavolcanic units and associated gabbroic units. Felsic metavolcanic and metasedimentary rocks exist to the north of the property and pinch out to the east. Most rock units are strongly deformed and metamorphosed to at least lower amphibolite facies (Blackburn and Young, 1992).

## Description of Rock Units

*Mafic Metavolcanic (Unit 1)*

This unit is the predominant rock type in the area, constituting approximately 80% of the belt. The mafic metavolcanics tend to appear basaltic in composition, but no whole rock analyses have been completed to qualify this statement. In the field, this unit usually appears fine to medium grained, medium gray to black in colour. The unit is exposed in outcrops of low to moderate relief.

Texturally, the unit tends to be locally well foliated which lends to the description of basaltic tuff being applied to field descriptions. Pillowed and massive flows appear as the dominant unit type. Numerous pillowed flows were encountered in the field, but were generally to deformed to determine tops. Where possible, pillow tops appeared to indicate that tops were to the north-northwest.

*Felsic Metavolcanic (Unit 2)*

The felsic metavolcanic unit encountered in the project area is generally tuffaceous. The texture ranges from tuff to lapilli tuff and appears to be rhyolitic in composition. The unit generally is fine to medium grained and gray to green in colour.

The unit is moderately foliated and situated in a broad deformation zone. The deformation has in many places, obliterated the primary textures and structures. Moderate relief is encountered on the southern exposure of the felsic unit. Flat outcrop exposure occurs in the interior of the unit. Many of the flat surfaces have been highly polished by glaciation, making sampling difficult.

The felsic unit encountered in the northern section of the property appears to be pinching out toward the east. The western extent of this unit was not defined. The northern contact of the unit is with the Treelined Lake Granite. This contact appears fault related as the contact runs along a structural lineament, occupied by a creek. Some units described as felsic metavolcanics, may in part be deformed granite.

*Iron Formation (Unit 3)*

The iron formations are chemical metasediments that occur in the mafic volcanic units. They typically are layered, 1 to 5 metres in thickness, with a chert-magnetite composition. The magnetite is locally replaced by pyrrhotite and minor pyrite. These formations occupy two identified stratigraphic levels within the map area. The lower unit is located at, or close to, the base of the mafic metavolcanic sequence. The upper unit appears separated either by mafic flows or gabbros. The iron formation has a very strong magnetic signature and is highly gossaned. The unit can be used as a marker horizon in trying to determine folding and structure. In several locations, the iron formation was observed in close proximity to pegmatites.

*Clastic Metasediments (Unit 4)*

The metasedimentary unit has been stratigraphically identified in two levels. One is within the mafic metavolcanics and is a feldspathic arenite to wacke. The other unit is overlying the felsic metavolcanics and is a polymictic conglomerate. In places, the conglomerate is interbedded with wacke. It was noted in the field, that the conglomerate lies directly on top of the felsic metavolcanics in apparent conformity (Appendix C, de la Fuente, 1998).

*Mafic Intrusive (Unit 5)*

The mafic intrusive units in the area appear to be coarse grained, dark gray to black colored, highly competent gabbro. Commonly, outcrop exposures are of high relief. The coarse grained gabbros may represent thicker sections of flows or subvolcanic sills. The unit outcrop distribution indicates folding.

*Granitic Gneiss (Unit 6)*

Gneissic and migmatitic rocks have been encountered to the extreme north and south in the western portion of the property. Very little attention was given to this unit. Commonly, it was noted as quartz-feldspar-biotite gneiss or granitic gneiss. The unit is typically gray in colour and medium grained.

*Granite (Unit 7)*

The granites within the property area are essentially divided into two units.

The Treelined Lake Granite to the north, is a large, broad, well-exposed felsic intrusive of the English River Subprovince. It appears to be a contact with the felsic metavolcanics to the north of the property by means of a structurally controlled deformation zone. This deformation has imprinted itself onto the felsic metavolcanics.

The granite to the south of the property (and the Separation Lake Belt) is a well-exposed felsic intrusive of the Winnipeg River Subprovince. This unit was dominant in the eastern portion (claim K 1149774) of the 1998 field mapping. The unit generally can be described as a well jointed, white, homogenous granite with a mafic component consisting of biotitic banding. Compositionally it is more probably a tonolitic granite then a true granite.

*Pegmatitic Granite (Unit 8)*

The granite or pluton in the situated in the centre of English River and within the western portion of the property, is the Separation Rapids Pluton. It has an aerial extent of approximately four square kilometres.

The Separation Rapids Pluton has been described as a fertile, peraluminous S-type granite (Breaks, 1993). Within this unit there is widespread layering of pegmatitic leucogranite, sodic aplite, potassic pegmatite and coarse grained granitic units. Even though it was originally described in the literature as a pluton, a portion of it appears to be a layered flat lying sheet of pegmatitic granite (Appendix C, de la Fuente, 1998). This is confirmed by texture and contacts, as well as from Champion Bear's 1989 aeromagnetic data as filed in the Ontario assessment files (L07 SE M-6).

Numerous large pegmatitic granites exist elsewhere on the property. They are characterized by being simple in their mineralogy. Their mineralogy consists of megacrystic blocks of potassic feldar, quartz, aplite units and mica banding. The mica commonly occurs as radiating structures called "birds-foot mica".

The accompanying report by Wiebe (1998) (Appendix B) examines two such pegmatitic granites, the Turtleback Pegmatitic Granite (Cliam K 1162991) and the Cook's Pegmatitic Granite (Claim K 1178296). Their location with are indicated in Figure 5. The report examines their mineralogy, structural orientation and their relationship to each other.

*Pegmatites*

Numerous pegmatite dykes were encountered on the property. To date, several companies and individuals have encountered some 200 plus pegmatites within the Separation Lake Greenstone Belt. Mineralogically, they range from simple potassium feldspar-dominant pegmatites to more complex petalite subtype.

To date, several exposed pegmatites have been tested by diamond drilling programs (Galeschuk 1997, Galeschuk 1998) conducted by Tanco. Detailed examination was initiated this field season. Two detailed pegmatite sketches are presented in Appendix G. Their locations are shown in Figure 5.

## STRUCTURAL MAPPING OF TWO PEGMATITIC GRANITES

The mapping by Wiebe of the Turtleback and Cook's Pegmatitic Granites was conducted over the coarse of the summer and amounted to 14 days of mapping and measurements and 3 days of drafting with accompanying data entry.

The objective of the project was to examine the structural characteristics of the Turtleback and Cook's Pegmatitic Granite and determine if any relationship existed existed between them.

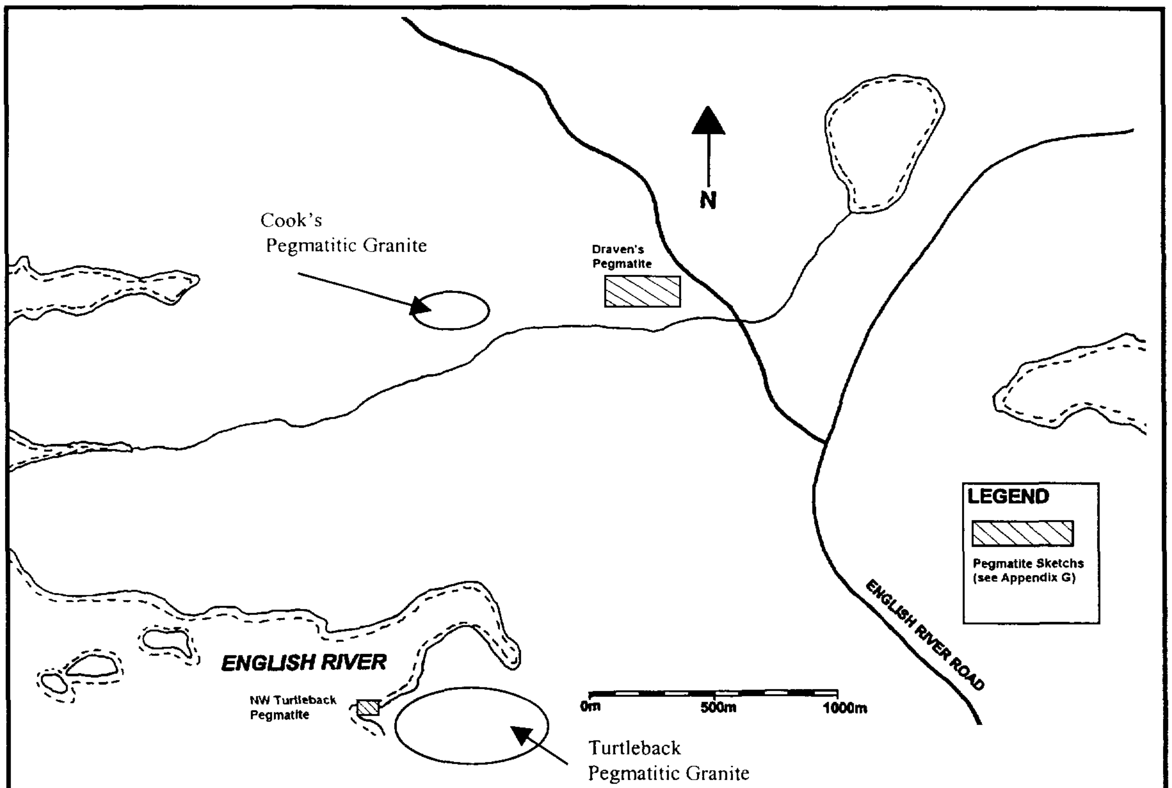


**Figure 5: Location of mapped and sketched pegmatites**

The Cook's Pegmatitic Granite is located on claim K 1178296. The Turtleback Pegmatitic Granite is located on claim K 1162991.

The four textural phases listed below are commonly indicative of pegmatitic granites (Cerny et al, ap81). Theses textures were noted and mapped in the field:

- Pegmatitic leucogranite
- Fine-grained leucogranite
- Sodic aplite
- Pegmatitic potassic phase

A more detailed description may be found in the body of the report in Appendix B.

The work determined that the two pegmatitic granites were similar topographically, texturally, compositionally and structurally. These similarities suggest that the two units were derived from the same parental source.

The main difference between the two units concerned the texture and composition of the feldspars. The Cook's Pegmatitic Granite had a greater proportion of pink potassium feldspar, whereas the Turtleback Pegmatitic Granite was more enriched in white albitic plagioclase feldspar. As well, the Cook's Pegmatitic Granite tended to have an overall coarser grain size.

From Wiebe's work, two distinct deformation events, D1 and D2, were distinguished in the field,. Both events affected the emplacement of the pegmatitic granites.

Deformation event D1 created the S1 foliation. Both pegmatitic granites appear to be emplaced along the structural weakness in the host metavolcanic rocks generated by this deformation event. The emplacement resulted in parallel orientation of the pegmatitic granite and the host rock along the S1 foliation. This association is commonly observed with other pegmatites and pegmatitic granites in the Separation Lake area.

Deformation event D2 created the S2 foliation and transposed the S1 parallel to S2. This represents the present structural state of the studied pegmatitic granites. The D2 event was a compressional event and caused visible isoclinal folds in the pegmatitic granite.

From structural measurements, it was found that even though the Cook's and Turtleback Pegmatitic Granite are separated by over a kilometre, their foliations and jointing were identical. Due to their similarities, it suggests that the same mechanisms are responsible for the creation of both pegmatitic granite units.

**STRUCTURAL ANALYSIS OF THE SEPARATION LAKE PROPERTY**

A structural analysis study of of the Separation Lake property was carried out under contract by Fernando de la Fuente Consultores, S.L. A copy of this report is supplied in Appendix C. The work performed by Tanco personal in conjunction with this study amounted to one day of drafting and four days of field investigations.

In the field, seven pegmatite locations and four pegmatitic granites were examined. As well the Treelined Granite, north of the Separation Lake Property area, was examined to observe its relationship with the Separation Lake Greenstone Belt.

The work performed by de la Fuente determined that the pegmatites in the Separation Lake Project area essentially correspond to two main intrusive phases. It was noted that classification of the pegmatites and pegmatitic granites could be performed in regard to the number of deformation events effecting the units. The classification would be based on pre-D2 deformation phase and post-D2 deformation phase.

It has been suggested that the Treelined Granite is the source granite for the pegmatites and pegmatitic granites that belong to the pre-D2 deformation phase. The Separation Lake Pluton is suggested to be the parent granite of the pegmatites and pegmatitic granites of the post-D2 deformation phase.

De la Fuente (Appendix C) also performed an air-photo structural interpretation. Four orders of lineaments were distinguished.

The first order lineaments are described as long lineaments that effect the other three orders of lineaments. It has been suggested that they correspond to fractures and imply a north-south shortening of the D3 deformation phase (de la Fuente, 1998).

The second order lineaments effect the third and fourth order lineaments. They appear to be distensive fractures formed as a result of release of the north-south compressive stress after the D1 and D2 phase (de la Fuente, 1998).

Third order lineaments are described as short lineaments that did not produce relative movement. De la Fuente suggests that they may correspond to joints.

Fourth order lineaments are described as short lineaments that do not produce realtive movement. They correspond to S1-S2 schistosities, lithological contacts and folds. It was noted, on examination of de la Fuente's report by Tanco exploration personal, that many of the pegmatites encountered in the Separation Lake Project area correspond with the fourth order lineaments. No explanation is offered for this observation, but it does represent a possible exploration tool.

## 1998 LITHOGEOCHEMICAL AND MAPPING FIELD PROGRAM

The 1998 field program portion of lithogeochemical sampling and geological mapping was performed during a five-day period and encompassed 14 man days. Work was performed on claims K 1220596, K 1149774, and K 1178678. Fieldwork consisted of geological mapping at a scale of 1:5000 carried out on hip chained and compassed traverse lines. Lithogeochemical samples were taken every 25 metres where available.

A total of 86 rock samples were collected in the field (Appendix D). All samples were analysed by ITS Bondar-Clegg & Company Limited (Vancouver, BC) for parts per million lithium, cesium, and rubidium. Results are presented in Appendix E.

Tanco personal carried out the fieldwork with the program being supervised by the author of this report.

The data augments Tanco's geochemical data-base from previous surveys. Mapping was completed to determine rock types, which was later used in the statistical analysis of the lithogeochemical results. For a complete map of the anomalies, sample sites, claim lines, geology, and structure, refer to the map sets in the back of the report.

A small amount of time was spent examining a few known pegmatites. Sketches of two pegmatites are available in Appendix G and their location location is shown in Figure 5.

## Lithogeochemical Survey Methods

In the field, samples were taken at 25 metre intervals where available and lithology was noted. Where possible, structural measurements were obtained. Sample sites were marked in the field with flagging tape. At each site, unweathered chip samples were obtained.

The geological premise behind the lithogeochemical survey is based on the relative mobility of the elements and metasomatic aureoles associated with pegmatites. During the emplacement of highly fractionated, rare element pegmatites, exomorphic aureoles consisting of the highly mobile alkali elements and volatile components form in the host rock. Of all the elements within these aureoles, lithium, rubidium and cesium offer the best combination of mobility and target discrimination. The element cesium, although least mobile, is the most discriminatory when trying to differentiate between aureoles generated from simple pegmatites and those of a more complex variety (Vanstone, 1996).

Several problems are associated with this method. One problem is the difficulty in determining a sense of burial depth of the pegmatite with respect to its aureoles. Another problem with this model is that the exomorphic aureoles generated by the pegmatite emplacement envelopes the pegmatite. Consequently, there exists no way to differentiate between hanging and footwall associated aureole. Therefore, a lithogeochemical anomaly could be the hanging wall of a buried pegmatite or a foot wall anomaly of an eroded pegmatite (Vanstone, 1996).

## Analytical Methods

All samples were analyzed for parts per million (ppm) elemental lithium, rubidium and cesium utilizing atomic absorption spectroscopy (AAS) for lithium and instrumental neutron activation analysis (INAA) for the latter two elements. Lower detection limits were 1 ppm for lithium and cesium and 10 ppm for rubidium. The analytical methods for both AAS and INAA are outlined in Appendix F. For the lithium analysis, however, a multi-acid dissolution (HF-$HNO_3$-$HClO_4$-HCL) was used in place of the aqua regia dissolution.

Quality control was maintained by the internal standards employed by the lab. For lithium and cesium, there is good replication of analyses in the low and middle concentration ranges.

## Statistical Analysis

Statistical data for interpretation of the 1998 field samples was done using background and anomaly values determined from 1996 geochemical database. The anomalous threshold values used are in Table 2 (Galeschuk, 1999).

The 1996 anomalous thresholds were determined by first grouping all of the samples (977 in total), at that time, according to their lithology and then these lithology-based data sets were statistically analyzed separately. Each of the lithology based data sets were broken down into three data sets, one for each of the lithium, rubidium and cesium. Each data sets was then statistically analyzed utilizing the PROBPLOT computer program (Stanley, 1987).

In the analysis of a data set, the first step was to construct a histogram from which a cumulative probability plot was generated. Once a cumulative frequency distribution was defined, it was then optimized using the Maximum Likelihood Optimization on Raw Data function, which gave the 'best fit' estimate. The number of populations was then determined from the optimized cumulative probability plot and the plot partitioned. From the partitioning, the value limits for each population were then defined (Sinclair, 1976).

The value limits for each data set are summarised in Table 2 and shows four categories with each category defined by either a maximum value or a minimum value or a value range. The two populations are defined as 'background' and 'anomalous'. The 'possibly anomalous' category is the overlap area between the upper limit of population 1 (background) and the lower limit of population 2 (anomalous). The 'highly anomalous' category includes all values greater than the upper limit of the 'anomalous' category.

| SEPARATION LAKE 1996 LITHOGEOCHEMICAL STATISTICALLY DERIVED ANOMALY THRESHOLDS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROCK TYPE | BACKGROUND | | | POSSIBLY ANOMALOUS | | | ANOMALOUS | | | HIGHLY ANOMALOUS | | |
| | Li | Cs | Rb | Li | Cs | Rb | Li | Cs | Rb | Li | Cs | Rb |
| MAFIC VOLCANIC | <35.6 | <1.7 | <72.2 | 35.6-55.9 | 1.7-5.6 | 72.2-100.9 | 55.9-227.7 | 5.6-39.6 | 100.9-484.6 | >227.7 | >39.6 | >484.6 |
| FELSIC VOLCANIC | <16.6 | <3.0 | <75.8 | 16.6-38.9 | 3.0-5.5 | 75.8-159.7 | 38.9-109.8 | 5.5-21.9 | 159.7-406.5 | >109.8 | >21.9 | >406.5 |
| MAFIC INTRUSIVE | <46.0 | <4.2 | <29.6 | 46.0-54.0 | 4.2-6.4 | 29.6-38.4 | 54.0-334.6 | 6.4-15.1 | 38.4-134.3 | >334.6 | >15.1 | >134.3 |
| FELSIC INTRUSIVE | <27.2 | <6.6 | <302.4 | 27.2-42.3 | 6.6-15.2 | 302.4-485.1 | 42.3-86.1 | 15.2-29.4 | 485.1-1769.4 | >86.1 | >29.4 | >1769.4 |
| PEG. GRANITE | <49.6 | <12.4 | <230.4 | 49.6-116.4 | 12.4-16.2 | 230.4-321.3 | 116.4-380.6 | 16.2-125.7 | 321.3-3392.7 | >380.6 | >125.7 | >3392.7 |

**Table 2:** Separation Lake 1996 Lithogeochemical Anomaly Thresholds
(Threshold values in parts per million (ppm))

## Treatment of Results

The geology and structural measurements for the area are shown on Map 1 and Map 4 (rear pocket). Sample sites with their corresponding assays for lithium, rubidium and cesium are on Map 2 and Map 5 (rear pocket). Maps 3 and 6 (rear pocket) displays symbols for anomalous sample sites for lithium, rubidium and cesium and interpreted anomalous areas (identified as *SLTA-98A* and *SLTA-98B).*

To aid interpretation of the plotted results while, at the same time, taking into account the relative mobility of the three elements, each anomalous sample, single element and/or multi-element in the survey area was ranked according to the sum of the element anomalies for the sample (Table 3). For this ranking, possibly anomalous was assigned a value of 1, anomalous a value of 2, and highly anomalous a value of 3. Additionally, based on the fact that the mobility of lithium > rubidium > cesium, only samples consisting of above background levels of lithium, or lithium and rubidium or lithium and rubidium and cesium were taken into account when identifying anomalous areas which may warrant further work. Clusters of anomalous samples were then identified and labelled.

| Possibly Anomalous | Anomalous | Highly Anomalous | Elements |
|---|---|---|---|
| A1 | A2 | A3 | Li only |
| B1 | B2 | B3 | Li + Rb |
| C1 | C2 | C3 | Li + Rb + Cs |

**Table 3. Separation Lake Project, 1998 lithogeochemical survey – Coding for anomalous samples**

## Description of the Geology and Lithogeochemical Anomalies

Essentially three small claims were covered in the 1998 mapping and lithogeochemical field program. Each claim will be covered separately and the results discussed.

### Claim 1220596

The majority of this claim is situated over mafic metavolcanic rocks an granite (Map 4, rear pocket). The unit is generally described as black, fine-grained, pillow basalt. Pillows ranged in length from 30 to 60 centimetres. No tops were determined.

Pegmatitic granite was encountered in the northwest portion of the claim. It is described as consisting mainly of a leuco-granititic phase with sporadic dykes and pods of pegmatitic material. Occasional aplite zones were encountered. The unit is pink, moderate to coarse grained, and tends to exhibit high relief with respect to the surrounding mafic metavolcanic units. The contact with the mafic metavolcanic unit is irregular.

The lithogeochemical samples from the metavolcanic unit are within background range. Several anomalous samples are associated with the pegmatitic granite (Map 6, rear pocket). Overall the unit is possibly anomalous in lithium, rubidium and cesium. No anomalous zone is defined here due to lack of coverage and information.

Structurally, it appears as a fold axis may cut through the claim area. It was observed that the foliation dip angles change direction (Map 4, rear pocket). Such an axis would correspond with the 1994 mapping of Blackburn.

### Claim 1149774

This claim is situated over mainly outcrops of granite and pegmatitic granite (Map 1, rear pocket). To the north of the claim, mafic metavolcanic units were encountered.

From the field notes, the granite is generally described as gray to white in color, biotite rich, moderate to well foliated, and displaying good joint development. The joints tend to be exhibited in the form of ridges. Within the granitic units, bands and pods of aplite and pegmatitic granite are commonly observed. The granite units represented here are part of the granitoid component of the Winnipeg River Sub-province.

The pegmatitic granite is described as a pink colored, coarse grained, homogenous unit. Mineralogy consisted of potassium feldspar, quartz with minor biotite and albite. Textures ranged from pegmatitic to graphic with finer aplitic sections.

Mafic units encountered in the north section of the claim, were pillow metavolcanics, apparently of basaltic composition. A high amount of deformation observed in these units suggests the presence of some large structural feature. This deformation may be, in part, related to the adjacent granites.

The lithogeochemical study shows that the granite is anomalous with respect to lithium. This may be explained by the concept that this area of the granite may natural be enriched in lithium. The pegmatitic granite and the mafic metavolcanic units do not display any obvious geochemical anomalous trends.

An anomalous area, *SLTA-98A*, is defined on this claim block (Map 3, rear pocket). It trends at approximately 45° and is 500 metres long and 75 metres long. The extent of this defined area is questionable due to sampling and mapping distribution. *SLTA-98A,* is hosted in granite, at the contact of the pegmatitic granite. The area is anomalous with respect to its lithium and rubidium levels. It is possible that the anomaly exists due to fluid enrichment derived from the nearby pegmatitic granite.

**Claim 1178678**

The area mapped in this claim consisted with the northern half of the claim situated over mafic metavolcanic outcrops and the southern portion of the claim situated over granites (Map 1, rear pocket). Nestled between the two units in a localized small wedge of pegmatitic granite. This unit may represent a pegmatitic phase of the neighboring granite.

The description of the a units is identical to those mentioned above. It would still appear that this portion of the granite has an elevated lithium content with respect to what has been calculated background for granites elsewhere on the Separation Lake Project.

An anomalous area, *SLTA-98B*, is defined on this claim block. It trends east to west and is approximately one kilometre long and 150 metres wide (Map 3, rear pocket). The actual extent however, is questionable due to the extent of the field survey. The anomalous area extends over the contact of the granite and mafic metavolcanic. The anomaly is defined as being possibly anomalous to anomalous with respect to the geochemical concentrations of lithium, rubidium and cesium.

## Discussion and Recommendations of the Lithogeochemical Anomalies

***SLTA-98A***

The *SLTA-98A* anomaly appears to be associated, at least in part, to the nearby presence of the pegmatitic granite and represents a low priority target. It is recommended that a day of field investigation be completed to examine the relationship of the pegmatitic granite and the anomaly. The priority of this target may change with increased activity in the area.

***SLTA-98B***

*SLTA-98B* is a target of low to moderate interest. It is anomalous in all three pathfinder elements. The anomalous zone is not only confined to the granite, but extends into the mafic metavolcanic units that are a more preferred host for rare-element pegmatites. The drawback of SLTA-*98B* is that it is situated on the south side of English River and has poor access.

It is recommended an 8000 metre mapping and lithogeochemical sampling program be carried out on the southern portion of claim K 1178678. This work would better define the existence of any anomaly and dictate the future of the area in question. Due to the low distribution of outcrop it is suggested that the sampling density will be low and samples would probably total in the range of 100 lithogeochemical samples. All work would be accomplished by hip chain and compass, with no grid being cut.

**Costs of Recommendations**

| | | |
|---|---|---|
| *SLTA-98A* Area | 2 mandays of field investigations | $ 500.00 |
| | 10 samples @ $45.50 (Ta, Sn, Li, Cs) | $ 455.00 |
| | 10 samples @ $20.75 (Li, Rb, Cs) | $ 208.00 |
| | Room/Board @ $90.00 (2 days) | $ 180.00 |
| | Transportation @ $50.00 a day | $ 100.00 |
| | Report and drafting (3 days @ $250.00) | $ 750.00 |
| | *SLTA-98A* Total: | $ 2193.00 |
| *SLTA-98B* Area | 10 mandays of field work | $ 5000.00 |
| | 10 samples @ $12.50 (Ta, Sn, Li, Cs) | $ 455.00 |
| | 100 samples @ $20.75 (Li, Rb, Cs) | $ 2075.00 |
| | Room/Board @ $90.00 (10 days) | $ 900.00 |
| | Transportation @ $50.00 a day | $ 500.00 |
| | Report and drafting (5 days @ $250.00) | $ 1250.00 |
| | *SLTA-98B* Total: | $ 10180.00 |

**Respectively submitted,**

**Carey R. Galeschuk, B.Sc., P. Geo.**
**Project Geologist**
**Tantalum Mining Corporation of Canada**
**March 21st, 2000**

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# Appendix A:

# Program Expenditures for 1998 Lithogeochemical, Geological Mapping and Structural Analysis

# 1998 FIELD EXPENDITURES FOR SEPARATION LAKE PROJECT AREA

## 1998 Lithogeochemical Field Work

| WORK PERFORMED AND PERSONS RESPONSIBLE | Units | Unit Cost | Totals |
|---|---|---|---|
| **1998 Field Preparation:** | | | |
| C. Galeschuk | 1 days | $ 209.00 | $ 209.00 |
| **1998 Lithogeochemical Field Work:** | | | |
| C. Galeschuk | 2 days | $ 210.00 | $ 420.00 |
| R. Kelly | 5 days | $ 135.00 | $ 675.00 |
| N. Weibe | 2 days | $ 113.00 | $ 226.00 |
| K. Wittmier | 5 days | $ 106.00 | $ 530.00 |
| **1998 Data Entrty:** | | | |
| C. Galeschuk | 2 days | $ 210.00 | $ 420.00 |
| N. Weibe | 1 days | $ 113.00 | $ 113.00 |
| K. Wittmier | 1 days | $ 106.00 | $ 106.00 |
| **Drafting:** | | | $ - |
| C. Galeschuk | 2 days | $ 210.00 | $ 420.00 |
| **SUB-TOTAL (LABOUR)** | **21 man days** | | **$ 3,119.00** |

| EXPLORATION COSTS | Units | Unit Cost | Totals |
|---|---|---|---|
| Transportation: Note: 90 km is from Reddit to property return | 90 km @ 5 days | 0.3 per km | $ 135.00 |
| Accommodation: Hideaway Cabins, Reddit, Ontario | 1 week | $ 825.00 | $ 825.00 |
| Food: | | | $ 300.00 |
| Assays: Activation Laboratories, Ancaster, Ontario | 86 assays | $ 22.50 | $ 1,935.00 |
| Shipping: | | | $ 125.00 |
| **SUB-TOTAL (COSTS)** | | | **$ 3,320.00** |
| **1998 LITHOGEOCHEMICAL SURVEY GRAND TOTAL** | | | **$ 6,439.00** |

## Field Work for the Report on Structural Mapping of Two Pegmatitic Granites

| WORK PERFORMED AND PERSONS RESPONSIBLE | Units | Unit Cost | Totals |
|---|---|---|---|
| **1998 Lithogeochemical Field Work:** | | | |
| N. Weibe | 14 days | $ 113.00 | $ 1,582.00 |
| C. Galeschuk | 3 days | $ 210.00 | $ 630.00 |
| R. Kelly | 3 days | $ 135.00 | $ 405.00 |
| K. Wittmier | 8 days | $ 106.00 | $ 848.00 |
| **1998 Data Entrty and Drafting** | | | |
| N. Weibe | 3 days | $ 113.00 | $ 339.00 |
| **SUB-TOTAL (LABOUR)** | **31 man days** | | **$ 3,804.00** |

| EXPLORATION COSTS | Units | Unit Cost | Totals |
|---|---|---|---|
| NOTE: All costs have been absorbed by prevoius survey work. | | | 0 |
| **SUB-TOTAL (COSTS)** | | | **$ -** |
| **FIELD WORK GRAND TOTAL** | | | **$ 3,804.00** |

## Structural Analysis - Fernando de la Fuente Consultores

| WORK PERFORMED AND PERSONS RESPONSIBLE | Units | Unit Cost | Totals |
|---|---|---|---|
| **Field Work - Tanco Personal** | | | |
| C. Galeschuk | 4 days | $ 210.00 | $ 840.00 |
| **1998 Data Entrty and Drafting** | | | |
| K. Wittmier | 1 days | $ 106.00 | $ 106.00 |
| **SUB-TOTAL (LABOUR)** | **5 man days** | | **$ 946.00** |

| EXPLORATION COSTS | Units | Unit Cost | Totals |
|---|---|---|---|
| NOTE: All costs have been absorbed by prevoius survey work | | | 0 |
| **SUB-TOTAL (COSTS)** | | | **$ -** |

| | | |
|---|---|---|
| **Consultant Costs and Report** | **US** | **$ 15,143.95** |
| - see attached bill | | |
| | **CAN (1.53)** | **$ 23,170.24** |
| | as of invoice date | |

**STRUCTURAL ANALYSIS GRAND TOTAL** **$24,116.24**

## Report Writing and Compilation

| 2000 Office Work - C. Galeschuk | Units | Unit Cost | Totals |
|---|---|---|---|
| Report Writing | 8 days | $ 222.00 | $ 1,776.00 |
| Data Entry | 1 days | $ 222.00 | $ 222.00 |
| Drafting | 4 days | $ 222.00 | $ 888.00 |
| **SUB-TOTAL (LABOUR)** | **13 man days** | | **$ 2,886.00** |

| EXPLORATION COSTS | Units | Unit Cost | Totals |
|---|---|---|---|
| Photocopy Charges | 1 job | $319.07 | $319.07 |
| **SUB-TOTAL (COSTS)** | | | **$ 319.07** |
| **REPORT WRITING AND COMPILATION** | | | **$ 3,205.07** |

Appenix A: Program Expenditures for 1998 Lithogeochemistry, Geological Mapping and Structural Analysis

DESDE: F.de la Fuente Consultores N° TELEFONO: +34 58 256 010 28 SEP. 1998 04:33PM P2

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• -09- 2 8 1998 •
TANCO


FERNANDO DE LA FUENTE CONSULTORES, S.L.
Camino de Ronda, 74, 5° - 3
18004 GRANADA
SPAIN

Tel: +34-958-25 72 14
Fax: +34-958-25 60 10


(for work performed Aug 15 – Sept 15/98)

TANTALUM MINING CORPORATION OF CANADA LIMITED
Att: Mr Peter Vanstone
P.O. Box 2000
LAC DU BONNET
MB R0E 1A0
CANADA

| N° FACTURA: | FECHA: | CODIGO: |
|---|---|---|
| SL-1 | 28/09/98 | 01/10/98 |

| N° | CONCEPT | CURRENCY | UNIT COST | TOTAL US $ |
|---|---|---|---|---|
| 17 | Days F. de la Fuente | US$ | 600 | 10,200 |
| 3 | Drafting Services | US$ | 150 | 450 |
| 1 | Air ticket Málaga-Winnpeg-Málaga | US$ | 4,253 | 4,253 |
| | Hotel Winnipeg | US$ | 79.75 | 79.75 |
| | Other travel expenses | US$ | | 161.27 |
| | | | | 0 |
| | | | | 0 |
| | | TOTAL | | 15,143.95 |
| | | VAT 0% | | 0.00 |
| | | TOTAL INVOICE | | 15,143.95 |

PAYMENT: Direct transfer to the following account:

Fernando de la Fuente Chacón
Account nº: 0500.210.187631
BANCO NACIONAL ULTRAMARINO
Rua Conde de Boavista, 20
7800 BEJA
PORTUGAL

# GRAND TOTALS SUBMITTED FOR ASSESSMENT

**1998 Lithogeochemical Field Work**

| | |
|---|---|
| 1998 LITHOGEOCHEMICAL SURVEY GRAND TOTAL | $ 6,439.00 |

**Field Work for the Report on Structural Mapping of Two Pegmatitic Granites**

| | |
|---|---|
| FIELD WORK GRAND TOTAL | $ 3,804.00 |

**Structural Analysis - Fernando de la Fuente Consultores**

| | |
|---|---|
| STRUCTURAL ANALYSIS GRAND TOTAL | $ 24,116.24 |

**Report Writing and Compilation**

| | |
|---|---|
| REPORT WRITING AND COMPILATION | $ 3,205.07 |

| | |
|---|---|
| GRAND TOTAL SUBMITTED | $ 37,564.31 |

**Submitted by :**

**Carey R. Galeschuk, B.Sc., P. Geo.**

PROVINCE OF MANITOBA C.R. GALESCHUK REGISTERED PROFESSIONAL GEOSCIENTIST 3/20/00

**March 20th, 2000**
**Project Geologist**
**Tantalum Mining Corporation of Canada**

# CLAIM DISTRIBUTION ALLOCATION PER PROGRAM

## 1998 Lithogeochemical Field Work and Report Writing

These two program aspects are combined for purposes of claim distribution of monies spent. Distribution will be based on total samples taken as follows:

| CLAIM | No. of Samples | % Distributed | Distributed Costs Per Claim |
|---|---|---|---|
| K 1149774 | 47 | 55 % | $5,270.60 |
| K 1178689 | 20 | 23 % | $2,242.81 |
| K 1220596 | 19 | 22 % | $2,130.67 |

Total Sample 86
Total Costs $ 9,644.07 $9,644.07

## Field Work for the Report on Structural Mapping of Two Pegmatitic Granites

Work divided equally betwwen K 1162991 and K 1178296:

| CLAIM | Distributed Costs Per Claim |
|---|---|
| K 1178296 | $ 1,902.00 |
| K 1162991 | $ 1,902.00 |

**Structural Analysis - Fernando de la Fuente Consultores**
**Claim Distribution for the Program**

| CLAIM NUMBER | CLAIM HECTRES | Calculated % | % Amounts | Dollar Amounts |
|---|---|---|---|---|
| K 1178866 | 32 | 0.016 | 1.44% | $386 |
| K 1149772 | 16 | 0.008 | 0.72% | $193 |
| K 1178867 | 32 | 0.016 | 1.44% | $386 |
| K 1178575 | 32 | 0.016 | 1.44% | $386 |
| K 1178574 | 64 | 0.032 | 2.88% | $772 |
| K 1178787 | 48 | 0.024 | 2.16% | $579 |
| K 1178730 | 48 | 0.024 | 2.16% | $579 |
| K 1178295 | 16 | 0.008 | 0.72% | $193 |
| K 1178296 | 256 | 0.128 | 11.51% | $3,087 |
| K 1178690 | 16 | 0.008 | 0.72% | $193 |
| K 1178598 | 32 | 0.016 | 1.44% | $386 |
| K 1178689 | 128 | 0.064 | 5.76% | $1,543 |
| K 1178678 | 208 | 0.104 | 9.35% | $2,508 |
| K 1162991 | 128 | 0.064 | 5.76% | $1,543 |
| K 1178297 | 96 | 0.048 | 4.32% | $1,158 |
| K 1162990 | 64 | 0.032 | 2.88% | $772 |
| K 1149773 | 32 | 0.016 | 1.44% | $386 |
| K 1149776 | 48 | 0.024 | 2.16% | $579 |
| K 1149775 | 16 | 0.008 | 0.72% | $193 |
| K1162989 | 96 | 0.048 | 4.32% | $1,158 |
| K 1178437 | 192 | 0.096 | 8.63% | $2,315 |
| K 1149774 | 96 | 0.048 | 4.32% | $1,158 |
| K 1220538 | 48 | 0.024 | 2.16% | $579 |
| K 1220539 | 48 | 0.024 | 2.16% | $579 |
| K 1220540 | 48 | 0.024 | 2.16% | $579 |
| K 1220541 | 64 | 0.032 | 2.88% | $772 |
| K 1220542 | 48 | 0.024 | 2.16% | $579 |
| K 1166804 | 16 | 0.008 | 0.72% | $193 |
| K 1220596 | 32 | 0.016 | 1.44% | $386 |

**Total Hectres** **2000**
**Costs** **$ 24,116.24**

Note: Costs were disributed evenly to all claims active at time of report
as the structural analysis covered the entire project area

## TOTAL COST DISTRIBUTION PER CLAIM

| Claim Number | Stuctural Analysis | Other Programs | Total Costs |
|---|---|---|---|
| K 1178866 | $386 | $0 | $386 |
| K 1149772 | $193 | $0 | $193 |
| K 1178867 | $386 | $0 | $386 |
| K 1178575 | $386 | $0 | $386 |
| K 1178574 | $772 | $0 | $772 |
| K 1178787 | $579 | $0 | $579 |
| K 1178730 | $579 | $0 | $579 |
| K 1178295 | $193 | $0 | $193 |
| K 1178296 | $3,087 | $1,902 | $4,989 |
| K 1178690 | $193 | $0 | $193 |
| K 1178598 | $386 | $0 | $386 |
| K 1178689 | $1,543 | $2,243 | $3,786 |
| K 1178678 | $2,508 | $0 | $2,508 |
| K 1162991 | $1,543 | $1,902 | $3,445 |
| K 1178297 | $1,158 | $0 | $1,158 |
| K 1162990 | $772 | $0 | $772 |
| K 1149773 | $386 | $0 | $386 |
| K 1149776 | $579 | $0 | $579 |
| K 1149775 | $193 | $0 | $193 |
| K1162989 | $1,158 | $0 | $1,158 |
| K 1178437 | $2,315 | $0 | $2,315 |
| K 1149774 | $1,158 | $5,271 | $6,428 |
| K 1220538 | $579 | $0 | $579 |
| K 1220539 | $579 | $0 | $579 |
| K 1220540 | $579 | $0 | $579 |
| K 1220541 | $772 | $0 | $772 |
| K 1220542 | $579 | $0 | $579 |
| K 1166804 | $193 | $0 | $193 |
| K 1220596 | $386 | $2,131 | $2,517 |
| **Grand Totals** | **$24,116.24** | **$13,448.08** | **$37,564** |

# Appendix B:

# Structural Mapping of Two Pegmatitic Granites
# N. Wiebe

# STRUCTURAL MAPPING OF TWO PEGMATITIC GRANITES IN THE SEPARATION LAKE GREENSTONE BELT

## *- Implications for Rare Metal Pegmatite Exploration -*

Separation Lake Greenstone Belt, Superior Province, Ontario, Canada

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Geol. 492. 6 Special Research Topics: Undergraduate Thesis
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Submitted: April 1999

## ABSTRACT

The Separation Lake Greenstone Belt of the Superior Province of northwestern Ontario is an exploration target for rare-element pegmatite deposits. One of the keys to delineation of rare-element pegmatite deposits is understanding their parental sources, pegmatitic granites. Two such pegmatitic granites were studied within the Separation Lake Greenstone Belt, the Turtleback pegmatitic granite and Cook's pegmatitic granite. Although separated by over a kilometer in a north-south direction, these potential sources of highly fractionated rare-element pegmatites are similar with respect to: areal extent, topographic relief, texture, mineralogy, and structure.

Both pegmatitic granites crop out along a west-southwest to east-northeast trend for approximately 280 m east to west and between 100 and 150 m north to south. The Turtleback and Cook's pegmatitic granites both exhibit positive topographic relief in the form of "humps" and ridges of pegmatitic granite outcrop. Four textural phases are recognizable in both outcrops: **1.** pegmatitic leucogranite, **2.** fine-grained leucogranite, **3.** sodic aplite, and **4.** pegmatitic potassic phase. These textural phases have consistent mineralogy regardless of in which outcrop they occur.

The Turtleback and Cook's pegmatitic granites, as well as the rocks between these two outcrops, also share many common structural features. S2 foliation was developed during D2 deformation. This strong foliation transposed earlier S1 foliation parallel to itself having similar strikes of: 072° in the Turtleback pegmatitic granite and 069° in Cook's pegmatitic granite. Foliation has steep to subvertical dip in both the pegmatitic granites mapped as well as in the rocks between these two outcrops. Both pegmatitic granites are isoclinally folded with attenuated limbs and minor folding visible in fold noses. Two late stage joint sets are present within each of the two pegmatitic granites. These joint sets both dip subvertically and set one strikes between 159° and 166°. The strike of joint set two ranges from 070° to 079°. It is notable that joint set two is parallel to foliation.

## ACKNOWLEDGEMENTS

I would like to thank the many people who encouraged and assisted me throughout the preparation of this undergraduate thesis. First of all, thank you to the TANCO field crew from the summer of 1997. Carey Galeschuk, Ryan Kelly and Krista Wittmier are appreciated for their knowledge, experience, assistance, and humor. Peter Vanstone of TANCO also offered valuable guidance with my thesis.

My advisor, Dr. Mel Stauffer of the University of Saskatchewan, has been a great help with ready information and resources. I would also like to acknowledge the generous assistance offered to me by the technical staff at the University of Saskatchewan, in particular Tom Bonli and Blain Novekovski.

Finally, I would like to thank my fiancé Doug Goda for his support, encouragement, and expertise with the presentation aspects of my thesis. Thank you also to my parents, Clifford and Maxine Wiebe, for bringing me this far and putting up with my endless ramblings about rocks.

TABLE OF CONTENTS PAGE

| LIST OF FIGURES | | PAGE |
|---|---|---|

## LIST OF ABBREVIATIONS USED

| | |
|---|---|
| Albite | Ab |
| Cook's pegmatitic granite | CPG |
| Energy Dispersive Spectrometry | EDS |
| English River Subprovince | ERS |
| Foliation | Fol'n |
| Garnet | Gt |
| Muscovite | Musc |
| Pegmatitic | Peg. |
| Plagioclase Feldspar | Plag |
| Potassium Feldspar | K-feldspar |
| Quartz | Qtz |
| Scanning Electron Microprobe | SEM |
| Separation Lake Greenstone Belt | SLGB |
| Separation Rapids Pluton | SRP |
| Turtleback pegmatitic granite | TPG |
| Winnipeg River Subprovince | WRS |

# 1. INTRODUCTION

The Separation Lake Greenstone Belt (SLGB), a greenschist to amphibolite grade metavolcanic belt (personal communication from Dr. Y. Pan, Department of Geology, University of Saskatchewan), is located in the Superior Province of Ontario, sandwiched between the high-grade metasediment-dominated English River Subprovince to the North and the granite-tonalite dominated Winnipeg River Subprovince to the south (Fig. 1, Fig. 2, and Fig. 3). This greenstone belt is of economic interest because it contains Ontario's highest concentration or rare-element class, complex type, petalite-subtype pegmatites. This category of pegmatites is the most desirable target for economic tantalum, cesium, rubidium, and ceramic grade petalite mineralization (Breaks and Tindle, 1997). Another reason for economic interest in the SLGB is the relationships this area has with the TANCO rare-element pegmatite deposit in Manitoba. The SLGB is considered to be a narrow eastward extension of the Bird River metasedimentary and metavolcanic belt (Fig. 2). As the Bird River Belt widens westward into Manitoba (Fig. 2), it hosts the world class TANCO deposit of the Bernic Lake Mine near Lac Du Bonnet Manitoba. Another link between the SLGB and the TANCO deposit is that pegmatites in the Separation Rapids Pegmatite group are regarded as the easternmost extent of the Cat-Lake Winnipeg River pegmatite field. Classification within the same pegmatite field as the TANCO pegmatite suggests that this regional population of pegmatites shares a common formation depth range (in this case intermediate depth between 3.5 km and 7 km), common geological and structural environment, common age and common igneous source (Cerny, 1982). The igneous source for Cook's pegmatitic granite (CPG) and the Turtleback pegmatitic granite (TPG) is believed to be partial melt derived from the Treelined Lake granite which is located to the north of these pegmatitic granites. The Treelined Lake granite fractionated (accumulated rare metals, and volatiles such as; fluorine, $H_20$, boron, chlorine and phosphorus in low-viscosity residual melt as parental melt gradually crystallized) to produce the Separation Rapids pluton (Fig. 3). The Separation Rapids pluton, a fertile granite, then evolved compositionally and texturally to form pegmatitic granites such as the TPG and CPG (Breaks and Tindle, 1997). Pegmatite fields may exhibit extremely different degrees of fractionation due to the level of emplacement of the erosion level (Cerny, 1989) (Fig. 4).

Tantalum Mining Corporation of Canada Ltd. (TANCO) is currently exploring for rare-element pegmatites in the Separation Lake Greenstone Belt (SLGB) of northwestern Ontario. Rare-element pegmatites such as the TANCO rare-element pegmatite deposit of southeastern Manitoba are valued for their tantalum, spodumene, pollucite, and lepidolite mineralization. Tantalum is a rare metal used for capacitors in the electronics industry and for surgical pins, skull plates, and internal joint replacements in the medical industry. Spodumene is a pyroxene group mineral used in glass and ceramics. Pollucite is a cesium rich mineral currently being used to produce cesium formate, an experimental drilling fluid for the petroleum industry. Lepidolite, a lithian muscovite, is valued for it's high Rb and Li content. Rb and Cs have similar properties and uses, and lithium carbonate can be used used in the medical treatment of manic depression.

During summer employment with TANCO, I constructed 1:500 scale maps of two pegmatitic granites within the Separation Rapids Pegmatite Group and gathered structural data at these two locations. The Turtleback pegmatitic granite (TPG) is located on a peninsula jutting into the English River approximately one kilometer south of Cook's pegmatitic granite (CPG) (Fig. 3). These pegmatitic granites are important because they may be potential sources for rare-element pegmatite deposits. Economic rare-element pegmatites may crystallize from fractionated residual melts derived from these pegmatitic granites.

Although geographically separated by over a kilometer, the TPG and CPG are topographically, texturally, compositionally and structurally similar. The purpose of this thesis is to describe the structural characteristics of these two pegmatitic granites and to determine the similarities, and differences between them. The importance of this research is that description of parental fertile granites and their derivatives (moderately fractionated pegmatitic granites) will lead to better understanding of these lithologies as potential sources for highly fractionated, economic rare-element pegmatites. An understanding of parental granites and pegmatitic granites, will lead ultimately to better delineation of pegmatite rare-element deposits.


**Fig. 1** *Map of Canada showing location of Separation Lake Greenstone Belt.*

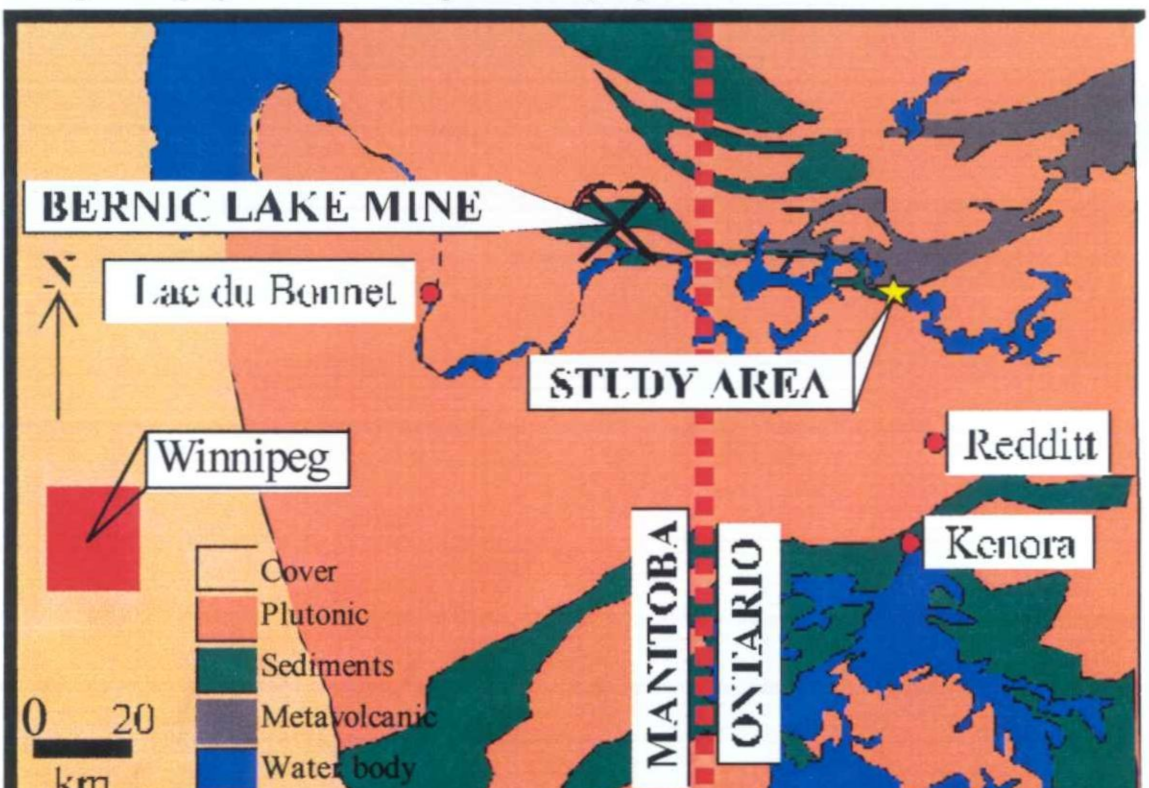



**Fig. 2** *Regional map of geology showing location of the study area and Bernic Lake Mine. Note that both the study area and Bernic Lake Mine are located in a continuous greenstone belt; the Bird River Belt. The Separation Lake Greenstone Belt, the location of the study area, is considered to be a narrow, eastward extension of the Bird River Belt.*

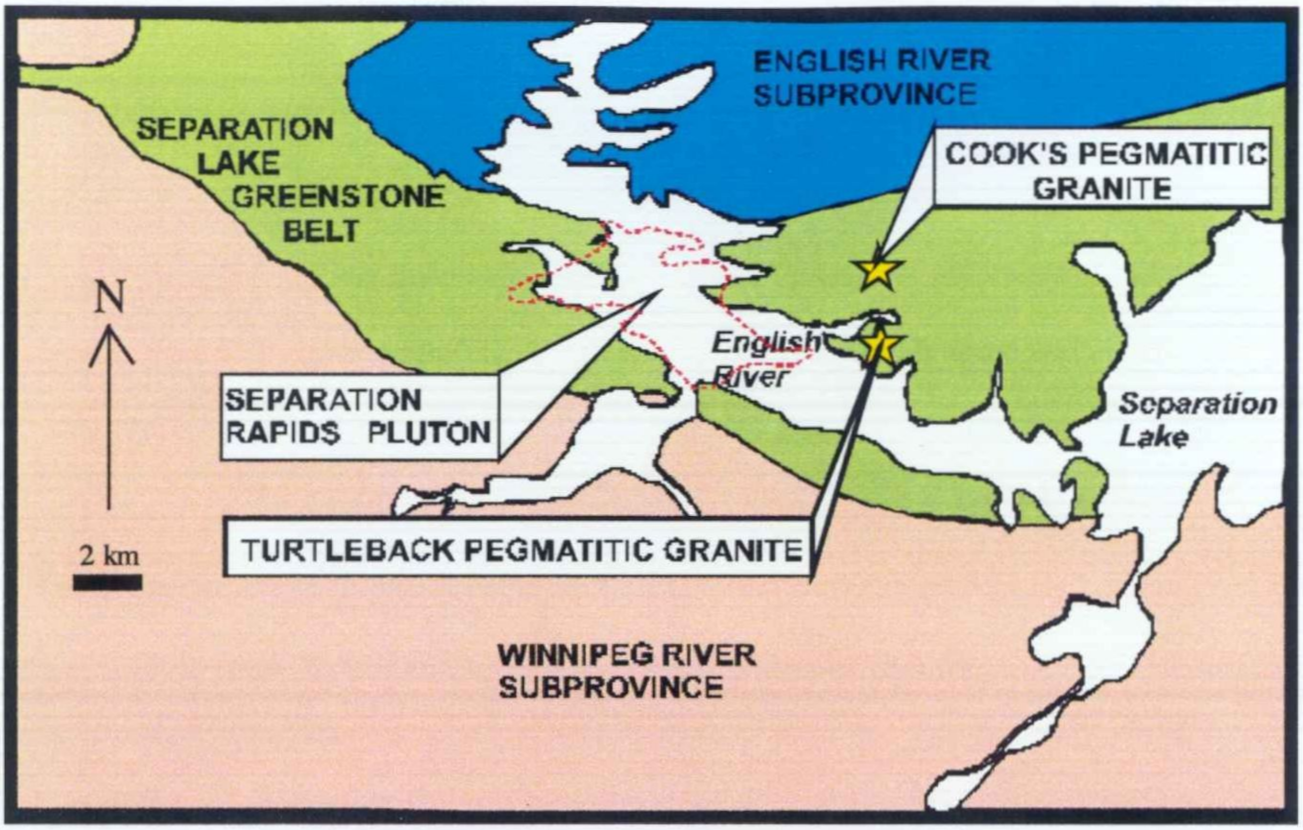



**Fig. 3** *Map showing location of Cook's pegmatitic granite and the Turtleback pegmatitic granite within the Separation Lake Greenstone Belt. This map also shows the bounding geological subprovinces; the Winnipeg River Subprovince to the south and the English River Subprovince to the north as well as the extents of the Separation Rapids Pluton with respect to the pegmatitic granites mapped.*

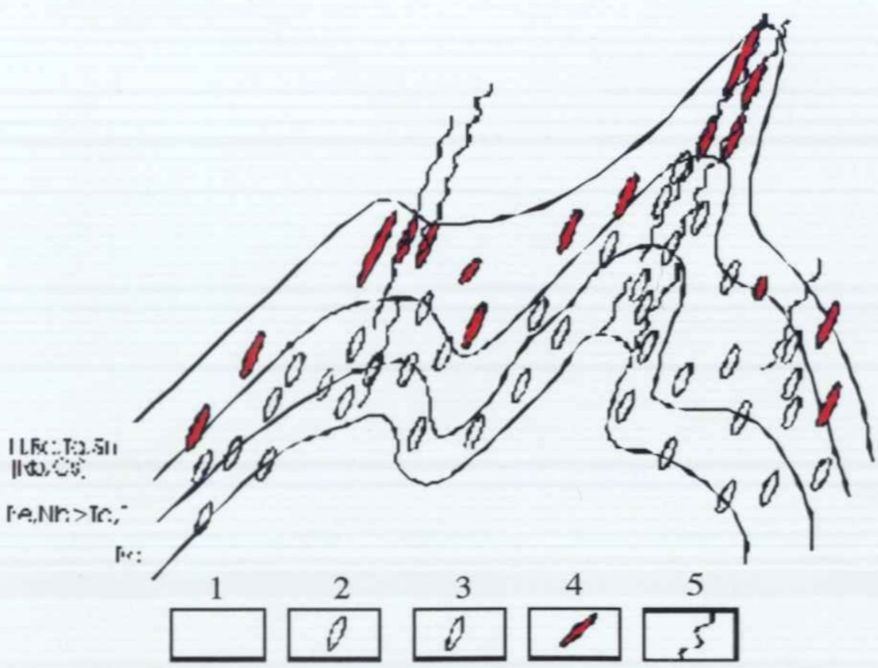



**Fig. 4** *Schematic vertical section through a zoned fertile granite- pegmatite system showing compositional gradation from fertile granite to pegmatitic granite then to rare element pegmatite. Note the gradation vertically and laterally from 1. Fertile granite to; 2. Barren to beryl-bearing pegmatities, 3. Beryl-type columbite- to phosphate-bearing pegmatites, 4. Complex spodumene- (or petalite-)bearing pegmatites with tin, tantalum and locally cesium mineralization, 5. Faults. (modified from Cerny, 1989).*

## 2. REGIONAL GEOLOGY

The English River Subprovince of the Superior Province of northwestern Ontario bounds the SLGB to the north (Fig. 3). This subprovince is mainly composed of highly metamorphosed and migmatized metasedimentary rocks. Locally, the regional amphibolite-facies metamorphism decreases to low or medium-pressure granulite-facies metamorphic grade along the English River-Winnipeg River subprovincial boundary. This is the case for the medium-grade metavolcanic rocks of the SLGB occurring where the Bird River Subprovince is in contact with the southern boundary of the English River Subprovince (Breaks, 1991).

The English River Subprovince has been interpreted as a long, narrow, fore-arc basin lying downslope of an island arc to the north (Breaks, 1991). The present day Uchi Subprovince represents this island arc to the north of the English River Subprovince. The Uchi Subprovince contributed both metavolcanic and tonalitic sediments to the fore-arc basin to produce an accretionary prism comprised of turbidites stacked in a southward prograding submarine fan. This accretionary prism was later brought into juxtaposition tectonically with the Uchi Subprovince to the north (Breaks, 1991).

The Winnipeg River Subprovince flanks the SLGB to the south (Fig. 3). This subprovince is dominated by granitoid plutons, which intrude older massive and pillowed metabasalts as well as minor metasedimentary rocks. These plutons were emplaced between 2.83 and 3.17 Ga (Breakhouse, 1991). The tonalitic plutonic rocks which comprise the Winnipeg River Subprovince were probably derived from melt of mafic rocks at the base of the crust or at upper mantle levels.

The Bird River Subprovince (equivalent to the SLGB of northwestern Ontario) widens to an average of 8 km thick in Manitoba from a relatively narrow 200 m in Ontario. However, in the Separation Lake area, this greenstone belt widens to several kilometers (Breaks, 1991). To the north, the English River Subprovince lies in fault contact with the metavolcanics of the Bird River Subprovince. The Winnipeg River Subprovince contacts the Bird River Subprovince along an intrusive boundary.

Previously attained geochronological ages show the Bird River belt volcanics to be younger than the Winnipeg River Subprovince (Breakhouse, 1991). Despite it's age and distinction as a separate subprovince, the Bird River Subprovince is related to both the English River Subprovince and the Winnipeg River Subprovince in many ways. Many metasedimentary units are continuous across these subprovincial boundaries and the granitic plutonism and late sedimentation are synchronous for the Winnipeg River and the Bird River Subprovinces.

## 3. DEFINITION OF PEGMATITIC GRANITE

The two outcrops mapped are classified as pegmatitic granites. Pegmatitic granites commonly form outer concentric zones around fertile granite cores. Texturally homogeneous, fine-grained, equigranular, fertile granites grade into more heterogeneous, coarser-grained, inequigranular, pegmatitic granites. This textural gradation is probably due to enrichment in $H_2O$ and other volatiles in the residual melt as the granitic melt crystallizes to form the fertile granite core. Enrichment in volatiles serves to depolymerize residual melts effectively reducing the viscosity of these melts and allowing them to crystallize at lower temperatures.

As well as textural gradation, there is also compositional gradation from fertile granites to pegmatitic granites. This transition may be facilitated by the process of thermogravitational convection-diffusion. According to P. Cerny, this process causes concentration gradients to develop in a multicomponent (liquid and gas) system, which is subjected to a thermal gradient. The thermal gradient causes the lower portions of the system to convect more rapidly and become compositionally separated from the upper portions of the system. Compositional layering leads to enrichment in Nb, Ta, Sb, Sn, Mo, W, U, Th, Li, Rb, Cs, Tl, Be, Sc, Mn, Y, HREE's, $H_2O$, Cl, and F upwards and outwards from the fertile granite core into the pegmatitic granite (Fig. 4). Thermogravitational convection diffusion also leads to relative depletion of Mg, Ca, Ba, Sr, Fe, P, Ar, and LREE's in pegmatitic granites (Cerny, 1982). The compositional differences between fertile granites and pegmatitic granites is later exaggerated by fractionation of pegmatitic granites (but not fertile granites) to form pegmatites.

# 4. ULTIMATE ORIGIN OF PEGMATITIC GRANITES

Since pegmatitic granites are derived from fertile granites, the source for fertile granites is intuitively also the ultimate source for pegmatitic granites. Fertile granites were probably formed from a mixture of three melts of different composition (Cerny, 1982). The earliest contribution to a fertile granite is tonalite-granodiorite bodies, which are derived from the melting of basaltic rocks at the base of the crust or the mantle. The second contribution is batholithic granodiorites-granites, which are supplied to fertile granites by partial melting of tonalite to form I-type granites, and the direct anatexis of supracrustals to form peraluminous S-type granites. The last contribution to a fertile granite system are leucogranites and alaskites which are intruded during the late tectonic history of an area or post tectonism (as S-type melts mobilized by anatexis of greenstone belt sediments). Alaskites are defined as plutonic rocks composed of oligoclase, microcline and quartz with minor muscovite and no mafics (Bates *et al.*, 1984).

## 5. PHASE CLASSIFICATION OF PEGMATITIC GRANITES

Both the TPG and CPG were mapped using a scale of 1:500. This scale was chosen because it is appropriate to show the relatively fine detail of the textural phase contacts within these pegmatitic granites. Four textural phases were identified; in order of decreasing predominance these are: 1) pegmatitic leucogranite, 2) fine-grained leucogranite, 3) sodic aplite, and 4) pegmatitic potassic phase. Phase classification was based on Cerny *et al.* (1981). These phases commonly contact each other gradationally and locally occur together as thin alternating layers. For this reason, mapped units are subdivided based on the dominant phase in each area, and do not indicate that all other phases are absent in the location. In the case of extremely slow gradation from one phase into another, contacts were mapped arbitrarily at some point along the gradation where one phase became noticeably dominant over the other. However, despite these difficulties encountered while mapping, maps generated demonstrate the strongly developed foliation in both the TPG and CPG (Fig. 22, and Fig. 30).

### 5.1 Pegmatitic Leucogranite Phase

Pegmatitic leucogranite is the most abundant textural phase within the mapped pegmatitic granites . This phase is characterized by large (5-100 cm diameter but most commonly 5-10 cm) megacrysts of potassium feldspar (K-feldspar). These megacrysts are locally intergrown with graphic quartz, a texture created by the coeval and interpenetrative crystallization of quartz and K-feldspar (Fig. 10) (Klein and Hurlbut, 1993). A matrix of fine to medium-grained K-feldspar, albite plagioclase, quartz and muscovite surrounds the K-feldspar megacrysts. Locally, minor garnet and/or tourmaline are also present, although these are not obvious in outcrop.

Megacrysts of K-feldspar are subhedral and exhibit a somewhat winged appearance (Fig. 5). These "winged" megacrysts appear rotated but do not clearly define the sense of rotation, therefore, these "wings" are interpreted as edge effects created by dynamic recrystallization in response to north-northwest to south-southeast directed compression during D1 deformation (described later in this paper). Dynamic recrystallization is a mechanism by which recovery and recrystallization proceed during deformation. Recovery rearranges and destroys dislocations (distortions in the crystal lattice) in order to promote "healing" of grains. Recrystallization transforms old "defective" grains into new grains with more ordered crystal form (Davis and Reynolds, 1996). Dynamic recrystallization often results in reduced grain size, which is evident in the pegmatitic leucogranite textural phase around the edges of and between K-feldspar megacrysts (Fig. 21).

Plumose intergrowths of muscovite and quartz in a variety of forms, constitutes another notable texture within the pegmatitic leucogranite phase. Muscovite and quartz may be intergrown: 1) in randomly distributed patches ranging from 2 cm to 10 cm in diameter (Fig. 6a), 2) as radial outgrowths originating at a larger mineral grain such as a garnet crystal,

3) as randomly oriented, interweaving strands several 10's of cm long (Fig. 6b), or 4) as concentrations of quartz and muscovite intergrown along contacts between textural phases (Fig. 9).

### 5.2 Fine-grained Leucogranite Phase

Fine-grained leucogranite is also abundant within the pegmatitic granites mapped. Rocks exhibiting this textural phase are equigranular and relatively homogeneous, but are compositionally similar to the pegmatitic leucogranite phase (Fig. 9). In the field, fine-grained leucogranite appears pale-pink mottled with darker patches of muscovite. Perthitic microcline, quartz, albitic plagioclase, and muscovite are abundant whereas zircon, garnet and apatite comprise accessory minerals. The only textural inhomogeneity observable is rare, poorly developed, zones enriched in muscovite and/or garnet. Fine-grained leucogranite commonly has gradational contacts with sodic aplite, the next most abundant textural phase.

### 5.3 Sodic Aplite Phase

The sodic aplitic phase is easily distinguished from other textural phases by its layered texture. Visible layering is due to concentrations of greenish muscovite and garnet parallel to foliation (Fig. 7). When compared to fine-grained leucogranite, sodic aplite has more muscovite, albitic plagioclase, and garnet but less K-feldspar (Cerny *et al.*, 1981). Aplite exhibits a sugary texture and appears pale pink to white.

## 5.4 Pegmatitic Potassic Phase

The fourth and final textural phase of pegmatitic granites is the potassic pegmatitic phase. This phase is very coarse with euhedral K-feldspar megacrysts commonly up to 15 cm in diameter, quartz megacrysts, and large books of muscovite also on the scale of ~15 cm diameter (Fig. 8). K-feldspar megacrysts display perthitic exsolution lamellae of albite. The pegmatitic potassic phase crosscuts all other textural phases indicating this is the last phase to crystallize from the pegmatitic melt.

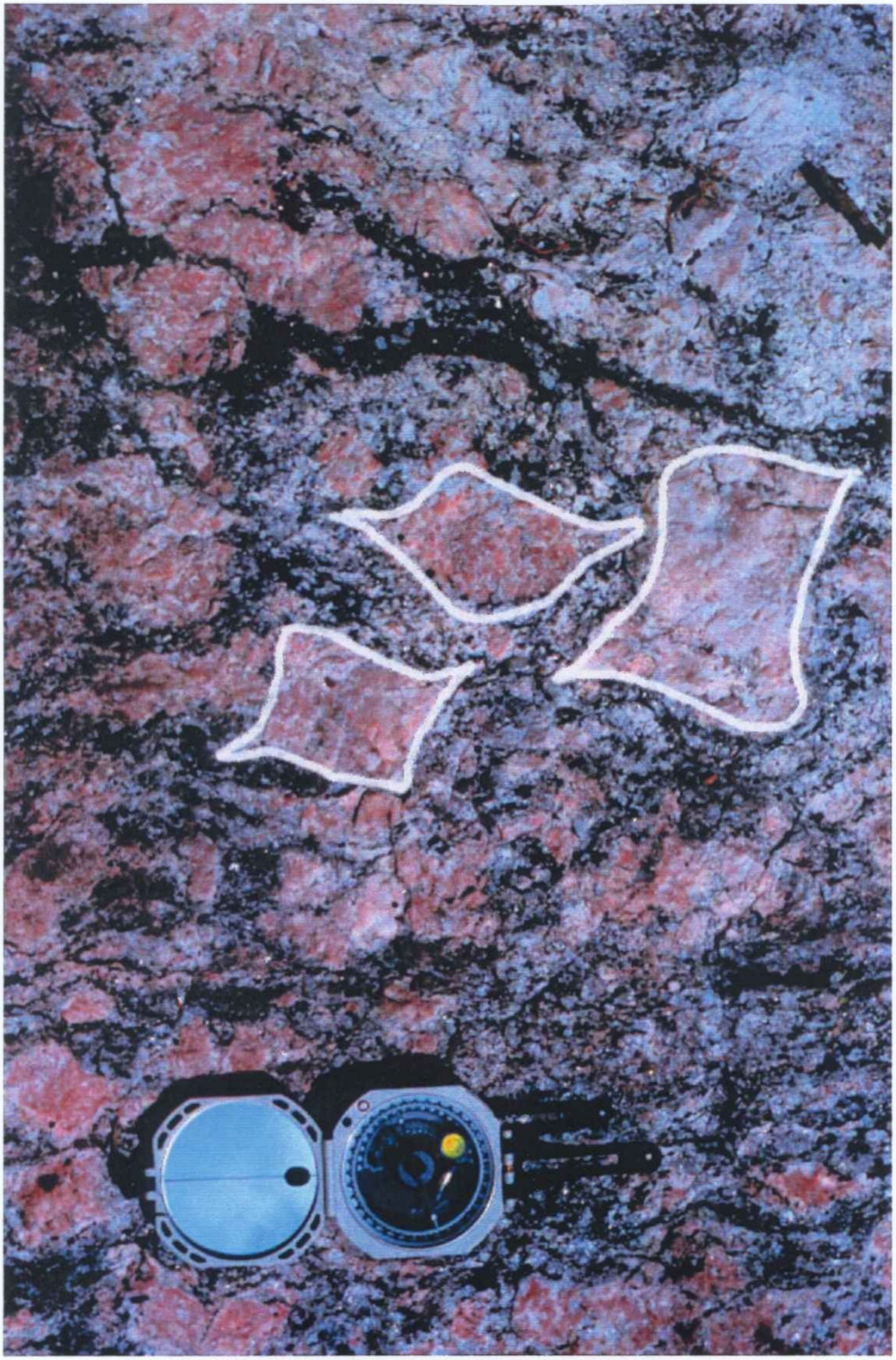
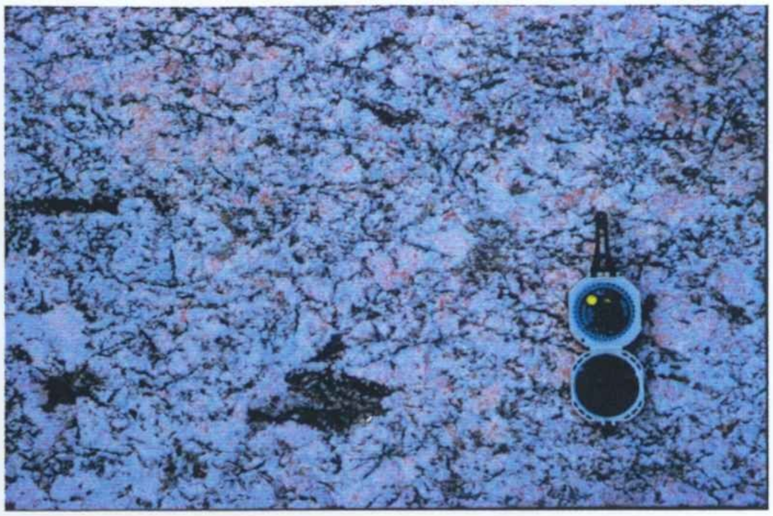


**Fig. 5** *K-feldspar megacrysts within the Pegmatitic Leucogranite phase of the Turtleback pegmatitic granite. The "winged" appearance of the megacrysts is due to edge-effects caused by dynamic recrystallization of the megacrysts during compressional deformation events.*


a.



b.

**Fig. 6** *Examples of Plumose muscovite-quartz intergrowth morphology; a) Patches b) Interweaving strands.*

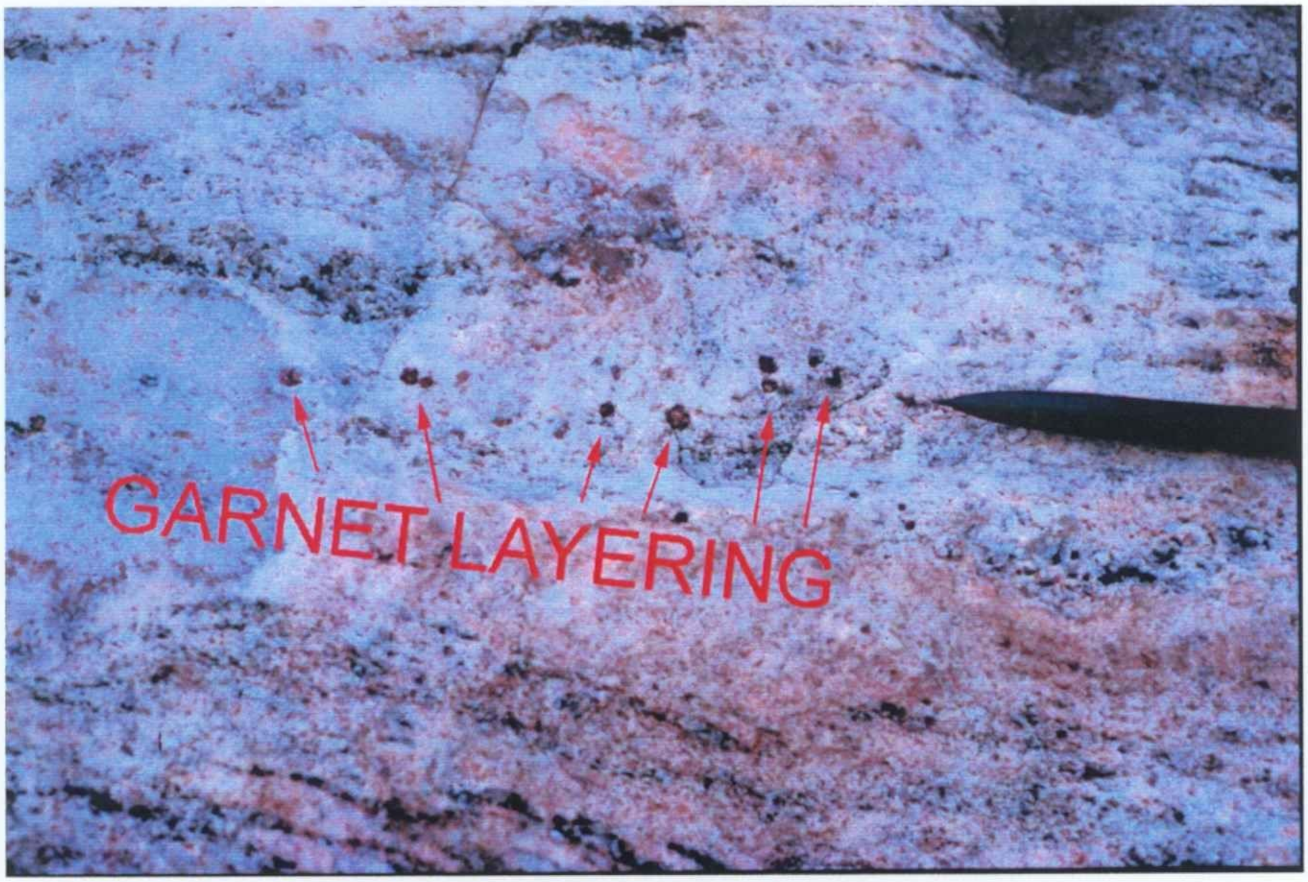



**Fig. 7** *Layered appearance of the sodic aplite textural phase. Layering is due to zones rich in muscovite and garnet.*

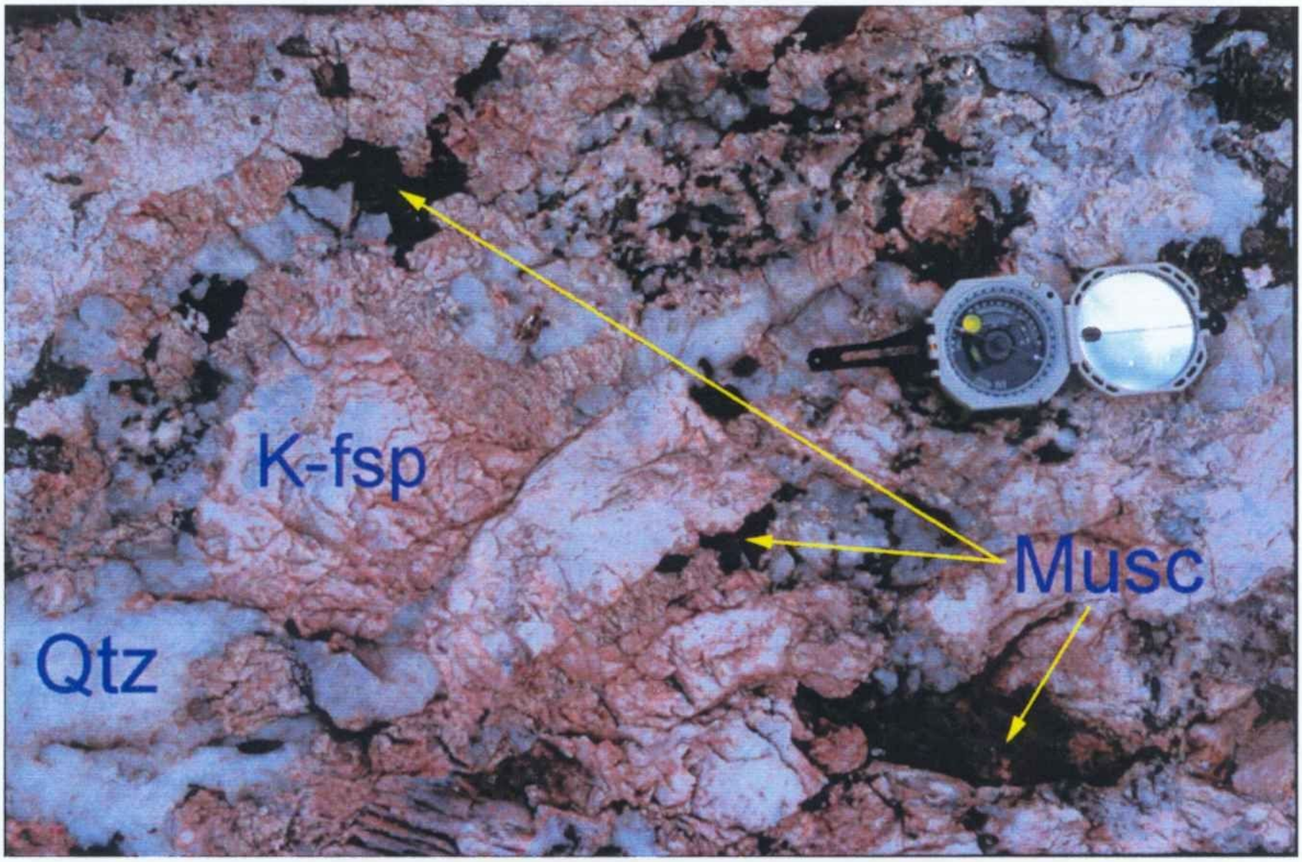



**Fig.8** *Pegmatitic potassic phase characterized by extremely megacrystic texture and perthitic exsolution apparent in K feldspar megacrysts.*

# 6. CONTACT RELATIONSHIPS BETWEEN TEXTURAL PHASES

As mentioned previously, contacts between textural phases in pegmatitic granites are commonly gradational. In particular, contacts between fine-grained leucogranite and sodic aplite are typically gradational beginning with small layers of sodic aplite appearing within the fine-grained leucogranite phase or vice versa. These small layers gradually widen and become more abundant until equal amounts of sodic aplite and fine-grained leucogranite are present. Locally, within the pegmatitic granites mapped, areas with interlayered sodic aplite and fine-grained leucogranite were quite widespread without either phase obviously dominant. At these sites, it was necessary to map a mixed lithology comprising both the interlayered textural phases. Contacts between fine-grained leucogranite and sodic aplite were mapped at the point where either sodic aplite or fine-grained leucogranite layers became dominant. Within the sodic aplite phase, however, thin layers of fine-grained leucogranite are commonly still present.

Fine-grained leucogranite also has gradational contacts with the pegmatitic leucogranite phase. The transition to pegmatitic leucogranite is characterized by the appearance of K-feldspar megacrysts and contacts were consequently mapped using this criterion. Contacts between the pegmatitic leucogranite and fine-grained leucogranite appear gradational because the dynamically recrystallized matrix of the pegmatitic leucogranite phase looks similar to the fine-grained leucogranite phase. This is because dynamic recrystallization often results in reduced grain size (Davis and Reynolds, 1996). A different type of contact occurs where plumose muscovite concentrations delineate contacts between pegmatitic leucogranite and fine-grained leucogranite (Fig. 9). The color contrast between the pale pink leucogranite phases and the dark colored plumose muscovite intergrowths emphasizes the contact giving a sharp contact appearance. The shape of these contacts are commonly well defined "scalloped" shapes subparallel to foliation. Plumose muscovite intergrowths at these locations often "finger" away from the contact and into the adjacent pegmatitic granite phases.

The pegmatitic potassic phase forms the only truly sharp contacts between the textural phases of a pegmatitic granite. This phase crosscuts other textural phases and forms very sharp contacts with no visible gradation. This offers further evidence that the pegmatitic potassic phase was a late stage melt which crystallized only after all other textural phases had solidified.

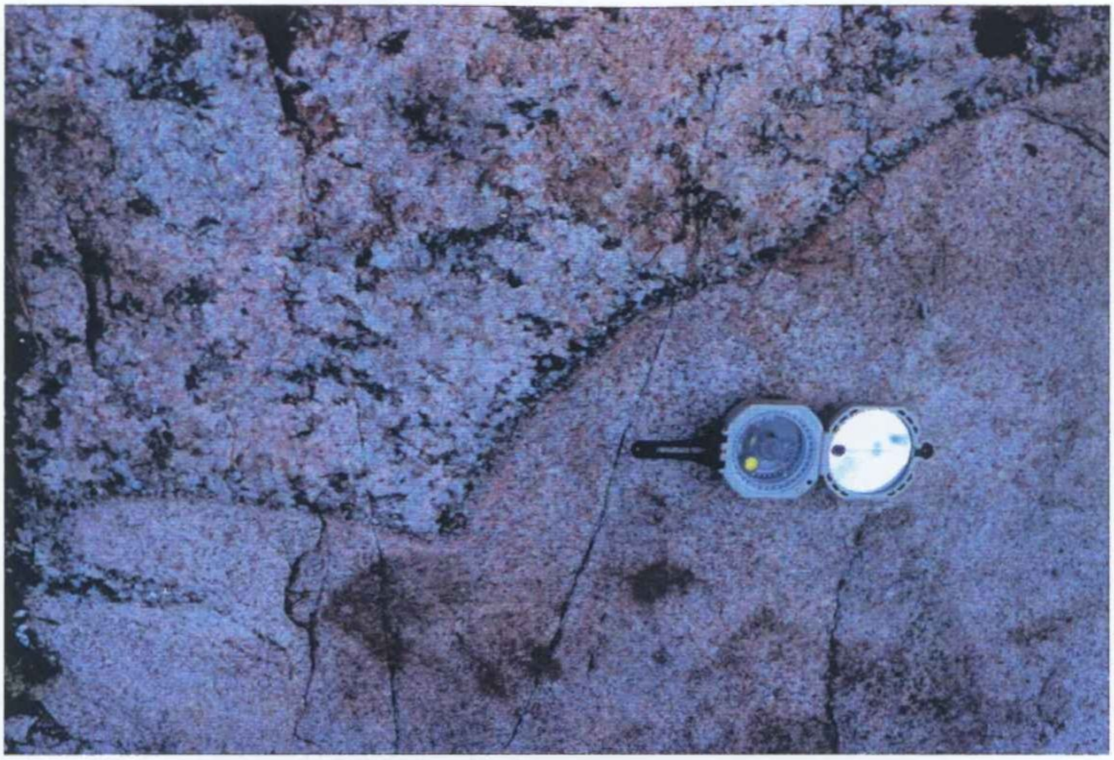


**Fig. 9** *Scalloped contact between pegmatitic leucogranite (at top left of figure) and fine grained leucogranite (at bottom right of figure).*

**Fig. 10** *Graphic intergrowth of quartz and K-feldspar located within the pegmatitic potassic phase of the Turtleback pegmatitic granite.*

## 7. DIFFERENCES OBSERVED BETWEEN PEGMATITIC GRANITES STUDIED

The phase descriptions above apply to pegmatitic granites in general and describe the textural variability of both the TPG and CPG. However, some notable differences exist between these two outcrops. The TPG is overall lighter pink in color than CPG, which is commonly a dark salmon-pink in many places especially within the pegmatitic leucogranite phase. This may be due to the more elevated relief of CPG, which could have resulted in more intensive weathering of this outcrop when compared to the TPG. The dark pink color observed in CPG may also be due to compositional variations such as a greater proportion of salmon-pink K-feldspar in CPG than in the TPG, which is richer in white albite plagioclase.

CPG is much coarser grained than the TPG, and seems to undergo a gradual coarsening southward across the outcrop. For example, although pegmatitic leucogranite is the predominant phase in both CPG and the TPG, CPG has much more abundant pegmatitic leucogranite (with larger K-feldspar megacrysts) and even the fine-grained leucogranite of CPG is coarser in texture than the fine-grained leucogranite phase of the TPG. Sodic aplite is nearly absent from CPG except for a few small exposures of this textural phase near the southern edge of the outcrop. This may help to explain why the fine-grained leucogranite of CPG appears coarser grained than that of the TPG. The fine-grained leucogranite in CPG is not interlayered with sodic aplite the same way it is in the TPG. This leads to an overall coarser appearance of the fine-grained leucogranite phase in CPG.

Perthitic texture commonly occurs within K-feldspar megacrysts in both the TPG and CPG, however this exsolution texture is much more widespread and visible in CPG. This may simply be because K-feldspar megacrysts are so much more abundant and larger in CPG than in the TPG. The same observations are true of graphic texture in K-feldspar megacrysts (Fig. 10).

No beryl mineralization was observed within the TPG, but at least one large euhedral green beryl crystal was present in CPG. The observed beryl was approximately 4 cm long and 2cm wide, pale-milky-green in color, and was situated in a matrix of megacrystic graphic K-feldspar. Perhaps, beryl mineralization occurs in the TPG and was simply overlooked during mapping. The overall finer grain size on the TPG may have resulted in beryl crystals too fine-grained for field identification.

Despite the apparent differences between the two pegmatitic granites mapped, they are similar in many ways. Topographically, compositionally, texturally, and even structurally, the TPG and CPG are closely related.

# 8. OUTCROP STYLE

## 8.1 Turtleback Pegmatitic Granite

The TPG crops out for approximately 280 m in an east-west direction as a complex series of north-northeast trending ridges and patches of pale pink to white pegmatitic granite bounded to the north, south and west by pillowed basalt and coarser grained gabbroic units (probably the bases of thick flows rather than "true" gabbros) (Fig. 11). The eastern boundary of this outcrop is not exposed in the area mapped. North to south, the TPG is nearly 150 m wide. This outcrop is so named because the topographic relief is reminiscent of the curved backs of turtles.

## 8.2 Cook's Pegmatitic Granite

CPG crops out as a narrow west southwest-east northeast trending linear ridge for approximately 280 m (Fig. 12). This pegmatitic granite is approximately 100 m wide from north to south. CPG has moderately high relief and steep north and south flanks. Bounding lithologies are not observed except for a small outcrop of strongly foliated, altered basalt on the southwest tip which appears sheared in an east-west direction, a few small gabbroic outcrops along the base of the southern outcrop flank and another gabbroic outcrop at the easternmost outcrop boundary.

# *TURTLEBACK PEGMATITIC GRANITE*

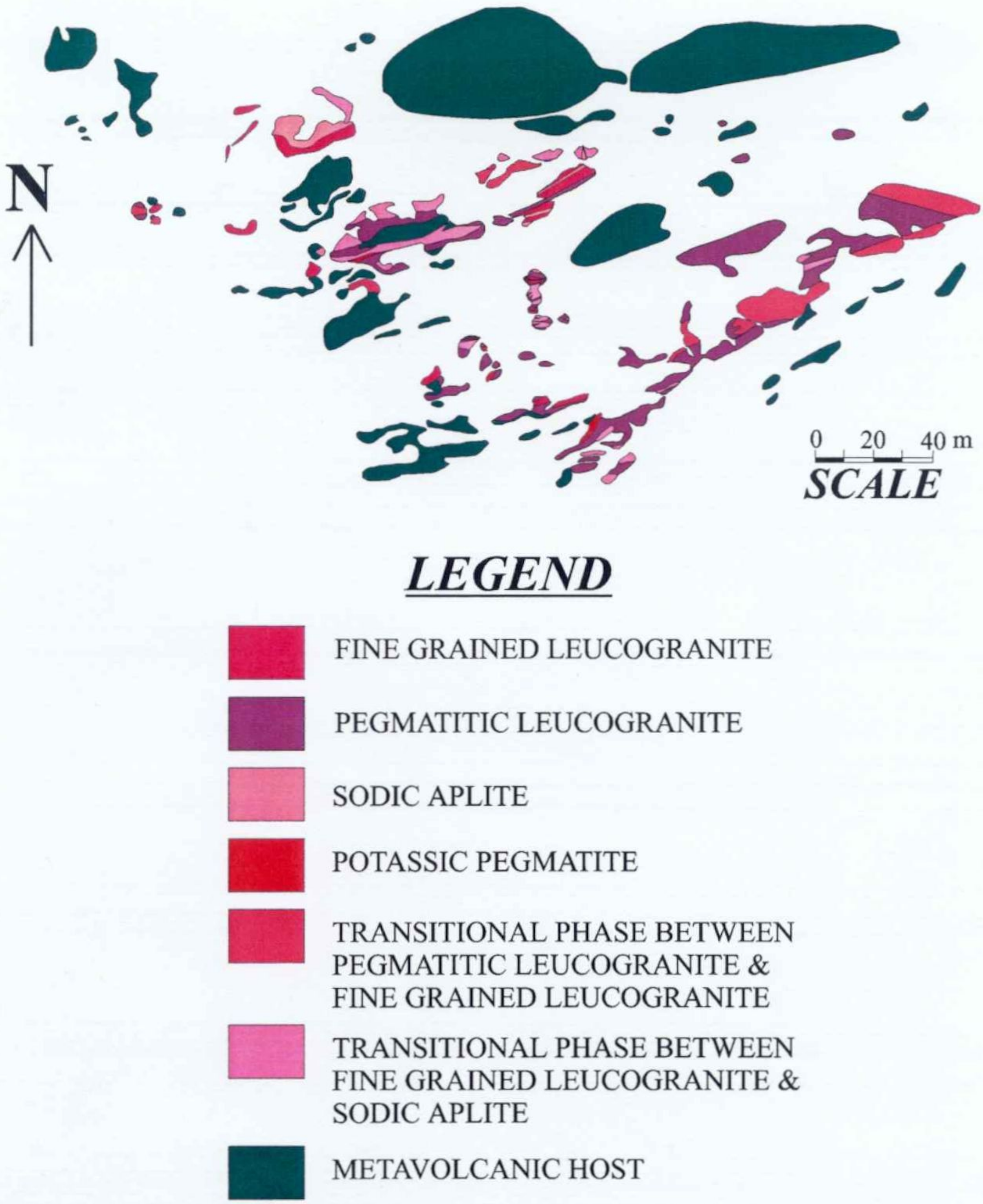



**Fig. 11** *Map of the Turtleback pegmatitic granite with textural phases delineated.*

# *COOK'S PEGMATITIC GRANITE*


**Fig. 12** *Map of Cook's pegmatitic granite with textural phases delineated.*

## 9. MICROSCOPIC AND SCANNING ELECTRON MICROPROBE ANALYSIS

The major minerals of pegmatitic granites are K-feldspar, plagioclase feldspar, muscovite, and quartz. K-feldspar takes the form of microcline ($KAlSi_3O_8$) in the pegmatitic granites studied. This type of K-feldspar is characterized by tartan twinning when observed under polarized light. Microcline is commonly graphically intergrown with quartz to form graphic granite such as that observed in the pegmatitic potassic textural phase (Fig. 11). Graphic granite is formed by the crystallization of quartz and K-feldspar (usually microcline) simultaneously so that the crystals interpenetrate as they form (Klein and Hurlbut, 1993). Perthitic texture (Fig. 13) is also common within microcline and occurs when slow cooling at considerable depths allow albite to exsolve and form laminae within the microcline crystals.

Albite ($NaAlSi_3O_8$) is the common plagioclase feldspar of the pegmatitic granites studied. Albite is classified as an alkali feldspar along with microcline and orthoclase. This mineral is the common plagioclase feldspar of granites, syenites, pegmatites, rhyolites and other acid igneous rocks (Klein and Hurlbut, 1993). Albite may be identified by parallel twinning lines (albite twins) and by the white color it exhibits.

Muscovite ($KAl_2(AlSi_3O_{10})(OH_2)$) appears pale greenish to yellow or silvery in the two pegmatitic granites mapped. In the field, the cross-sectional edges of muscovite books appear dark-grey to brown or even black depending on the thickness of the book and degree of weathering the book has undergone. However, regardless of the color displayed by muscovite books, individual muscovite sheets from the TPG and CPG are transparent and colorless.

As well as the major minerals forming the pegmatitic granites, there are a number accessory minerals of note. Rutile ($TiO_2$), also called ilmenite, is a minor constituent of the pegmatitic granites studied. This titanium oxide occurs as granular masses associated with zircons (Fig. 14a) or as reddish brown acicular crystals along the cleavage planes of muscovite (Fig. 14b). Rutile indicates that the rock containing it formed over a high range of pressures and temperatures and is commonly found in granite and granitic pegmatites (Klein and Hurlbut, 1993).

Zircons ($ZrSiO_4$) are also found within pegmatitic granites. This mineral occurs as tiny euhedral stubby or prismatic crystals, which are distributed throughout the textural phases of the pegmatitic granites, studied. Zircons are common in all types of igneous rocks but are especially common in granites and other $SiO_2$ rich rocks (Mottana *et al.*, 1978).

Gahnite ($ZnAl_2O_4$) is another accessory mineral of pegmatitic granites (Fig. 15). This rare mineral occurs within granitic pegmatites as striated octohedral-shaped crystals with a characteristic dark green color. Gahnite crystals are pleochroic, euhedral, tiny and pebbly in appearance. Gahnite is a zinc spinel (spinel is defined as an isomorphous series of oxides) (Bates *et al.*, 1984).

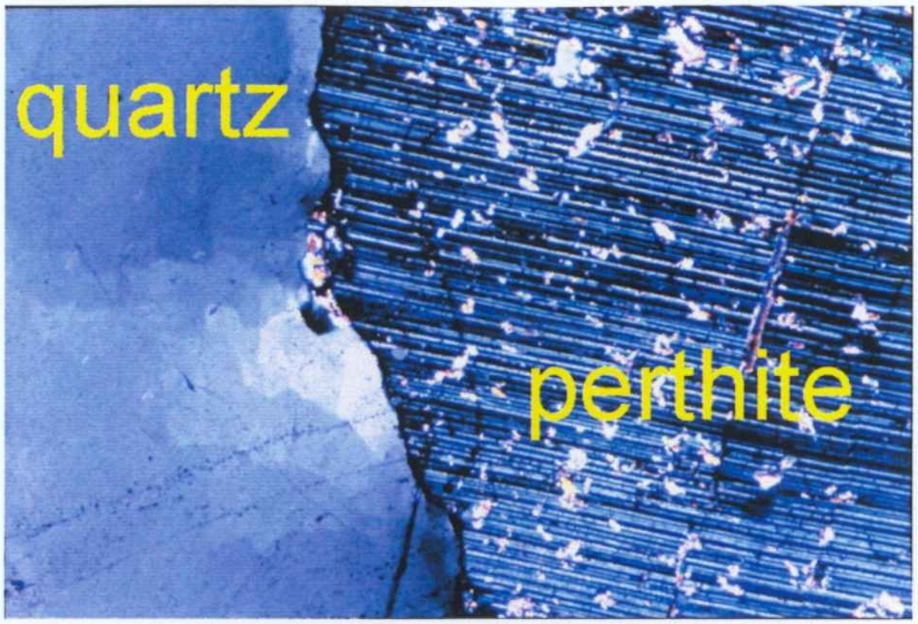



**Fig. 13** *Perthite exsolution texture. Note the pale colored albite exsolution lamellae within darker microcline. This perthite crystal contacts quartz within the pegmatitc potassic phase of Cook's pegmatitic granite. (50x magnification, crossed polars.)*

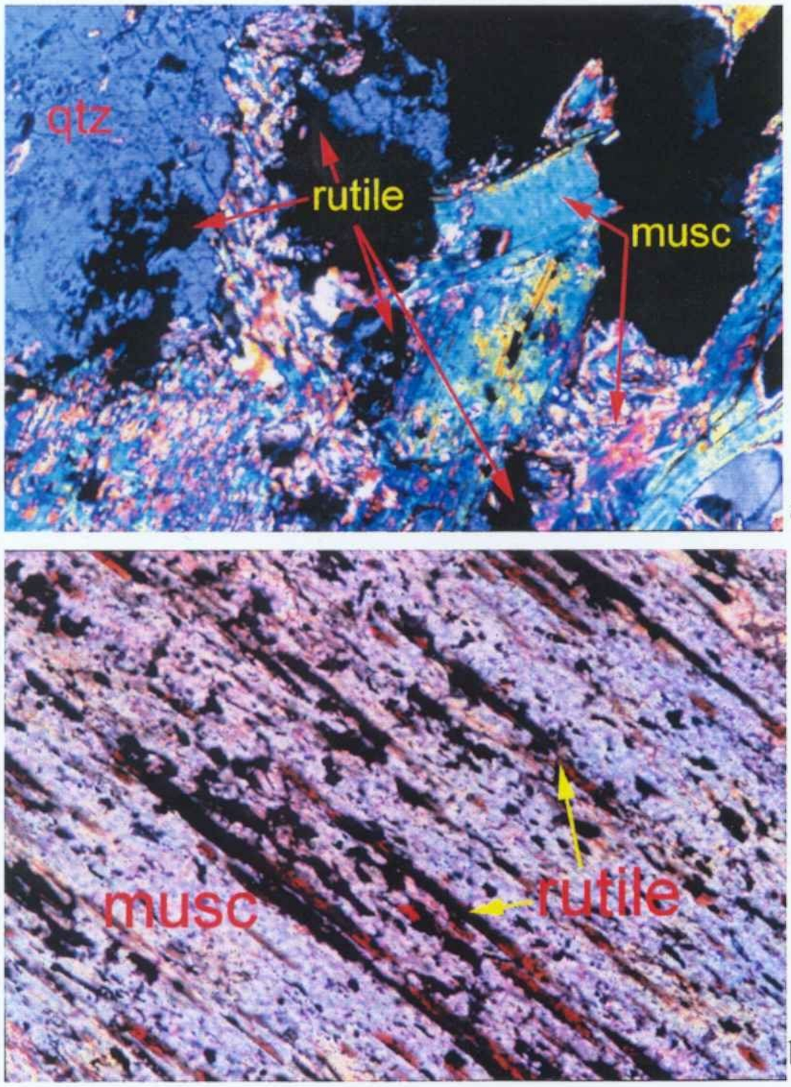



**Fig. 14** *Rutile occurs as:*

***a)*** *granular masses associated with zircons. (200x magnification, crossed polars.)*

***b)*** *in the form of acicular crystals parallel to cleavage planes in muscovite. (200x magnification, plane polars.)*

Apatite [$Ca_5(PO_4)_3(F,Cl,OH)$], a phosphate mineral, is also present within the pegmatitic granites studied. These crystals are generally long prismatic or short prismatic in crystal form, usually green or brown in color but also sometimes appearing blue, violet, colorless, transparent, or translucent. In the two pegmatitic granites studied, apatite can be recognized in the field by its rich blue color and euhedral crystal form. Apatite is a common accessory in rocks of all types (igneous, metamorphic and sedimentary) but when apatite occurs in pegmatites it probably originated hydrothermally (Klein and Hurlbut, 1993).

Monazite [$(Ce,La,Y,Th)PO_4$] is yet another accessory mineral in pegmatitic granites. This mineral occurs in granular masses or as small flattened crystals which are translucent and reddish-brown in color. This mineral, like apatite, is also a phosphate mineral but monazite is a phosphate of rare-earth metals so it is much different in composition from apatite. Monazite is quite rare but is occasionally found in granites, gneisses, aplites and pegmatites. It is associated with rutile, magnetite, ilmenite and zircon. Energy Dispersive Spectrometry (EDS) performed on this mineral are characterized by several percent $SiO_2$, as well as Th, and Y highs. When extremely rich in Y, this phosphate can be classified as yttrium phosphate instead of as monazite (personal communication from Mr. Tom Bonli, University of Saskatchewan).

Garnets are the most abundant accessory mineral found within the pegmatitic granites studied (Fig. 16). Scanning electron microprobe (SEM) analysis of garnets indicates that the garnets present within the pegmatitic granites range in composition from spessartine

($Mn_3Al_2Si_3O_{12}$) to almandine ($Fe_3Al_2Si_3O_{12}$). Spessartine has a brownish-red color and comprises most of the garnets analyzed. Almandine is usually a deep red to brownish red in color and there is some almandine component present in all the garnets analyzed although the garnets are predominantly the spessartine variety (Klein and Hurlbut, 1993).

One group of accessory minerals of special note is ferrocolumbite - ferrotantalite [$(Fe,Mn)Nb_2O_6$ - $(Fe,Mn)Ta_2O_6$)]. These rare-metal oxides were first identified as opaques under transmitted and polarized light (Fig. 17). Further investigation using the SEM determined that these opaques were indeed iron rich Nb-Ta oxides. Crystals of this mineral have a short prismatic or thin tabular form occasionally becoming quite elongate (Fig. 17 and Fig. 18). Ferrocolumbite - ferrotantalite crystals have a striated, black, metallic appearance. These oxides are associated with quartz, feldspar, mica, tourmaline, beryl, cassiterite, wolframite, microlite and monazite. Commonly ferrocolumbite - ferrotantalite is found in granitic pegmatites rich in Li-silicates and phosphates associated with spodumene, lepidolite, beryl and other minerals (Klein and Hurlbut, 1993).

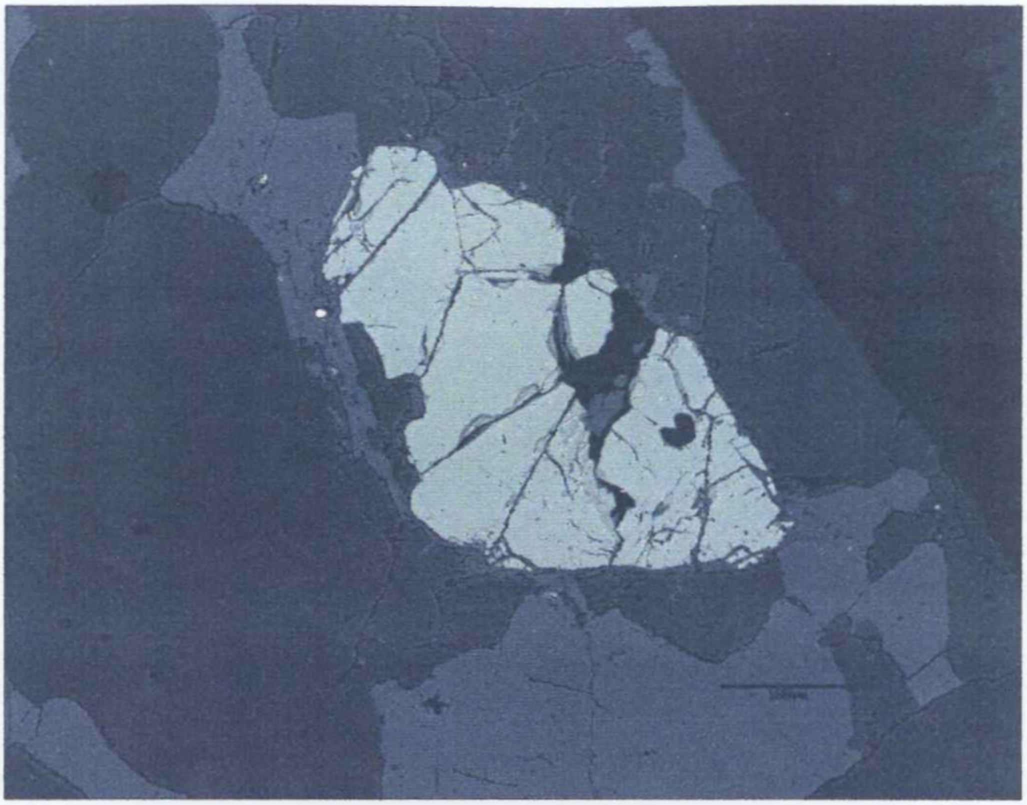


**Fig. 15** *Microprobe photo of gahnite crystal within the sodic aplitic phase of Cook's pegmatitic granite.*

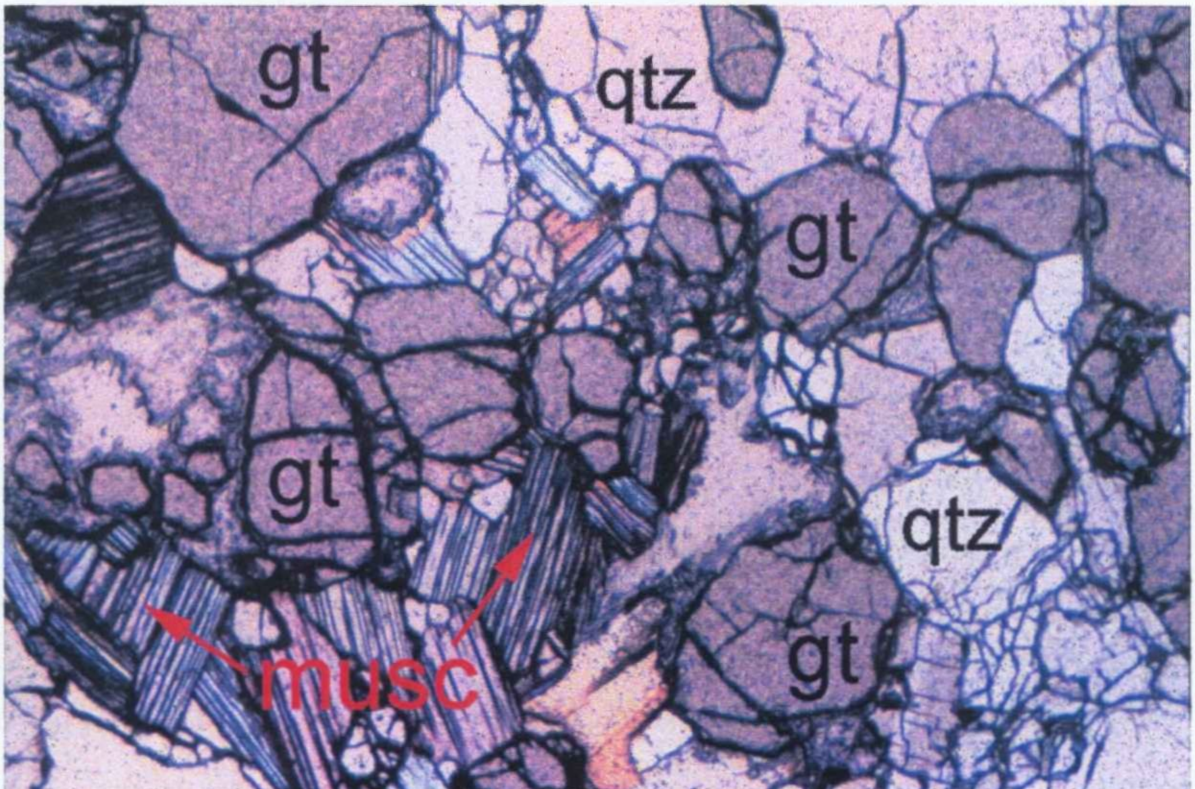



**Fig. 16** *Micrograph of garnets found in association with muscovite within a muscovite and garnet rich zone in the fine grained leucogranite phase of the Turtleback pegmatitic granite. (50x magnification, plane polars.)*

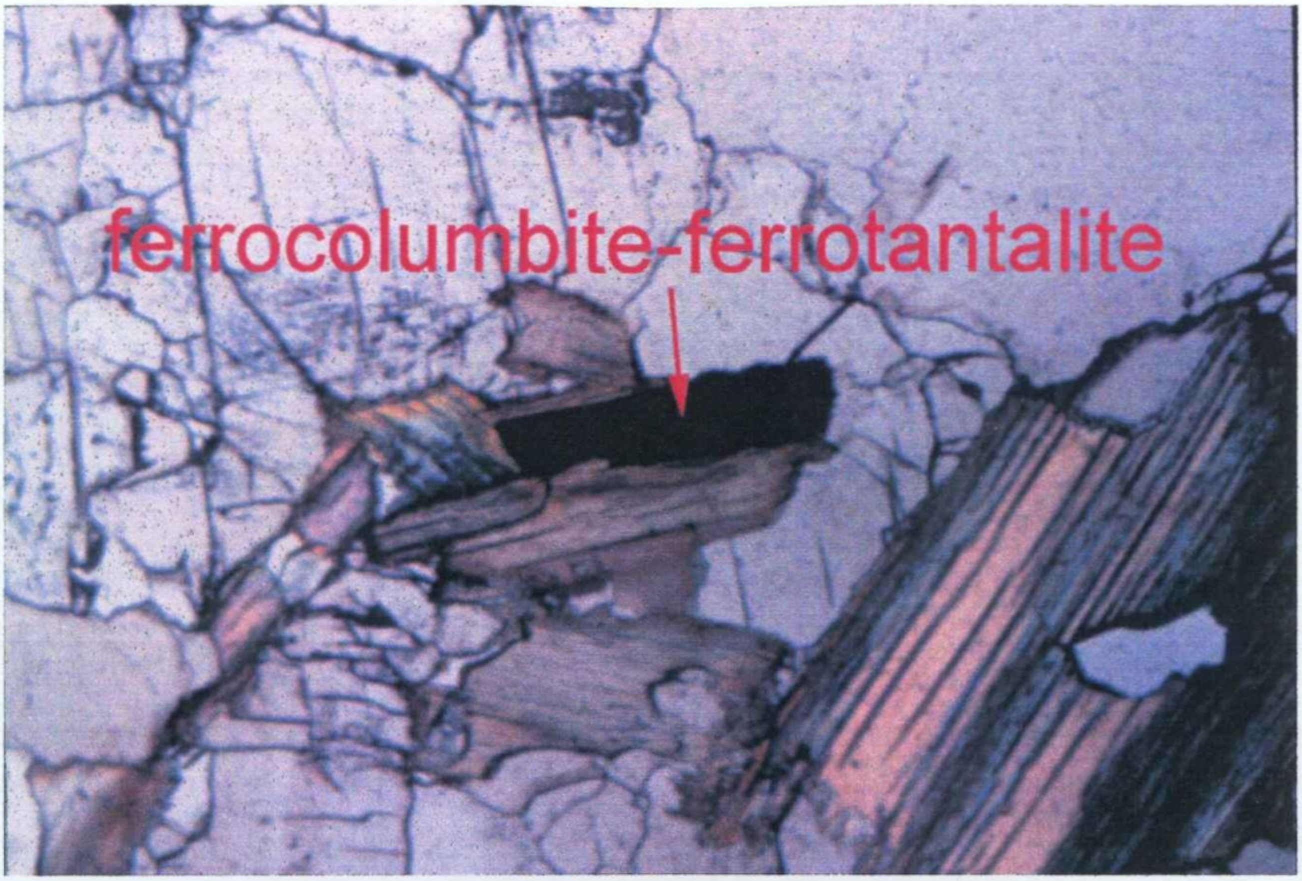



**Fig. 17** *Micrograph of euhedral ferrocolumbite-ferrotantalite crystal observed within the fine grained leucogranite phase of Cook's pegmatitic granite. (50x magnification, plane polars.)*



**Fig. 18** *Two ferrocolumbite-ferrotantalite crystals as seen through a scanning electron microprobe. The crystal on the left is the same crystal shown above. The crystal on the right is another crystal from Cook's pegmatitic leucogranite. Both crystals show zoning within.*

# 10. STRUCTURAL HISTORY

The structural history of the region encompassing the TPG and CPG can be subdivided into two distinct deformation events. Deformation D1 provided the weaknesses within the host metavolcanic along which the pegmatitic granites were emplaced and facilitated the development of S1 fabric. Deformation D2 acted next to cause isoclinal folding of the pegmatitic granites. D2 deformation created S2 foliation, transposed S1 parallel to S2, and resulted in the present orientations of the structural features within the pegmatitic granites studied.

D1 and D2 deformations are named for their relationship with the pegmatitic granites studied only, and do not suggest that D1 is the first deformation in the SLGB. Rather, D1 is the first deformation that affected the pegmatitic granites because this deformation controlled their emplacement and resulting internal fabric (S1). However, metavolcanics were variably deformed prior to pegmatitic granite emplacement by a number of deformation events beyond the scope of this study.

## 10.1 Deformation D1 - Formation of S1 Fabric

Deformation D1 was the first deformation event, which affected the pegmatitic granites studied. This deformation created an S1 fabric, which overprinted previously developed fabrics within the variably deformed metavolcanic rocks of the study area. This deformation is referred to D1 for the purposes of this thesis because, although it is not the first deformation affecting the study area metavolcanics, it is the first deformation event affecting the pegmatitic granites which are the focus of this study. This so-called S1 foliation acted as a structural weakness within the host metavolcanics along which pegmatitic granites were emplaced. Emplacement processes resulted in parallel orientations of; 1) the contacts between pegmatitic granites and host metavolcanics, 2) textural phase contacts within the pegmatitic granites, and 3) mineralogical layering with the pegmatitic granites. These three structural phenomena define S1 foliation.

The next deformation event (D2), caused transposition of S1 fabric into the newly developed S2 fabric. This transposition makes definition of the stress regimes associated with D1 impossible. Therefore, the direction D1 stresses acted cannot be determined through field relationships. Perhaps, this information could be attained through careful study of the complete sequence of deformations within the host metavolcanics, however, this is beyond the scope of study.

## 10.1 Deformation D2 - Formation of S2 Fabric

Deformation D2 was the next deformation event to affect the TPG and CPG. North-northwest to south-southeast directed compression during this deformation caused isoclinal folding of the pegmatitic granites, the development of minor folds on fold noses within these pegmatitic granites, and dynamic recrystallization within the pegmatitic leucogranite textural phase. S2 foliation fabric developed in response to deformation D2. D2 also caused the transposition of previously developed S1 foliation into an orientation parallel S2. S2 foliation strikes roughly west-southwest to east-northeast, therefore so does the transposed S1 foliation in most locations within the pegmatitic granites.

S1 and S2 foliations are predominantly parallel within the pegmatitic granites and can only distinguished as different foliations where fold noses are visible and at some locations where pegmatitic granite contacts the host metavolcanics. In fold noses located in the TPG, S1 foliation approximately follows the trace of fold limbs, whereas S2 foliation cuts across fold limbs and noses parallel to fold axial plane orientations and parallel to the predominant foliation within the pegmatitic granite (~072° strike) (Fig. 19). Along some boundaries of the TPG, the metavolcanic host lithology exhibits S1 fabric developed parallel to the contact between the pegmatitic granite and the host regardless of the local contact orientation (i.e. even if this contact has an irregular orientation). In these situations, S1 is not always parallel to S2. These locations display S2 fabric developed roughly parallel to the S1 fabric except where the S1 fabric "bends" around the contact between pegmatitic leucogranite and the host lithology. Here, the S2 fabric appears to overprint the S1 fabric obliquely with the same strike as the predominant foliation in the area (072°) and is not affected by the irregular contact boundary.

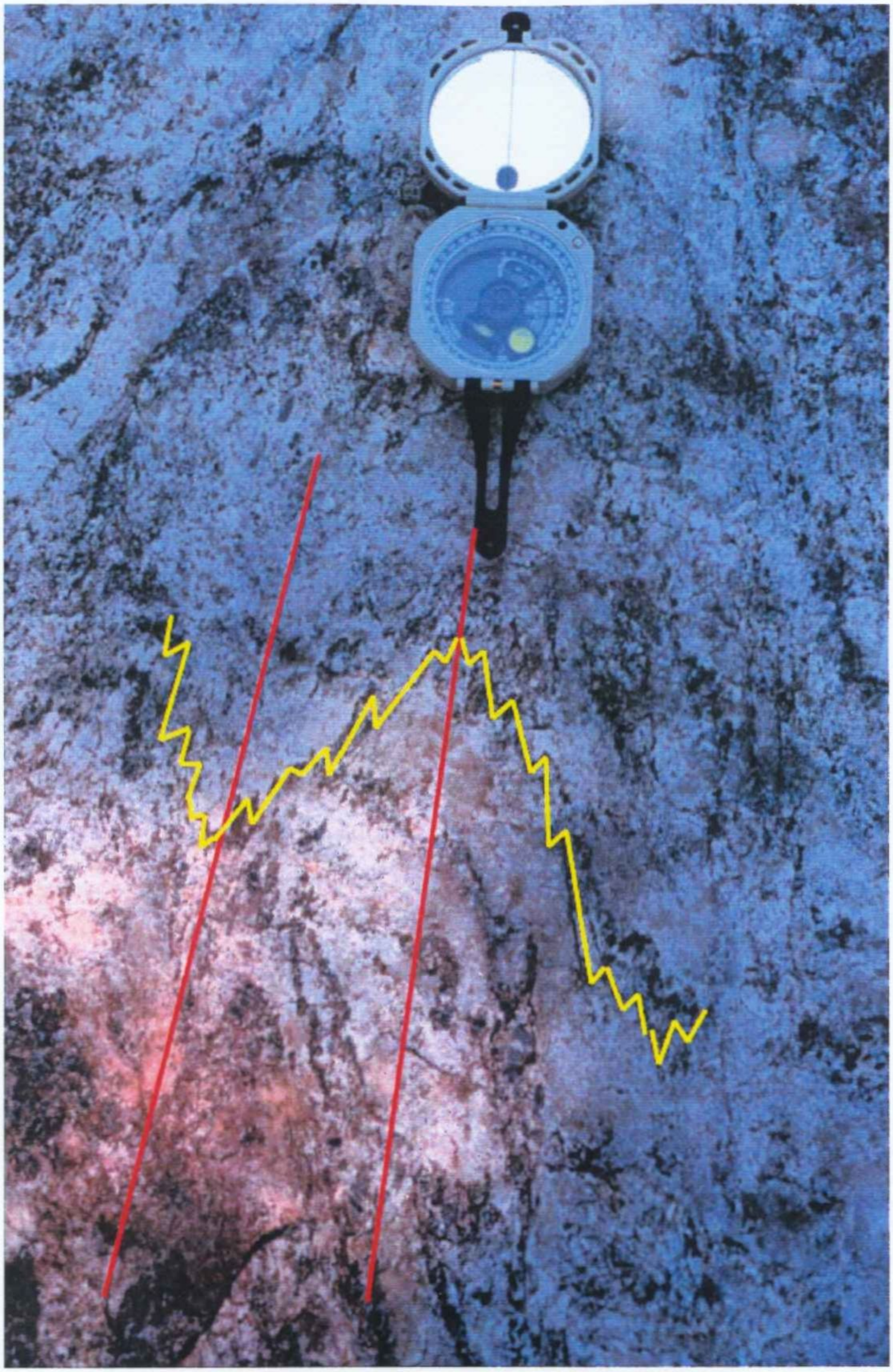


**Fig. 19** *Fold noses in the Turtleback pegmatitic granite. Note that S1 and S2 fabrics can be distinguished at this location. S1 fabric follows the trace of the fold limb (shown in yellow) whereas S2 is parallel to the axial plane of the fold (shown in red). Minor buckle folds are evident on the limbs of the major folds in the vicinity of the fold noses.*

Within the TPG and CPG, free folding occurred in response to D2 compressive deformation (Fig. 20). This type of folding occurs when layer-parallel compression causes poly-layer lithologic sequences to shorten and thicken. Next, buckling instabilities develop within the stiffest layers. These buckling instabilities develop fold wavelengths related to the stiffness of the strongest, thickest unit as well as related to the stiffness of the specific layer which is buckling. Continued folding is accommodated by flexural-slip. Flexural slip is a mechanism by which layer-parallel slip occurs along the contacts between rock layers during folding. Flexural slip can be illustrated by bending a phonebook and noting the way the pages slide past one another. Free folding created the minor folds visible in the fold noses in the TPG. Sub-vertically dipping, isoclinal folds were also developed in response to D2 deformation. The limbs of these folds are attenuated and display no minor folds. The noses of these isoclinal folds display well-developed minor folds. This is probable because the noses of these isoclinal folds were undergoing compression while the limbs were in a state of extension during D2 deformation.

Dynamic recrystallization of K-feldspar megacryst edges observed within the pegmatitic leucogranite phase (described previously) is evident even on a microscopic scale. A dynamically recrystallized matrix of fine-grained albite, quartz, microcline, and muscovite is deflected around the edges of megacrystic perthite crystals (Fig. 21). Beyond the field of view of Fig. 21, this dynamically recrystallized matrix merges with the fine-grained K-feldspar "wings" which extend away from the K-feldspar megacrysts. These "wings" were also formed by dynamic recrystallization of the pegmatitic leucogranite phase in response to layer parallel compression during D2 deformation. "Wings" extend out from the K-feldspar megacrysts perpendicular to the direction of compression during D2 deformation. Grain size within these "wings" decreases outward from the central megacryst mass. The edges of the K-feldspar megacrysts appear pitted and rough due to the effects of recrystallization.

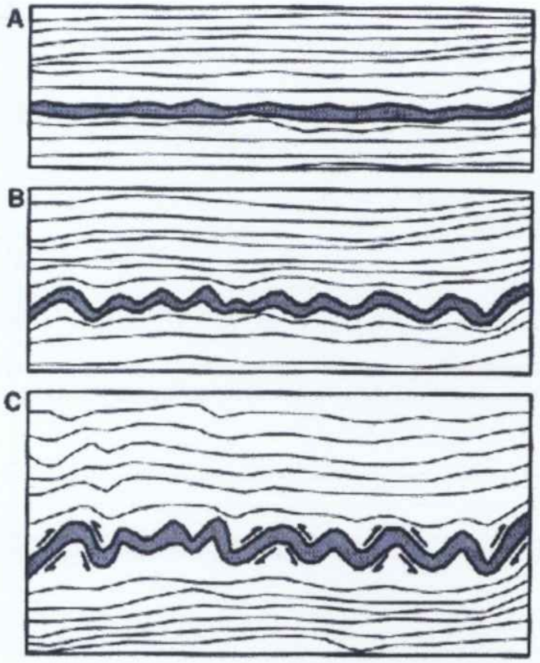



**Fig. 20** *Simulation of free folding at the subregioinal to regional scale.* ***A)*** *Layer-parallel tectonic loading just begins to compress and shorten a thick sequence of sedimentary strata.* ***B)*** *A buckling instability develops, with a dominant wavelength that relates to the stiffness of the thickest, strongest unit.* ***C)*** *Initial buckling and continued folding are accompanied by flexural-slip and flexural-flow folding. "Minor" structures form as a result of flexural-slip folding, outer arc extension, and inner arc compression. (modified from Davis and Reynolds, 1996).*

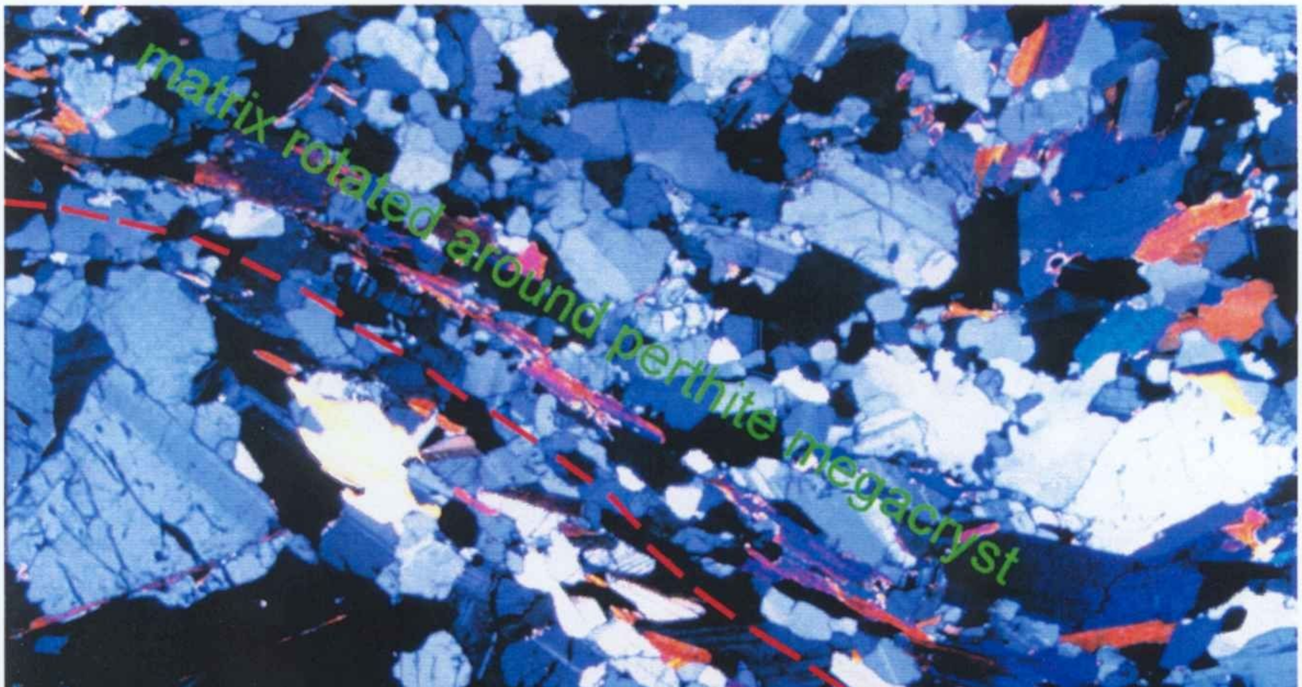



**Fig. 21** *Dynamically recrystallized matrix around edges of K-feldspar megacryst (perthite) within the pegmatitic leucogranite phase of the Turtleback pegmatitic granite. Recrystallization such as this develops "edge effects" within the pegmatitic leucogranite textural phase and create the misleading appearance of "wings". (15x magnification, crossed polars.)*

## 11. STEREOGRAPHIC NET REPRESENTATION OF STRUCTURAL DATA

All collected structural data was plotted using Spheristat 2 for Windows 3.1 computer software - Version 2.1. All stereonets were constructed as lower hemisphere projections on a Schmidt net. Contour intervals were chosen individually to best suit the number of relevant data points available for each stereographical plot. The chosen contour intervals attempt to keep the stereonets as simple as possible with the minimum number of contour intervals required to accurately describe the data. All contouring was done using Gaussian counting. This method was chosen over fixed-circle counting because it includes all samples but rather than weighting all data points equally, this counting method allots more statistical weight to those data points near the center of the data cluster. Gaussian counting is favored for the purposes of this paper because it gives much smoother density contours than fixed-circle counting making stereonet interpretations straightforward and representative while reducing the effects of widely scattered data points. The 3x Sigma method of Gaussian counting was used because this method yields smoother contour surfaces than other Gaussian counting methods in which contour surfaces have sharp peaks and valleys. Smooth contour surfaces facilitates rapid comparison between structural data acquired at different locations and between different structural features. Smooth contours emphasize the similarities between data collections rather than the variations. Joint measurements had to be subdivided into two separate joint sets for each location. Subdivision was done by hand picking joints which showed grouping characteristics and were separated from other joint clusters by intervals with no data points.

A general plane has been plotted on each stereonet generated. This plane represents the strike and dip of the plane oriented perpendicular to the plunge and trend of a pole at the center of the highest density contour on the stereonet. This general plane is representative of the most common orientation of the specific structural feature being plotted.

## 12. STRUCTURAL FEATURES OF THE TURTLEBACK PEGMATITIC GRANITE

### 12.1 Foliation

The TPG has strongly developed foliation. The general foliation plane has a strike of 072° and dip of 86°N. The measured foliation is comprised of both S2 and the transposed S1 foliations which are parallel in most locations. As well as development within the outcrop, foliation is mirrored by the external morphology of the TPG outcrop which is elongated along the strike 072° and was controlled by S1 then transposed into S2. This relationship suggests that emplacement of the TPG occurred in an active tectonic regime at which time compressional deformations developed strong S1 foliation in the host rock. The TPG intruded along the structural weaknesses of the S1 fabric.

### 12.2 Jointing

Jointing in the TPG occur in two major directions (Fig. 24 and Fig. 25). The first joint set is vertically dipping and strikes at 164°. The second joint set is also vertically dipping and has a calculated average joint plane with 072° strike. This second joint set strikes parallel to foliation in the TPG. These joint sets strike at 92° from one another making them nearly perpendicular sets. Neither joint set one nor joint set two are folded, therefore, jointing must be a late stage structural feature postdating both D1 and D2 deformations. Joints are formed during brittle deformations and therefore are suspected to have formed after peak metamorphism and also after cooling of the pegmatitic granite intrusions. Regional stress regimes formed these joint sets which are equally developed within the host metavolcanic and the pegmatitic granite. Joints present on the TPG show no offsets and show no significant degree of spreading. These joints appear as narrow, regular, closed cracks which show infill only very rarely where veins of pegmatitic granite are injected into the host metavolcanics.

## 12.3 Veins

Narrow veins injected into metavolcanics in the vicinity of the TPG a general orientation of 050° with a northwesterly dip of 74° (Fig. 26). This steep dip mirrors the steep dip of both foliation and jointing on the TPG. The strike of veins on the TPG is also similar to the orientation of foliation and joint set two. The general vein orientation of 050° varies by 22° when compared to the general orientation of the second joint set or when compared to foliation. This variation in the orientation of major structural features may be explained by the small number of data points available for vein analysis. However, the departure of 22° between vein strike and joint/foliation could indicate that veins on and near the TPG were not controlled by foliation nor by jointing, and may in fact have formed prior to jointing. It is notable that there are only seven data points representing veining on the TPG. These data points show scatter of nearly 80° variation in strike orientation. This creates an inaccurate general plane estimation because the center of density can vary up to 30°. However, every vein measurement lies within the field of joint set two of the TPG. This correlation suggests that veins are controlled by and infill joints belonging to joint set two. Veins tend to travel along weaknesses in the host lithology. For example, veins are developed along pillow selvedges (a lithological weakness) found within a roof pendant of pillow metabasalt present in the TPG (Fig. 27).

## 12.4 Boudinage

A boudinaged pegmatitic granite layer was found within the roof pendant of pillow basalt in the TPG (Fig. 28). The more mechanically soft pillow basalt layers enveloped the mechanically stiff pegmatitic granite layer so that when compression occurred perpendicular to the pegmatitic granite layer, extension occurred parallel to the layer direction. This extension caused the stiff pegmatitic granite layer to stretch producing pinch-and-swell type boudinage structures. The thin neck of pegmatitic granite was produced by ductile necking of this material as a form of strain. Ductile necking of materials occur when the difference in the stiffness of the materials involved is relatively small, in this case; between the metabasalt and the pegmatitic granite. The pillow basalt wraps around the edges of the pegmatitic granite as a result of compression pushing the basalt inwards towards the neck structures in the pegmatitic granite. This deflection of pillow basalt into the gap between the pegmatitic granite boudins is described as prolapse.

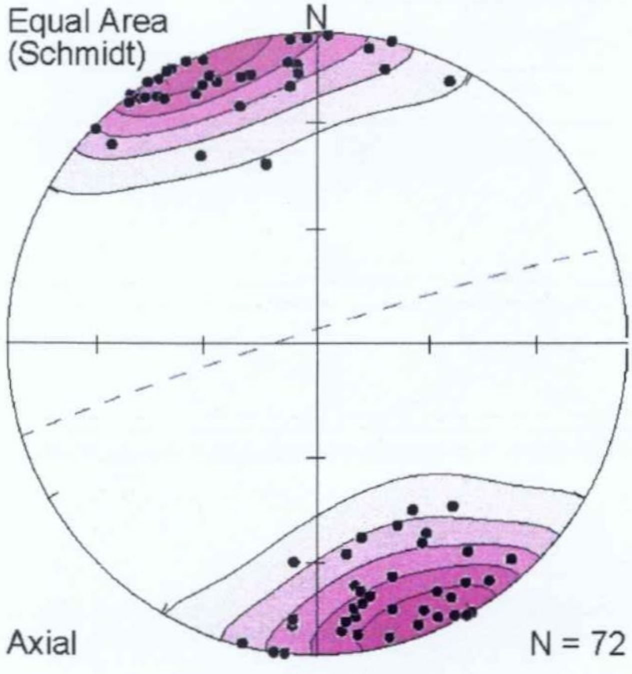
Since the pegmatitic granite material behaved as though it had only slightly higher strength than the metabasalt, this boudinage structure must have been formed when the pegmatitic granite material was in a ductile or semi-ductile state. This suggests that compression acting to create the pinch-and-swell structures occurred soon after emplacement of the pegmatitic granite, or more likely that the pegmatitic granite was boudinaged during amphibolite grade metamorphic conditions. Evidence for the second scenario is that the metamorphic minerals within the pillow basalt are aligned parallel to S1 so it must have been deformed at a temperature of 650°C or higher (personal communication from Dr. Mel Stauffer, University of Saskatchewan). This suggests that the pegmatitic granite was also at a temperature ~650°C. Therefore, the pegmatitic granite would have behaved in a ductile or semi-ductile manner during boudin formation.

# *TURTLEBACK PEGMATITIC GRANITE*
# FOLIATION


**Fig. 22** *Map of the Turtleback pegmatitic granite with selected foliation measurements shown.*

**Turtleback Pegmatitic Granite: Foliation**

General Foliation Plane: 072 / 86 N




Contour Interval: 0,4,8,12,16

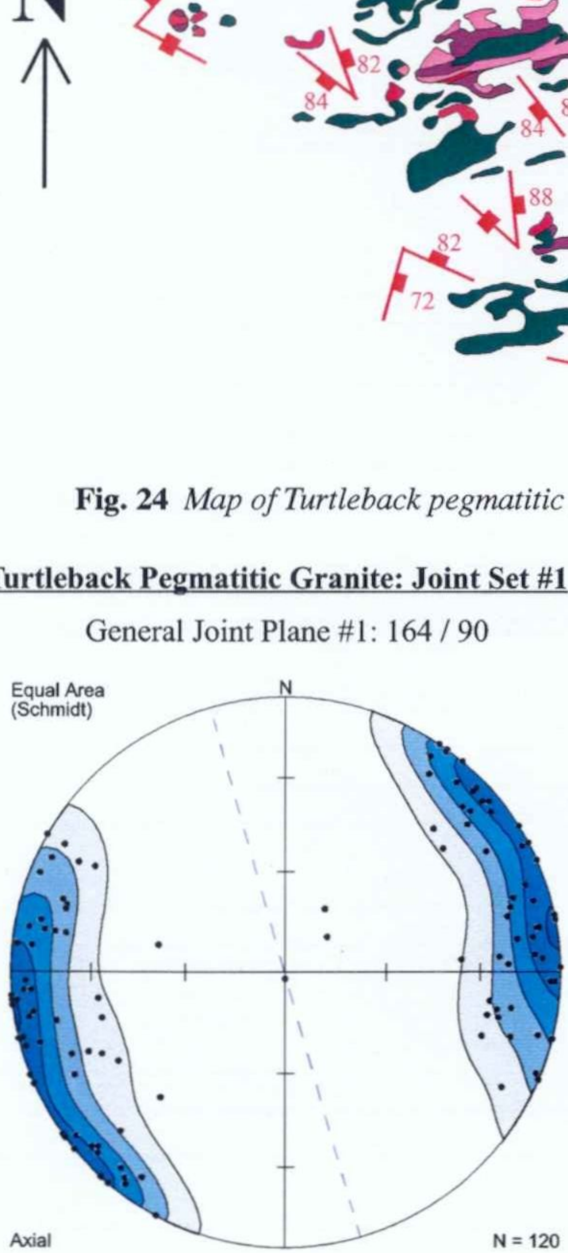
**Fig. 23** *Stereonet representation of Turtleback pegmatitic granite foliation measurements.*

# *TURTLEBACK PEGMATITIC GRANITE*
# JOINTING


**Fig. 24** *Map of Turtleback pegmatitic granite with selected joint measurements shown.*

**Turtleback Pegmatitic Granite: Joint Set #1**

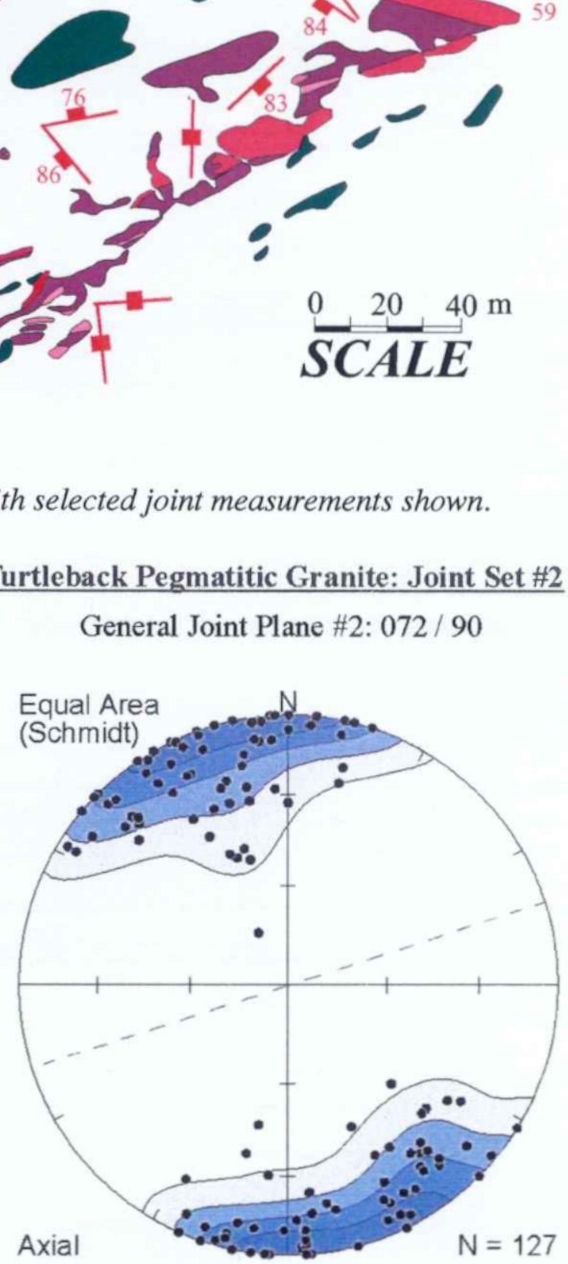
General Joint Plane #1: 164 / 90




Contour Interval: 0,4,8,12,16

**Turtleback Pegmatitic Granite: Joint Set #2**

General Joint Plane #2: 072 / 90

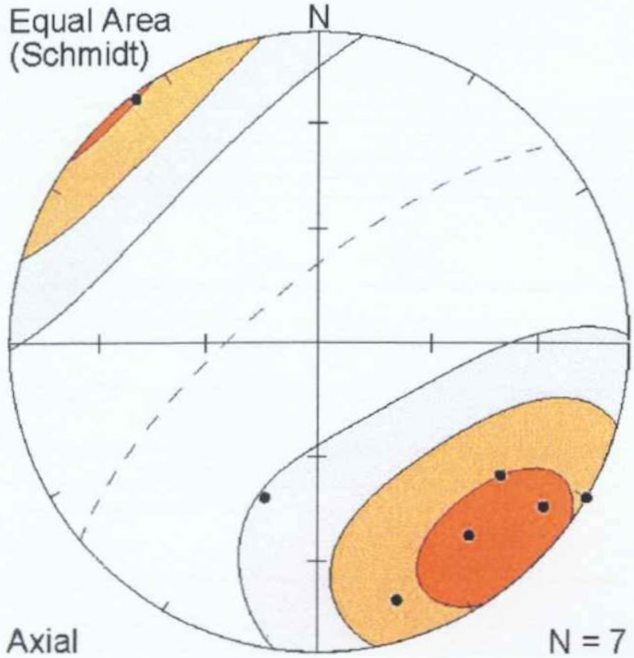



Contour Interval: 0,4,8,12,16

**Fig. 25** *Stereonet representations of Turtleback pegmatitic granite joint measurements.*

**Turtleback Pegmatitic Granite: Veins**

General Vein Orientation: 050 / 74 NW




Contour Interval: 0,2,4,6

**Fig. 26** *Stereonet representation of Turtleback pegmatitic granite vein measurements.*

**Fig. 27** *Carbonate vein development along pillow selvedges within a roof pendant of metabasalt in the Turtleback pegmatitic granite.*

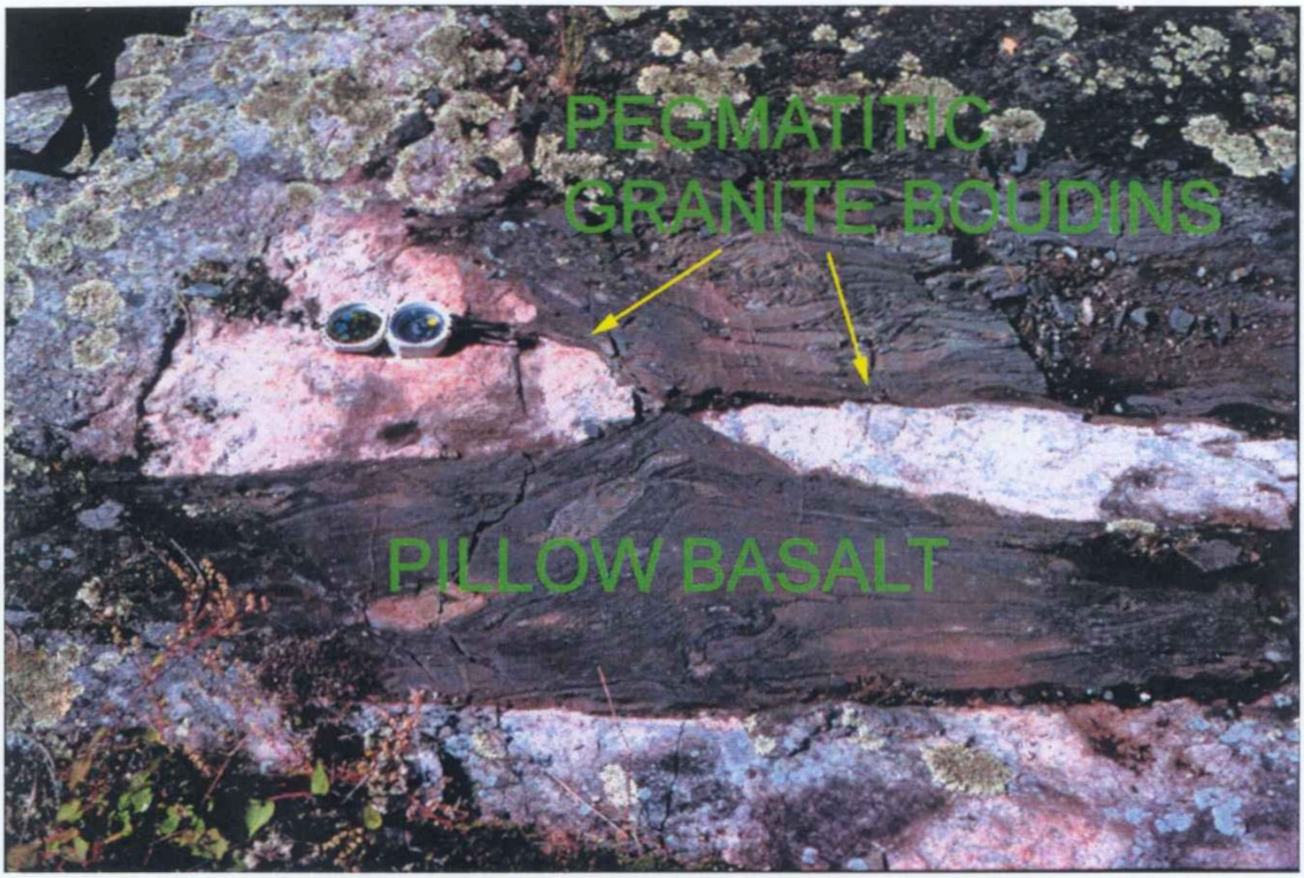



**Fig. 28** *Boudinaged pegmatitic granite material within a roof pendant of pillow metabasalt located within the Turtleback pegmatitic granite.*

# 13. STRUCTURAL FEATURES OF COOK'S PEGMATITIC GRANITE

## 13.1 Foliation

Foliation in CPG has a strike of 069° and a steep southerly dip of 74° (Fig. 29 and Fig. 30). This orientation is similar to the foliation present in the TPG which is 072°/86°S. Strike is only 3° different and dip varies by 17° but acts in the opposite direction (south on CPG). These variations are easily accounted for by sampling errors and by errors in the stereonet calculation of general plane. Although over a kilometer separates CPG from the TPG, both these outcrops were affected by the same regional events. Foliation in CPG was therefore, controlled by the same mechanisms which created the foliation in the TPG. The foliation producing mechanisms were emplacement during D1 and folding during D2 deformation.

## 13.2 Jointing

There are two identified joint sets present in CPG (Fig. 31 and Fig. 32). Joint set one is oriented at; 159°/84°SW. Joint set two is oriented at; 070°/75°N. These joint sets are similar to the respective joint sets measured on the TPG. Joint set one varies in strike by only 5° and in dip by only 2°. Joint set two varies in strike by only 2° and in dip by a somewhat larger, but still negligible amount; 15°steeper in the TPG. Because the similarities between joint orientations are so striking when the TPG and CPG are compared, it is interpreted that the same mechanism which created jointing in the TPG was also active in CPG.

# *COOK'S PEGMATITIC GRANITE*

# FOLIATION

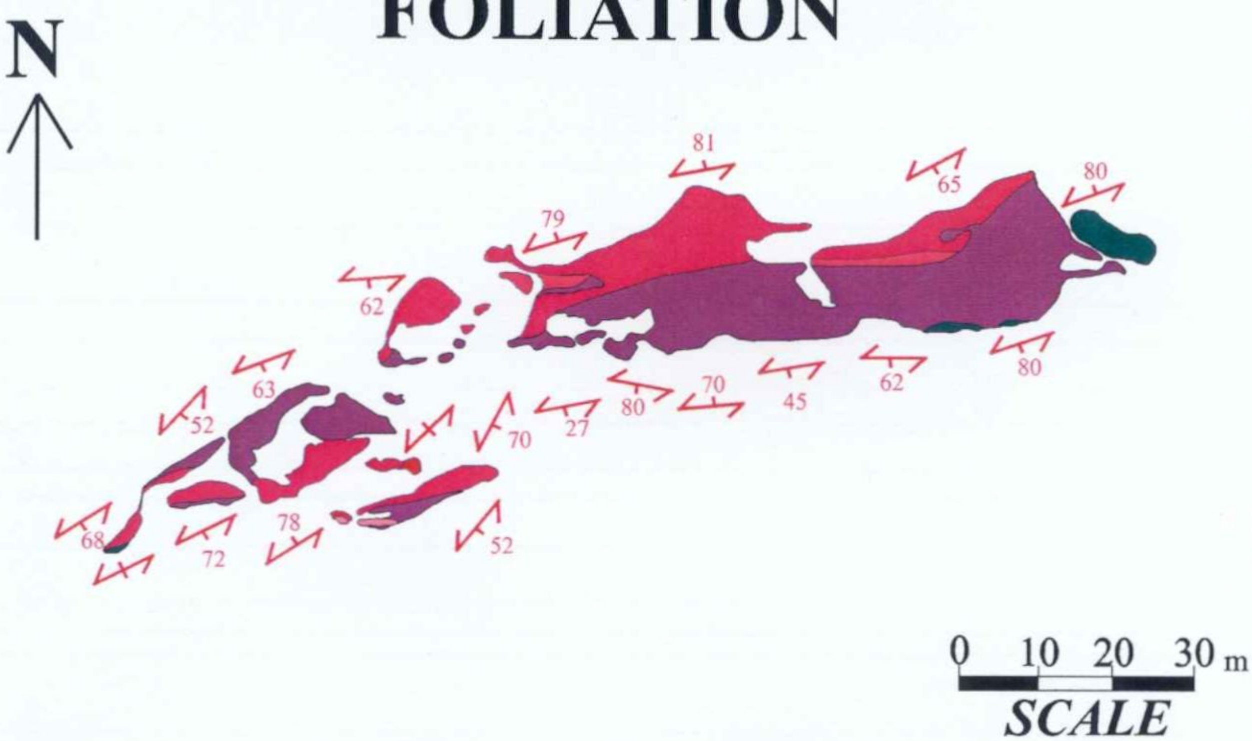
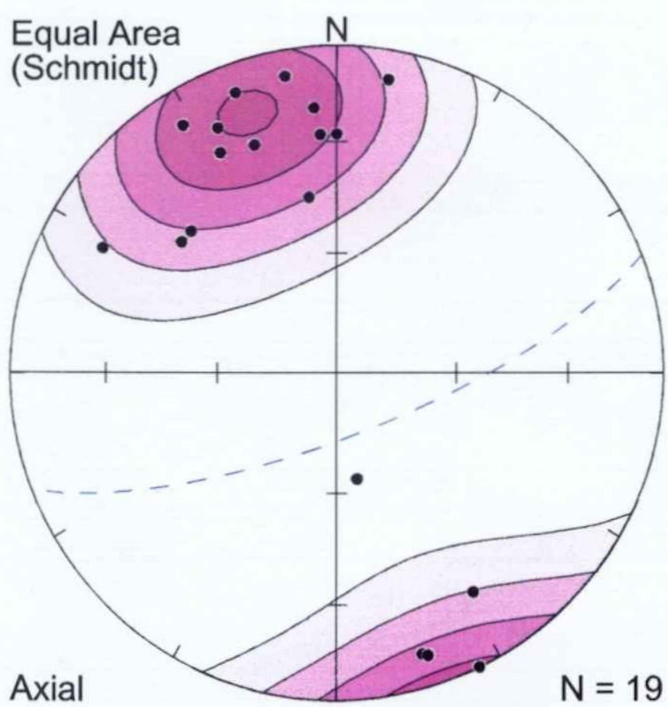



**Fig. 29** *Map of Cook's pegmatitic granite with selected foliation measurements.*

## Cook's Pegmatitic Granite: Foliation

General Foliation Plane: 069 / 74 S




Contour Interval: 0,2,4,6,8

**Fig. 30** *Stereonet representation of foliation measurements taken in Cook's pegmatitic granite.*

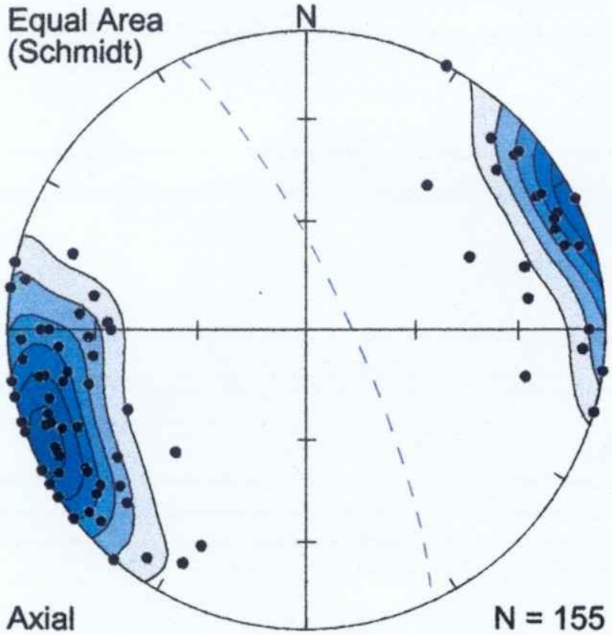
# *COOK'S PEGMATITIC GRANITE*

# JOINTING


**Fig. 31** *Map of Cook's pegmatitic granite with selected joint measurements.*

**Cook's Pegmatitic Granite: Joint Set #1**

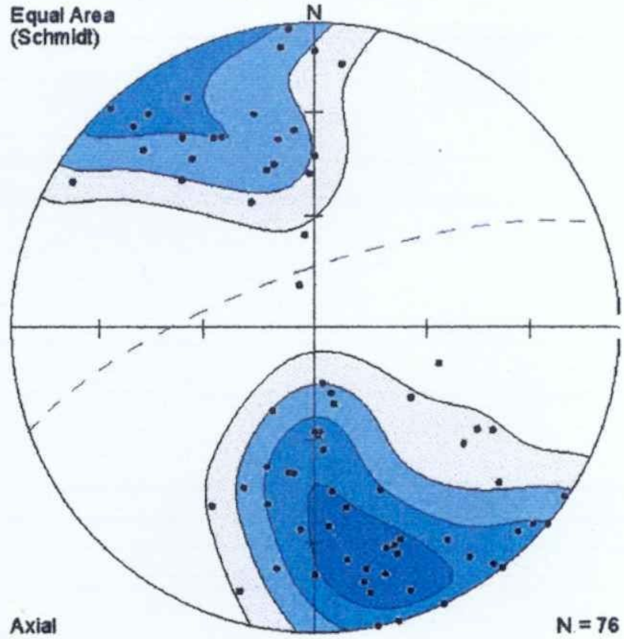
General Joint Plane #1: 159 / 84 E




Contour Interval: 0,2,4,6,8,12,16

**Cook's Pegmatitic Granite: Joint Set #2**

General Joint Plane #2: 070 / 75 N




Contour Interval: 0,2,4,6,8,12,16

**Fig. 32** *Stereonet representations of Cook's pegmatitic granite joint measurements.*

# 14. STRUCTURAL FEATURES BETWEEN THE PEGMATITIC GRANITES

## 14.1 Foliation

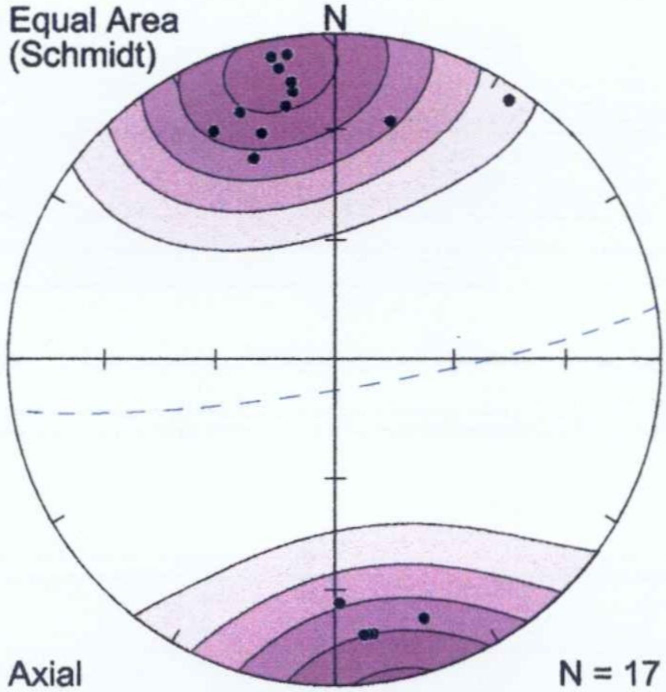
The rocks between CPG and the TPG contain mainly metavolcanics in which foliation was similar to that measured in the two pegmatitic granites (Fig. 33). Foliation between the two pegmatitic granites has a general orientation of 081°/82°S. The strike of this foliation is 9° off the TPG foliation and 12° off CPG foliation. The dip of foliation between the pegmatitic granites is 4° different than the foliation in the TPG but dipping north instead of south, and 8°steeper than the foliation in CPG.

## 14.2 Jointing

Jointing in the rocks between pegmatitic granites forms in two distinct joint sets (Fig. 34). Joint set one has a general orientation of 166°/84°E. This varies from the foliation strike in the TPG by 2° and only 7° from the foliation strike in CPG pegmatitic granite. The general plane of joint set one shows the dip of joint set one between the pegmatitic granites to be identical to the dip of joint set one in CPG and only 6° shallower than the dip of this joint set in the TPG. Joint set two has a general joint plane of 079°/79°S. This varies by only 9° strike from CPG and by only 7° strike from the TPG. The dip of joint set two's general plane between the two pegmatitic granites is 11° shallower than the general dip in the TPG, and 4° steeper than the dip in CPG.

**Measured Between Two Outcrops: Foliation**

General Foliation Plane: 081 / 82 S

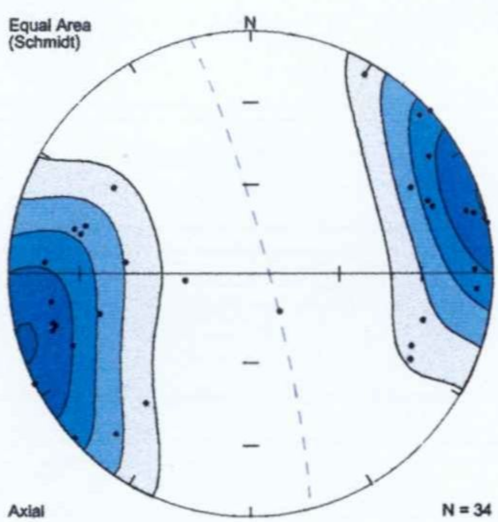



Contour Interval: 0,2,4,6,8

**Fig. 33** *Stereonet representation of foliation measurements taken between the two pegmatitic granites studied.*

Measured **Between Two Outcrops: Joint Set #1**

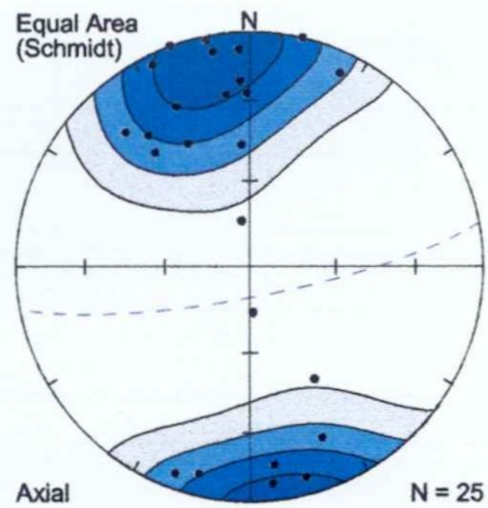
General Joint Plane #1: 166 / 84 E




Contour Interval: 0,2,4,6,8

Measured **Between Two Outcrops: Joint Set #2**

General Joint Plane #2: 079 / 79 S




Contour Interval: 0,2,4,6

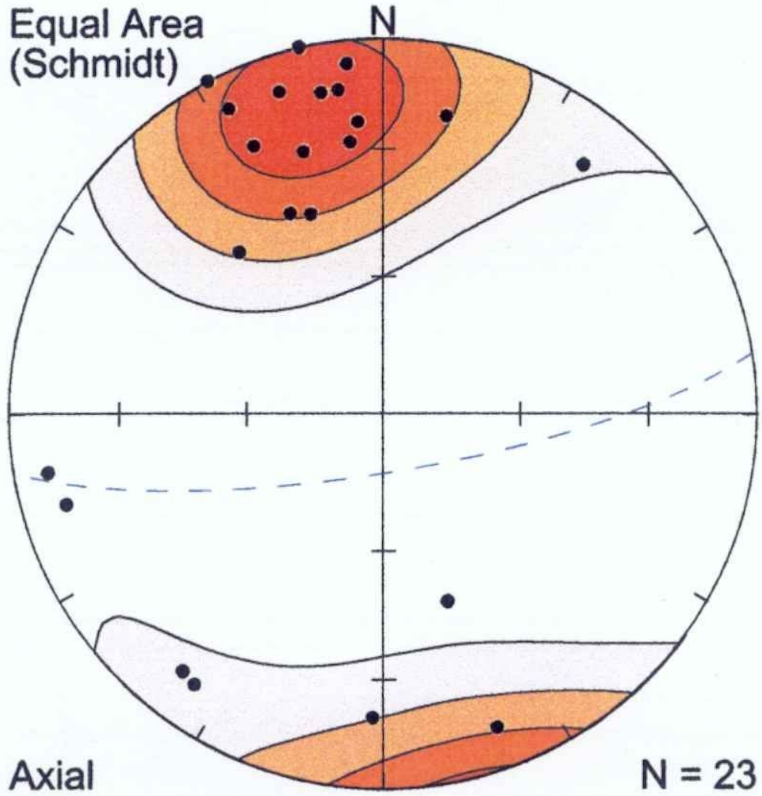
**Fig. 34** *Stereonet representations of joint measurements taken between the two pegmatitic granites studied.*

## 14.3 Veins

The general orientation of veins measured between the two pegmatitic granites is 081°/77°S. This is 31° than the strike of the veins encountered in the vicinity of the TPG. Veins measured between the TPG and CPG have a general dip which is 3° steeper than the dip of the veins near the TPG pegmatitic granite. Also, between the granite bodies, veins dip south, and in the TPG veins dip northwest. The most likely cause for these variations in vein orientation is error due to a very low number of data points. When data points are so few in number, each point is allotted a large value when density contouring is done. This often results in less accurate calculation of stereonet general planes. Another possible cause for the variation may be that different veining mechanisms act in the metavolcanics significantly distant from the pegmatitic granites than the mechanisms causing veins proximal to the pegmatitic granites.

<u>Measured **Between Two Outcrops: Veins**</u>

**General** Foliation Plane: 081 / 77 S




Contour Interval: 0,2,4,6

**Fig. 35** *Stereonet representation of vein measurements taken between the two pegmatitic granites studied.*

## 15. DISCUSSION

Although separated by over a kilometer in a north-south direction, the TPG and CPG are similar with respect to; areal extent, topographic relief, texture, mineralogy, and structure. Once related by such similarities, the TPG and CPG may be treated as one type of potential source for highly fractionated rare-element pegmatite deposits. Therefore, understanding these pegmatitic granites could lead to better understanding and delineation of rare-element deposits.

As seen in Fig. 11 and Fig. 12, both these pegmatitic granites crop out along a west-southwest to east-northeast trend for approximately 280m east to west and between 100 and 150m north to south. This relationship with respect to areal extent suggests that the TPG and CPG may; have similar volumes, be emplaced and subsequently deformed by similar mechanisms (i.e. emplaced along S1 foliation then deformed by D2), and may therefore, have similar timing of emplacement. Due to the resistant nature of pegmatitic granite lithologies, both the TPG and CPG crop out as "humps" and ridges of resistant rock. Four textural phases are recognizable in both outcrops: **1.** pegmatitic leucogranite, **2.** fine-grained leucogranite, **3.** sodic aplite, and **4.** pegmatitic potassic phase. Since each of these textural phases is characterized by specific mineralogy, the occurrence of these textural phases within both the pegmatitic granites indicates that the pegmatitic granites are similar compositionally as well as texturally. Compositional similarities suggest that the two pegmatitic granites were derived from the same parental fertile granite, or at least they underwent parallel processes during generation of pegmatitic granite melt. The occurrence of ferrocolumbite-ferrotantalite within these two pegmatitic granites reaffirms their potential as sources for rare-element-bearing pegmatites.

Structural features are strikingly similar both between and within the Turtleback and Cook's pegmatitic granites. S2 foliation was developed during D2 deformation. This strong foliation transposed earlier S1 foliation parallel to itself. S2 has similar strikes of: 072° in the Turtleback pegmatitic granite and 069° in Cook's pegmatitic granite. Foliation has steep to subvertical dip in both the pegmatitic granites mapped as well as in the rocks between these two outcrops. The Turtleback and probably Cook's pegmatitic granite are isoclinally folded. Attenuated limbs and minor folding in fold noses are evident in the Turtleback pegmatitic granite only, although hidden isoclinal folding is a distinct possibility for Cook's pegmatitic granite. Two late stage joint sets are present within each of the two pegmatitic granites. These joints sets probably developed in a late brittle stage because they do not show deformation features, are not offset, and are rarely infilled. All joint sets dip subvertically and set one strikes between 159° and 166°, whereas, the strike of joint set two ranges from 070° to 079°. It is notable that joint set two is parallel to foliation. This relationship suggests that S2 foliation acts as planes of weakness along which joint set two develops.

In conclusion, noting the similarities in areal extent, topographic relief, texture, composition, and structure between the Turtleback and Cook's pegmatitic granites allows these two pegmatitic granites to be considered as analogous structures. Therefore, conclusions drawn for one of these outcrops is probably also applicable to the other.

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# Appendix C:

# Structural Analysis of the Separation Lake Property

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# STRUCTURAL ANALYSIS OF THE TANCO'S SEPARATION LAKE PROPERTY. WESTERN ONTARIO (CANADA)

CLIENT: TANTALUM MINING CORPORATION OF CANADA LIMITED

F. DE LA FUENTE

DECEMBER 1998

# INDEX

# STRUCTURAL ANALYSIS OF THE TANCO'S SEPARATION LAKE PROPERTY. WESTERN ONTARIO (CANADA)

## 1. INTRODUCTION

This report on the structural analysis of Separation lake property in western Ontario (Canada) has been commissioned to Fernando de la Fuente Consultores, S.L. by the Tantalum Mining Corporation of Canada Limited (Tanco).

Two days have been devoted to airphoto interpretation, two days were spent at Tanco's mine site reviewing the existing information on the area, four days were devoted to field work, one day was spent at the Ontario Geological Survey office in Kenora to review the available information and to examine selected holes previously drilled by Champion Bear Resources, two more days, after the field work, were devoted to prepare the information and discussions with Tanco geologists and, finally, one day was spent in visiting the Big Whopper area.

Five more days have been devoted to compile the information and reporting.

## 2. LOCATION, ACCESS AND PROPERTY

The claim group is located N of the English River and N and W of the Separation Lake, some 75 km N of Kenora, Ontario.

Main access to the area is from Redditt via the English River Road, through a well maintained gravel road. Numerous tracks and drilling accesses transept the NE part of the area.

Most of the central and southern portions of the area are accessible by boat.

The Separation Lake property consists of 30 claims at present under agreement between Tanco and Gossan Resources Limited.

The claims cover 137 claim units.

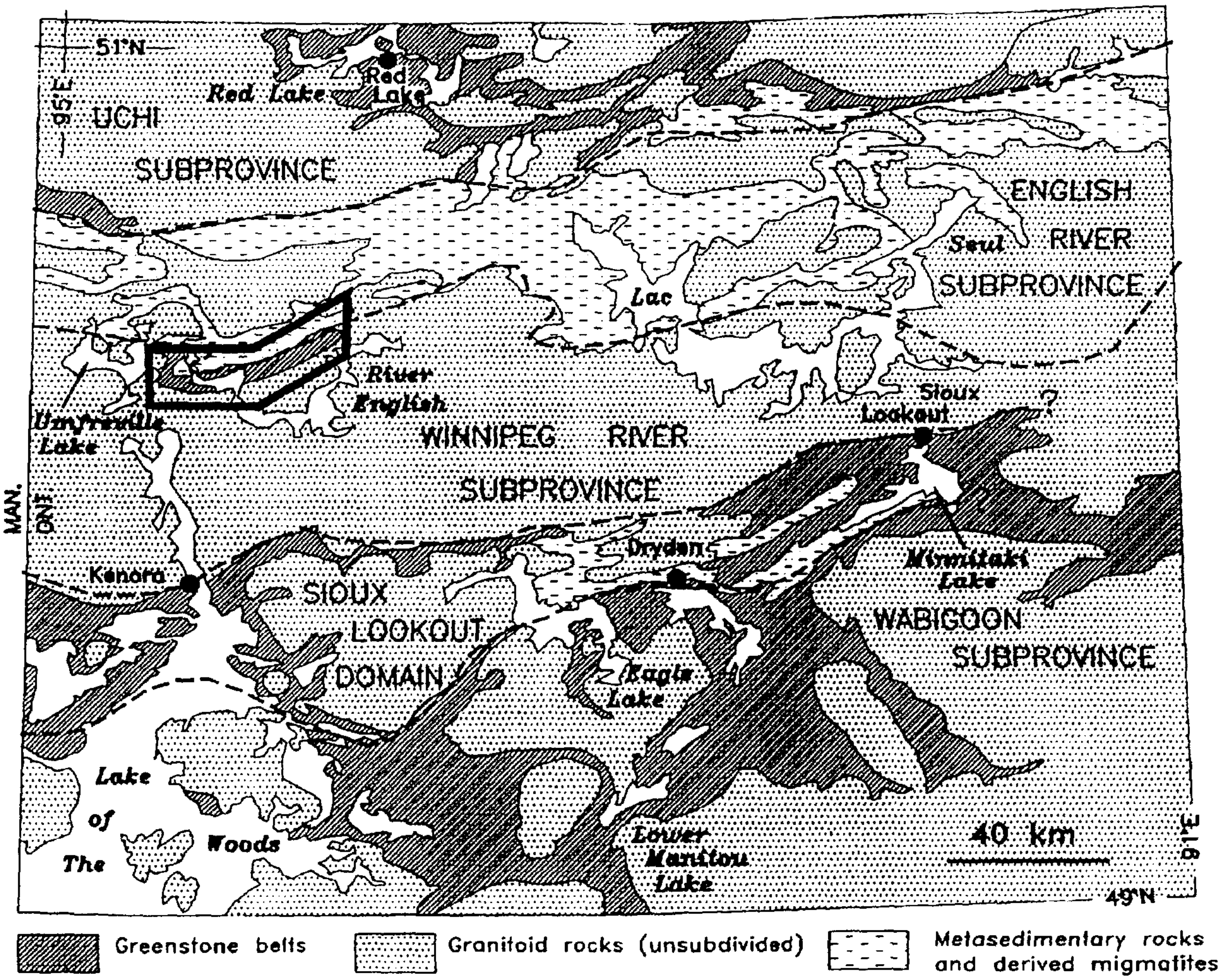
# 3. REGIONAL GEOLOGICAL SETTING

The pegmatites, subject of this report, are hosted by the Separation Lake greenstone belt.

This metavolcanic complex lies within the Superior Province, and constitutes the boundary between the English River Subprovince (ERS) to the north and the Winnipeg River Subprovince (WRS) to the south (Map nº 1). It has been considered to be the eastern continuation of the southern part of the Bird River metavolcanic-metasedimentary belt in Manitoba.

The limit between the Separation Lake Belt and the ERS is a fault contact with metasedimentary rocks to the north.

The southern limit is a clearly intrusive contact with younger plutonic rocks of the WRS.




Map nº 1: Regional Geological Setting.

## 3.1. THE ENGLISH RIVER SUBPROVINCE

The English River Subprovince is a linear belt, up to 50 kilometres wide and at least 800 kilometres long, characterised by highly metamorphosed and migmatised sedimentary rocks and compositionally diverse intermediate to felsic plutonic rocks.

The intermediate to felsic plutonic rocks include: strongly peraluminous granitoid rocks related to the migmatization process and leucocratic, metaluminous to weakly peraluminous tonalitic to granitic stocks and batholiths that seem to be unrelated to the migmatization process.

## 3.2. THE WINNIPEG RIVER SUBPROVINCE

This subprovince is a plutonic domain, up to 70 kilometres wide and at least 400 kilometres long. The subprovince is composed of diverse plutonic rocks and minor amounts of supracrustal rocks.

The plutonic rocks intrude the southern part of the Separation Lake greenstone belt. Microcline-megacrystic granodiorites with subordinate granites with locally foliated to gneissic tonalites have been described.

## 3.3. THE SEPARATION LAKE GREENSTONE BELT

The Separation Lake Greenstone Belt is the largest segment of the metavolcanic rock belt that occurs discontinuously along the English River-Winnipeg River subprovincial boundary.

It extends from the east shore of Umfreville Lake to Helder Lake, 45 kilometres, and has a maximum width of 5 kilometres.

The Separation Lake belt is characterised by a bimodal volcanic sequence comprising mainly mafic volcanics and minor felsic pyroclastic rocks overlying the mafics to the north.

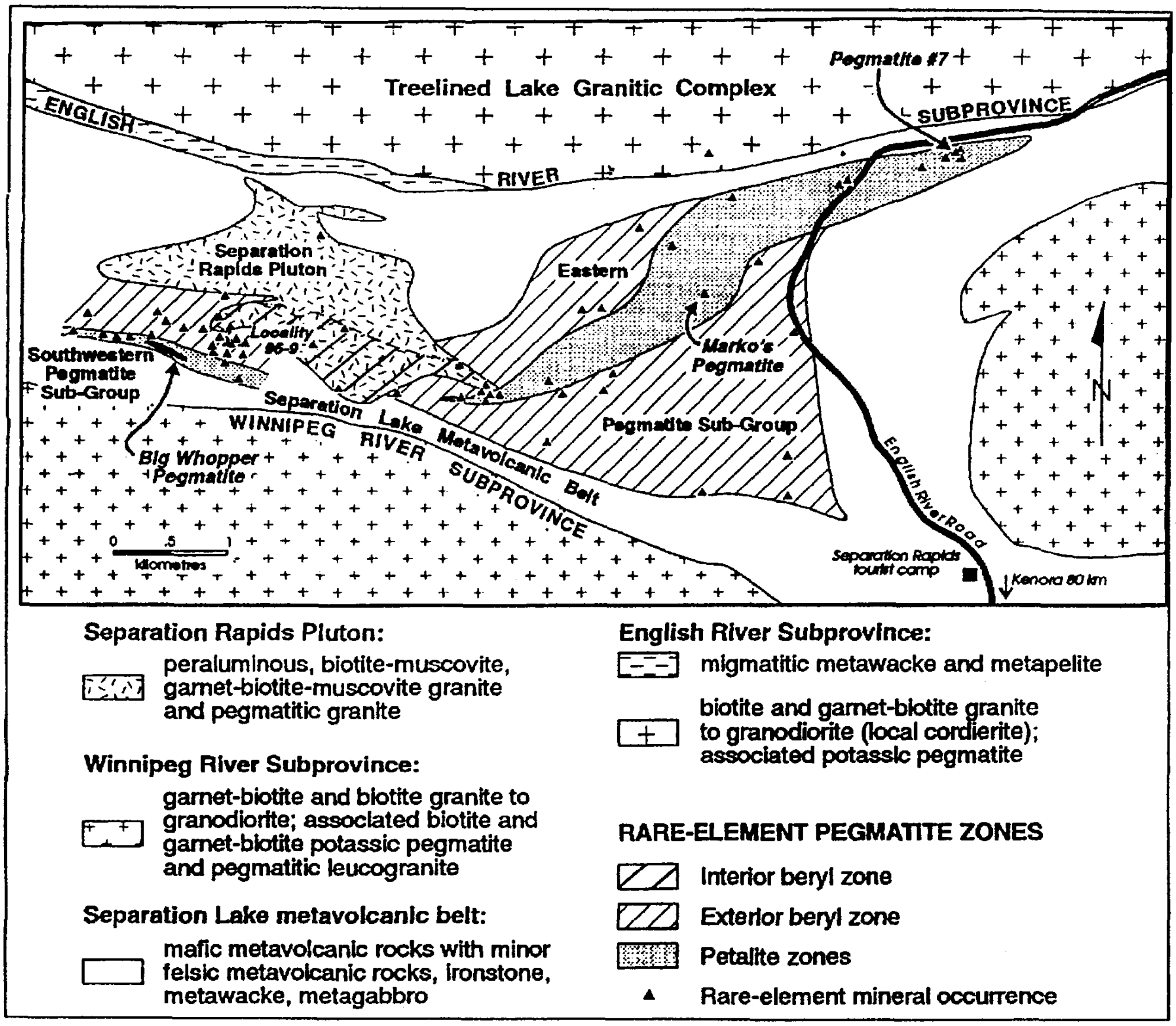
The mafic volcanics, composed of pillowed and massive flows, are strongly deformed and metamorphosed to amphibolites. The gabbros occurring in the area seem to be thicker parts of the flows.

The felsic pyroclastics comprise mainly tuffs and lapilli tuffs.

Chemical metasediments occur within the mafic volcanics. They typically are layered chert-magnetite iron formations 1 to 5 thick. Pyrrhotite and minor pyrite locally replace magnetite.

Polymictic conglomerates, in places interbedded with wackes, overly the metavolcanics to the north of the area.

# 4. LOCAL GEOLOGICAL SETTING (Map nº 2)




Map nº 2: Geology of the Separation Lake Belt (After Blackburn and Young 1994a,b).

## 4.1. SEPARATION LAKE GREENSTONE BELT

### 4.1.1. MAFIC METAVOLCANICS

Mafic metavolcanic rocks constitute approximately 80% of the belt. They are mainly pillowed and banded flows metamorphosed to amphibolites.

Coarser grained gabbros may correspond to thicker sections of flows or subvolcanic sills.

### 4.1.2. FELSIC METAVOLCANICS

They are mainly composed of tuffs and lapilli-tuffs. Because of the location of a broad deformation zone in its vicinity, primary textures and structures have been obliterated in many places.

### 4.1.3. METASEDIMENTS

Chemical metasediments occur within the mafic volcanics. They typically are layered chert-magnetite iron formations 1 to 5 thick. Pyrrhotite and minor pyrite locally replace magnetite.

They occupy two presently identified stratigraphic levels:

- The lower unit is located at, or close to, the base of the mafic metavolcanic sequence.
- Two upper units separated either by mafic flows or gabbros.

Clastic metasediments occur at two stratigraphic levels:

- Within the mafic metavolcanics as feldspathic arenite to wacke.
- Overlying the felsic metavolcanics as polymictic conglomerates, in places interbedded with wacke, up to 30 metres thick.

In places it has been observed that the conglomerates lie directly on top of the felsic volcanics in apparent conformity. This might question the placement of the subprovincial boundary.

### 4.1.4. GRANITIC ROCKS

#### 4.1.4.1. Separation Rapids Pluton

This 4 $km^2$ pluton has been described as a fertile, peraluminous S-type granite. Salient petrographic features include:

- Widespread layering between pegmatitic leucogranite, sodic aplite, potassic pegmatite and coarse-grained granite units.
- Beryl-garnet-muscovite-biotite pseudomorphs after cordierite megacrysts.
- Metasomatic reactions with widespread amphibolite enclaves.
- Sporadic ferrocolumbite and beryl in potassic pegmatite units.

On the basis of geochemical studies it was suggested that the Separation Rapids Pluton was derived from the Treelined Lake granitic complex.

#### 4.1.4.2. Separation Rapids Pegmatite Group

These pegmatites constitute the most mineralogically evolved part of the granitic rocks.

On the basis of columbite group mineral compositions, the pegmatites can be divided into a Fe-suite and a Mn-suite. The two largest pegmatites of the originally identified are both from the Mn-suite. This was tentatively interpreted as products of two distinct magmas.

## 4.2. MIGMATITES AND GRANITOID ROCKS OF THE ERS

Migmatites and associated granitic rocks corresponding to the English River Subprovince outcrop to the north of the greenstone belt.

The granites have been described as derived from the migmatites by melting of predominantly sedimentary rocks.

The pegmatitic granites that intrude the Separation Lake Belt area derived from the fractionation of magmas produced by melting of the ERS sediments and should by considered part of that subprovince.

### 4.2.1. THE TREELINED LAKE GRANITIC COMPLEX

It is a large S-type peraluminous granite containing cordierite-orthopyroxene-garnet-biotite.

Mineralogical and geochemical analyses suggest an origin involving mainly partial melting of the clastic sedimentary rocks of the English River Subprovince during granulite-facies metamorphism with input from the mantle.

## 4.3. GRANITOID ROCKS OF THE WRS

In the project area, they mainly comprise medium to coarse grained late-tectonic tonalites and granodiorites.

Abundant enclaves of mafic to ultramafic blocks are common near the margins.

## 5. PREVIOUS EXPLORATION WORK

Exploration work carried out on the area prior to 1993 was focused on iron, base metals, gold and uranium.

Several companies, W.S. Moore Company, Tombill-Glen Echo Mines and Centurion Mines, examined the potential for iron of the iron formations between 1948 and 1957.

In the 60's and 70's, Can-Fer Mines Limited, Consolidated Summit Mines Limited and Noranda Inc., carried out exploration work for uranium, and erratic mineralization was encountered associated with pegmatites.

Selco Mining Corporation Limited, Sherritt Gordon Mines Limited and, specially, Champion Bear Resources conducted intensive exploration work in the area for base metals and gold.

In 1993, the Ontario Geological Survey started an inventory of known rare-element mineralization occurrences.

In June 1996, fieldwork carried out by the OGS in the Separation Lake area, leaded to the discovery of seventeen new occurrences of rare-element pegmatites, nearby the Separation Rapids Pluton (SPR). A total of 55 occurrences are known within the area.

These occurrences lie in an area of at least 7 x 3 km.

The pegmatitic area, located near the SW end of the Separation Rapids Pluton, can be subdivided, from N to S, into beryl and petalite zones, indicating zonation from N to S, away from the SRP.

The largest pegmatite, named Big Whopper, is petalite-rich, up to 80 m thick and up to 450 m in strike length.

## 6. TANCO'S EXPLORATION ACTIVITY

Tanco conducted two diamond drilling programmes in 1996 and 1997 to determine the mineralogical and structural characteristics of the pegmatites at depth. Several pegmatites were drilled.

In the period September-October 1996 a total of 1,700 feet was drilled in seven holes named SL-96-03 to SL-96-09.

The conclusions were:

- Pegmatites general strike is 70°, dipping to the NW.
- "Mineralization was not too encouraging". Pegmatites to the NE encountered the best values up to 0.035% $Ta_2O_5$.
- Pegmatites likely pinch and swell at depth and at surface.

854.35 A second drilling programme was undertaken in September-October 1997 with the same objective that the previous year programme. Nine pegmatites were drilled in 10 holes, SL-97-01 to SL-97-10, totalling 854.36 metres.

Remarkable results were:

- Best tantalum results were obtained from the Turtleback Pegmatitic Granite.
- Significant lithium (1.82%) was intersected in Draven's pegmatite.
- Maximum Caesium value encountered so far was 0.01%.

# 7. PRESENT WORK

## 7.1. FIELD WORK

The following are notes recorded at the different localities visited during the fieldwork. They are located in Map nº 3.

### 7.1.1. BALLPEEN PEGMATITE

This pegmatite, intruded in mafic metavolcanics, is quite fractionated.

It is strongly deformed and folded (Photograph nº 1). The pegmatite contacts are concordant with the $S_1$ planes in the metavolcanics indicating that likely the pegmatite was intruded along those planes and both the hosts and the pegmatite are folded by $D_2$ phase folds.

Photograph nº 1: Tight $D_2$ deformation phase vertical folds at Ballpeen Pegmatite.

The second deformation phase, $D_2$, produced tight folds with sub-vertical axis (Photograph nº 1). $S_2$ is sub-parallel to $S_1$ planes except at the hinges of the folds where $S_1$ and $S_2$ are easily identifiable. General schistosity attitudes are:

- $S_1$ = N60° 70⁰ SW
- $S_2$ = N60° vertical

Two sets of joints, likely related to late deformation phase $D_2$ can be measured: N10° and N150° both sets vertical.

### 7.1.2. PEGMATITE #10

Less fractionated, more feldspathic and finer grained than Ballpeen Pegmatite, is intruded in felsic meta-tuffs and tuffites. Folded by $D_2$ in tight folds with sub-vertical axis. $S_2$ is sub-parallel to $S_1$ planes.

Measured schistosities are: $S_1$ = N80° dipping 70° SW and $S_2$ = N80°, vertical

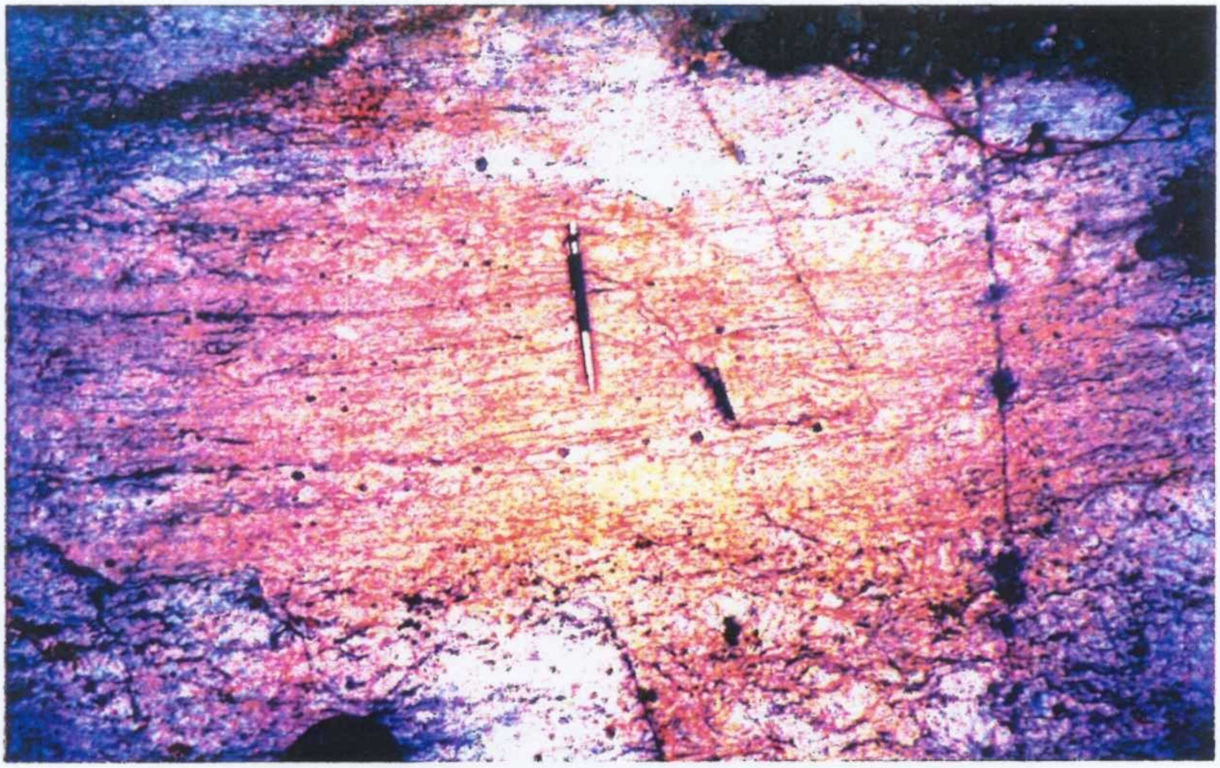
$D_2$ late joints strike N10° and N160° respectively and dip vertical.

### 7.1.3. DRAVEN'S PEGMATITE

It is fine-grained, mostly feldspathic and appears strongly deformed. Rotated feldspar and garnet crystals are easily identifiable (Photograph nº 2). It intrudes in mafic meta-volcanics parallel to $S_1$ planes. Folded by $D_2$ in tight folds with sub-vertical axis, being $S_2$ sub-parallel to $S_1$. It seems to have been deformed in semi-plastic stage during $D_2$.

$S_1$ = N100° 70° SW

$S_2$ = N100° vertical



Photograph nº 2: Draven's Pegmatite showing rotate feldspars and garnet within a strongly sheared feldspar groundmass.

### 7.1.4. IRON FORMATION

The iron formation was observed a few hundred of metres to the north of Draven's Pegmatite. It has an equigranular recrystalised quartz matrix with biotite and sulphides. Magnetite-pyrrohite minor pyrite, sphalerite and chalcopyrite were identified.

### 7.1.5. PEGMATITES N OF DRAVEN'S

Outcropping in the road from Draven's to Treelined Lake Granite, there is a set of fine-grained aplites and pegmo-aplites intruded in mafic meta-volcanics.

Mainly feldspathic in composition, appear little fractionated and show contacts parallel to $S_1$ planes.

They are folded by $D_2$ in tight folds with sub-vertical axis, being $S_2$ planes sub-parallel to $S_1$.

$D_3$ deformation phase gives open folds with sub-horizontal axis striking N70°. $S_3$ fracture cleavage offsets joints N10° and N160°, all of them later filled by quartz (Photograph nº 3).

Photograph nº 3: $S_3$ fracture cleavage offsetting $D_2$ late joints.

$S_1$ strikes N80° and dips 70° SW. $S_2$ strikes N80° and dips vertical. Fracture cleavage $S_3$ strike is N70° dipping sub-vertically. The two late $D_2$ phase joints have N10° and N160° directions and vertical dips.

### 7.1.6. TREELINED LAKE GRANITE

It shows an equigranular texture and layering (better developed towards the edges). The layering, generally striking N60-70°, is folded by $D_2$ in sub-vertical axis folds as well as later thin pegmatitic veins.

Two sets of joints, N10° and N160° with vertical dips are also visible.

Late-stage quartz veins are strongly sheared (Photograph nº 4).

Photograph nº 4: Strongly sheared late-stage quartz veins in Treelined Lake Granite.

### 7.1.7. LOU´S PEGMATITE

This pegmatite has a maximum thickness of 2 metres. It is also poorly fractionated, feldspathic and fine grained. Garnet, Beryl and Tourmaline have been observed. Columbite-tantalite and cassiterite have been previously recorded.

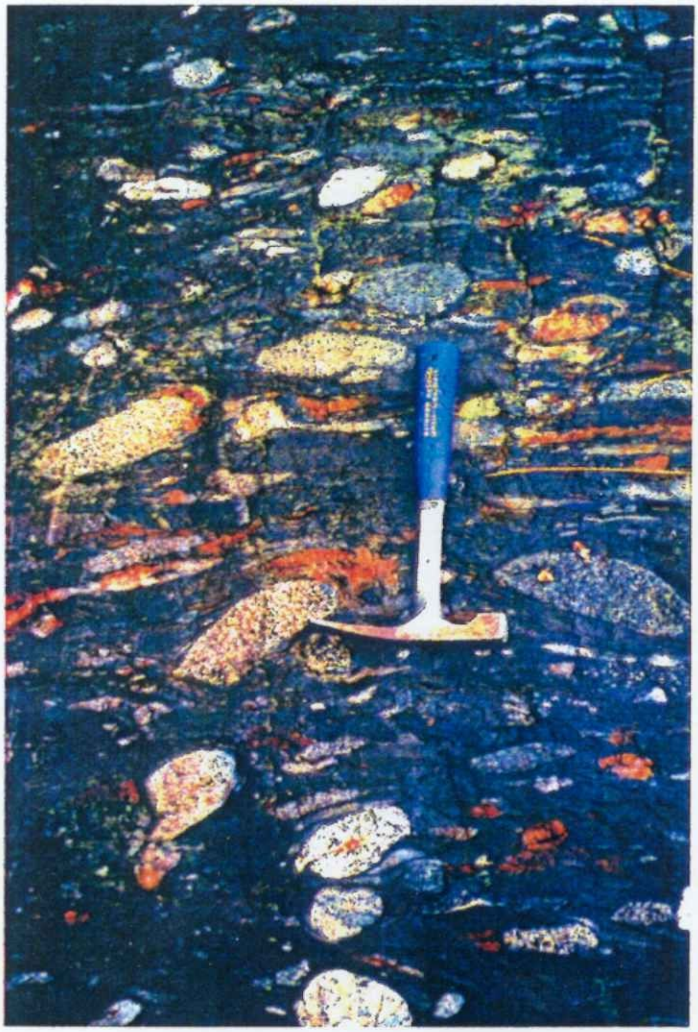
Intruded in mafics, the contacts are parallel to $S_1$ planes striking N60° and dipping 50° to the SW. It is folded by $D_2$ tight folds with sub-vertical axis.

### 7.1.8. COOK'S PEGMATITIC GRANITE

It outcrops along two prominent ridges that might correspond to the flanks of a $D_3$ phase fold. It seems to be intruded in mafic metavolcanics but the contacts are not exposed. The linear shape of the ridges suggests tectonic contacts. It is strongly deformed.

The mineralogical composition is mostly feldspathic and contains coarse-grained pegmatitic pods.

### 7.1.9. POLYMICTIC CONGLOMERATE



Photograph nº 5: General aspect of the conglomerate.

Between the felsic volcanics and the migmatites of the English River Subprovince lies a polymictic conglomerate and sandstone horizon.

The conglomerates are composed of granite, quartz and mafic metavolcanic clasts in a silt and sand matrix. The clasts are strongly flattened and folded. Rotation of clasts has been also noticed (Photograph nº 5).

These conglomerates show a strong deformation and two schistosities $S_1$ and $S_2$ corresponding to deformation phases $D_1$ and $D_2$, respectively (Photograph nº 6).

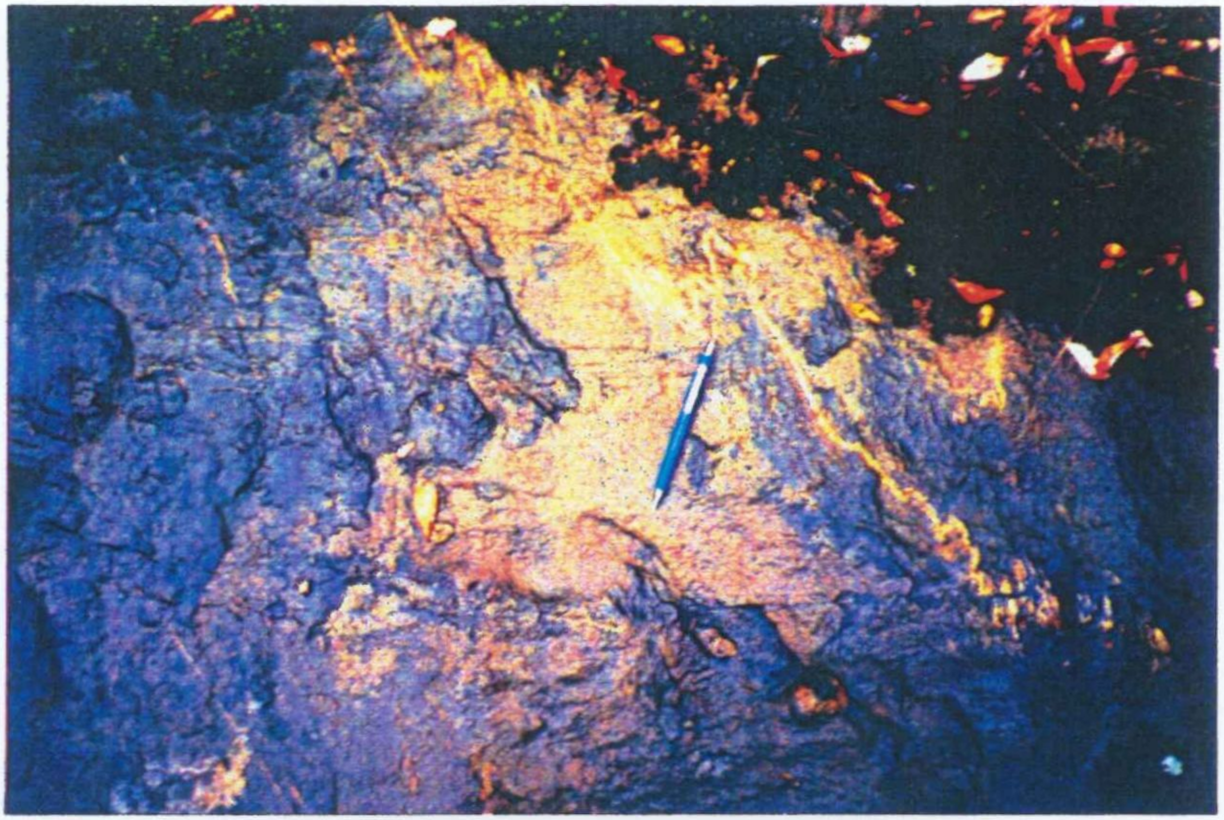
Within the conglomerate there are folded pegmatite pods. These folds are of phase $D_2$ and they have and associated $S_2$ striking N70-80° and dipping subvertical (Photograph nº 7).

Photograph nº 8 shows a deformed pegmatitic dike intruding the conglomerate near the Treelined Lake Granite contact.

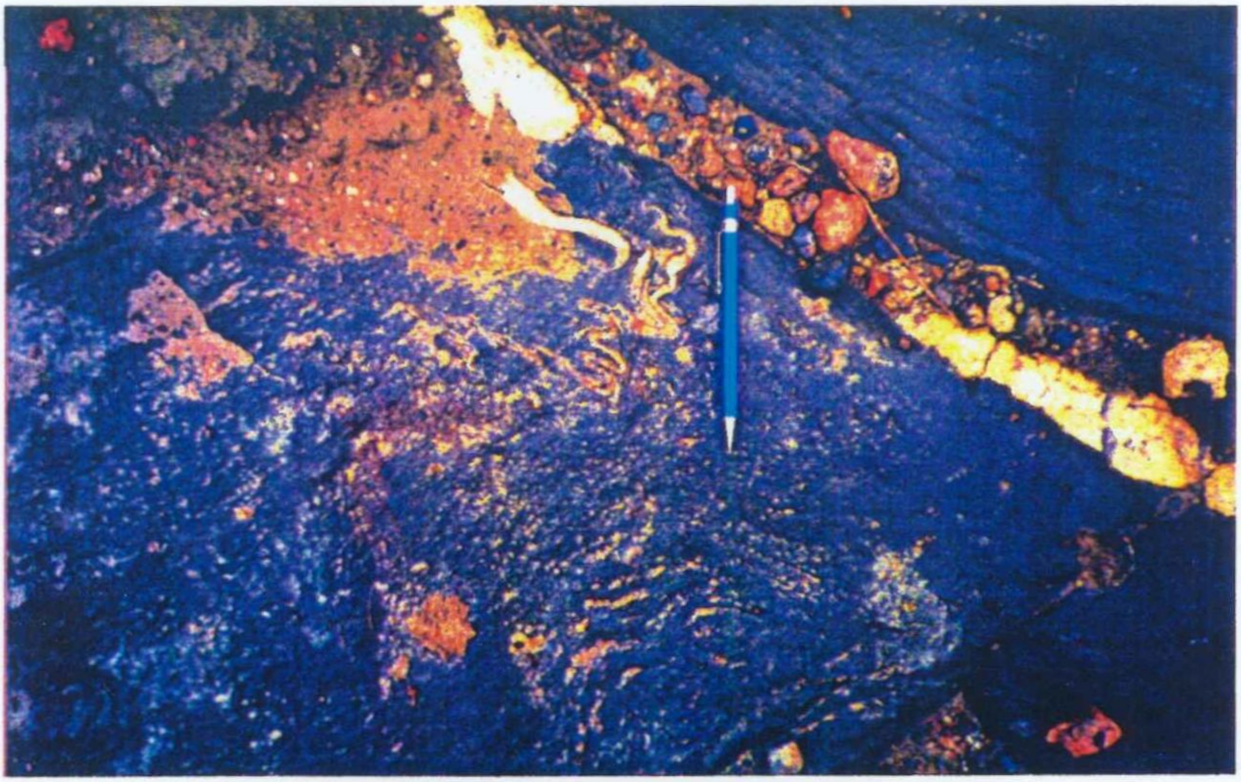
Near this last locality, a deformed pegmatite intruded in felsic metavolcanics is in its turn intruded by an undeformed, coarse-grained, quartz-rich pegmatite.

### 7.1.10. TURTLEBACK PEGMATITIC GRANITE

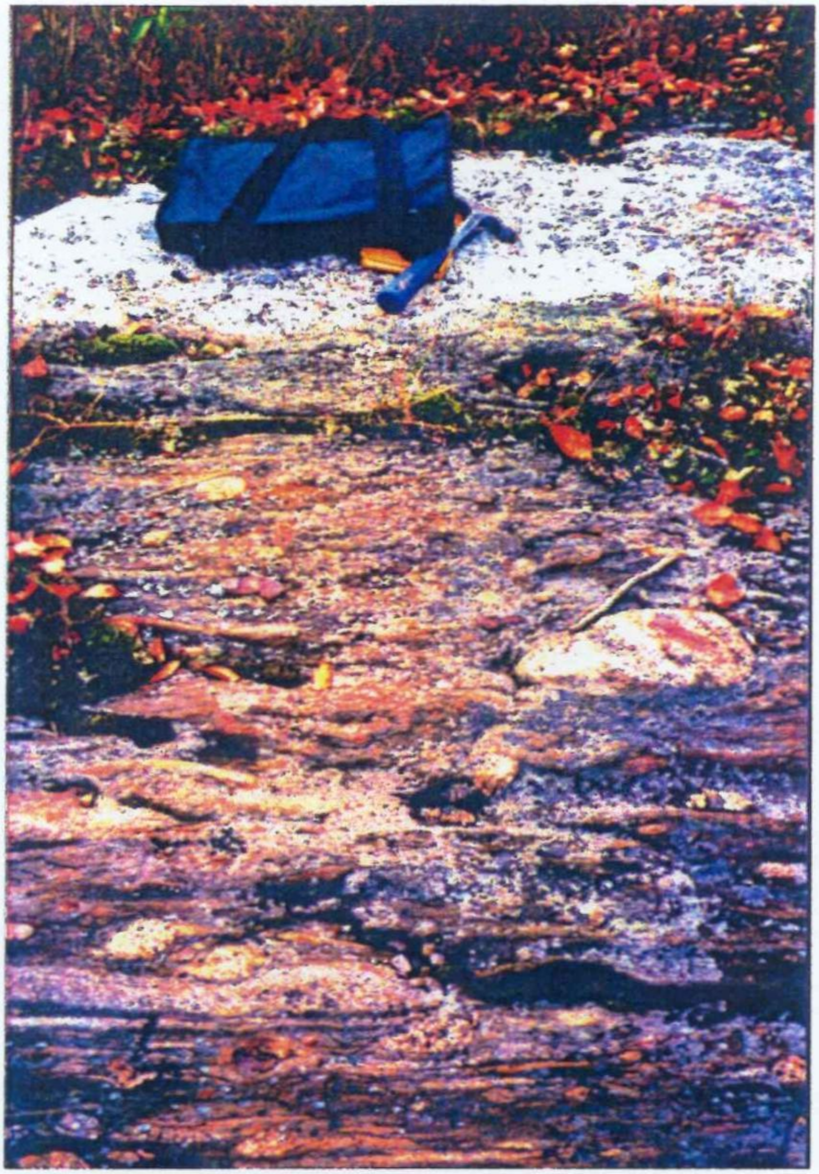
This porphyritic pegmatitic granite shows layering structures oriented N70° and a mineralogical composition of coarse K-feldspar crystals in an equigranular finer-grained matrix mainly feldspathic (Photograph nº 9). Feldspar megacrysts are rotated and sheared evidencing the strong deformation suffered during $D_2$.



Photograph nº 6: Detail of $D_2$ folds.



Photograph nº 7: Folded and boudinaged pegmatite pods in sandstone.

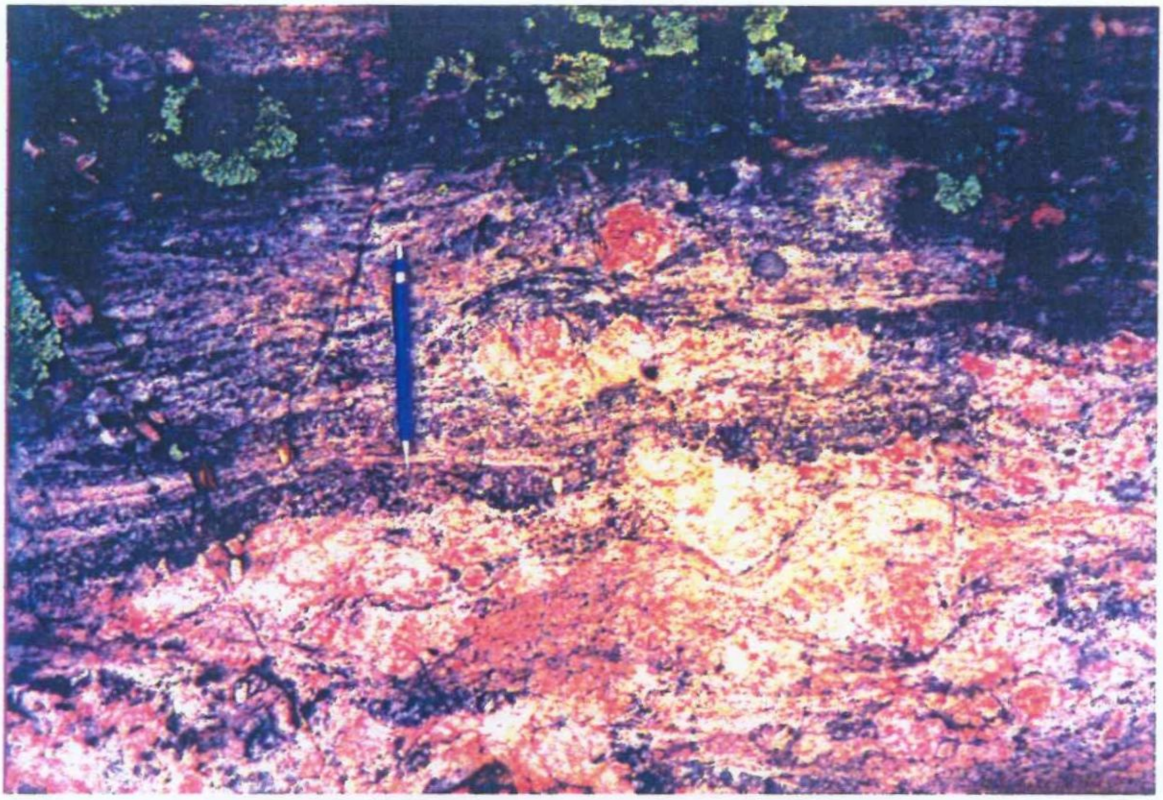


Photograph nº 8: Deformed pegmatite intruding conglomerates.

The pegmatitic granite has contacts parallel to $S_1$.

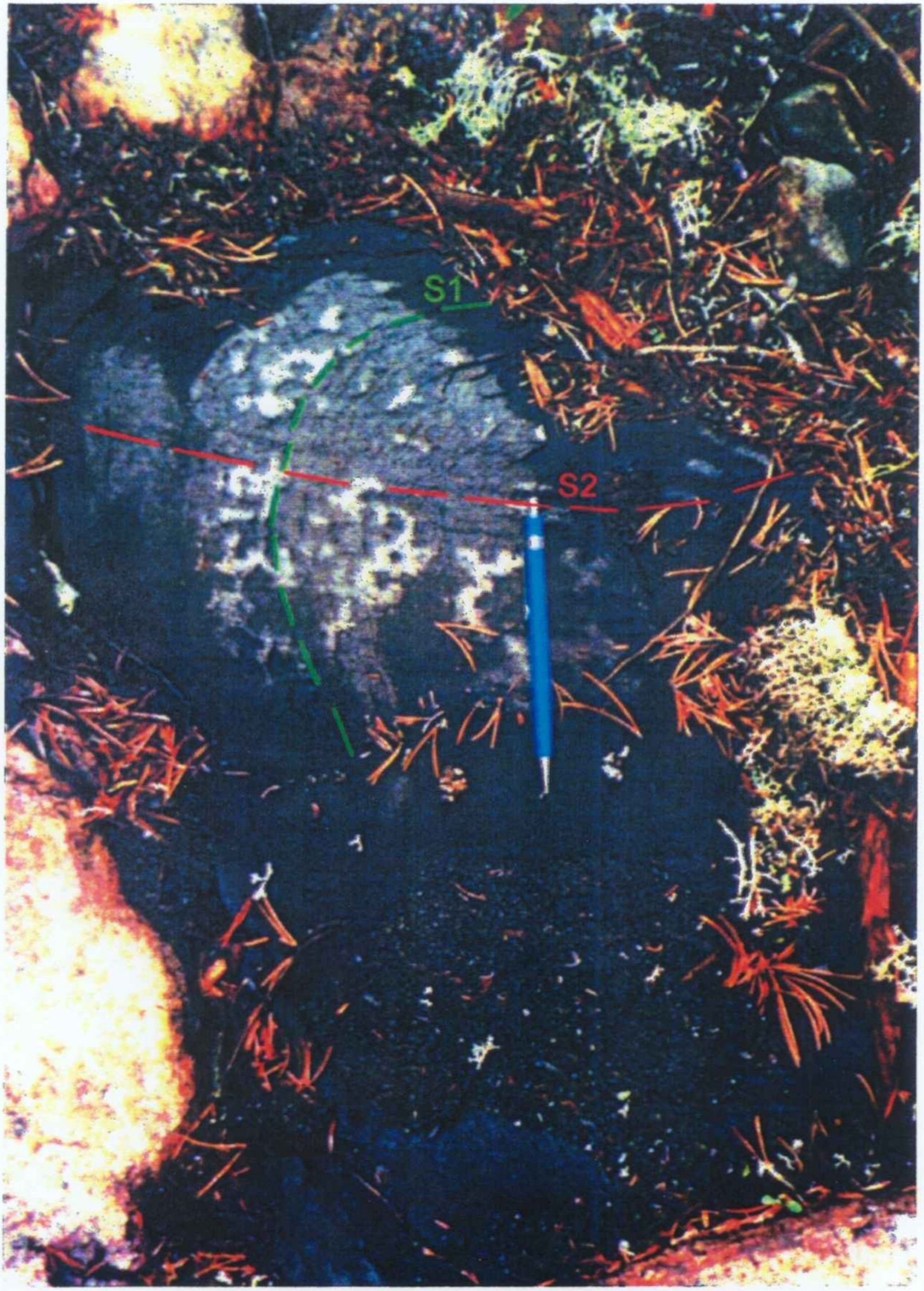
The layering seems to have been deformed in semi-plastic stage by $D_2$ giving ptygmatic folds as the ones displayed in Photograph nº 10

Photograph nº 11 illustrates an example of the $S_1$ - $S_2$ relationship at the hinge of a $D_2$ fold.



Photograph nº 9: Aspect of Turtleback pegmatitic granite showing layering and rotated and sheared K-feldspar megacrystals.

Photograph nº 10: $D_2$ phase ptygmatic folds of the layering.




Photograph nº 11: $S_1$ - $S_2$ relationship visible at the hinge of a $D_2$ fold at the contact between the Turtleback granite and the host mafic metavolcanics. Note $S_1$ adapted to the granite contact.

## 7.1.11. FOLDED PEGMATITE IN SHORE OF RIVER

It is located some 1,800 metres to the west of the English River bridge in the northern shore of the Separation Rapids. It is a thin, 40-60 cm, pegmatite tightly folded by $D_2$ vertical axis folds as illustrated by Photograph nº 12.

Photograph nº 12: $D_2$ phase folded pegmatite.

## 7.1.12. RED HANDED ISLAND PEGMATITIC GRANITE

This flat lying lepidolite-bearing pegmatitic granite is mostly undeformed, post-dating deformation phases $D_1$ and $D_2$,

It is affected by $D_3$ phase open folds with E-W axes gently plunging to the W.

Photographs nº 13 and 14 show the pegmatitic granite contact clearly crosscutting $S_1$ and $S_2$ schistosities.

Photographs nº 13 and 14: Pegmatitic granite contact crosscutting $S_1$ and $S_2$ schistosities developed in host mafic metavolcanics.

### 7.1.13. SEPARATION RAPIDS PLUTON

It is originally described as a pluton but seems to be a flat lying, sheet-like, layered, very fractionated pegmatitic granite.

The observed contacts during the field visit confirm the above, as well as the Champion Bear's 1989 aeromagnetic data consulted at the OSG office in Kenora.

These magnetic data show continuity, with the same amplitude and intensity, of the magnetic structures under the SRP, at least in the eastern part of the pluton (Map nº 4). The root of the pluton could be either in its western portion or related to the mainly undeformed WRS granites outcropping to the south.

The Separation Rapids Pluton seems to be just affected by $D_3$ phase gentle folds.

It is clearly related with the Red Handed Island pegmatitic granite and the later could be an external facies of the same pluton.

### 7.1.14. BIG WHOPPER PEGMATITE

The Big Whopper Pegmatite System comprises a set of large pegmatite lenses within an area 1350 metres long by 160 metres wide.

These pegmatites are the most fractionated ones of all pegmatites visited during the fieldwork.

The Big Whopper is a steeply-dipping layered pegmatite that seems to have been deformed in plastic stage.

During the field visit pegmatites of several phases have been identified:

- Strongly deformed and sheared pegmatites affected by $D_2$ and $D_3$ deformation phases with contacts parallel to $S_1$-$S_2$ schistosities (Photographs nº 15, 16 and 17).

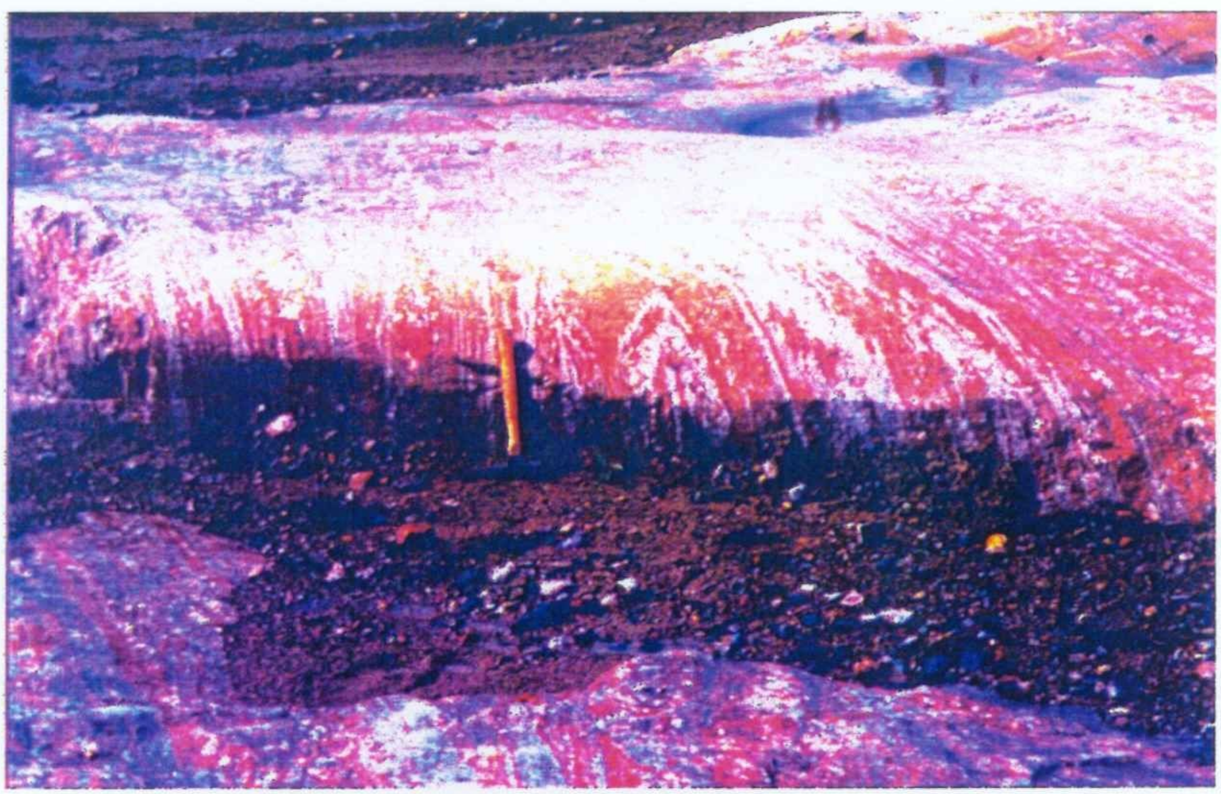
- Much less deformed pegmatites, just affected by $D_3$ deformation phase with contacts crosscutting $S_1$ and $S_2$ (Photographs nº 18, 19 and 20)

- In places a third, undeformed, pegmatitic event has been recognised intruding the other two pegmatite groups (Photograph nº 22).

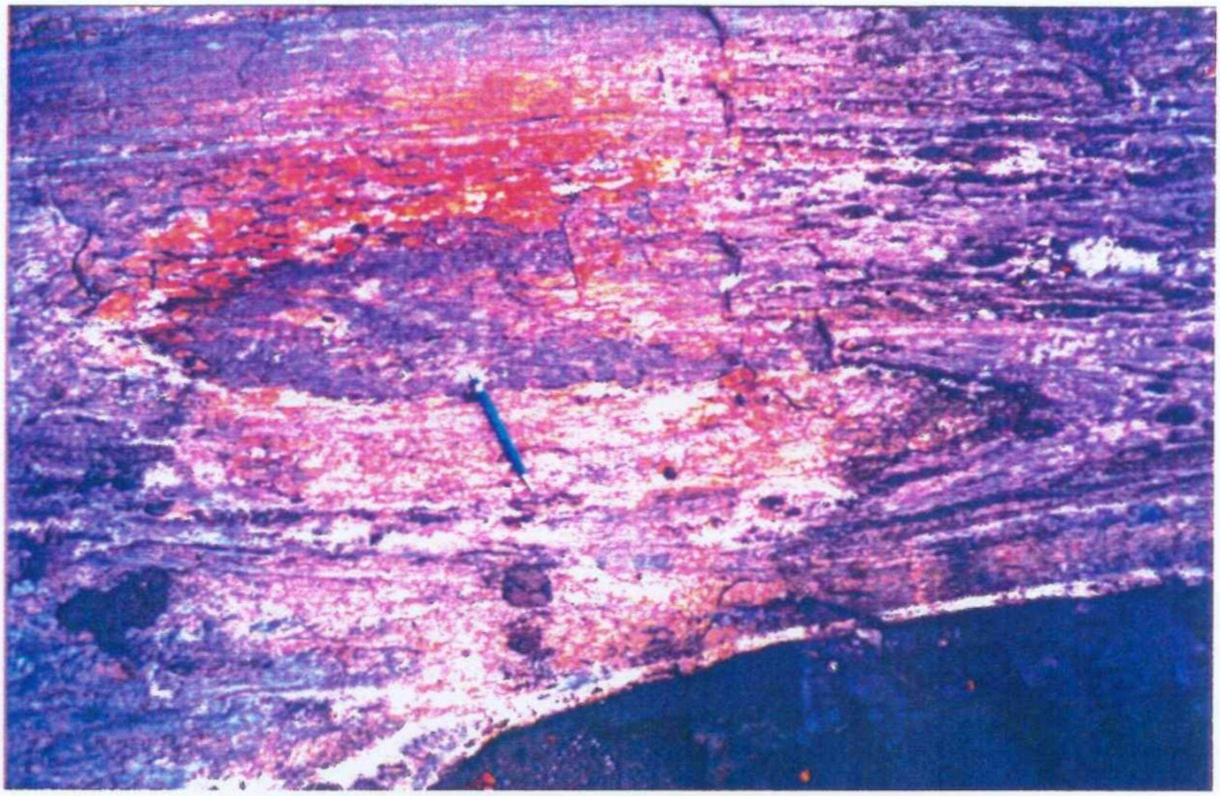
Two lithium events have been previously described: one pre-tectonic and a second one post-tectonic. The author interpretation is that the first one is pre $D_2$ deformation phase and that the second one is post-$D_2$ pre-$D_3$.

The relationship between the different pegmatitic phases and their mineralogical assemblages should be further investigated.

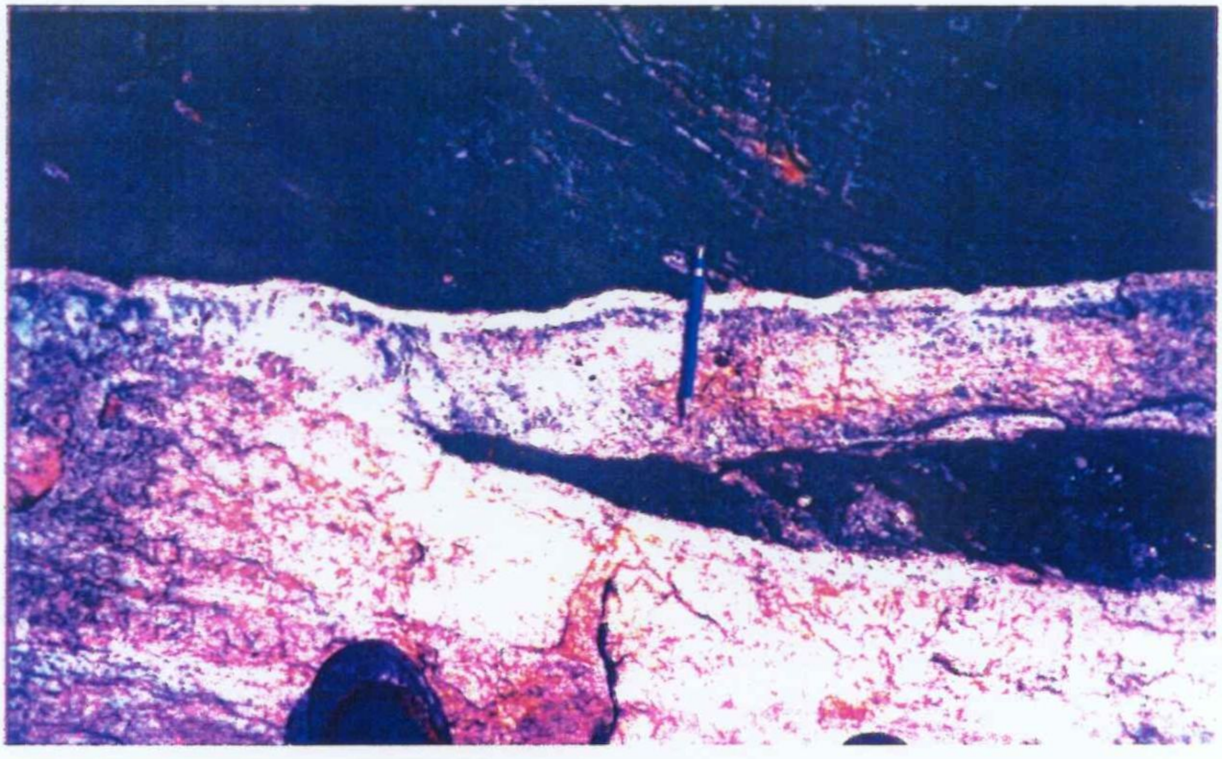
Photograph nº 15: Strongly deformed pegmatite affected by $D_2$ and $D_3$ deformation phases.



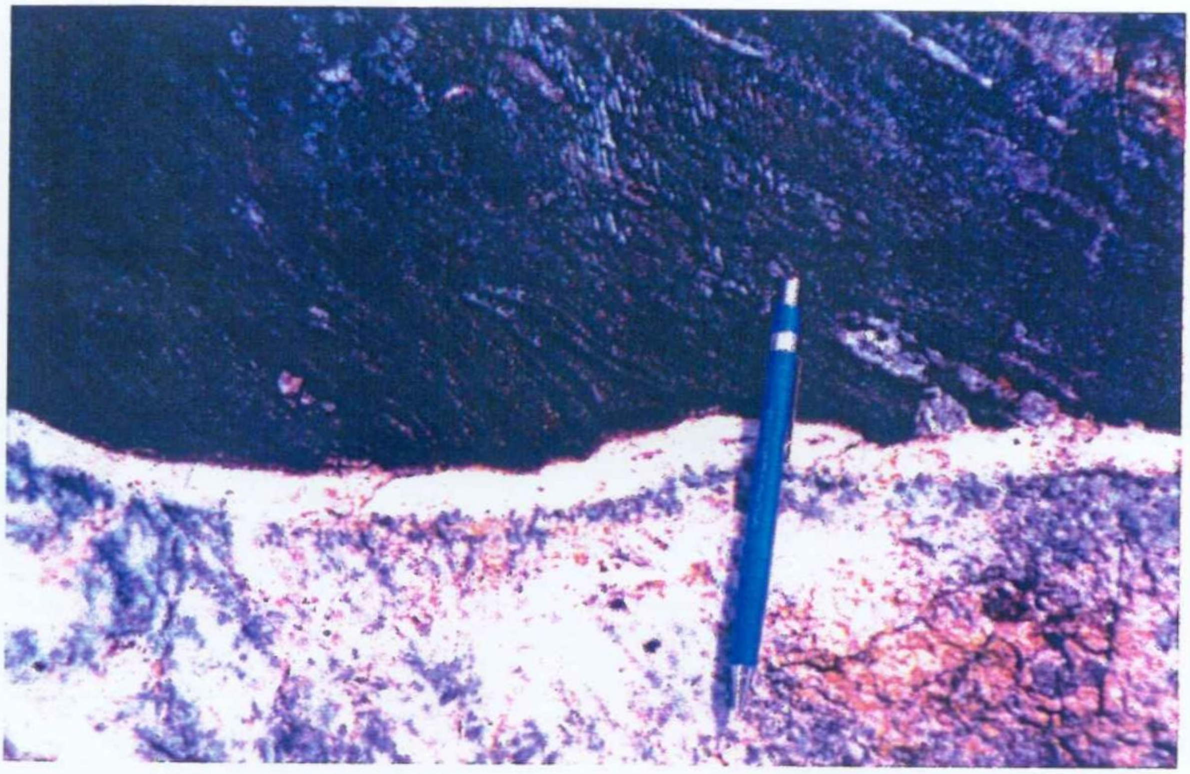
Photograph nº 16: $D_3$ phase folds affecting pegmatites deformed by $D_2$.



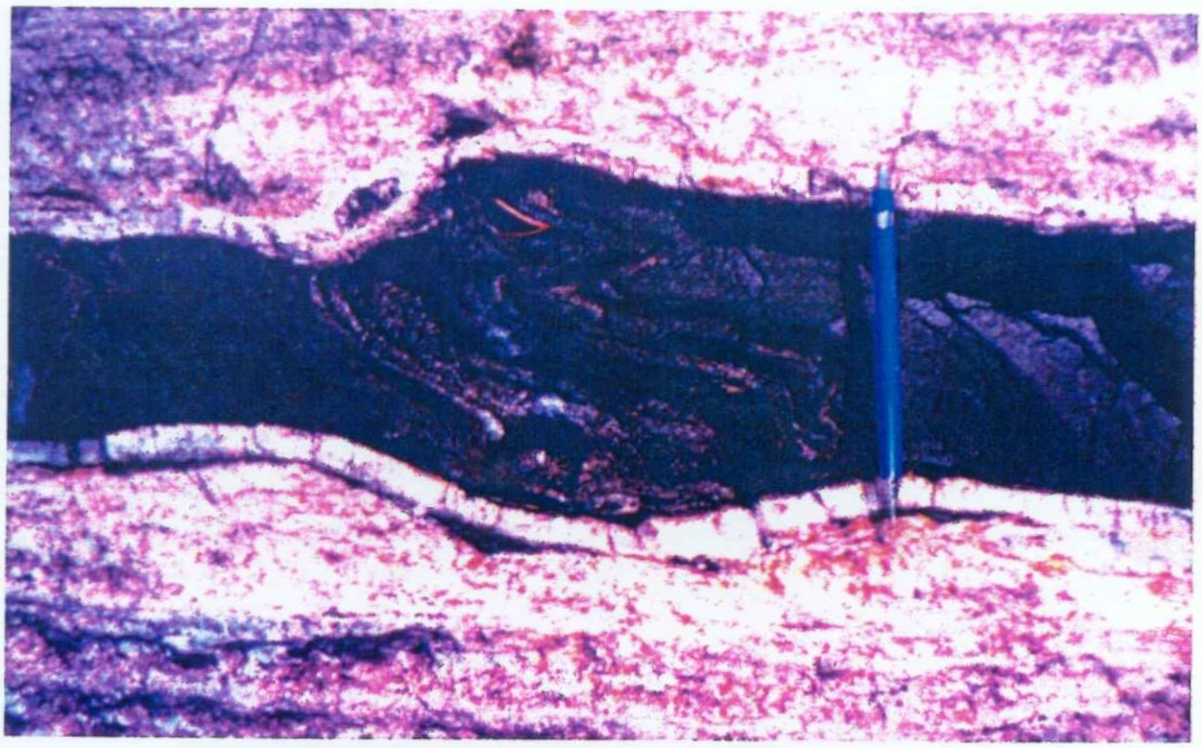
Photograph nº 17: $D_2$ folds in lepidolite-rich pegmatite.



Photograph nº 18: Pegmatite just affected by $D_3$. Note the contacts crosscutting $S_1$ and $S_2$



Photograph nº 19: Detail of photograph nº 18.



Photograph nº 20: Another example of pegmatite affected by $D_3$ with contacts crosscutting $S_1$ - $S_2$.

Photograph nº 21: Latest undeformed pegmatite intruding a strongly deformed pegmatite affected by $D_2$ and $D_3$ deformation phases

## 7.2. PHOTOINTERPRETATION

In this study the different lineaments have been grouped in families taking into account criteria such as length, strike and relationship between them.

Four groups or orders have been differentiated (Map nº 5):

### 7.2.1. FIRST ORDER LINEAMENTS

Shown in Map nº 5 as red lines, they are long lineaments that affect the second, third and fourth order lineaments.

They seem to correspond to fractures implying N-S shortening of the $D_3$ phase. They display two preferential strikes:

- ✓ E-W Lineaments: The likely are $D_2$ thrust faults, later reactivated as normal faults.
- ✓ N-S Lineaments: Corresponding to shears.

### 7.2.2. SECOND ORDER LINEAMENTS

Shown in the map as green lines, these lineaments affect the third and fourth order lineaments.

They seem to be distensive fractures formed as a consequence of release of the N-S compressive stress after the $D_1$ and $D_2$ phases.

Several preferential strikes are displayed: NE-SW, ENE-WSW and NW-SE. Other sensibly N-S structures might correspond to NE-SW structures rotated during the formation of the first order structures.

### 7.2.3. THIRD ORDER LINEAMENTS

These short lineaments apparently do not produce relative movement of the blocks. Marked in map as blue lines they likely are joints striking NNE-SSW, NE-SW y SSE-NNW.

### 7.2.4. FOURTH ORDER LINEAMENTS

Although they show great continuity they are short lineaments that do not produce relative movements.

They correspond to $S_1$-$S_2$ schistosities striking E-W, lithological contacts and folds.

## 7.3. EXAMINATION OF CHAMPION BEAR'S CORE

Selected core sections of Champion Bear's drillholes, drilled in the area, were examined at the OGS offices in Kenora.

Holes CB-031, CB-033 and CB-057 were selected on the basis of recorded pegmatitic intervals in the logs.

The pegmatites intersected in CB-031 and CB-033 are all of them strongly deformed showing contacts parallel to $S_1$-$S_2$.

In hole CB-057, thin pegmatites remained in the racks. Of those, some pegmatitic stringers were strongly deformed but other veinlets seem to be mainly undeformed with contacts at an angle with $S_1$-$S_2$. The later are also the more fractionated.

The core examined confirmed the impressions from the field visit of the existence of two pegmatitic episodes.

# 8. CONCLUSIONS

## 8.1. PEGMATITES AND PEGMATITIC GRANITES

The pegmatites visited in the Separation Lake project seem to correspond to two main phases of intrusions and could be classified according to the number of deformation episodes affecting them:

**Pegmatites and Pegmatitic Granites pre $D_2$ deformation phase**

These pegmatites and pegmatitic granites show contacts parallel to $S_1$ schistosity, likely indicating that they have been intruded along $S_1$ planes.

They are strongly deformed, usually sheared and affected by $D_2$ and $D_3$ deformation phases. Some of them seem to have been deformed in plastic or semi-plastic stage during $D_2$.

Good examples are: Ballpeen, Pegmatite #10, Draven's, Lou's, Cook's, Turtleback, first phase pegmatites in the Big Whopper area and other pegmatites described in chapter 7.

**Pegmatites and Pegmatitic Granites post $D_2$ deformation phase**

These are much less deformed pegmatites and pegmatitic granites, just affected by $D_3$ deformation phase with contacts clearly crosscutting $S_1$ and $S_2$.

Examples are: Red Handed Island pegmatitic granite and other mainly undeformed pegmatites described in chapter 7.

## 8.2. GRANITES

The Treelined Lake granite shows the same deformation than the first phase pegmatites and it is affected by $D_2$ and $D_3$ deformation phases.

In our opinion it is the source granite for the pegmatites and pegmatitic granites pre $D_2$ deformation phase.

The Separation Rapids Pluton, as described above, is post $D_1$ and $D_2$ deformation phases, and in our opinion the parent granite of the pegmatites and pegmatitic granites post $D_2$ deformation phase.

This is contradictory with the previous assumptions for the area where the Treelined Lake granite is the source area of the SRP and this in its turn is the parent granite of all the pegmatites.

A proposed geological history synthesis is presented in graphic for min the following page.

## 8.3. IMPLICATIONS IN THE EXPLORATION

The existence of more than one phase of pegmatitic intrusions rises the key question of which of the phases is responsible for the rare-element mineralization.

At this stage is very difficult to give an accurate answer to the question and only a few facts can be pointed out as the guide-lines to be followed by further investigations:

- The pegmatites and pegmatitic granites pre $D_2$ deformation phase seem to be less fractionated than the post $D_2$ deformation phase pegmatites and pegmatitic granites.
- For Big Whopper, two lithium events, one pre-tectonic and another post-tectonic, have been previously recognised.
- The richer pegmatites so far encountered in the area are either completely or partially (Big Whopper) post $D_2$ deformation phase.
- The Treelined Lake Granite seems to be the source for the pre $D_2$ deformation phase pegmatites and pegmatitic granites.
- The Separation Rapids Pluton seems to be the parent granite for the post $D_2$ deformation phase pegmatites and pegmatitic granites.
- The source granite for the Separation Rapids Pluton is not the Treelined Lake Granite, as previously invoked, and it has to be located either at grater depth within the Separation Lake Belt or within the mainly undeformed Winnipeg River Subprovince late granites outcropping to the south.

Granada, 17th December, 1998

Fernando de la Fuente
*Economic Geologist*

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English River Subprovince (Breaks, F.W.)

# Appendix D:

# 1998 Lithogeochemical Sample Descriptions

# 1998 SEPARATION LAKE PROJECT, LITHOGEOCHEMICAL SAMPLE DESCRIPTIONS

| Sample # | Rock Type | Date Sampled | Claim # | Rock # | Foliation | Joint 1 | Joint 2 | Structure (Other) | Description |
|---|---|---|---|---|---|---|---|---|---|
| 11875 | pillow basalt | 09/26/1998 | 1220596 | 1 | | | | | vfg,dk grey, wk gossan and slfd |
| 11876 | pillow basalt | 09/26/1998 | 1220596 | 1 | 082/vert | | | pillows @ 090-100° | folded qtz vn , axizl plane @ 082° |
| 11877 | pillow basalt | 09/26/1998 | 1220596 | 1 | 090° | | | pillows @ 090-100° | |
| 11878 | pillow basalt | 09/26/1998 | 1220596 | 1 | 090° | | | | |
| 11879 | granite | 09/26/1998 | 1220596 | 7 | | | | | pk, kspar +qtz+bio+musc.,mg |
| 11880 | granite | 09/26/1998 | 1220596 | 7 | | | | ct with MV @ 040° | pk, kspar +qtz+bio+musc.,mg |
| 11881 | pillow basalt | 09/26/1998 | 1220596 | 1 | 060° | | | | vfg, dk grey |
| 11882 | basalt | 09/26/1998 | 1220596 | 1 | 064° | | | ct with granite @ 050° | 3m wide dyke |
| 11883 | pillow basalt | 09/26/1998 | 1220596 | 1 | 078° | | | ct with granite @ 060° | vfg, dk grey |
| 11884 | basalt | 09/26/1998 | 1220596 | 1 | 046° | | | ct with granite @ 070° | 10m section in sharp contact |
| 11885 | granite | 09/26/1998 | 1220596 | 7 | | | | | pk, kspar +qtz+bio+musc.,mg |
| 11886 | granite | 09/26/1998 | 1220596 | 7 | | | | | pk, kspar +qtz+bio+musc.,mg |
| 11887 | granite | 09/26/1998 | 1220596 | 7 | | 150° | 175° | qtz vn @ 025° | pegmatitic pods within |
| 11888 | pillow basalt | 09/26/1998 | 1220596 | 1 | 050° | | | | dk grey, vfg |
| 11889 | pillow basalt | 09/26/1998 | 1220596 | 1 | 050° | | | | dk grey, vfg |
| 11890 | basalt | 09/26/1998 | 1220596 | 1 | 079° | | | | vfg |
| 11891 | pillow basalt | 09/26/1998 | 1220596 | 1 | 050° | | | | dk grey, vfg |
| 11892 | pillow basalt | 09/26/1998 | 1220596 | 1 | | | | 10 cm wide qtz vn @ 075° | dk grey, vfg |
| 11893 | pillow basalt | 09/26/1998 | 1220596 | 1 | | | | folded peg @ ax. Pl. 067°/68° SW | vfg, bk, wealy sil. |
| 13435 | granite | 06/02/1998 | 1149774 | 7 | | | | zoned peg kspar to main unit | wkly peg ranite, med-c gr, pegs trend EW |
| 13436 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 280/70 NE | | | gneissic, kspar peg veins @ 110 | wt-lt pnk, med gr |
| 13437 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 285/90 | | | well fol't, z-folds in granitic veins | veins @ 300 or 260 |
| 13438 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 286/ NE | | | med gr, well fol't, gneissic | veins 1-15cm thick @ 285, veins have coarse kspar cores |
| 13439 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 264/90 | | | peg veins 3cm thick @ 250 | same as EX 13438 |
| 13440 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | 75% c gr kspar, qtz, bt, musc | |
| 13441 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | same as EX13440 | |
| 13442 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | wt-pnk, med-c gr kspar, qtz, bt | graphic texture |
| 13443 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | same as previous EX13442 | |
| 13444 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | same as previous EX13443 | |
| 13445 | granite | 06/02/1998 | 1149774 | 7 | 290/90 | | | wk fol'n, m-c gr kspar, qtz, bt | peg kspar, pink-wht |
| 13446 | granite | 06/02/1998 | 1149774 | 7 | | | | same as previous EX13445 | |
| 13447 | granite | 06/02/1998 | 1149774 | 7 | 280/ SW | | | wk fol'n, semi-graphic texture | bt poor, mainly kspar + qtz |
| 13448 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | v. c gr kspar, med gr kspar, qtz, bt | |
| 13449 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | 275/78 S | | | semi-graphic texture | c gr kspar, med gr kspar, qtz |
| 13450 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 285/ ? | | | peg veins 3-8cm thick // fol'n | wht-lt grey pink |
| 13451 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 110/80 S | | | well fol't, gneissic | |
| 13452 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 105/60 | | | 40cm wide peg dike @ 105 | |
| 13453 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 125/70 SW | 072/90 | 115/80 S | wt-pnk, med-c gr, kspar, qtz, bt | |
| 13454 | pegmatitic granite | 06/05/1998 | 1149774 | 8 | | | | grain size ~ 1-3cm | mostly kspar,qtz, pink and white |
| 13455 | pegmatitic granite | 06/05/1998 | 1149774 | 8 | | 140/61 NE | | coarse grained~2-5cm | kspar,qtz, biotite pink, white and black |
| 13456 | granite | 06/05/1998 | 1149774 | 7 | 102/84 N | | | wh + grey, mostly white feldspar w/ ~ 30% biotite | Kspar infilling veins |
| 13457 | granite | 06/05/1998 | 1149774 | 7 | 90/82 S | 90/82 N | 122/56 N | biotite elongated, 3:1 elongation | black & grey,large irregular peg stringers, 2-12cm thickness, infilling joints |
| 13458 | granite | 06/05/1998 | 1149774 | 7 | 90/64 S | | | 60-70% biotite, patchy Gossan rusting | grey,blk,white, 0.5-1% pyrrhotite |
| 13459 | granite | 06/05/1998 | 1149774 | 7 | | | | pink,white & blk, kspar,bio,qtz | med-coarse grained-5-10 mm |
| 13537 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 098/88 S | | | mod fol'n, peg stringers @ EW | irreg ct with granodiorite |
| 13538 | granite | 06/02/1998 | 1149774 | 7 | 285/68 N | 194/90 | 042/65 E | aplitic to pegmatitic - var texture | lg bt patches, kspar rich |
| 13539 | granite | 06/02/1998 | 1149774 | 7 | | | | linear ridge @ 216 | v bt rich |
| 13540 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 106/68 S | | | v bt rich, gneissic texture | mod to well fol't |
| 13541 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 090/40 S | | | patchy salt and pepper weather | well fol't |
| 13542 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 080/73 S | | | ridge trending @ EW | v bt rich |
| 13543 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 280/82 N | | | good fol'n | blue-grey peppered weathering |
| 13544 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 286/84 N | | | poor to mod fol'n, bt patches | kspar rich pods/stringers |

## 1998 SEPARATION LAKE PROJECT, LITHOGEOCHEMICAL SAMPLE DESCRIPTIONS

| Sample # | Rock Type | Date Sampled | Claim # | Rock # | Foliation | Joint 1 | Joint 2 | Structure (Other) | Description |
|---|---|---|---|---|---|---|---|---|---|
| 13545 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | no fol'n, no jointing, linear ridge | kspar rich, massive, homogeneous |
| 13546 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 070/78 S | | | v bt rich in patches ~0.5cm - 1cm | buff grey-pink with peppered bt |
| 13547 | pegmatitic granite | 06/02/1998 | 1149774 | 8 | | | | massive, no fol'n, no joints | salmon pink weathered color |
| 13548 | grey bt granite - foliated | 06/02/1998 | 1149774 | 7 | 086/72 S | 084/78 S | 184/88 W | mod joints, peg stringers on fol | grey-pink peppered appearance, dk grey fresh, bt rich |
| 13549 | granite | 06/02/1998 | 1149774 | 7 | | | | wk fol'n, massive, poor o/c | buff-pinkk weathered, mottled pnk, wht, blk fresh |
| 13550 | pillow basalt | 06/02/1998 | 1149774 | 1 | 286/88 N | NS/vert | 229/vert | strong fol'n, wk joints, deformed | dk grey color, f-m gr, bt rich |
| 13551 | pillow basalt | 06/02/1998 | 1149774 | 1 | EW/70 S | 164/90 | | intense deform, wk gossan | thin carb bands on fol'n |
| 13552 | pillow basalt | 06/02/1998 | 1149774 | 1 | 258/72 S | 030/vert | 170/vert | strong fol'n, mod joints | same as EX 13552 |
| 13553 | pegmatitic granite | 06/05/1998 | 1149774 | 8 | 114/86 S | | | coarse grained, joints not present | salmonpink fresh, buff pink weathered, kspar,qtz, bt,smokey qtz |
| 13554 | pegmatitic granite | 06/05/1998 | 1149774 | 8 | | | | poor to no foln, no jointing | coarser, but same o/c as above, mod bt-rich, ksp rich, steep ridge |
| 13555 | pegmatitic granite | 06/05/1998 | 1149774 | 8 | | | | no fol/joints | v. coarse, 0.5-10cm, very lge ksp xtls, less bt than prev. |
| 13556 | pillow basalt | 06/05/1998 | 1149774 | 1 | 072/86 S | 176/76 W | | ct w/ peg. granite @ 072/69 S | unit thin(~10m) only, can see peg granite to both N & S |
| 13557 | pillow basalt | 06/05/1998 | 1149774 | 1 | 108/82 S | 158/86 W | 204/73 W | good fol'n, homogeneous | fg, med-dk grey, qtz,bt,mafics etc |
| 13558 | pillow basalt | 06/05/1998 | 1149774 | 1 | 087/79 S | | | 1cm thick peg veins strike 094deg | similar to Ex 13557 |
| 13559 | basalt | 07/01/1998 | 1178678 | 1 | 275°/71° N | | | occ. Qtz veins | fg, sheet like |
| 13560 | basalt | 07/01/1998 | 1178678 | 1 | 280/56 N | | | low to mod foln | bk to grey, wk ox. |
| 13561 | pegmatitic granite | 07/01/1998 | 1178678 | 8 | | 178/80 W | | | ksp, bt, qtz, some garnet |
| 13562 | pegmatitic granite | 07/01/1998 | 1178678 | 8 | | 170/78 SW | 202/82 W | | Ksp and qtz |
| 13563 | pegmatitic granite | 07/01/1998 | 1178678 | 8 | | 221/80 W | | | Ksp and qtz |
| 13564 | granite | 07/01/1998 | 1178678 | 7 | | | | | pk to wh,perthitic |
| 13565 | granite | 07/01/1998 | 1178678 | 7 | | 033/vert | 130/76 S | | m-cg, ksp and qtz |
| 13566 | granite | 07/01/1998 | 1178678 | 7 | | | | | peg zones |
| 13567 | granite | 07/01/1998 | 1178678 | 7 | | | | | cg kspar |
| 13568 | granite | 07/01/1998 | 1178678 | 7 | | 202/76 W | 297/85 N | | cg kspar |
| 13569 | granite | 07/01/1998 | 1178678 | 7 | | | | | cg kspar, large musc books |
| 13570 | granite | 07/02/1998 | 1178678 | 7 | | 228/85 SW | | ct with MV @ 089°/vert | ksp and sodic plag, garnets |
| 13571 | granite | 07/02/1998 | 1178678 | 7 | | 156/vert | 52/81 SE | | m to cg, ksp,qtz, musc, garnets |
| 13572 | basalt | 07/02/1998 | 1178678 | 1 | | | | fold-limbs @ 303/67 NW,086/?,290/82SW | biotite rich |
| 13573 | pegmatitic granite | 07/02/1998 | 1178678 | 8 | | 346/76 NE | 61/88 SE | ct with MV @ 311° | ksp,qtz,gneissic texture |
| 13574 | granite | 07/02/1998 | 1178678 | 7 | 296° | 016/83 S | 141/63 N | ct @ 300/64 SE | m to cg, ksp,qtz, musc, garnets |
| 13575 | granite | 07/02/1998 | 1178678 | 7 | | | | | m to cg, ksp,qtz, musc, garnets |
| 13576 | basalt | 07/02/1998 | 1178678 | 1 | | 132/vert | 032/78 SE | | dk grey to green, wk ox'd |
| 13577 | basalt | 07/02/1998 | 1178678 | 1 | 106° | 106/vert | 32/78 SE | wk fol'n | dk gry to bk green |
| 13578 | basalt | 07/02/1998 | 1178678 | 1 | 297/75 NE | 290/78 NE | | | mod ox'd, on small peninsula |

# Appendix E:

# 1998 Assay Results
# Bondar Clegg

ITS Intertek Testing Services
Bondar Clegg

Geochemical
Lab
Report

TANTALUM MINING CORPORATION OF CANADA LTD.
MR. PETER VANSTONE
P.O. BOX 2000
LAC DU BONNET, MANITOBA
ROE 1A0

Bondar-Clegg & Company Ltd.
130 Pemberton Avenue, North Vancouver, B.C., V7P 2R5, Canada
Tel: (604) 985-0681, Fax: (604) 985-1071

# ITS Intertek Testing Services
## Bondar Clegg

# Geochemical Lab Report

REPORT: V98-01729.0 ( COMPLETE ) REFERENCE:

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. SUBMITTED BY: C.GALESCHUK/R.KELLY
PROJECT: SEPERATION LAKE DATE RECEIVED: 21-SEP-98 DATE PRINTED: 14-OCT-98

| DATE APPROVED | ORDER | | ELEMENT | NUMBER OF ANALYSES | LOWER DETECTION LIMIT | EXTRACTION | METHOD |
|---|---|---|---|---|---|---|---|
| 981013 | 1 | Li | Lithium | 33 | 1 PPM | HF-HNO3-HCLO4-HCL | ATOMIC ABSORPTION |
| 981013 | 2 | CS | CESIUM | 33 | 1 PPM | | NEUTRON ACTIVATION |
| 981013 | 3 | RB | RUBIDIUM | 33 | 10 PPM | | NEUTRON ACTIVATION |

| SAMPLE TYPES | NUMBER | SIZE FRACTIONS | NUMBER | SAMPLE PREPARATIONS | NUMBER |
|---|---|---|---|---|---|
| R ROCK | 33 | 2 -150 | 33 | CRUSH/SPLIT & PULV. | 33 |

REPORT COPIES TO: MR. PETER VANSTONE INVOICE TO: MR. PETER VANSTONE

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Tel: (604) 985-0681, Fax: (604) 985-1071

ITS Intertek Testing Services
Bondar Clegg

# Geochemical Lab Report

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. PROJECT: SEPERATION LAKE
REPORT: V98-01729.0 ( COMPLETE ) DATE RECEIVED: 21-SEP-98 DATE PRINTED: 14-OCT-98 

| SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|
| R2 EX-11875 | | 11 | <1 | <10 |
| R2 EX-11876 | | 34 | <1 | <10 |
| R2 EX-11877 | | 22 | <1 | <10 |
| R2 EX-11878 | | 35 | 1 | <10 |
| R2 EX-11879 | | 66 | 12 | 320 |
| R2 EX-11880 | | 57 | 13 | 430 |
| R2 EX-11881 | | 13 | 1 | <10 |
| R2 EX-11882 | | 79 | 2 | <10 |
| R2 EX-11883 | | 39 | 1 | <10 |
| R2 EX-11884 | | 36 | <1 | <10 |
| R2 EX-11885 | | 40 | 5 | 310 |
| R2 EX-11886 | | 27 | 5 | 240 |
| R2 EX-11887 | | 27 | 10 | 580 |
| R2 EX-11888 | | 20 | <1 | <10 |
| R2 EX-11889 | | 15 | <1 | <10 |
| R2 EX-11890 | | 8 | <1 | <10 |
| R2 EX-11891 | | 15 | <1 | <10 |
| R2 EX-11892 | | 25 | 1 | <10 |
| R2 EX-11893 | | 46 | <1 | <10 |

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## Bondar Clegg

Geochemical Lab Report

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. PROJECT: SEPERATION LAKE
REPORT: V98-01729.0 ( COMPLETE ) DATE RECEIVED: 21-SEP-98 DATE PRINTED: 14-OCT-98 

| STANDARD NAME | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|
| STD GEOCHEM STD 6 | | - | 1 | 26 |
| Number of Analyses | | - | 1 | 1 |
| Mean Value | | - | 1.1 | 26.0 |
| Standard Deviation | | - | - | - |
| Accepted Value | | 24 | - | - |
| CANMET STREAM-SED | | 17 | - | - |
| Number of Analyses | | 1 | - | - |
| Mean Value | | 17.0 | - | - |
| Standard Deviation | | - | - | - |
| Accepted Value | | - | - | - |
| ANALYTICAL BLANK | | <1 | - | - |
| Number of Analyses | | 1 | - | - |
| Mean Value | | 0.5 | - | - |
| Standard Deviation | | - | - | - |
| Accepted Value | | <1 | <1 | <1 |

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CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. PROJECT: SEPERATION LAKE

REPORT: V98-01729.0 ( COMPLETE ) DATE RECEIVED: 21-SEP-98 DATE PRINTED: 14-OCT-98 

| SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|
| EX-11880 | | 57 | 13 | 430 |
| Prep Duplicate | | 58 | 11 | 410 |
| EX-11887 | | 27 | 10 | 580 |
| Duplicate | | 25 | | |

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Bondar Clegg

# Geochemical Lab Report

TANTALUM MINING CORPORATION OF CANADA LTD.
MR. PETER VANSTONE
P.O. BOX 2000
LAC DU BONNET, MANITOBA
ROE 1AO

# Intertek Testing Services
## Bondar Clegg

ITS

Geochemical Lab Report

REPORT: V98-01551.0 ( COMPLETE ) REFERENCE: P.O. #98179

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. SUBMITTED BY: C.GALESCHUK/R.KELLY
PROJECT: SEPERATION LAKE DATE RECEIVED: 24-AUG-98 DATE PRINTED: 22-SEP-98

| DATE APPROVED | ORDER | | ELEMENT | NUMBER OF ANALYSES | LOWER DETECTION LIMIT | EXTRACTION | METHOD |
|---|---|---|---|---|---|---|---|
| 980921 | 1 | Li | Lithium | 110 | 1 PPM | HF-HNO3-HCLO4-HCL | ATOMIC ABSORPTION |
| 980921 | 2 | CS | CESIUM | 110 | 1 PPM | | NEUTRON ACTIVATION |
| 980921 | 3 | RB | RUBIDIUM | 110 | 10 PPM | | NEUTRON ACTIVATION |

| SAMPLE TYPES | NUMBER | SIZE FRACTIONS | NUMBER | SAMPLE PREPARATIONS | NUMBER |
|---|---|---|---|---|---|
| R ROCK | 110 | 2 -150 | 110 | CRUSH/SPLIT & PULV. | 110 |

REPORT COPIES TO: MR. PETER VANSTONE
MR. CUREY GALESCHUK

INVOICE TO: MR. PETER VANSTONE

******************************************************************************

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# Geochemical Lab Report

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD.
PROJECT: SEPERATION LAKE
REPORT: V98-01551.0 ( COMPLETE )
DATE RECEIVED: 24-AUG-98
DATE PRINTED: 22-SEP-98



| SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM | SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|---|---|---|---|---|
| R2 EX-13435 | | 20 | 4 | 300 | | | | | |
| R2 EX-13436 | | 74 | 10 | 190 | | | | | |
| R2 EX-13437 | | 59 | 7 | 120 | | | | | |
| R2 EX-13438 | | 42 | 6 | 110 | | | | | |
| R2 EX-13439 | | 37 | 5 | 76 | | | | | |
| R2 EX-13440 | | 33 | 7 | 310 | | | | | |
| R2 EX-13441 | | 34 | 5 | 160 | | | | | |
| R2 EX-13442 | | 110 | 12 | 180 | | | | | |
| R2 EX-13443 | | 46 | 5 | 420 | | | | | |
| R2 EX-13444 | | 23 | 3 | 260 | | | | | |
| R2 EX-13445 | | 76 | 6 | 320 | | | | | |
| R2 EX-13446 | | 46 | 2 | 360 | | | | | |
| R2 EX-13447 | | 37 | 4 | 270 | | | | | |
| R2 EX-13448 | | 14 | 6 | 300 | | | | | |
| R2 EX-13449 | | 17 | 4 | 260 | | | | | |
| R2 EX-13450 | | 8 | <1 | <10 | | | | | |
| R2 EX-13451 | | 38 | 5 | 81 | | | | | |
| R2 EX-13452 | | 41 | 4 | 100 | R2 EX-13537 | | 87 | 7 | 200 |
| R2 EX-13453 | | 42 | 4 | 180 | R2 EX-13538 | | 49 | 5 | 280 |
| R2 EX-13454 | | 9 | 4 | 350 | R2 EX-13539 | | 54 | 14 | 90 |
| R2 EX-13455 | | 18 | 10 | 400 | R2 EX-13540 | | 53 | 23 | 110 |
| R2 EX-13456 | | 43 | 4 | 78 | R2 EX-13541 | | 53 | 9 | 100 |
| R2 EX-13457 | | 37 | 7 | 110 | R2 EX-13542 | | 69 | 7 | 130 |
| R2 EX-13458 | | 50 | 14 | 85 | R2 EX-13543 | | 48 | 8 | 70 |
| R2 EX-13459 | | 31 | 3 | 340 | R2 EX-13544 | | 45 | 6 | 110 |
| | | | | | R2 EX-13545 | | 10 | 2 | 250 |
| | | | | | R2 EX-13546 | | 84 | 6 | 170 |
| | | | | | R2 EX-13547 | | 16 | 6 | 110 |
| | | | | | R2 EX-13548 | | 49 | 6 | 110 |

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**Geochemical Lab Report**

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. PROJECT: SEPERATION LAKE
REPORT: V98-01551.0 ( COMPLETE ) DATE RECEIVED: 24-AUG-98 DATE PRINTED: 22-SEP-98 

| SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM | SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|---|---|---|---|---|
| R2 EX-13549 | | 40 | 2 | 340 | | | | | |
| R2 EX-13550 | | 23 | <1 | <10 | | | | | |
| R2 EX-13551 | | 20 | <1 | <10 | | | | | |
| R2 EX-13552 | | 16 | <1 | <10 | | | | | |
| R2 EX-13553 | | 40 | 5 | 450 | | | | | |
| R2 EX-13554 | | 38 | 2 | 170 | | | | | |
| R2 EX-13555 | | 30 | 3 | 450 | | | | | |
| R2 EX-13556 | | 21 | <1 | <10 | | | | | |
| R2 EX-13557 | | 16 | 1 | <10 | | | | | |
| R2 EX-13558 | | 11 | <1 | <10 | | | | | |
| R2 EX-13559 | | 15 | <1 | <10 | | | | | |
| R2 EX-13560 | | 20 | <1 | <10 | | | | | |
| R2 EX-13561 | | 70 | 7 | 180 | | | | | |
| R2 EX-13562 | | 12 | 4 | 620 | | | | | |
| R2 EX-13563 | | 7 | 2 | 230 | | | | | |
| R2 EX-13564 | | 41 | 4 | 490 | | | | | |
| R2 EX-13565 | | 34 | 7 | 420 | | | | | |
| R2 EX-13566 | | 25 | 4 | 410 | | | | | |
| R2 EX-13567 | | 28 | 6 | 800 | | | | | |
| R2 EX-13568 | | 17 | 4 | 420 | | | | | |
| R2 EX-13569 | | 61 | 7 | 210 | | | | | |
| R2 EX-13570 | | 44 | 3 | 72 | | | | | |
| R2 EX-13571 | | 87 | 5 | 360 | | | | | |
| R2 EX-13572 | | 221 | 142 | 670 | | | | | |
| R2 EX-13573 | | 23 | 4 | 530 | | | | | |
| R2 EX-13574 | | 12 | 3 | 19 | | | | | |
| R2 EX-13575 | | 31 | 5 | 540 | | | | | |
| R2 EX-13576 | | 71 | <1 | <10 | | | | | |
| R2 EX-13577 | | 36 | <1 | <10 | | | | | |
| R2 EX-13578 | | 35 | <1 | <10 | | | | | |

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CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD. PROJECT: SEPERATION LAKE
REPORT: V98-01551.0 ( COMPLETE ) DATE RECEIVED: 24-AUG-98 DATE PRINTED: 22-SEP-98 

| STANDARD NAME | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|
| STD GEOCHEM STD 6 | | 26 | <1 | 52 |
| Number of Analyses | | 1 | 1 | 1 |
| Mean Value | | 25.8 | 0.5 | 52.0 |
| Standard Deviation | | - | - | - |
| Accepted Value | | 24 | - | - |
| ANALYTICAL BLANK | | 1 | - | - |
| ANALYTICAL BLANK | | 1 | - | - |
| ANALYTICAL BLANK | | 1 | - | - |
| ANALYTICAL BLANK | | 1 | - | - |
| Number of Analyses | | 4 | - | - |
| Mean Value | | 1.0 | - | - |
| Standard Deviation | | 0.00 | - | - |
| Accepted Value | | <1 | <1 | <1 |
| BCC GEOCHEM STD 5 | | - | 2 | 25 |
| Number of Analyses | | - | 1 | 1 |
| Mean Value | | - | 2.1 | 25.0 |
| Standard Deviation | | - | - | - |
| Accepted Value | | 32 | - | - |
| BCC GEOCHEM STD 4 | | 12 | - | - |
| Number of Analyses | | 1 | - | - |
| Mean Value | | 11.8 | - | - |
| Standard Deviation | | - | - | - |
| Accepted Value | | 10 | - | - |
| Neut.Actvtion Std | | - | 2 | 25 |
| Number of Analyses | | - | 1 | 1 |
| Mean Value | | - | 1.9 | 25.0 |
| Standard Deviation | | - | - | - |
| Accepted Value | | - | - | - |
| CANMET LAKE-SED 1 | | 8 | - | - |
| Number of Analyses | | 1 | - | - |
| Mean Value | | 7.8 | - | - |
| Standard Deviation | | - | - | - |
| Accepted Value | | - | - | - |
| Neut.Actvtion Std | | - | 4 | 97 |
| Number of Analyses | | - | 1 | 1 |
| Mean Value | | - | 3.5 | 97.0 |
| Standard Deviation | | - | - | - |
| Accepted Value | | - | - | - |

| STANDARD NAME | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|
| CANMET STREAM-SED | | 16 | - | - |
| Number of Analyses | | 1 | - | - |
| Mean Value | | 16.2 | - | - |
| Standard Deviation | | - | - | - |
| Accepted Value | | - | - | - |

# Intertek Testing Services
## Bondar Clegg

Geochemical Lab Report

CLIENT: TANTALUM MINING CORPORATION OF CANADA LTD.    PROJECT: SEPERATION LAKE
REPORT: V98-01551.0 ( COMPLETE )    DATE RECEIVED: 24-AUG-98    DATE PRINTED: 22-SEP-98    

| SAMPLE NUMBER | ELEMENT UNITS | Li PPM | CS PPM | RB PPM |
|---|---|---|---|---|
| EX-13443 | | 46 | 5 | 420 |
| Duplicate | | 46 | | |
| EX-13452 | | 41 | 4 | 100 |
| Prep Duplicate | | 40 | 5 | 64 |
| EX-13455 | | 18 | 10 | 400 |
| Duplicate | | | 9 | 410 |
| EX-13503 | | 20 | <1 | <10 |
| Duplicate | | 21 | | |
| EX-13511 | | 31 | 3 | <10 |
| Prep Duplicate | | 32 | 3 | <10 |
| EX-13521 | | 23 | 2 | <10 |
| Duplicate | | 24 | | |
| EX-13527 | | 19 | <1 | <10 |
| Duplicate | | | <1 | <10 |
| EX-13543 | | 48 | 8 | 70 |
| Duplicate | | 48 | | |
| EX-13556 | | 21 | <1 | <10 |
| Prep Duplicate | | 21 | <1 | <10 |
| Prep Duplicate | | | <1 | <10 |
| EX-13559 | | 15 | <1 | <10 |
| Duplicate | | 16 | | |
| Prep Duplicate | | 21 | <1 | <10 |
| Duplicate | | 21 | | |

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Tel: (604) 985-0681, Fax: (604) 985-1071

# Appendix F:

# Analytical Techniques

BONDAR-CLEGG

Please find below our analytical techniques for Neutron Activation Analysis and Atomic Absorption.

## NEUTRON ACTIVATION ANALYSIS

Procedure: A sample of material is exposed to (irradiated in) a flux of neutrons, usually by inserting it into the core of a nuclear reactor. Most of the elements in the sample become radioactive and begin to emit radiation in the form of penetrating gamma-rays whose energies (or wavelengths) are characteristic of particular elements. The sample is removed from the neutron flux and placed close to a gamma-ray detector, which is commonly a germanium crystal held at liquid nitrogen temperature. The gamma-rays radiate continuously and the interaction of these with the detector produces discrete voltage pulses which are proportional in height to the incident gamma-ray energies. Our specially developed multichannel analyzers sort out the voltage pulses from the detector according to size and digitally constructs a spectrum of gamma-ray energies versus intensities. By comparing spectral peak positions and areas with library standards, the elements constituting the sample are qualitatively and quantitatively identified. The concentration of the elements are then computed and the data reports prepared.

## ATOMIC ABSORPTION SPECTROSCOPY

Following the dissolution of the sample with aqua regia. AAS is an instrumental method of analysis in which a sample that has been put into an aqueous solution is aspirated into the flame of the instrument for measurement of the concentration of the element(s) of interest. A light source emits light at the wave length of the element to be measured in a beam that passes through the flame. The atoms of the element in the flame absorb the light in proportion to the concentration of the element in the sample solution. This absorption is compared to those measured when a series of standard solutions has been aspirated in order to estimate the concentration of the element in the sample solution.

Should you need additional information, please contact me at (604) 985-0681.

Sincerely,

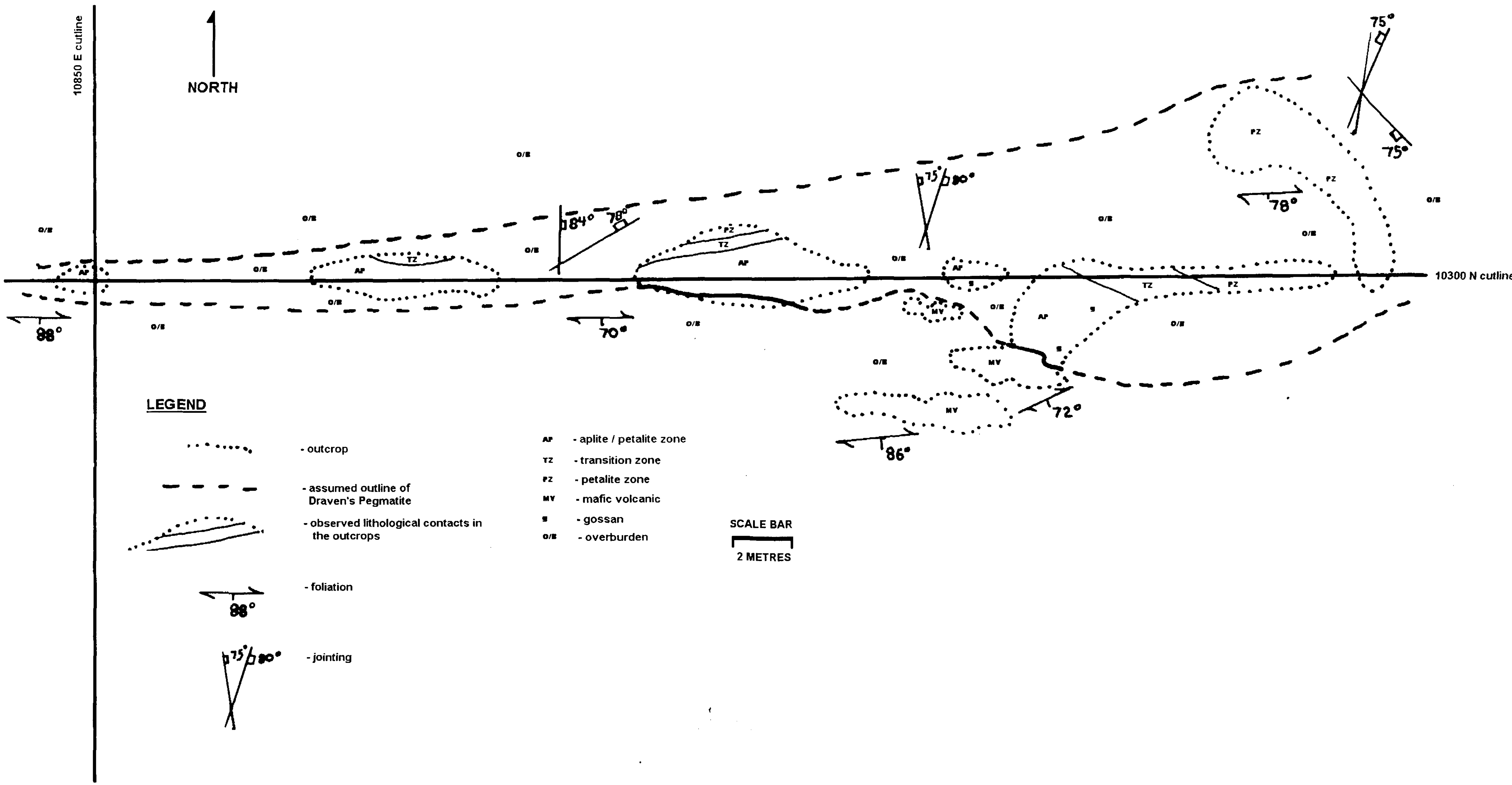
Rick McCaffrey
Manager, Geochem Department

# Appendix G:

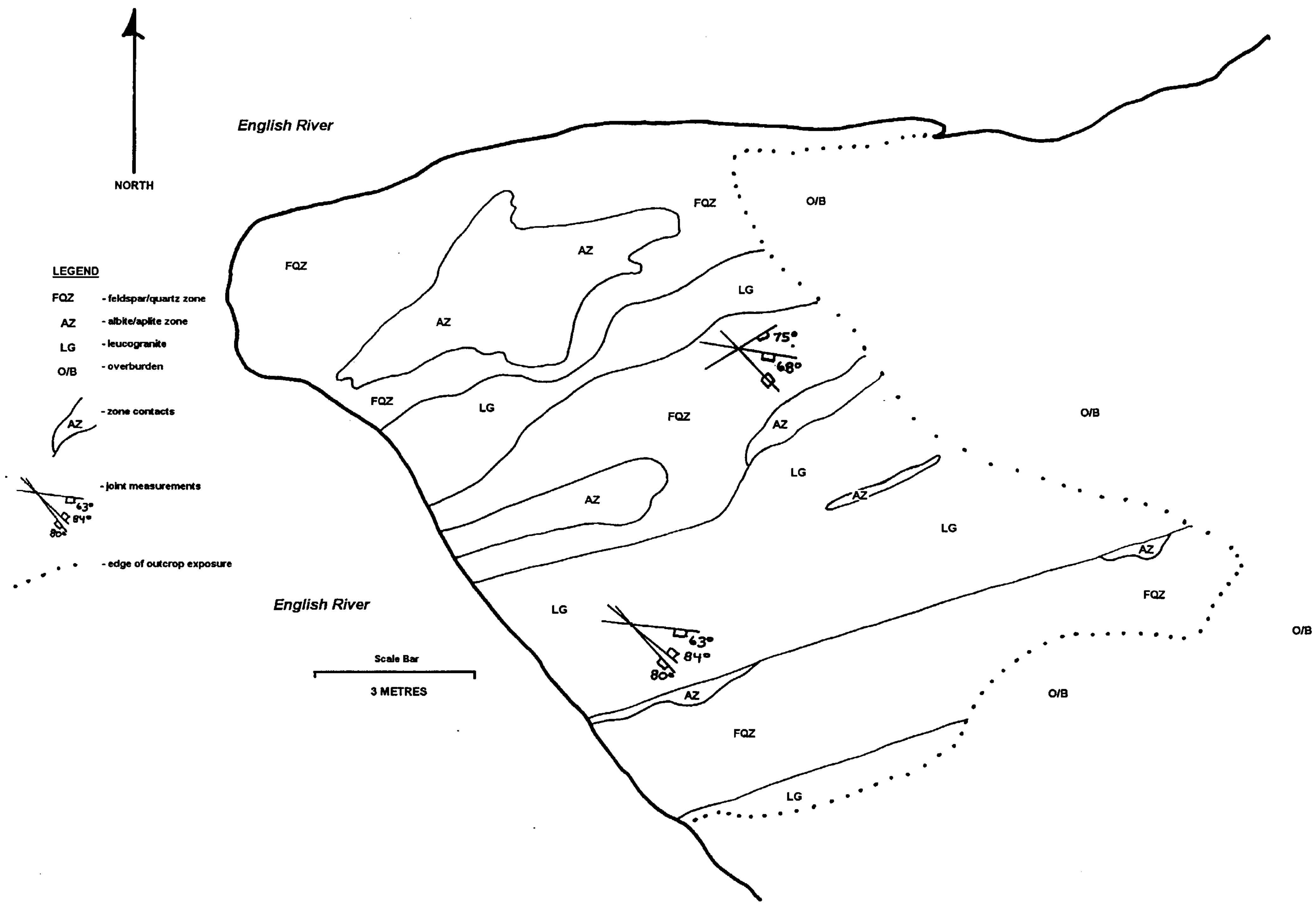
# Pegmatite Sketches

# DRAVEN'S PEGMATITE SKETCH MAP

# SEPARATION LAKE PROJECT (1998)



# NW Turtleback Pegmatitic Granites, Separation Lake Project



# Appendix H:

# Statement of Qualifications

## Statement of Qualification:

I, Carey R. Galeschuk, reside at the following address:

Box 427
16 Aberdeen Street
Pinawa, Manitoba
R0E 1L0 Telephone: (204) 753-2022

I hereby state that I am the person responsible for the preparation of this report and the supervision of the work performed as mentioned. I am currently employed by the Tanatalum Mining Corporation of Canada Limited as a Project Geologist, and have been since January 30th, 1996.

Following is my employer's address:

Tanatalum Mining Corporation of Canada Limited
PO Box 2000
Lac du Bonnet, Manitoba
R0E 1A0 Telephone: (204) 884-2400 extension 230

I am a 1988 graduate of the University of Saskatchewan in Saskatoon, Saskatchewan with a Bachelor of Science (Advanced) degree in Geological Sciences. I have practiced my profession as a geologist since my graduation for numerous companies involved in the exploration of industrial, base and precious metals in Canada.

I am a registered Professional Geoscientist in the provinces of Saskatchewan and Manitoba. As well, I am a Fellow member with the Geological Association of Canada and hold memberships in the Association of Geoscientists of Ontario, Association of Exploration Geochemists, Manitoba Prospectors and Developers Association and the CIM (Winnipeg Chapter and National member). My Ontario Prospector's License number is H13984.

C.R. Galeschuk, B.Sc., P.Geo.
Project Geologist
March 21st, 2000

**DISCLAIMER:**

This report was prepared for the purposes of reporting work performed for assessment in accordance with the mining regulations as set forth by the Province of Ontario. All interpretations are based on my best judgement from the available information at the time of preparation. Any use or reliance on this information by a third party is that party's responsibility. I accept no responsibility or liability for damages, if any, that may result from any actions or decisions undertaken by a third party as a result of information contained within this report.

Ministry of Northern Development and Mines

# Declaration of Assessment Work Performed on Mining Land

Mining Act, Subsection 65(2) and 66(3), R.S.O. 1990

Transaction Number (office use)
W 0010.00037
Assessment Files Research Imaging

of subsection 65(2) and 66(3) of the Mining Act. Under section 8 of the Mining Act, the assessment work and correspond with the mining land holder. Questions about of Northern Development and Mines, 3rd Floor, 933 Ramsey Lake Road, Sudbury,

52L08SW2008 2.20238 TREELINED LAKE 900

ns: - For work performed on Crown Lands before **recording** a claim, use form 0240.
- Please type or print in ink.

**Recorded holder(s)** (Attach a list if necessary)

| | |
|---|---|
| .ie<br>**antalum Mining Corporation of Canada Limited** | Client Number<br>**# 199962** |
| Address<br>**P.O. Box 2000** | Telephone Number<br>**(204) 884-2400** |
| **Lac du Bonnet, Manitoba R0E 1A0** | Fax Number<br>**(204) 884-2211** |
| Name<br>**Gossan Resources Limited** | Client Number<br>**# 138329** |
| Address<br>**105 52 Donald Street** | Telephone Number<br>**(204) 943-1990** |
| **Winnipeg, Manitoba R3C 1L6** | Fax Number<br>**(204) 942-3434** |

**2. Type of work performed:** Check (✓) and report on only ONE of the following groups for this declaration.

Geotechnical: prospecting, surveys, assays and work under section 18 (regs) | Physical: drilling stripping, trenching and associated assays | Rehabilitation

| | |
|---|---|
| Work Type<br>**LITHOGEOCHEMISTRY, GEOLOGICAL MAPPAING AND STRUCTURAL ANALYSIS. ACCOMPANYING REPORTS AND MAPS** | Office Use<br>Commodity<br>Total $ Value of Work Claimed 37,568 ⁰⁰ |
| Dates Work Performed From Day **13** Month **06** Year **1998** To Day **29** Month **08** Year **1998** | NTS Reference |
| Global Positioning System Data (if available) / Township/Area **Treelined/Paterson/Stop/Snook** | Mining Division Kenora |
| M or G-Plan Number **G-2652, G-2634, G-2523, G2644** | Resident Geologist District Kenora |

Please remember to:
- obtain a work permit from the Ministry of Natural Resources as required;
- provide proper notice to surface rights holders before starting work;
- complete and attach a Statement of Costs, form 0212;
- provide a map showing contiguous mining lands that are linked for assigning work;
- include two copies of your technical report.

**3. Person or companies who prepared the technical report** (Attach a list if necessary)

| | |
|---|---|
| Name<br>**CAREY GALESCHUK, PROJECT GEOLOGIST, TANATALUM MINING CORP.** | Telephone Number<br>**(204) 753-2022 (HOME) (204) 884-2400 (WORK)** |
| Address<br>**(HOME) PO BOX 427, PINAWA, MB. R0E 1L0**<br>**(WORK) PO BOX 2000, LAC DU BONNET, MB, R0E 1A0** | Fax Number<br>**(204) 884-2211 (WORK)** |
| Name | Telephone Number |
| Address | Fax Number |
| Name | Telephone Number |
| Address | Fax Number |

RECEIVED APR - 6 2000 GEOSCIENCE ASSESSMENT OFFICE

PROVINCIAL RECORDING OFFICE - RECEIVED APR 06 2000 A.M. 3:30 P.M. 7 8 9 10 11 12 1 2 3 4 5 6

RECORDED APR 06 2000

**4. Certification by Recorded Holder or Agent**

I, Carey Galeschuk (Print Name), do hereby certify that I have personal knowledge of the facts set forth in this Declaration of Assessment Work having caused the work to be performed or witnessed the same during or after its completion and, to the best of my knowledge, the annexed report is true.

| | | |
|---|---|---|
| Signature of Recorded Holder or Agent [signature] | | Date April 03/2000 |
| Agent's Address(HOME) PO BOX 427, PINAWA, MB. R0E 1L0<br>(WORK) PO BOX 2000, LAC DU BONNET, MB, R0E 1A0 | Telephone Number<br>(204) 753-2022 (HOME)<br>(204) 884-2400 (WORK) | Fax Number<br>(204) 884-2211 (WORK) |

0241 (03/97)

#1348

5. **Work to be recorded and distributed.** Work can only be assigned to claims that are contiguous (adjoining) to the mining land where work was performed, at the time work was performed. A map showing the contiguous link must accompany this form

Revised Copy

W-0010-00037

| | Mining Claim Number. Or if work was done on other eligible mining land, show in this column the location number indicated on the claim map | Number of Claim Units. For other mining land, list hectares. | Value of work performed on this claim or other mining land | Value of work applied to this claim. | Value of work assigned to other mining claims. | Bank. Value of work to be distributed at a future date |
|---|---|---|---|---|---|---|
| eg | TB 7827 | 16 ha | $26,825 | N/A | $24,000 | $2,825 |
| eg | 1234567 | 12 | 0 | $24,000 | 0 | 0 |
| eg | 1234568 | 2 | $ 8,892 | $ 4,000 | 0 | $4,892 |
| 1 | 1178866 | 2 | $ 386 | $ 386 | 0 | 0 |
| 2 | 1149772 | 1 | $ 193 | $ 193 | 0 | 0 |
| 3 | 1178867 | 2 | $ 386 | $ 386 | 0 | 0 |
| 4 | 1178575 | 2 | $ 386 | $ 386 | 0 | 0 |
| 5 | 1178574 | 4 | $ 772 | $ 772 | 0 | 0 |
| 6 | 1178787 | 3 | $ 579 | $ 579 | 0 | 0 |
| 7 | 1178730 | 3 | $ 579 | $ 579 | 0 | 0 |
| 8 | 1178295 | 1 | $ 193 | $ 193 | 0 | 0 |
| 9 | 1178296 | 16 | $ 4989 | $ 4989 | 0 | 0 |
| 10 | 1178690 | 1 | $ 193 | $ 193 | 0 | 0 |
| 11 | 1178598 | 2 | $ 386 | $ 386 | 0 | 0 |
| 12 | 1178689 | 8 | $ 3786 | $ 3786 | 0 | 0 |
| 13 | 1178678 | 13 | $ 2508 | $ 2508 | 0 | 0 |
| 14 | 1162991 | 8 | $ 3445 | $ 3445 | 0 | 0 |
| 15 | 1178297 | 6 | $ 1158 | $ 1158 | 0 | 0 |
| 16 | 1162990 | 4 | $ 772 | $ 772 | 0 | 0 |
| 17 | 1149773 | 2 | $ 386 | $ 386 | 0 | 0 |
| 18 | 1149776 | 3 | $ 579 | $ 579 | 0 | 0 |
| 19 | 1149775 | 1 | $ 193 | $ 193 | 0 | 0 |
| 20 | 1162989 | 6 | $ 1158 | $ 1158 | 0 | 0 |
| 21 | 1178437 | 12 | $ 2315 | $ 2315 | 0 | 0 |
| 22 | 1149774 | 6 | $ 6428 | $ 4652 | 0 | $ 1776 |
| 23 | 1220538 | 3 | $ 579 | $ 579 | 0 | 0 |
| 24 | 1220539 | 3 | $ 579 | $ 579 | 0 | 0 |
| 25 | 1220540 | 3 | $ 579 | $ 579 | 0 | 0 |
| 26 | 1220541 | 4 | CRA $ 772 | CRS $ 772 | 0 | 0 |
| 27 | 1220542 | 3 | 04/13/00 $ 579 | 04/13/00 $ 579 | 0 | 0 |
| 28 | 1166804 | 1 | $ 193 | $ 193 | 0 | 0 |
| 29 | 1220596 | 2 | $ 2517 | $ 1600 | 0 | $ 917 |
| | Column Totals | 125 | ~~$ 37564~~ 37,568 | ~~$ 34875~~ 34,875 | 0 | $ 2693 |

I, Carey Rus Galeschuk (Print Full Name), do hereby certify that the above work credits are eligible under subsection 7 (1) of the Assessment Work Regulation 6/96 for assignment to contiguous claims or for application to the claim where the work was done.

| Signature of Recorded Holder or Agent Authorized in Writing | Date |
|---|---|
| [signature] | April 3/2000 |

6. **Instruction for cutting back credits that are not approved.**

Some of the credits claimed in this declaration may be cut back. Please check (✓) in the boxes below to show how you wish to prioritize the deletion of credits:

- ☑ 1. Credits are to be cut back from the Bank first, followed by option 2 or 3 or 4 as indicated.
- ☐ 2. Credits are to be cut back starting with the claims listed last, working backwards; or
- ☐ 3. Credits are to be cut back equally over all claims listed in this declaration; or
- ☐ 4. Credits are to be cut back as prioritized on the attached appendix or as follows (describe):

RECORDED
APR 0 6 2000

RECEIVED
APR - 6 2000
GEOSCIENCE ASSESSMENT OFFICE

Note: If you have not indicated how your credits are to be deleted, credits will be cut back from the Bank first, followed by option number 2 if necessary.

**For Office Use Only**

| Received Stamp | Deemed Approved Date | Date Notification Sent |
|---|---|---|
| | Date Approved | Total Value of Credit Approved |
| | Approved for Recording by Mining Recorder (Signature) | |

0241 (03/97)



Note: If you have not indicated how your credits are to be deleted, credits will be cut back from the Bank first, followed by option number 2 if necessary.
GEOSCIENCE ASSESSMENT OFFICE

**For Office Use Only**

| Received Stamp | Deemed Approved Date | Date Notification Sent |
|---|---|---|
| | Date Approved | Total Value of Credit Approved |
| | Approved for Recording by Mining Recorder (Signature) | |

0241 (03/97)

Revised Copy

Ontario Ministry of Northern Development and Mines

# Statement of Costs for Assessment Credit

Transaction Number (office use): W-0010-00037



| Work Type | Units of work<br>Depending on the type of work, list the number of hours/day worked, metres of drilling, kilometres of grid line, number of samples, etc. | Cost Per Unit of work | Total Cost |
|---|---|---|---|
| Field Preparation | 1 Day | $ 209 | $ 209 |
| Field Work (Labor) | 9 Days | $ 210 | $ 1890 |
| | 8 Days | $ 135 | $ 1080 |
| | 16 Days | $ 113 | $ 1378 |
| | 13 Days | $ 106 | $ 1378 |
| Data Entry and Field Drafting | 4 Days | $ 210 | $ 840 |
| | 4 Days | $ 113 | $ 452 |
| | 2 Days | $ 106 | $ 212 |
| Report Writing/Drafting/Data Entry | 13 Days | $ 222 | $ 2886 |
| Structural Consultant Work | INVOICE | $ 23170.24 | $ 23170.24 |
| **Associated Costs (e.g. supplies, mobilization and demobilization).** | | | |
| 86 Assays ( Rock Lithogeochemistry) | | $ 22.50 | $ 1935 |
| Photocopy charges for the report | | $ 319.07 | $ 319.07 |
| Shipping | | $ 125 | $ 125 |
| **Transportation Costs** | | | |
| 90 kilometres for 5 days = 450 kilometres | | 0.30 per km | $ 136 |
| **Food and Lodging Costs** | | | |
| Food | | $ 300 | $ 300 |
| Lodging (Accommodations) | | $ 825 | $ 828 |
| | | Total Value of Assessment Work | $ 37568.34 |

RECORDED APR 06 2000

RECEIVED APR - 6 2000 GEOSCIENCE ASSESSMENT OFFICE

Calculations of Filing Discounts:

1. Work filed within two years of performance is claimed at 100% of the above Total Value of Assessment Work.
2. If work is filed after two years and up to five years after performance, it can only be claimed at 50% of the Total Value of Assessment Work. If this situation applies to your claims, use the calculation below:

TOTAL VALUE OF ASSESSMENT WORK ______ x 0.50 = ______ Total $ value of worked claimed.

**Note:**

- Work older than 5 years is not eligible for credit.
- A recorded holder may be required to verify expenditures claimed in this statement of costs within 45 days of a request for verification and/or correction/clarification. If verification and/or correction/clarification is not made, the Minister may reject all or part of the assessment work submitted.

**Certification verifying costs:**

I, Carey Rus Galeschuk (please print full name), do hereby certify, that the amounts shown are as accurate as may reasonably be determined and the costs were incurred while conducting assessment work on the lands indicated on the accompanying Declaration of Work form as Project Geologist - Tantalum Mining Corporation of Canada (recorded holder, agent, or state company position with signing authority) I am authorized to make this certification.

Signature: [signature] Date: April 3/2000

0212 (03/97)



Certification verifying costs:

I, Carey Rus Galeschuk (please print full name), do hereby certify, that the amounts shown are as accurate as may reasonably be determined and the costs were incurred while conducting assessment work on the lands indicated on the accompanying Declaration of Work form as Project Geologist - Tantalum Mining Corporation of Canada (recorded holder, agent, or state company position with signing authority) I am authorized to make this certification.

Signature: [signature] Date: April 3/2000

0212 (03/97)

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

Ontario

Geoscience Assessment Office
933 Ramsey Lake Road
6th Floor
Sudbury, Ontario
P3E 6B5

Telephone: (888) 415-9845
Fax: (877) 670-1555

Visit our website at:
www.gov.on.ca/MNDM/MINES/LANDS/mlsmnpge.htm

August 30, 2000

Carey R. Galeschuk
TANTALUM MINING CORPORATION OF CANADA LIMITED
P.O. BOX 2000
LAC DU BONNET, MANITOBA
R0E-1A0

Dear Sir or Madam:

**Submission Number:** 2.20238

| | | **Status** |
|---|---|---|
| **Subject: Transaction Number(s):** | W0010.00037 | Approval After Notice |

We have reviewed your Assessment Work submission with the above noted Transaction Number(s). The attached summary page(s) indicate the results of the review. WE RECOMMEND YOU READ THIS SUMMARY FOR THE DETAILS PERTAINING TO YOUR ASSESSMENT WORK.

If the status for a transaction is a 45 Day Notice, the summary will outline the reasons for the notice, and any steps you can take to remedy deficiencies. The 90-day deemed approval provision, subsection 6(7) of the Assessment Work Regulation, will no longer be in effect for assessment work which has received a 45 Day Notice. Allowable changes to your credit distribution can be made by contacting the Geoscience Assessment Office within this 45 Day period, otherwise assessment credit will be cut back and distributed as outlined in Section #6 of the Declaration of Assessment work form.

Please note any revisions must be submitted in DUPLICATE to the Geoscience Assessment Office, by the response date on the summary.

If you have any questions regarding this correspondence, please contact JIM MCAULEY by e-mail at james.mcauley@ndm.gov.on.ca or by telephone at (705) 670-5880.

Yours sincerely,

Steven B. Beneteau

ORIGINAL SIGNED BY
Steve B. Beneteau
Acting Supervisor, Geoscience Assessment Office
Mining Lands Section

Correspondence ID: 15187
Copy for: Assessment Library

# Work Report Assessment Results

**Submission Number:** 2.20238

**Date Correspondence Sent:** August 30, 2000 **Assessor:** JIM MCAULEY

| Transaction Number | First Claim Number | Township(s) / Area(s) | Status | Approval Date |
|---|---|---|---|---|
| W0010.00037 | 1178866 | TREELINED LAKE, PATERSON LAKE, STOP LAKE, SNOOK LAKE | Approval After Notice | August 14, 2000 |

**Section:**
12 Geological GEOL

The 45 days outlined in the Notice dated June 30, 2000 have passed and no new information has been provided.

Assessment work credit has been approved as outlined on the attached Distribution of Assessment Work Credit sheet. Note that claim 1188296 as listed in the 45 Day Notice Distribution of Assessment Work Credit Sheet has been corrected to read claim 1178296 in this Distribution of Assessment Work Credit Sheet.

The assessment credit is being reduced by $9383. The TOTAL VALUE of assessment credit that will be allowed, based on the information provided in this submission, is $28,185. Note that an extra $4 has been added to claim 1220596 to account for differences in the original statement of cost (due to rounding) as was noted when the original report was submitted.

At the discretion of the Ministry, the assessment work performed on the mining lands noted in this work report may be subject to inspection and/or investigation at any time.

**Correspondence to:**
Resident Geologist
Kenora, ON

Assessment Files Library
Sudbury, ON

**Recorded Holder(s) and/or Agent(s):**
Carey R. Galeschuk
TANTALUM MINING CORPORATION OF CANADA LIMITED
LAC DU BONNET, MANITOBA

GOSSAN RESOURCES LIMITED
WINNIPEG, MANITOBA



Correspondence ID: 15187

# Distribution of Assessment Work Credit

The following credit distribution reflects the value of assessment work performed on the mining land(s).

**Date:** August 30, 2000

**Submission Number:** 2.20238

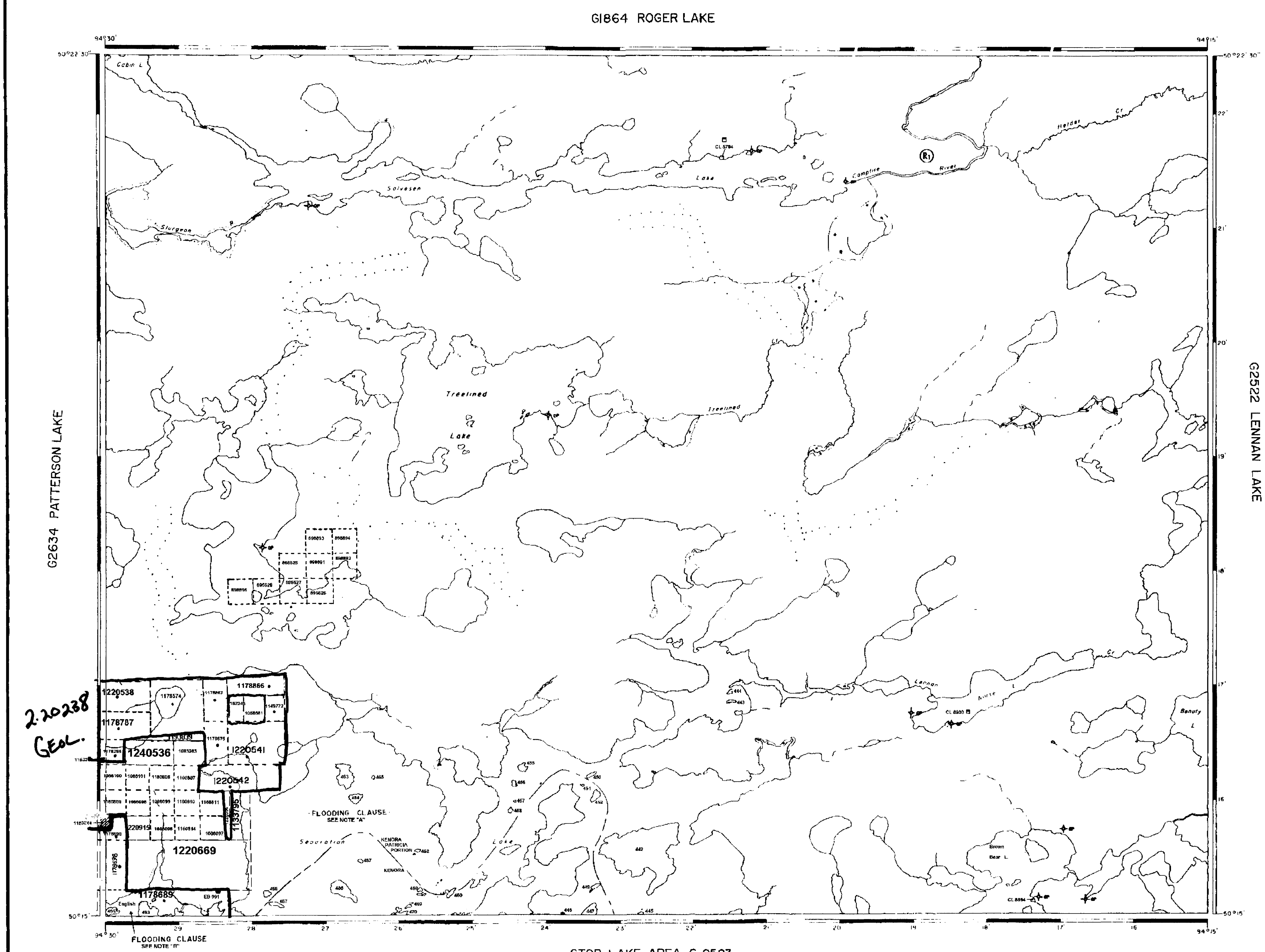
---

**Transaction Number:** W0010.00037

| Claim Number | Value Of Work Performed |
|---|---|
| 1178866 | 235.00 |
| 1149772 | 117.00 |
| 1178867 | 236.00 |
| 1178575 | 236.00 |
| 1178574 | 472.00 |
| 1178787 | 354.00 |
| 1178730 | 354.00 |
| 1178295 | 118.00 |
| 1178296 | 3,787.00 |
| 1178690 | 118.00 |
| 1178598 | 236.00 |
| 1178689 | 3,185.00 |
| 1178678 | 1,532.00 |
| 1162991 | 2,844.00 |
| 1178297 | 707.00 |
| 1162990 | 472.00 |
| 1149773 | 236.00 |
| 1149776 | 354.00 |
| 1149775 | 118.00 |
| 1162989 | 707.00 |
| 1178437 | 1,414.00 |
| 1149774 | 5,977.00 |
| 1220538 | 354.00 |
| 1220539 | 354.00 |
| 1220540 | 354.00 |
| 1220541 | 472.00 |
| 1220542 | 354.00 |
| 1166804 | 118.00 |
| 1220596 | 2,370.00 |
| **Total: $** | 28,185.00 |



Correspondence ID: 15187




# LEGEND

| | |
|---|---|
| HIGHWAY AND ROUTE No. | |
| OTHER ROADS | |
| TRAILS | |
| SURVEYED LINES | |
| TOWNSHIPS, BASE LINES, ETC. | |
| LOTS, MINING CLAIMS, PARCELS, ETC. | |
| UNSURVEYED LINES | |
| LOT LINES | |
| PARCEL BOUNDARY | |
| MINING CLAIMS ETC. | |
| RAILWAY AND RIGHT OF WAY | |
| UTILITY LINES | |
| NON PERENNIAL STREAM | |
| FLOODING OR FLOODING RIGHTS | |
| SUBDIVISION OR COMPOSITE PLAN | |
| RESERVATIONS | |
| ORIGINAL SHORELINE | |
| MARSH OR MUSKEG | |
| MINES | ⚒ |
| TRAVERSE MONUMENT | ◆ |

# DISPOSITION OF CROWN LANDS

| TYPE OF DOCUMENT | SYMBOL |
|---|---|
| PATENT, SURFACE & MINING RIGHTS | ● |
| " , SURFACE RIGHTS ONLY | ◓ |
| " , MINING RIGHTS ONLY | ◒ |
| LEASE, SURFACE & MINING RIGHTS | ■ |
| " , SURFACE RIGHTS ONLY | ⬒ |
| " , MINING RIGHTS ONLY | ⬓ |
| LICENCE OF OCCUPATION | ▼ |
| ORDER IN COUNCIL | OC |
| RESERVATION | Ⓡ |
| CANCELLED | ⊗ |
| SAND & GRAVEL | Ⓢ |

NOTE MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT R.S.O. 1970 CHAP. 380 SEC. 63 SUBSEC. 1

# REFERENCES

AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+S. MINING AND SURFACE RIGHTS

| Description | Order No. | Date | Disposition | File |
|---|---|---|---|---|
| R1 SEC 35 | W-LL-C 2368/99 | ONT MAY 10/99 | M+S | |

FLOODING

RESERVE FLOODING RIGHTS AND LAND UNDER THE WATERS OF THE ENGLISH RIVER BETWEEN SEPARATION RAPIDS AND CARIBOU FALLS, INCLUDING THE STURGEON RIVER, BELOW CONTOUR ELEVATION 1049.0, G.S.C. DATUM, 1919, TO H.E.P.C. OF ONTARIO FOR THE DEVELOPMENT OF WATER POWER AT CARIBOU FALLS.
FOR DETAIL OF CONTOUR, REFER TO PLAN No. U 2-27, dated 15th MARCH 1958, (H.E.P.C. PLAN No. 80G-3359).
W.P.L.A. No. 50, dated 21st DECEMBER 1959 File 34779

NOTE "A"

RESERVE FLOODING RIGHTS ON THE ENGLISH RIVER FROM THE UPPER END OF SEPARATION RAPIDS TO THE FOOT OF MAYNARD FALLS, INCLUDING SEPARATION LAKE, BEAUTY LAKE, AND LENNAN CREEK, TO A CONTOUR 5' ABOVE THE HIGH WATER MARK. Files 34179 69307
RESERVATION REQUESTED 30th NOVEMBER 1959

SCALE: 1 INCH = 40 CHAINS

FEET 0 1000 2000 4000 6000 8000
METRES 0 200 1000 2000
(1 KM) (2 KM)

AREA TREELINED LAKE

M.N.R. ADMINISTRATIVE DISTRICT
KENORA

MINING DIVISION
KENORA

LAND TITLES / REGISTRY DIVISION
KENORA/KENORA (PATRICIA PORTION)

Ontario Ministry of Natural Resources Land Management Branch

Date FEBRUARY, 1984

M-2694

Number G-2651

503942

LEGEND

TOURIST CAMPS (OR OUTPOST)

UPDATES

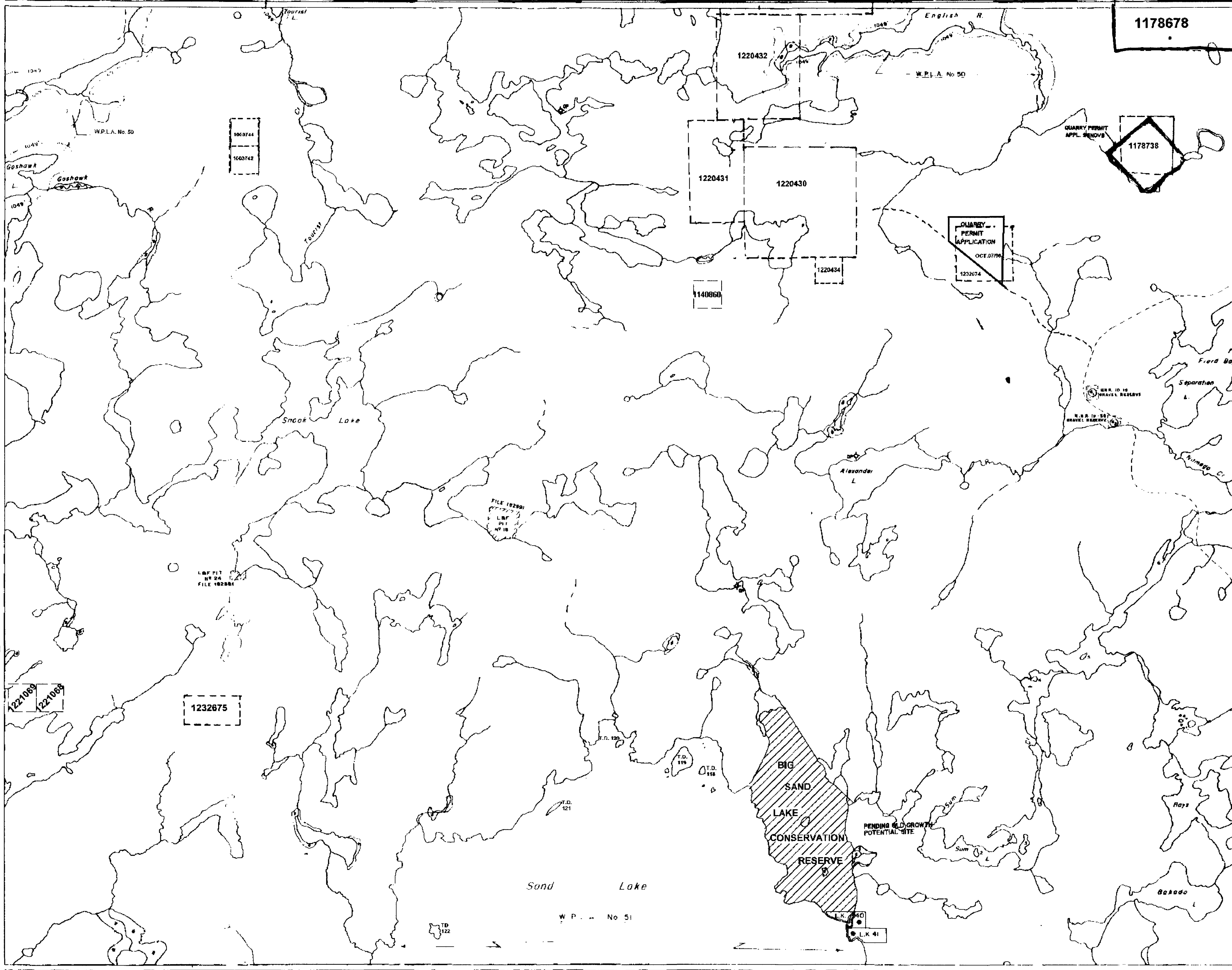
DATE PUT IN SERVICE
JUL 19 1996
KENORA
MINING DIVISION

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.

52L08SW2008 2.20238 TREELINED LAKE 200

GEOL 2.20238

G2634 PATERSON LAKE




THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.

G2620 GOSHAWK LAKE

STOP LAKE AREA G-2523

G2641 SAND LAKE

## LEGEND

HIGHWAY AND ROUTE No.
OTHER ROADS
TRAILS
SURVEYED LINES:
TOWNSHIPS, BASE LINES, ETC.
LOTS, MINING CLAIMS, PARCELS, ETC.
UNSURVEYED LINES
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT
TOURIST CAMPS (OP - OUTPOST)

## DISPOSITION OF CROWN LANDS

**TYPE OF DOCUMENT** — **SYMBOL**

PATENT, SURFACE & MINING RIGHTS
" , SURFACE RIGHTS ONLY
" , MINING RIGHTS ONLY
LEASE, SURFACE & MINING RIGHTS
" , SURFACE RIGHTS ONLY
" , MINING RIGHTS ONLY
LICENCE OF OCCUPATION
ORDER-IN-COUNCIL — OC
RESERVATION
CANCELLED
SAND & GRAVEL

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1.

## REFERENCES

**AREAS WITHDRAWN FROM DISPOSITION**

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

| Description | Order No. | Date | Disposition | File |
| --- | --- | --- | --- | --- |

**FLOODING**

RESERVE FLOODING RIGHTS AND LAND UNDER THE WATERS OF THE ENGLISH RIVER BETWEEN SEPARATION RAPIDS AND CARIBOU FALLS, INCLUDING GOSHAWK LAKE AND TOURIST LAKE, BELOW CONTOUR ELEVATION 1049.0' G.S.C. DATUM 1919, TO H.E.P.C. OF ONTARIO FOR THE DEVELOPMENT OF WATER POWER AT CARIBOU FALLS.
FOR DETAIL OF CONTOUR REFER TO PLAN No. U2-27 DATED 15th MARCH 1958, (H.E.P.C. PLAN No. 800-3359)
W.P.L.A. No. 50 DATED 21st DECEMBER 1959 FILE: 34179

RESERVE FLOODING RIGHTS WITHOUT COMPENSATION ON SAND LAKE UP TO CONTOUR ELEVATION 1042.0', G.S.C. DATUM 1923 ADJUSTMENT, TO H.E.P.C. OF ONTARIO FOR THE DEVELOPMENT OF WATER POWER AT WHITEDOG FALLS ON THE WINNIPEG RIVER.
FOR DETAIL OF CONTOUR, REFER TO PLAN No. L.28-44 DATED 31st MARCH 1958, (H.E.P.C. PLAN No. FP 3-e-3256)
W.P.L.A. No. 51 DATED 27th MARCH 1961
FILES: 12999, 4922, 69307.

RESERVE FLOODING RIGHTS ON FIORD BAY OF SEPARATION LAKE TO A CONTOUR 5' ABOVE THE HIGH WATER MARK RESERVATION REQUESTED 30th NOVEMBER 1959
FILE: 34179.

SCALE: 1 INCH = 40 CHAINS

FEET 0 1000 2000 4000 6000 8000
METRES 0 200 1000 (1 KM) 2000 (2 KM)

AREA

# SNOOK LAKE

M.N.R. ADMINISTRATIVE DISTRICT
**KENORA**
MINING DIVISION
**KENORA**
LAND TITLES / REGISTRY DIVISION
**KENORA**

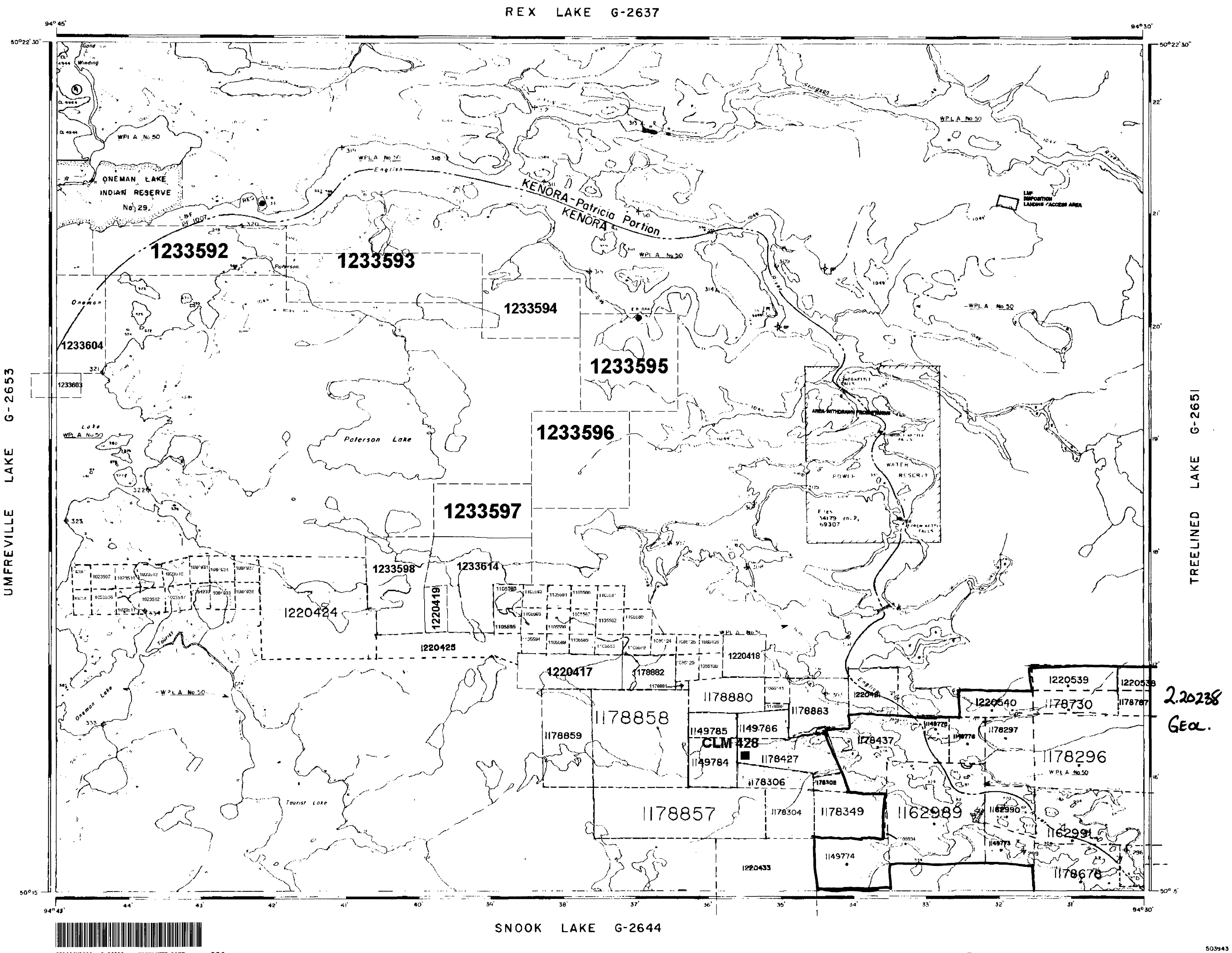
Ministry of Natural Resources — Ministry of Northern Development and Mines
Ontario

Date FEBRUARY, 19__ — Number G-2644

M- 2642

502943

M.E. 52L08SW2008 2.20238 TREELINED LAKE 210




# LEGEND

- HIGHWAY AND ROUTE No.
- OTHER ROADS
- TRAILS
- SURVEYED LINES
  - TOWNSHIPS, BASE LINES, ETC.
  - LOTS, MINING CLAIMS, PARCELS, ETC.
- UNSURVEYED LINES
  - LOT LINES
  - PARCEL BOUNDARY
  - MINING CLAIMS ETC.
- RAILWAY AND RIGHT OF WAY
- UTILITY LINES
- NON-PERENNIAL STREAM
- FLOODING OR FLOODING RIGHTS
- SUBDIVISION OR COMPOSITE PLAN
- RESERVATIONS
- ORIGINAL SHORELINE
- MARSH OR MUSKEG
- MINES
- TRAVERSE MONUMENT

## DISPOSITION OF CROWN LANDS

| TYPE OF DOCUMENT | SYMBOL |
|---|---|
| PATENT, SURFACE & MINING RIGHTS | ● |
| " , SURFACE RIGHTS ONLY | |
| " , MINING RIGHTS ONLY | |
| LEASE, SURFACE & MINING RIGHTS | ■ |
| " , SURFACE RIGHTS ONLY | |
| " , MINING RIGHTS ONLY | |
| LICENCE OF OCCUPATION | ▼ |
| ORDER IN COUNCIL | OC |
| RESERVATION | |
| CANCELLED | |
| SAND & GRAVEL | |

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913 VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

## REFERENCES

AREAS WITHDRAWN FROM DISPOSITION

M.R.O. MINING RIGHTS ONLY
S.R.O. - SURFACE RIGHTS ONLY
M.+S. MINING AND SURFACE RIGHTS

| Description | Order No. | Date | Disposition | File |
|---|---|---|---|---|
| (R) | W.6/82 | 21/7/72 | S.R. & M.R. | 19 42 23 |

FLOODING

Flooding rights to contour elevation shown thus Mining claims staked in the vicinity, subject to flooding. See Files 34179- (vol. 2) and ...307

SCALE: 1 INCH = 40 CHAINS

FEET 0 1000 2000 4000 6000 8000
METRES 0 200 1000 (1 KM) 2000 (2 KM)

AREA

# PATERSON LAKE

M.N.R. ADMINISTRATIVE DISTRICT
**KENORA**
MINING DIVISION
**KENORA**
LAND TITLES / REGISTRY DIVISION
**KENORA / KENORA (PATRICIA PORTION)**

Ministry of Natural Resources — Land Management Branch
Ontario

Date FEBRUARY, 1984 — M-2531 — Number G-2634

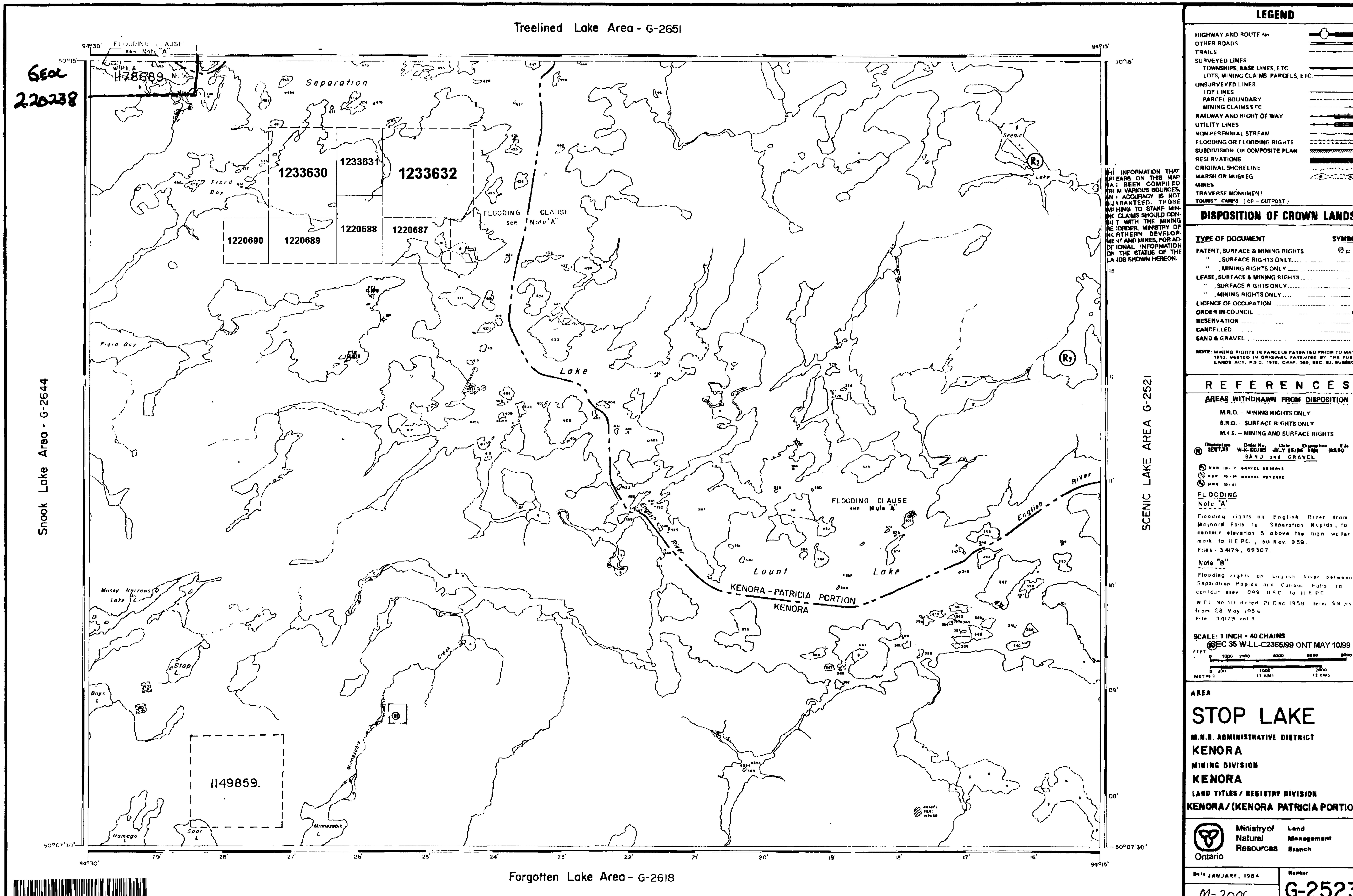
LEGEND

TOURIST CAMPS OR (OUTPOST)

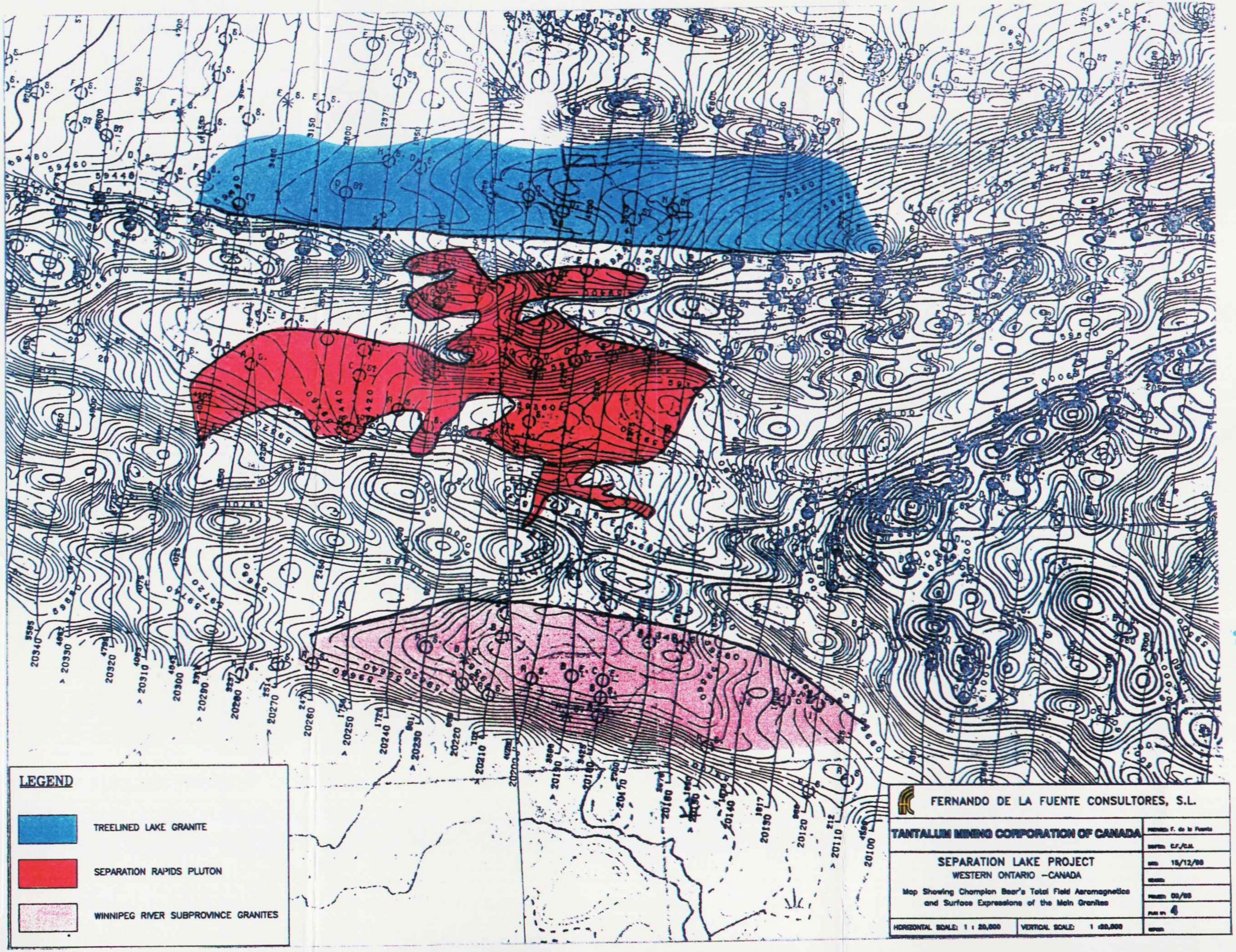
UPDATES

DATE PUT IN SERVICE
JUL 19 1996
KENORA MINING DIVISION

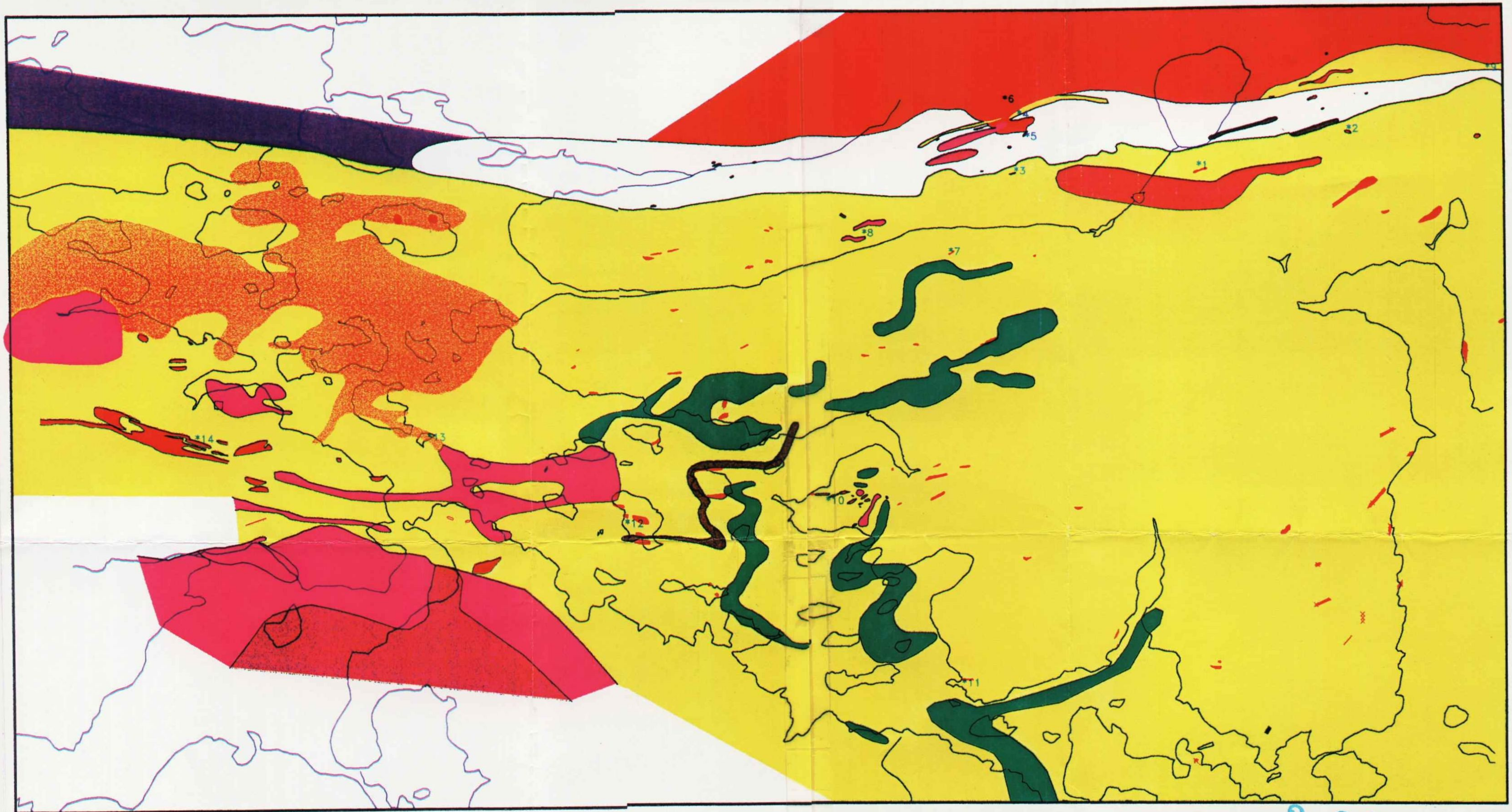
THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.




52L08SW2008 2.20238 TREELINED LAKE 230



LEGEND
TREELINED LAKE GRANITE
SEPARATION RAPIDS PLUTON
WINNIPEG RIVER SUBPROVINCE GRANITES
FERNANDO DE LA FUENTE CONSULTORES, S.L.
TANTALUM MINING CORPORATION OF CANADA
F. de la Fuente
C.F./C.M.
15/12/98
SEPARATION LAKE PROJECT
WESTERN ONTARIO –CANADA
Map Showing Champion Bear's Total Field Aeromagnetics
and Surface Expressions of the Main Granites
4
HORIZONTAL SCALE: 1 : 20,000
VERTICAL SCALE: 1 :20,000




# LEGEND

**SEPARATION RAPIDS BELT**

- MAFIC VOLCANICS
- FELSIC VOLCANICS
- IRON FORMATION
- MAFIC INTRUSIVE
- PEGMATITIC GRANITE
- PEGMATITES
- SEPARATION LAKE GRANITIC PLUTON

**ENGLISH RIVER SUBPROVINCE**

- CLASTIC SEDIMENT
- GNEISS/MIGMITITE
- FELSIC INTRUSIVE

**WINNIPEG RIVER SUBPROVINCE**

- GNEISS
- FELSIC INTRUSIVE

**FIELD VISIT POINTS (REFERENCES IN TEXT)**

*1 BALLPEEN
*2 PEGMATITE #10
*3 DRAVEN'S
*4 IRON FORMATION
*5 PEGMATITE N OF DRAVEN'S
*6 TREELINED LAKE GRANITE
*7 LOU'S
*8 COOK'S
*9 CONGLOMERATE
*10 TURTLEBACK
*11 PEGMATITE IN SHORE OF RIVER
*12 RED HANDED ISLAND
*13 SEPARATION RAPIDS PLUTON
*14 BIG WHOPPER



MODIFIED AFTER CAREY GALESCHUK AND OTHERS
TANTALUM MINING CORPORATION OF CANADA. MAY 1998

FERNANDO DE LA FUENTE CONSULTORES, S.L.

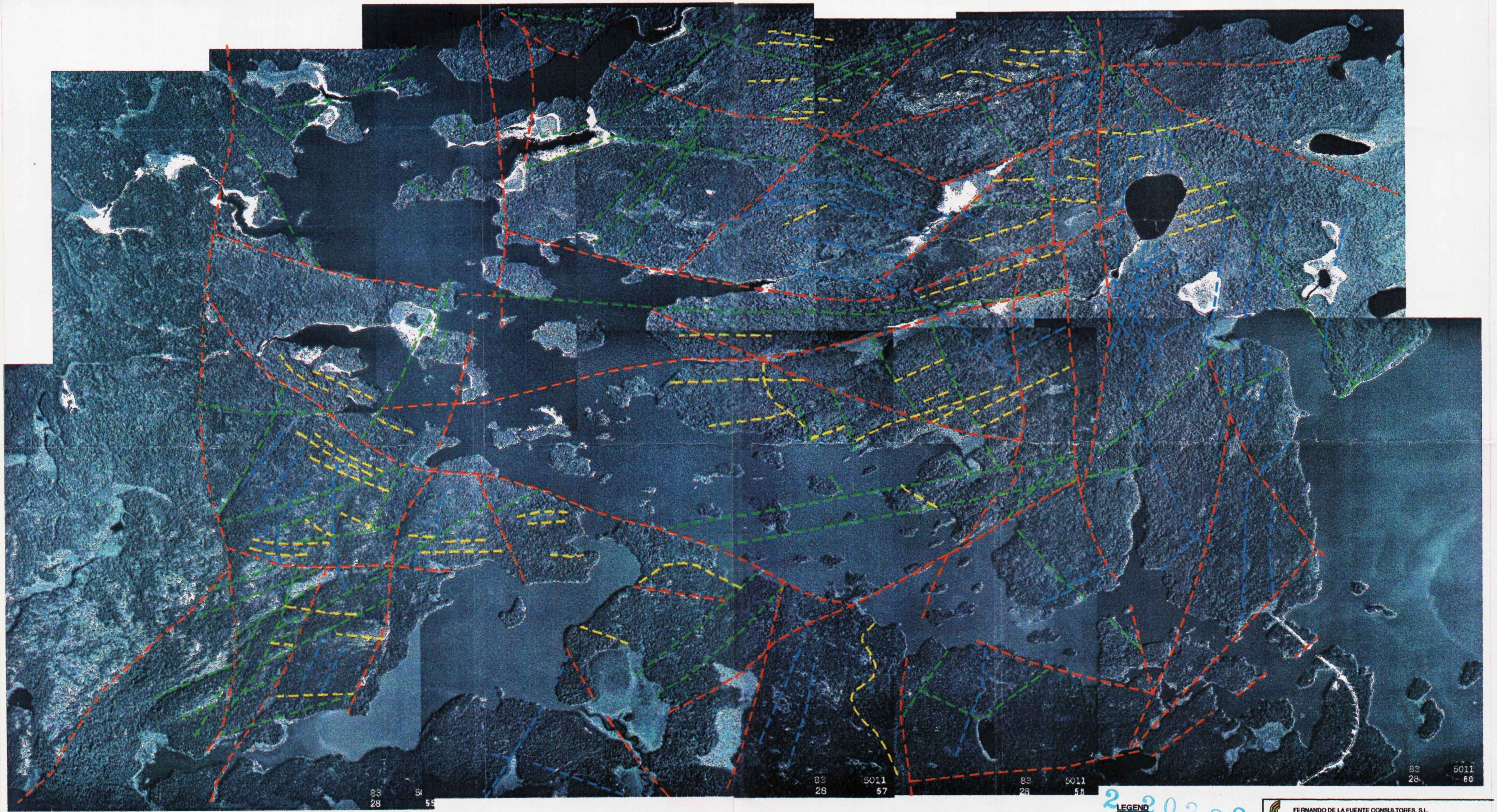
TANTALUM MINING CORPORATION OF CANADA

SEPARATION LAKE PROJECT
WESTERN ONTARIO –CANADA

GEOLOGICAL MAP WITH FIELD WORK REFERENCES

F. de la Fuente
C.F./C.M.
21/12/98
09/98
3

HORIZONTAL SCALE: 1 : 20,000 | VERTICAL SCALE: 1 :20,000




**LEGEND**

- Frist order lineament
- Second order lineament
- Third order lineament
- Fourth order lineament

FERNANDO DE LA FUENTE CONSULTORES, S.L.

| | |
|---|---|
| TANTALUM MINING CORPORATION OF CANADA | PREPARED: F. de la Fuente |
| | DRAFTED: C.F |
| SEPARATION LAKE PROJECT<br>WESTERN ONTARIO -CANADA<br>- PHOTOINTERPRETATION - | DATE: 15/12/98 |
| | REVISED: |
| | PROJECT: 09/98 |
| | PLAN Nº: 5 |
| SCALE : APPROX 1: 22.000 | REPORT: |


## LEGEND

| | |
|---|---|
| 1 | MAFIC VOLCANICS |
| 2 | FELSIC VOLCANICS |
| 3 | IRON FORMATION |
| 4 | CLASTIC SEDIMENT |
| 5 | MAFIC INTRUSIVE |
| 6 | GNEISS MIGMATITE |
| 7 | FELSIC INTRUSIVE |
| 8 | PEGMATITIC GRANITE |
| | PEGMATITES |

## LIST OF SYMBOLS

GEOLOGICAL CONTACT

CLAIM LINE

CLAIM POST (observed, assumed, line post) LP

PEGMATITE EXPOSURE

OUTCROP EXPOSURE (WITH ROCK CODE)

JOINTS

FOLIATION

## STAMP

PROVINCE OF MANITOBA
C.R. GALESCHUK
REGISTERED GEOSCIENTIST
02/20/00

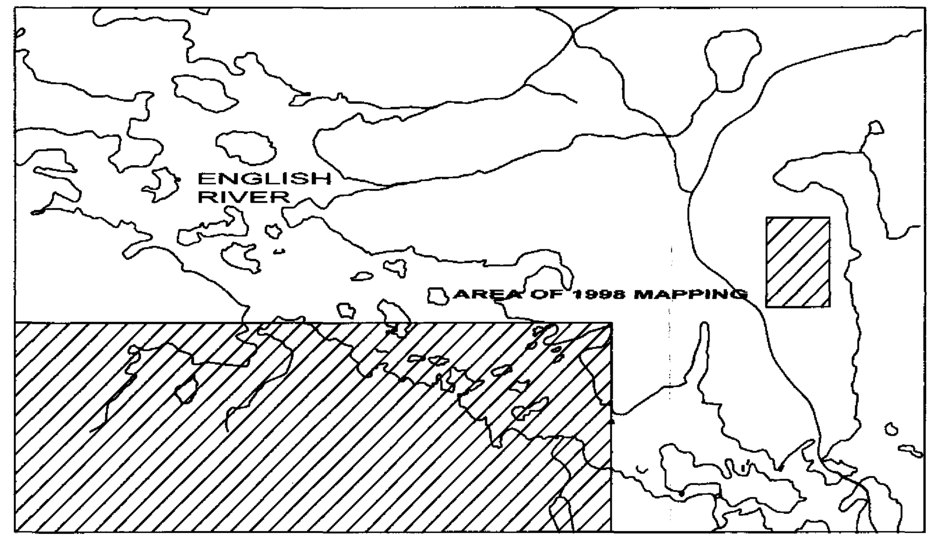
North - Magnetic Declination at 5° East

## SCALE

1 : 5000

0 100 200 300 400 500 (Metres)

## SEPARATION LAKE AREA MAP




# TANTALUM MINING CORPORATION OF CANADA LIMITED

# SEPARATION LAKE PROJECT

1998 West Claims - Geology and Structure

**DRAWN BY**

CAREY GALESCHUK, PROJECT GEOLOGIST

**DATE DRAWN**

FEBRUARY 20TH, 2000

**NTS SHEETS**

52L/7 Umfreville Lake Sheet

**MAP NUMBER**

Map 1 of 6


RECEIVED
APR - 6 2000
GEOSCIENCE ASSESSMENT OFFICE

## LEGEND

| | |
|---|---|
| 1 | MAFIC VOLCANICS |
| 2 | FELSIC VOLCANICS |
| 3 | IRON FORMATION |
| 4 | CLASTIC SEDIMENT |
| 5 | MAFIC INTRUSIVE |
| 6 | GNEISS MIGMATITE |
| 7 | FELSIC INTRUSIVE |
| 8 | PEGMATITIC GRANITE |
| | PEGMATITES |

## LIST OF SYMBOLS

GEOLOGICAL CONTACT

CLAIM LINE

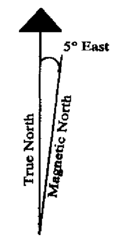
■ □ LP CLAIM POST (observed,assumed, line post)

PEGMATITE EXPOSURE

7 OUTCROP EXPOSURE (WITH ROCK CODE)

+13377 (25,14,3) SAMPLE NUMBER (LITHIUM, RUBIDIUM, CESIUM) IN PARTS PER MILLION (ppm)

## STAMP

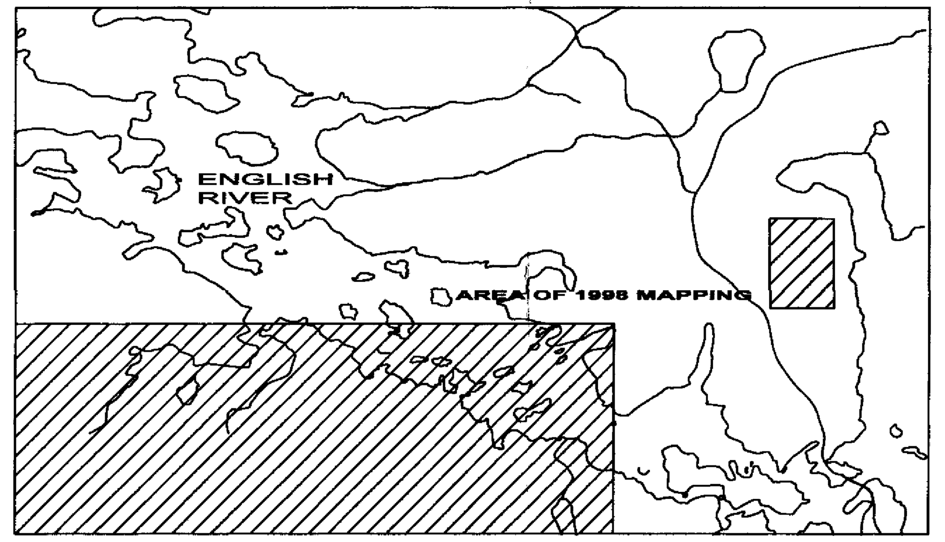

North - Magnetic Declination at 5° East

## SCALE

1 : 5000

0 100 200 300 400 500 (Metres)

## SEPARATION LAKE AREA MAP




TANTALUM MINING CORPORATION OF CANADA LIMITED

# SEPARATION LAKE PROJECT

1998 West Claims - Samples and Assay Results

**DRAWN BY**

CAREY GALESCHUK, PROJECT GEOLOGIST

**NTS SHEETS**

52L/7 Umfreville Lake Sheet

**DATE DRAWN**

FEBRUARY 20TH, 2000

**MAP NUMBER**

Map 2 of 6

52L08SW2008 2.20238 TREELINED LAKE 280


## LEGEND

| | |
|---|---|
| 1 | MAFIC VOLCANICS |
| 2 | FELSIC VOLCANICS |
| 3 | IRON FORMATION |
| 4 | CLASTIC SEDIMENT |
| 5 | MAFIC INTRUSIVE |
| 6 | GNEISS MIGMATITE |
| 7 | FELSIC INTRUSIVE |
| 8 | PEGMATITIC GRANITE |
| | PEGMATITES |

## LIST OF SYMBOLS

GEOLOGICAL CONTACT

CLAIM LINE

CLAIM POST (observed,assumed, line post)

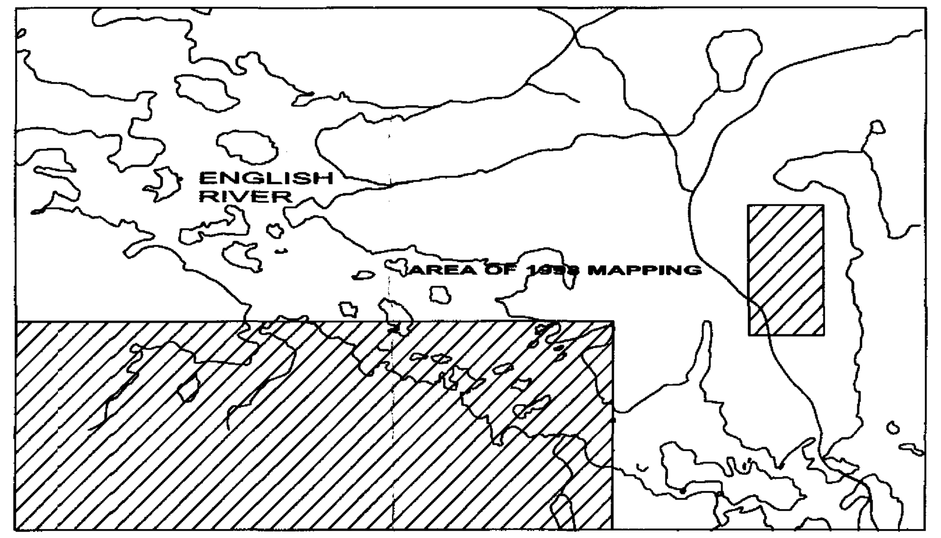
PEGMATITE EXPOSURE

OUTCROP EXPOSURE (WITH ROCK CODE)

LITHOGEOCHEMICAL ANOMALIES

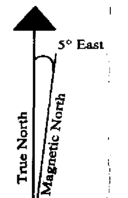
SLTA-98A

**SEPARATION LAKE AREA MAP**




**STAMP**






North - Magnetic Declination at 5° East

**SCALE**

1 : 5000

0 100 200 300 400 500 (Metres)

# TANTALUM MINING CORPORATION OF CANADA LIMITED

# SEPARATION LAKE PROJECT

1998 West Claims - Anomaly Map

**DRAWN BY**

CAREY GALESCHUK, PROJECT GEOLOGIST

**NTS SHEETS**

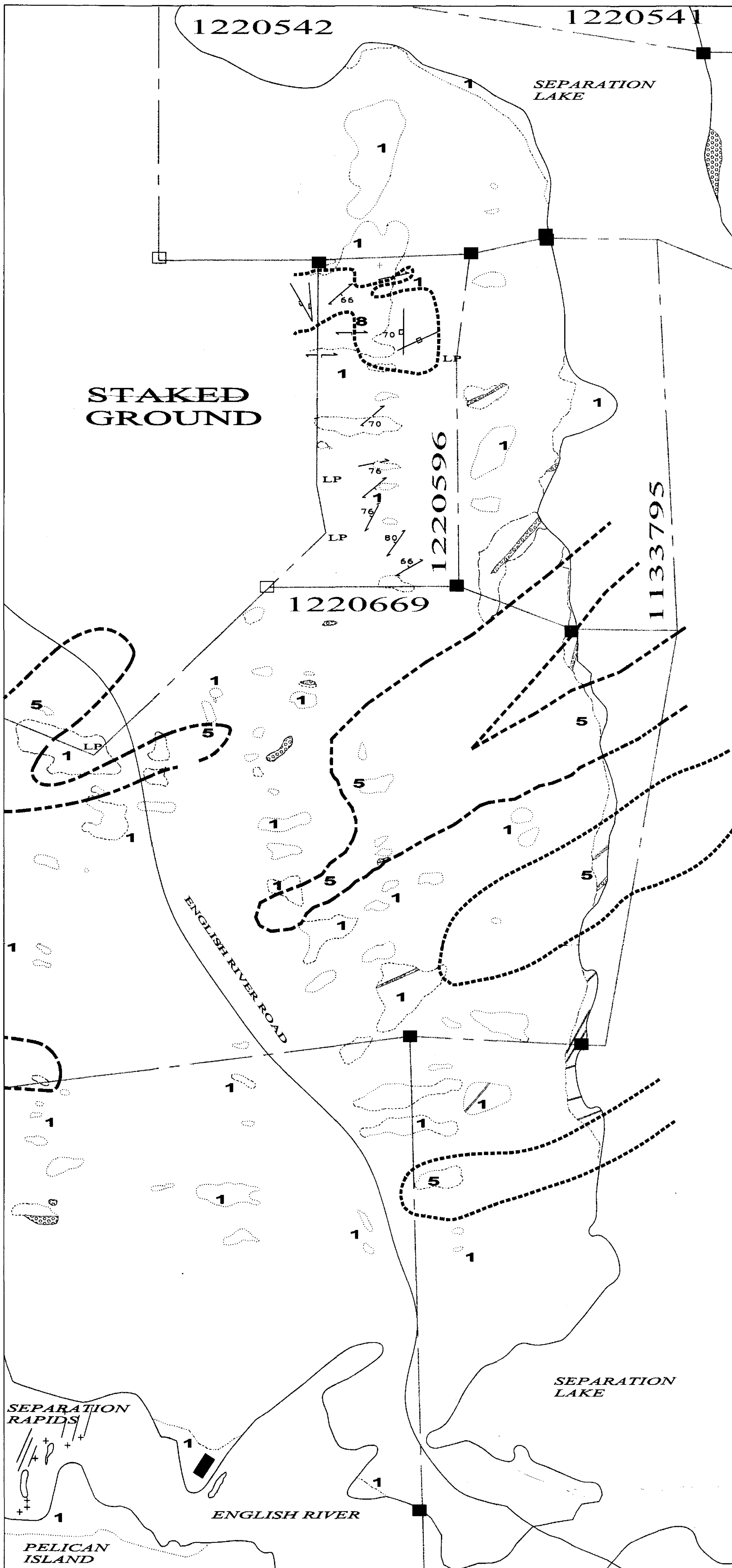
52L/7 Umfreville Lake Sheet

**DATE DRAWN**

FEBRUARY 20TH, 2000

**MAP NUMBER**

Map 3 of 6



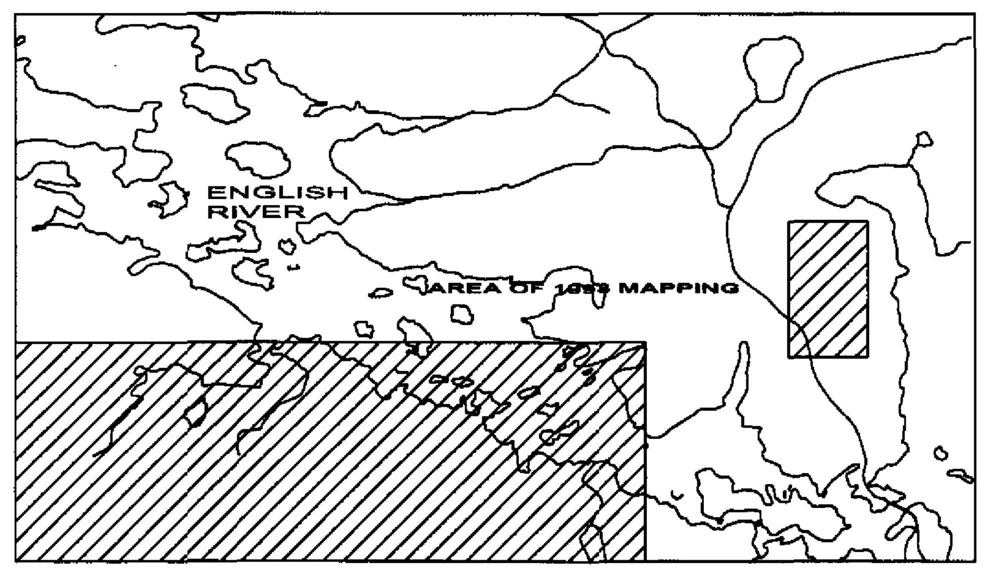

North
(Magnetic Declination at 5° East)

## SCALE

1 : 5000

0 100 200 300 400 500
(Metres)

## SEPARATION LAKE AREA MAP




## LEGEND

- 1 MAFIC VOLCANICS
- 2 FELSIC VOLCANICS
- 3 IRON FORMATION
- 4 CLASTIC SEDIMENT
- 5 MAFIC INTRUSIVE
- 6 GNEISS MIGMATITE
- 7 FELSIC INTRUSIVE
- 8 PEGMATITIC GRANITE
- PEGMATITES

## LIST OF SYMBOLS

- GEOLOGICAL CONTACT
- OUTCROP
- CLAIM LINE
- CLAIM POST (observed, assumed, line post)
- PEGMATITE EXPOSURE
- OUTCROP EXPOSURE (WITH ROCK CODE)
- FOLIATION
- JOINTING

TANTALUM MINING CORPORATION OF CANADA LIMITED

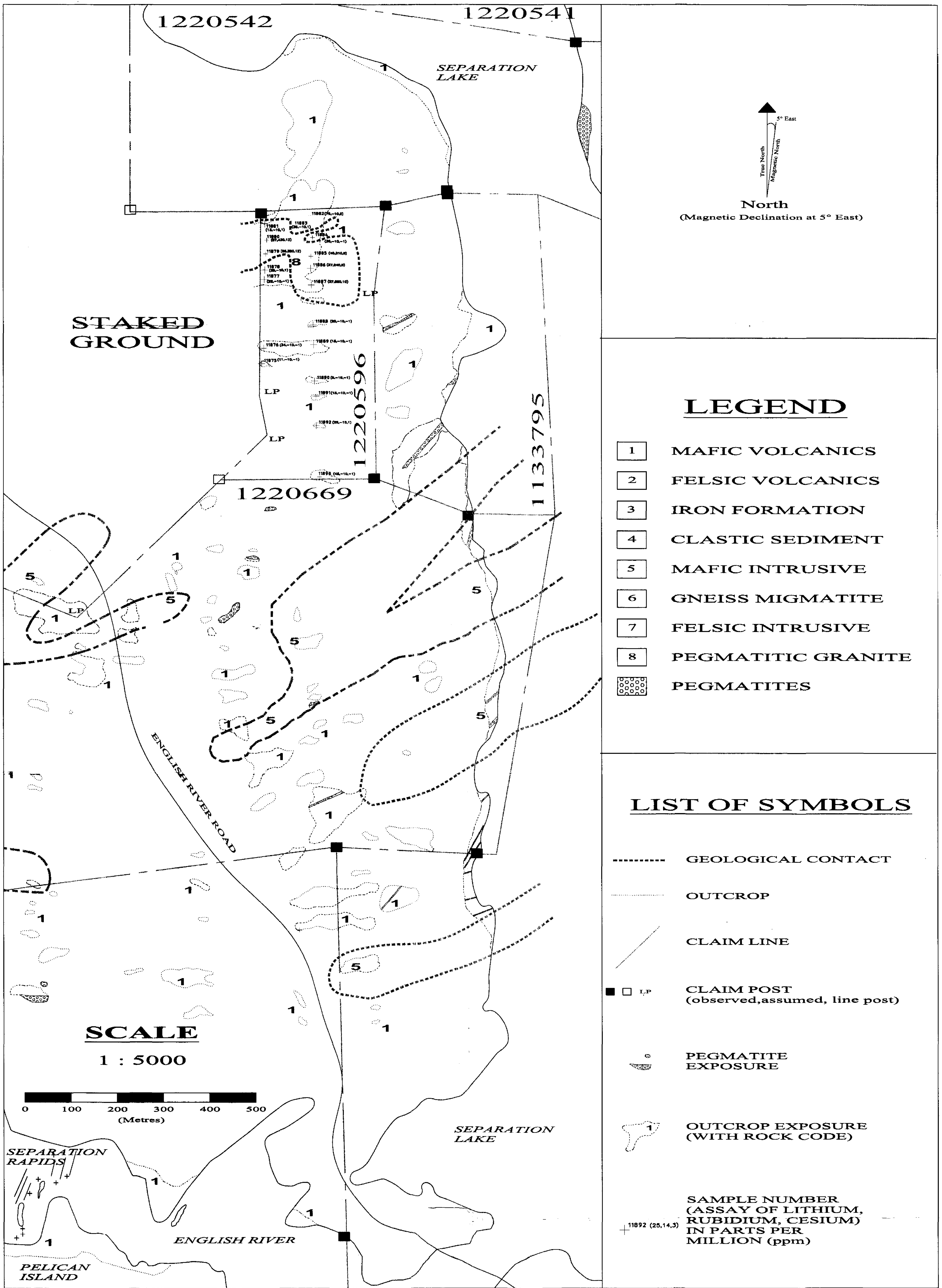
**STAMP:**

PROVINCE OF MANITOBA
C.R. GALESCHUK
02/20/00
REGISTERED PROFESSIONAL GEOSCIENTIST

# SEPARATION LAKE PROJECT

1998 East Claims - Geology and Structure Map

| DRAWN BY | NTS SHEETS |
|---|---|
| CAREY GALESCHUK, PROJECT GEOLOGIST | Lennan Lake Sheet, 52L/8 |
| **DATE DRAWN** | **MAP NUMBER** |
| FEBRUARY 15th, 2000 | Map 4 of 6 |




TANTALUM MINING CORPORATION OF CANADA LIMITED

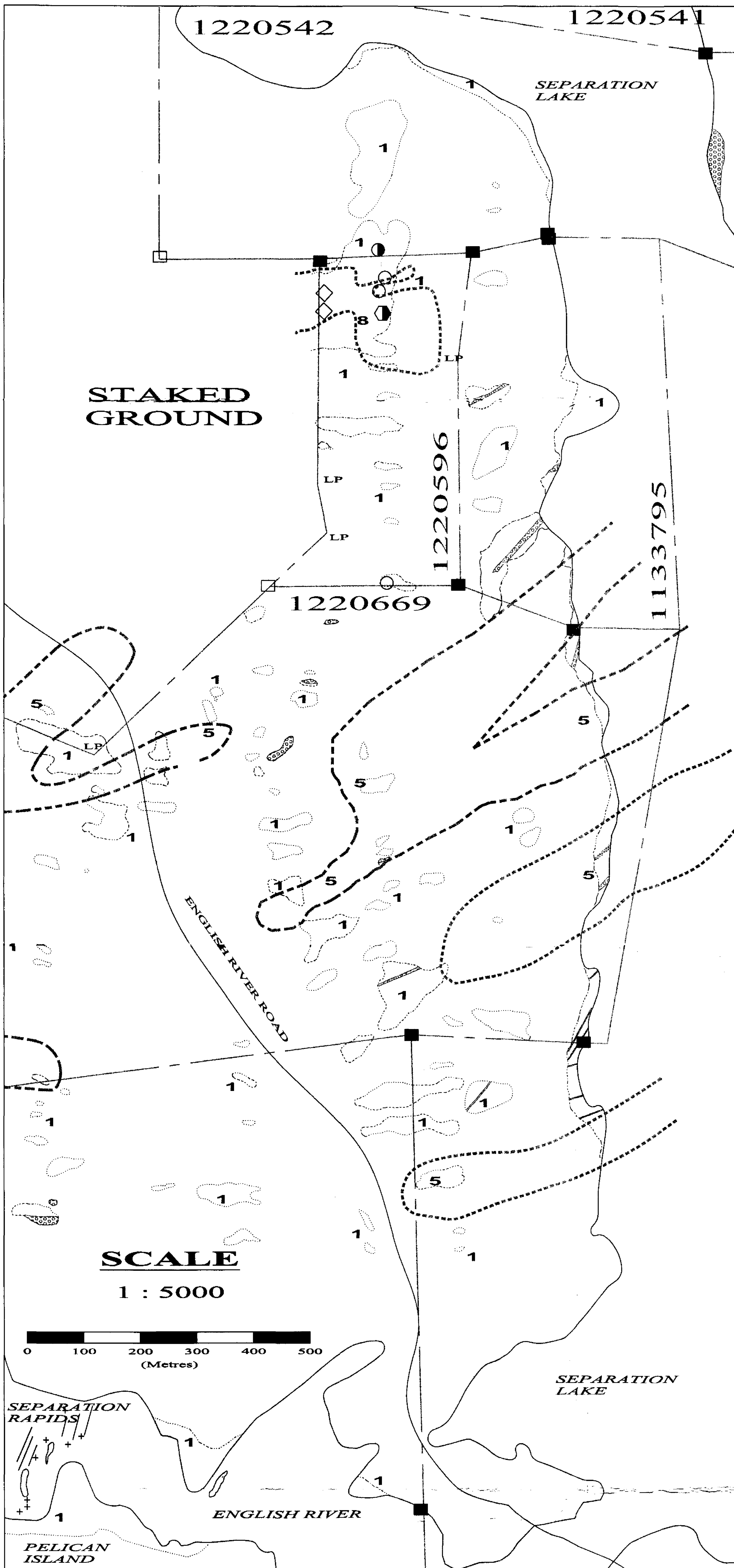
**STAMP:**

PROVINCE OF MANITOBA C.R. GALESCHUK 02/20/00 REGISTERED PROFESSIONAL GEOSCIENTIST

# SEPARATION LAKE PROJECT

1998 East Claims - Samples and Assay Results

| DRAWN BY | NTS SHEETS |
|---|---|
| CAREY GALESCHUK, PROJECT GEOLOGIST | 52L/1, 52L/2, 52L/7, 52L/8 |
| **DATE DRAWN** | **MAP NUMBER** |
| FEBRUARY 15th, 2000 | Map 5 of 6 |

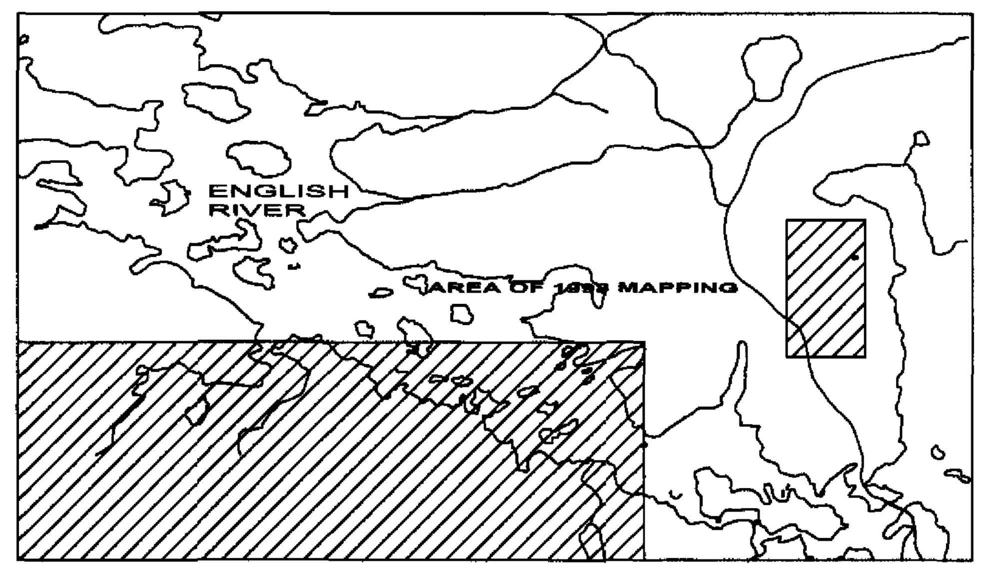



North
(Magnetic Declination at 5° East)

## ANOMALOUS SAMPLE SYMBOLS

| RELATIVE STRENGTHS | Li | Li + Rb | Li + Rb + Cs |
|---|---|---|---|
| POSSIBLY ANOMALOUS | ○ | ⬡ | ◇ |
| ANOMALOUS | ◑ | ◑ | ◆ |
| HIGHLY ANOMALOUS | ● | ⬢ | ◆ |

## SEPARATION LAKE AREA MAP




## LEGEND

- 1 MAFIC VOLCANICS
- 2 FELSIC VOLCANICS
- 3 IRON FORMATION
- 4 CLASTIC SEDIMENT
- 5 MAFIC INTRUSIVE
- 6 GNEISS MIGMATITE
- 7 FELSIC INTRUSIVE
- 8 PEGMATITIC GRANITE
- PEGMATITES

## LIST OF SYMBOLS

- GEOLOGICAL CONTACT
- OUTCROP
- CLAIM LINE
- CLAIM POST (observed, assumed, line post)
- PEGMATITE EXPOSURE
- OUTCROP EXPOSURE (WITH ROCK CODE)

TANTALUM MINING CORPORATION OF CANADA LIMITED

**STAMP:**

PROVINCE OF MANITOBA — C.R. GALESCHUK — 02/20/00 — REGISTERED PROFESSIONAL GEOSCIENTIST

# SEPARATION LAKE PROJECT

1998 East Claims - Anomaly Map

| DRAWN BY | NTS SHEETS |
|---|---|
| CAREY GALESCHUK, PROJECT GEOLOGIST | Lennan Lake Sheet, 52L/8 |
| **DATE DRAWN** | **MAP NUMBER** |
| FEBRUARY 15th, 2000 | Map 6 of 6 |