ISSN 0826-9580
ISBN 0-7729-1698-5

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Ontario Geological Survey
Open File Report 5606

# Geology of the Savant Lake Area Districts of Kenora and Thunder Bay

1986

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ONTARIO GEOLOGICAL SURVEY

Open File Report 5606

# Geology of the Savant Lake Area
# Districts of Kenora and Thunder Bay

by

N.F. Trowell

1986

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V.G. Milne, Director
Ontario Geological Survey

# FOREWORD

## Savant Lake Area

The Savant Lake metavolcanic-metasedimentary belt contains extensive; as yet unexploited, iron deposits south of Kashaweogama Lake and numerous gold and base metal occurrences. This report presents a compilation of detailed geological studies, supplemented by additional mapping, and a regional overview of the stratigraphy, structure and economic potential of the area.

V.G. Milne

Director

Ontario Geological Survey

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## ABSTRACT

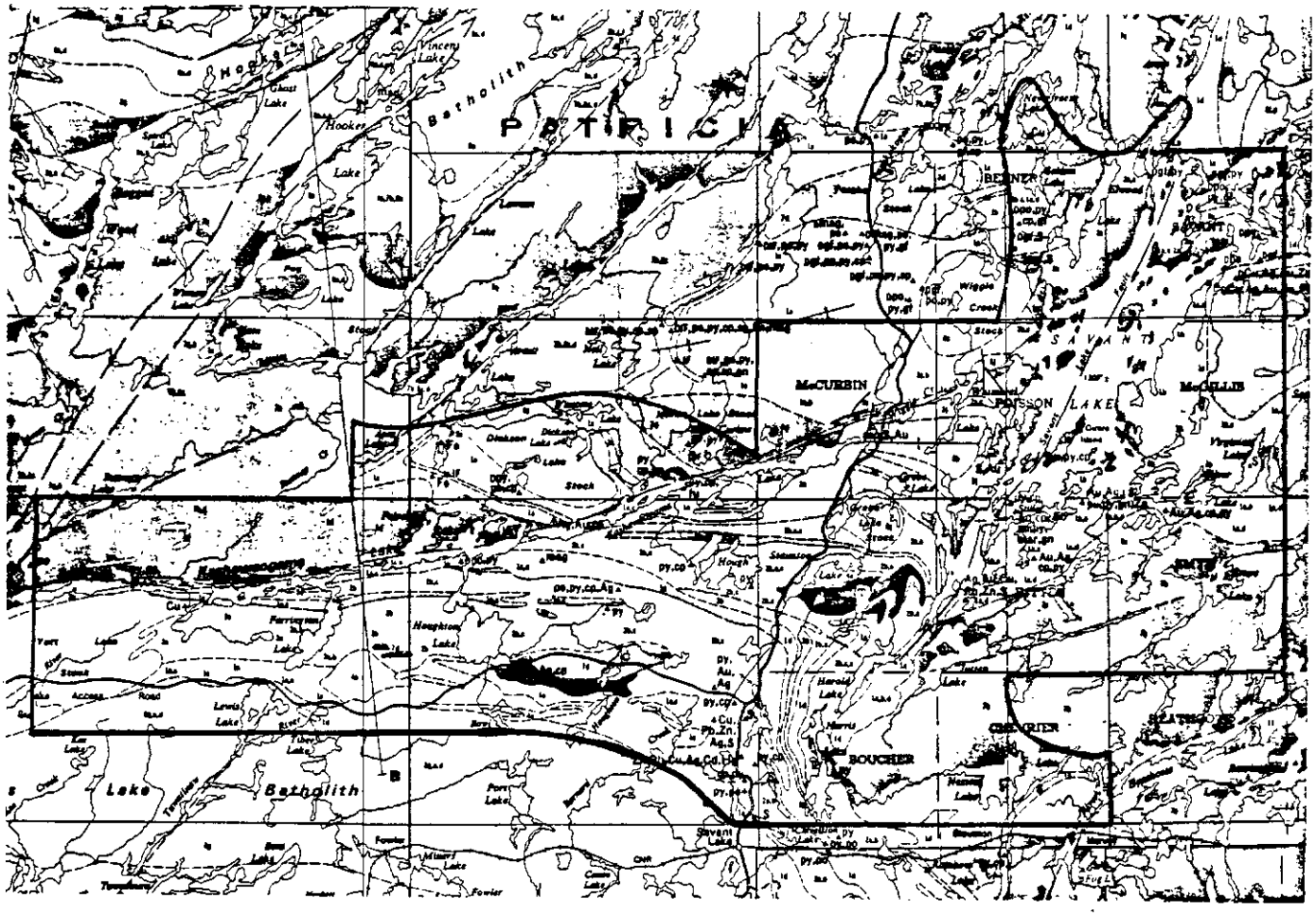


Figure 1:

This report describes geology and mineralization in the Savant Lake area. The area, situated 95 km northeast of Sioux Lookout, encompasses approximately 1400 km$^2$ within the Wabigoon Subprovince of the Precambrian Shield. The bedrock is of Precambrian age. The stratigraphic succession has been subdivided into informal groups and formations on the basis of

lithology and geographic distribution.

The Jutten group is the lowermost assemblage in the area. It is predominantly tholeiitic basalts with minor ultramafic intrusions and volcanogenic metasediments and tuffs. A chert-ironstone unit is near the base of the Jutten group north and west of Savant Lake. A conglomeratic unit, the Savant Narrows Formation unconformably overlies the Jutten group. It is locally transitional to a metavolcanic unit, the Whimbrel Lake Formation, comprised dominantly of intermediate pyroclastics and minor flows. This is succeeded upward by the Savant Lake Formation comprised of tholeiitic basalt flows. Contemporaneous volcanism and sedimentation, both clastic and chemical, are represented respectively by the Handy Lake and Savant groups. Mafic intrusions were emplaced near the exposed base of the Handy Lake group. Felsic to intermediate intrusions of several ages are present. These are porphyritic synvolcanic intrusions, early metamorphosed intrabelt plutons and marginal batholiths, and late (post-tectonic) plutons. The Jutten group was intruded by the Heron Lake Stock and deformed prior to deposition of succeeding supracrustal units. A second folding event after deposition of the Handy Lake and Savant groups produced a northeast-trending anticlinal structure with numerous subsidiary folds. Two major faults, the Kashaweogama and Savant Lakes Faults that likely developed during initial downsagging of the Jutten group were reactivated during late deformation that accompanied final

emplacement of the bounding granitoids. Occurrences of iron, gold and silver with minor base metal sulphides, and base metal massive sulphides (copper, zinc, lead) are present in the area. There has been no mineral production to date.

# GEOLOGY OF THE
# SAVANT LAKE AREA
# DISTRICTS OF KENORA AND THUNDER BAY

By

N.F. Trowell[1]

## INTRODUCTION

The Savant Lake area, in the Districts of Thunder Bay and Kenora, is centered approximately 95 km northeast of Sioux Lookout. The size of area is approximately 1400 km2 (Fig. 1). The portion covered by detailed mapping is 1100 km2.

The town of Savant Lake, at the junction of Highway 599 and the Canadian National Railway Transcontinental Line, is 1.2 km south of the southern boundary of the area (Fig. 1).

Access is provided by Highway 599 originating 1.6 km east of Ignace on Highway 17 and the 'Marchington Lake Access Road' that extends from Sioux Lookout to join Highway 599, 10 km north of the town of Savant Lake. Several logging roads extend from Highway 599 and provide access to the south-central part of the area. Watercourses such as the Kashaweogama Lake-Marchington River and Chilveston Lake - Savant Lake systems provide access, respectively to the western and northern parts of the area. Float-equipped aircraft, originating from Sturgeon Lake and Sioux Lookout, provide access to the more remote lakes in the area.

---

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Manuscript approved for publication by John Wood, Chief Geologist, Precambrian Geology Section, June 3,1986.
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The area straddles the boundary between the Wabigoon (Goodwin, 1970; Mackasey et al. 1974) and English River (Breaks and Bond, 1978) Subprovinces of the Superior Province, Canadian Shield. With the exception of rare diabase intrusions, the entire area is underlain by Archean metavolcanic-metasedimentary and intrusive rocks. Rocks of the English River Subprovince within the map-area are only briefly referred to in this report (see Breaks and Bond, 1978 for discussion of the English River Subprovince).

The area has been of interest to geologists and prospectors since the turn of the century. Initial attention was directed to the search for gold and iron ore deposits. More recently a concerted search for base metals, and now also for gold, has been directed towards the area.

Mapping was carried out in conjunction with a regional study of the Savant Lake-Crow Lake area, districts of Thunder Bay and Kenora (Trowell et al. 1980).

ACKNOWLEDGMENT

Assistance in the field was provided by P. McCarter and J. Carter in 1976 and R.H. Sutcliffe, J. Reid, and D. Guindon in 1977. Messers. McCarter and Sutcliffe as senior geological assistants were responsible for mapping selected portions of the map-area.

Much of the area has been mapped by the author's colleague, W.D. Bond (Bond, 1977, 1978, 1980). The author gratefully acknowledges the contribution of his data and synthesis of the

Savant Lake area, and the many discussions concerning the area. R.J. Shegelski spent several years studying the metasediments and iron deposits of the Savant Lake area, as part of his doctoral dissertation (Shegelski, 1978). Discussions with him have provided the author with many insights on the geological development of the area. The work of F.W. Breaks and W.D. Bond, has provided valuable information on the English River Subprovince and the nature of the boundary between it and the Wabigoon Subprovince. Discussions and correspondence with F. Wellmer on his extensive use of geophysical information to provide new insights into the geological evolution of the Savant Lake area were much appreciated.

## PRESENT GEOLOGICAL SURVEY

The majority of the data shown on the accompanying maps represent a compilation of previous mapping in the Savant Lake area (Moore, 1928; Bond, 1977, 1978, 1980; Trowell et al., 1980, Trowell, 1981; and Trusler, 1981).

Reconnaissance mapping at scales of 1:63 360 to 1:15 840 in the Savant Lake area, was carried out in the spring and summer months of 1976 and 1977 and was done in conjunction with regional compilation and structural, stratigraphic, and chemical studies of the Savant Lake-Crow Lake area (Trowell et al., 1980). Systematic coverage of the bedrock was not possible in the time available. Outcrop locations shown on the map in the Armit Lake and the north part of Savant Lake and Neverfreeze and Elwood Lakes area represent data points and do not represent the true extent of rock exposures.

Previous detailed mapping was re-examined and several stratigraphic sections were sampled for chemical analyses. Lithologic codes and outcrops have been generalized for presentation at a 1:50 000 scale. The reader should refer to the original maps and reports (Moore, 1928; Bond, 1977, 1978, 1980; Trowell, et al., 1980; Trowell, 1981; and Trusler, 1981) covering the area if further detailed information is required.

Other data sources used in the compilation of the maps include:(1) assessment files of the Assessment Files Research Office, Ontario Geological Survey, Toronto; (2) O.G.S.-G.S.C Aeromagnetic and radiometric, maps; (3) O.G.S. Data Series Maps (Palonen and Speed, 1976a, 1976b, 1976c, 1976d, 1977a, 1977b); (4) O.G.S. and G.S.C. geological maps and reports; (5) journal publications and (6) unpublished dissertations.

## PREVIOUS GEOLOGICAL MAPPING

W. McInnes of the Geological Survey of Canada was the first geologist known to have visited and described the Savant Lake area. Specifically he described the gold occurrences. His report appeared in the Summary Reports of the Geological Survey of Canada, 1901, pages 92A-95A. E.J. Davidson (1901, p. 207-250) made brief mention of the area in Survey 9, in Report of the Survey and Exploration of Northern Ontario in 1900. T.W. Gibson (1902, p. 18) reported gold-bearing quartz veins in the area. W.G. Miller (1903, p. 82-90, 104, 105) described the workings on many of the claims at Savant Lake. W.H. Collins (1907, p. 103-109; 1910, p. 1-67) mapped the geology of the area between Lake Nipigon and Lac Seul, including the present area. E.S. Moore (1910, p. 173) visited the area in 1907 to evaluate the

iron deposits of the Savant Lake region. He returned to the area in 1927 and conducted a geological survey of the entire Savant Lake area (Moore, 1928, p. 52-82). G. Rittenhouse (1936, p. 451-478) did a detailed study of Conant, Jutten, McCubbin, and Poisson Townships leading to his doctoral dissertation. F.J. Pettijohn (1937) referred to the area in his discussion of the Northern Subprovince of the Lake Superior Region. R. Skinner (1969) mapped the area at a reconnaissance scale (1:253 440). J.C. Davies et al. (1970) published a compilation map (Map 2169) at a scale of 1:253 440 that includes the Savant Lake area. R.P. Sage et al. (1974) mapped the adjacent area to the east at a reconnaissance scale. W.D. Bond mapped the townships of McCubbin, Poisson, and McGillis in 1971 (Bond, 1977); the townships of Conant, Jutten, and Smye in 1972 (Bond, 1978); and the Houghton-Hough Lakes Area in 1973 (Bond, 1980). J. Trusler mapped the Farrington Lake area in 1974 (Trusler, 1981). The author mapped the townships of Boucher and Chevrier and adjoining area to the west in 1975 (Trowell, 1981). F.W. Breaks (1980) published a revised compilation map (Map 2442) at a scale of 1:253 440 that includes the Savant Lake area.

R.J. Shegelski greatly elucidated the concepts of Archean sedimentation and the formation of Archean iron deposits in the work leading to his doctoral dissertation (Shegelski and Bell, 1976; Shegelski, 1973, 1976, 1978). Undergraduate theses by G.H. Funk (1973), W.R. Bulmer (1976), B. Cooke (1976), R.T. Kusmirski (1977), G.W. Turner (1978) and a Ph.D Thesis by B.S. Campbell (1980) plus studies by J.J. Lefebvre et al (1978)

S.A. Kusin (1981) and Wellmer (1982) give detailed information about specific geological features in the area.

## PROSPECTING AND MINING ACTIVITY

The Savant Lake area has been prospected since the turn of the century. Initial exploration was directed towards the search for gold. Attention shifted to iron with the discovery of extensive iron deposits south of Kashaweogama Lake (Moore, 1910). A ground magnetic survey was made over these deposits for the Ontario Bureau of Mines in 1920 (Assessment Files Research Office, Ontario Geological Survey, Toronto File 63.2932). These deposits were also described in the report of the Ontario Iron Ore Committee (1923). No iron production is recorded to date.

In 1926 and 1946 minor gold discoveries led to increased exploration activity in the area (see Bond, 1977, p. 4 for more complete discussion).

The discovery in 1968 of the zinc-copper-silver-lead Mattabi Mine on Sturgeon Lake (Trowell, 1980) led to increased exploration activity in the adjoining Savant Lake area. At present exploration is continuing for base metals and for gold due to the increased gold prices in the late 1970's.

## PHYSIOGRAPHY

The elevation of Savant Lake is 397 m (1306 feet) above sea level and the maximum local relief is nowhere more than 85 m above this elevation; elevation of a topographic survey monument

west of Evans Lake is 1583 feet a.s.l.[2]. The entire area has been glaciated with the relief partly reflecting the differential erosion of the underlying bedrock but primarily reflecting the topography of the Pleistocene and Recent deposits.

A river-system divide separating two major drainage basins passes through the area. All lakes and rivers east of Handy and Whimbrel Lakes drain to the northeast and are part of the Albany River Drainage Basin, which eventually drains into James Bay. Lakes and rivers to the west are part of the English River Drainage Basin which drains westwards into Lake Winnipeg.

## GENERAL GEOLOGY

The Savant Lake volcanosedimentary belt stretches from the Marchington River in the west to the eastern boundary of the area, a distance of approximately 70 km. Breaks and Bond (1979) report correlative metavolcanics and metasediments as far south as Kinnemin Lake (outside the present map-area) within the Miniss River Fault Zone.

The bedrock is partly covered by unconsolidated Cenozoic sediments that are dominantly the result of continental glaciation during the Pleistocene epoch.

Table 1 presents the lithologic units of the Savant Lake area. Table 2 and Figure 2 summarize the stratigraphic nomenclature applied by previous workers and the present author and provides the structural details for the map-area.

---

2 Elevation taken from Sioux Lookout topographic sheet 52J, Department of Energy, Mines and Resources, Ottawa. Scale 1:250,000.

Radiometric age determinations using the uranium-lead method on zircons (Davis and Trowell, 1982) are in progress. Zircons from a sample of an intermediate to felsic pyroclastic unit near the base of the Handy Lake Volcanics (Fig. 2) gives a crystallization date of 2745.2+1.9-1.8 m.y. (Davis and Trowell, 1982).

Due to the existing detailed descriptive lithologic information available from previous reports only a brief description of the lithologies found in the map-area is presented here. Summarized lithologic data is presented under the appropriate stratigraphic names in the section on stratigraphy of Savant Lake Area (this report). It should be pointed out that the stratigraphic terminology is used in a informal sense. Whereas several of these names have appeared in the geologic literature, none, as of yet, has been formalized.

The Jutten group, an apparently very thick sequence of predominantly homogeneous tholeiitic basalts, forms the basal unit of the volcanosedimentary belt. Sills and one definite flow of ultramafic composition are present at Armit Lake near the lowest portions of the Jutten group. The Jutten group has been intruded by the Dickson and Heron Lakes plutons. The Heron Lake pluton likely intruded before deposition of the overlying Handy Lake and Savant groups. An unit of intercalated chert and magnetite ironstone forms a distinctive semi-continuous marker horizon near the base of the Jutten group in the west and northwest parts of the area. Stratigraphically above this

ironstone chert unit are local occurrences of intermediate tuffaceous rocks and volcanogenic sediments. In the west, northwest and southwest part of the map-area, the Jutten group is unconformably overlain by the Savant Narrows formation (Shegelski, 1978) comprised of two members: (1) a lowermost granitoid-and volcanic-clast conglomerate member and (2) an upper volcanic-clast conglomerate member. While the granitoid clasts are lithologically similar to assumed early intrusions such as the Heron Lake stock, no definitive provenance has yet been recognized. The mafic volcanic clasts are similar texturally and petrographically to the tholeiitic basaltic flows of the Jutten group.

The Savant Narrows formation is interbedded with and shows a lateral facies change to the Whimbrel Lake formation in the areas north of Whimbrel Lake and along the west shore of Savant Lake. The felsic volcanic clasts in the volcanic-clast member of the Savant Narrows formation may be in part redeposited fragmental material of the Whimbrel Lake formation as the intermediate to felsic metavolcanic clasts in the Savant Narrows formation are petrographically similar to those in the Whimbrel Lake volcanic formation. In the north part of Savant Lake the Savant Narrows formation is overlain by mafic metavolcanic flows that comprise the Savant Lake formation.

Wacke and siltstone interbeds within the Savant Narrows formation increase in abundance from bottom to top. The Savant Narrows formation defines the base of the Savant sedimentary group and the fine sediments represent initial infilling of a sedimentary basin.

The Whimbrel Lake formation defines the base of the Handy Lake volcanic group. It is correlative to the Savant Narrows formation and is characterized by concomitant volcanism and sedimentation.

The Handy Lake group is comprised of a complexly intercalated sequence of mafic flows and minor pyroclastic rocks, felsic to intermediate flows and pyroclastic rocks, and volcanogenic sediments. A unit of turbiditic wacke-siltstone containing bands of interbedded recrystallized chert, iron silicate, and magnetite ironstone laminae subdivides the Handy Lake group into a lower (Evans Lake formation) and an upper (Conant Lake formation) formation.

The Savant sedimentary group comprises fine wacke and siltstone with substantial accumulations of intercalated chert and magnetite ironstone. Shegelski (1978) interpreted both the clastic and chemical metasediments to be of volcanogenic derivation.

Late felsic plutons and batholithic complexes represent the last major intrusive event within the area. Scattered diabase intrusions of uncertain age occur locally.

Deformation was a continuum beginning with deformation of the Jutten group prior to deposition of the overlying sequences and ending with folding and faulting associated with emplacement of the surrounding batholithic complexes. The more complex fold patterns of the Savant sedimentary group, and the similar, but less intense, fold patterns of the Handy Lake group may reflect multiply-oriented compression of these units against the more rigid blocks of the Jutten group.

The volcanosedimentary belt has been metamorphosed to greenschist and almandine amphibolite facies rank. Metamorphic rank decreases towards the centre of the belt away from the bounding granitoids. In the area around Evans Lake, however, the metamorphic rank appears to increase inwards into the belt as the indicator minerals staurolite followed by andalusite, kyanite, cordierite and sillimanite are found, with increasing distance from the granitoid body to the west. The development of these minerals also suggests there was a metamorphic-hydrothermal alteration of the rocks in this area prior to the main metamorphism event that created an alumina surplus, probably by leaching of alkalis and perhaps accompanied by addition of magnesium. The area in which this peraluminous chemistry has been developed in these metavolcanic rocks is a prime exploration target for both base and precious metals.

## Precambrian

### Archean

### Metavolcanics and Metasediments

#### Metavolcanics

The metavolcanic classification in this report is based upon: (1) field criteria supplemented by petrographic examination and (2) the constraints imposed by compilation of the geological data of several people into one legend. In this report the metavolcanics are classified into mafic and mafic to intermediate (more than 35 percent mafic minerals) and felsic to intermediate (less than 35 and generally less than 25 percent mafic

minerals). Bond (1980) proposed a three-fold subdivision for some of the rocks described here. Chemically the two subdivisions would correspond to basalts and andesites, and andesites, dacites and rhyolites respectively.

Mafic to Intermediate Metavolcanics

Mafic to intermediate metavolcanics are the dominant lithology in the survey area. They occur at several stratigraphic levels where they generally comprise the lower portion of individual volcanic cycles.

These rocks weather to various shades of green and grey. Fresh surfaces are similarly coloured but are of darker hues. White and brown hues are a consequence of carbonatization. Dark green to black hues reflect the development of hornblende under almandine amphibolite facies conditions.

The metavolcanics are variably massive, foliated and schistose. Banding in metavolcanics marginal to the batholithic complexes is due to accentuation of primary bedding of tuffaceous members or to metamorphic differentiation accompanying deformation.

Recrystallization is prevalent though pilotaxitic, subophitic to ophitic, and rare isogranular and relict quench textures are locally preserved in weakly deformed rocks.

For this report the mafic and intermediate metavolcanic rocks have been subdivided on the basis of flow features and textures into: massive flows, pillowed flows, porphyritic flows, amygdaloidal/vesicular flows, variolitic flows, autoclastic/hyaloclastic breccia, pyroclastics and interflow volcanic conglomerate.

Massive flows comprise both fine to medium-grained and medium to coarse-grained units. The coarse-grained varieties could represent very thick flows or synvolcanic intrusive sills.

Pillowed flows are common. Specific attention was paid to the size and shape of the pillows, selvage thickness and vesicularity so as to relate stratigraphic position of distinctive pillowed units to mode and environment of deposition and if possible chemical composition.

Porphyritic flows or flow zones and comagmatic porphyritic sills contain feldspar and/or uncommonly amphibole (after pyroxene) phenocrysts visible in hand specimen. While not widespread, and generally laterally discontinuous, they do occur at specific stratigraphic intervals (Bond, 1977) in that portion of the Jutten group located east of Southeast Bay of Savant Lake.

Amygdaloidal/vesicular flows are commonly also pillowed. Vesicularity is mainly a function of water depth and chemical composition. Changes in vesicularity through the stratigraphic sections were used to interpret environments of deposition. A variolitic flow of the Jutten group (not distinguished on map-face) is present north of the east end of Kashaweogama Lake in McCubbin Township (Bond, 1977). Small varioles (occurrences not shown on map-face) were noted to occur in a few outcrops of the upper four kilometres of section of the Jutten group along the east side of the belt.

Autoclastic/hyaloclastic breccias locally comprise the top, more rarely the bottom zones of flows. Like the porphyritic flows they also tend to occur at specific stratigraphic levels.

Mafic to intermediate pyroclastics and redeposited pyroclastic rocks are moderately abundant in upper volcanic units but are almost lacking from the lowermost part of the Jutten group. In this report, classification of pyroclastic rocks as being either mafic to intermediate or felsic to intermediate refers to the composition of the matrix. Classification of pyroclastics on the basis of size follows Fisher (1967).

A volcanoclastic conglomerate from the northern shore of the peninsula separating Southeast Bay from Savant Lake contains up to 18 cm diameter boulders of intermediate to felsic metavolcanics and fine-grained quartz-feldspar porphyry set in a tuffaceous matrix (Bond, 1977).

Felsic to Intermediate Metavolcanic Rocks

Felsic to intermediate metavolcanics occur at several stratigraphic intervals; their main development is in the Handy Lake group.

They are comprised dominantly of pyroclastic rocks, predominantly tuffs and lapilli tuffs with local accumulations of tuff breccia most noticeably west of Evans Lake and just south of Conant Lake. Dominantly lithic but also crystal varieties of tuff are present (not distinguished on the map-face). Some units contain matrix-supported subrounded clasts of volcanic material and in places are bedded, show grading and some sorting. These units likely formed by redeposition of pyroclastic material by debris flows.

Flows are both fine to medium-grained massive and porphyritic containing quartz and/or plagioclase phenocrysts. Autoclastic

breccia likely formed by auto-brecciation of domes, as exemplified in the area north and east of Evans Lake, or by auto-brecciation of flows (Bond, 1980).

Volcanogenic sandstone, while sensu stricto epiclastic, was included under this heading due to its close spatial association to the metavolcanics.

Porphyry units containing quartz and or plagioclase phenocrysts are massive units that may be either of metavolcanic or subvolcanic origin.

These felsic to intermediate metavolcanic rocks exhibit recrystallized granoblastic-polygonal to remnant porphyritic textures. They are variably massive, weakly foliated to strongly foliated. Locally non-penetrative shearing has transformed them to quartz-sericite schists and phyllites. Both the fresh and weathered surfaces exhibit various shades of pink, green, grey, yellow, and brown.

## METASEDIMENTS

### CLASTIC METASEDIMENTS

#### CONGLOMERATE

The Savant Narrows formation as previously described consists of a lowermost member of granitoid-clast conglomerate and as upper member of volcanic clast conglomerate. Granitoid clasts and clasts of volcanic rocks are the dominant clasts types but other varieties of clast occur in both members (see Savant Narrows formation, this report).

## FINE GRAINED CLASTICS METASEDIMENTS

The fine clastic metasediments consist of sandstone (wacke and arenite); siltstone; cherty metasediments, siliceous siltstone and mudstone; and tuffaceous metasediments. These metasedimentary types are commonly found intimately interbedded with one another though in places a single type will dominate.

## CHEMICAL METASEDIMENTS

Chemical metasediments comprise quartz-magnetite iron formation consisting of finely intercalated thinly laminated layers of metachert alterating with magnetite laminae, typical of Algoman-type oxide facies iron formation (Gross, 1965). Jasper is locally interlayered with the magnetite laminae while specular hematite is locally disseminated throughout the metasediments.

## MAFIC, INTERMEDIATE AND ULTRAMAFIC INTRUSIVE ROCKS

The mafic and intermediate intrusive rocks in the map-area are gabbro, diorite, quartz diorite, mafic trondhjemite and rare quartz gabbro. They are generally fine to medium-grained to locally, coarse-grained and/or (feldspar) porphyritic.

While mafic sills locally intrude metasediments of the Savant group, their main exposure is between the area of Houghton Creek to just east of Farrington Lake. Here large sill-like lenses consisting predominantly of quartz diorite are broadly concordant to stratigraphy. Several phases are present perhaps indicative of multiple intrusions though more likely due to minor differentiation, they are mutually gradational into one another.

Typical mineralogy is plagioclase + hornblende ± actinolite + quartz + biotite + chlorite + epidote + apatite + titanite ± opaques + muscovite. While these bodies are closely associated with extrusive rocks of similar composition to which they could be feeders the fact that they contain mafic metavolcanic xenoliths and are less recrystallized than the metavolcanics led Bond (1980) to interpret them as later intrusions not coeval or comagmatic with the mafic metavolcanics.

Peridotite and pyroxenite bodies are present at Armit Lake and as xenoliths within the Fairchild Lake Intrusion. They are more fully described under the Jutten Ultramafics (this report).

## FELSIC AND INTERMEDIATE INTRUSIVE ROCKS

On the basis of mineralogical and chemical composition, relative age, spatial distribution and degree of metamorphism a number of distinct phases and groupings of felsic to intermediate intrusive rocks have been recognized. For the present discussion they are subdivided into the following:

1. Metamorphosed Felsic to Intermediate Porphyritic Intrusions
   - (i) Kashaweogama Lake Intrusion
   - (ii) Neverfreeze Lake Intrusions
   - (iii) Handy Lake Porphyritic Sills
   - (iv) Patterson Lake Porpyritic Sills
2. Metamorphosed and/or Foliated Felsic to Intermediate Intrusions
   - (i) Conant Lake Intrusion
   - (ii) Heron Lake Stock
   - (iii) Hough Lake Stock

(iv) Lewis Lake Batholith

(v) Fairchild Lake Intrusion

(vi) Jutten Batholith

3. Unmetamorphosed Felsic to Intermediate Syn to Post Tectonic Intrusive Rocks

(i) Wiggle Creek Stock

(ii) Dickson Lake Stock

(iii) Grebe Lake Stock

(iv) Smye Township Stock

(v) Yett Lake Stock

## METAMORPHOSED FELSIC TO INTERMEDIATE PORPHYRITIC INTRUSIONS

### Introduction

There are three ages of porphyritic intrusions in the Savant Lake area. They are interpreted by the author to be epizonal subvolcanic and comagmatic with felsic to intermediate metavolcanics. They are: (1) the Kashaweogama Lake Intrusion considered to be the intrusive equivalent of the Jutten group metavolcanics; (2) the Neverfreeze Lake Intrusions considered to be the intrusive equivalent of the rocks of the Whimbrel Lake formation; and (3) the Handy Lake and Patterson Lake Porphyritic Sills considered to be the intrusive equivalents of felsic to intermediate metavolcanics of the Handy Lake group. The Kashaweogama Lake Intrusion and the Neverfreeze Lake Intrusions were investigated during reconnaissance mapping by Breaks and Bond (1976, 1977) and Trowell et al. (1977) respectively. Sufficient detailed information exists to discuss the Handy lake and Patterson Lake Porphyritic sills separately.

## HANDY LAKE PORPHYRITIC SILLS

The Handy Lake Porphyritic Sills (Bond,1979) comprise a series of syn-volcanic/subvolcanic metamorphosed intrusions centred around Handy Lake. Texturally and compositionally they are similar to the surrounding intermediate to felsic pyroclastic volcanics and in fact some phases of these sills could be extrusive. The presence of felsic metavolcanic xenoliths does, however, suggest that the sills are predominantly of intrusive origin. The prevailing mineralogy consists of phenocrysts of plagioclase (locally rare potassium feldspar) and of quartz set in a fine-grained matrix of plagioclase (albite) + quartz + sericite + biotite + epidote + carbonate + magnetite ± titanite ± zircon. Individual phases can be distinguished on the basis of: type and amount of phenocryst, either plagioclase or quartz; variations in phenocryst concentration; matrix grain size; and matrix to phenocryst ratio. All phases appear to be gradational and likely comagmatic. The presence of these sills likely reflects and marks the position of a former vent area for intermediate to felsic volcanics.

## PATTERSON LAKE PORPHYRITIC SILLS

The herein named Patterson Lake Porphyritic Sills (see Bond, 1980) comprise: a large sill-like body situated between Houghton and Patterson Lakes as well as smaller sills and dikes in the immediate area, all emplaced within felsic to intermediate metavolcanics of the Handy Lake group. Texturally and compositionally they resemble the surrounding felsic to intermediate

pyroclastic rocks except they contain fewer fractured phenocrysts.

These porphyritic masses consist predominantly of feldspar and quartz-feldspar porphyry with lesser amounts of feldspar-quartz and quartz porphyry. They range in composition from andesite to rhyolite. Mineral assemblages of low to middle greenschist facies rank include plagioclase + quartz + biotite + muscovite + chlorite + calcite + opaques ± accessories: epidote and hornblende. Mineral assemblages of middle to upper greenschist facies rank include plagioclase + quartz + biotite ± chlorite + microcline ± opaques + accessories: apatite, zircon, allanite.

Though gradational to one another, individual phases can locally be distinguished on the basis of type and amount of phenocrysts, phenocryst shape, and variations in phenocryst concentration and intensity of fracturing. Only rarely, however, do crosscutting relationships provide evidence for the timing of emplacement of the various phases. All phases are generally massive but locally have a weak foliation.

The porphyritic rocks are likely comagmatic with the felsic to intermediate metavolcanic rocks of the Handy Lake group and represent subvolcanic intrusions emplaced within their own volcanic pile. The fact that the main porphyritic mass is centered south and west of Evans Lake, may be further evidence that there were volcanic centres in this area. A similar situation to the above exists at Sturgeon Lake (Trowell, 1980) where a subvolcanic intrusion, the Beidelman Bay Pluton has been emplaced within the South Sturgeon Lake Volcanics.

## METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

### CONANT LAKE INTRUSION

The Conant Lake Intrusion (Bond, 1979) is a sill-like intrusion, of granodiorite to trondhjemite composition, situated on and west of Conant Lake. It is spatially associated with the Handy Lake Porphyritic sills which may represent finer-grained marginal or roof phases of the Conant Lake Intrusion; that is, the Conant Lake Intrusion is likely a synvolcanic intrusion emplaced within its own volcanic pile. Trondhjemite is the major phase while a minor granodiorite phase may represent a potassium metasomatized equivalent perhaps formed similarly as the granodiorite phase of the Heron Lake Stock (Kusmirski, 1977). The phases are massive to weakly foliated and the textures are equigranular to weakly porphyritic due to potassium feldspar overgrowths on plagioclase. The usual mineralogy is plagioclase + quartz + microcline + biotite + accessories: carbonate, apatite, zircon, titanite, and opaques. Fracturing of the plagioclase plus the development of mortar structure in, and peripheral granulation of the quartz are indicative of post-intrusion deformation.

### HERON LAKE STOCK

The Heron Lake Stock (Bond, 1977; Kusmirski, 1977) is a multiphase, predominantly trondhjemite, intrusion situated north of Kashaweogama Lake. Kusmirski has identified six phases that comprise the stock (Table 3) while the trondhjemite and granodiorite phases are gradational to each other the diorite and

quartz monzonite are later crosscutting phases. The quartz andesite is present as a dike situated northwest of the stock.

Foliation in the stock generally trends northwest and dips approximately 90 degrees. Along the southern boundary, east-northeast cataclastic foliations are present which likely developed in response to movement along the Kashaweogama Lake Fault. Minor quartz augen are locally present in the cataclastic zone. The trondhjemite is foliated, the quartz monzonite weakly foliated, and the quartz diorite is not foliated.

Indicative of its pre-tectonic emplacement within the Jutten volcanics, this stock has been intensely metamorphosed. It was likely emplaced as high level, low temperature intrusive body (Bond, 1977). Granitoid clasts in the Savant Lake Conglomerate are similar to the trondhjemite phases within the stock. Kusmirski does mention, however, that the quartz content of the clasts is higher than within the trondhjemite phases within the pluton. If the clasts were derived from erosion of this stock the equivalent intrusive phase may no longer be preserved.

A geochemical study by Kusmirski (1977) outlined chemical trends that are consistent with all the phases (with the possible exception of the quartz diorite-diorite), being derived from a single parental magma by processes of fractional crystallization. The granodiorite may have formed by potassic autometamorphism of trondhjemite while the quartz monzonite may have crystallized from a residual alkali-rich magma. The geochemical results also indicate that the Heron Lake Stock likely formed as a result of partial melting of lower crust/upper mantle material (Kusmirski, 1977).

## HOUGH LAKE STOCK

The Hough Lake Stock (Bond, 1980) is a biotite to hornblende-biotite trondhjemite that intrudes intermediate to felsic pyroclastics of the Handy Lake group west of Exploration Lake. It is homogeneous in texture and composition, and is not foliated. It is almost xenolith-free. Only one xenolith of quartz-feldspar porphyry was observed (Bond, 1980). The stock exhibits a smooth sharp contact with no apophyses into the country rock. The usual mineralogy is plagioclase + quartz +biotite ± chlorite ± hornblende ± accessories: epidote, allanite, titanite, opaque, minerals and tourmaline. It adjoins the Lewis Lake Batholith to the south.

## LEWIS LAKE BATHOLITH

The southwestern part of the map-area is underlain by a large batholithic complex, the Lewis Lake Batholith (Breaks, 1980) comprised of several granitic phases.

In the vicinity of the town of Savant Lake the dominant phase is a massive to weakly foliated, medium- to coarse-grained trondhjemite (Trowell, 1981). Granodiorite is only a minor phase. Several textural phases of the trondhjemite are present and were distinguished by a variation in grain size, type and dominance of phenocrysts and mafic mineral distribution. These textural phases intrude one another in the form of sills and dikes.

The mineral assemblage of the trondhjemite-granodiorite is plagioclase (oligoclase) + quartz ± microcline + biotite ± hornblende ± sericite + accessories: titanite, carbonate, pyrite, and epidote.

HOUGH LAKE STOCK

Between Patterson and Houghton Lakes a large granitoid mass, the Hough Lake Stock, has been emplaced within the lower part of the Handy Lake group (Bond, 1980). These rocks, except for being less recrystallized, are similar in composition to the granitoid rocks to the south which comprise a part of the Lewis Lake Batholith. The rocks to the south are somewhat less potassic being comprised of trondhjemite to granodiorite. The north margin is locally migmatitic due to abundant hybridized inclusions.

LEWIS LAKE BATHOLITH

Further to the west Trusler (1982) described the Lewis Lake Batholith as being dominantly a medium- to coarse-grained biotite trondhjemite with significant amounts of biotite quartz monzonite and hornblende-biotite granodiorite.

FAIRCHILD LAKE INTRUSION

The Fairchild Lake Intrusion (Bond, 1980), part of the southern granitoid domain of the English River Subprovince (Breaks and Bond, 1976) bounds the Savant Lake volcanosedimentary belt in the northwestern portion of the area. At Fairchild Lake Bond (1980) reports that the intrusion is composed of locally porphyritic granodiorite to quartzmonzonite that has been cataclastically deformed by faulting while Trusler (1982) reports that hornblende-bearing trondhjemite is present further to the west.

The Fairchild Lake Intrusion contains numerous xenoliths of mafic volcanics and ultramafic rocks. From the spatial distribution of the intrusion relative to the supracrustals the xenoliths are likely preserved remnants of the Jutten group.

## JUTTEN BATHOLITH

The Jutten Batholith borders and is locally intrusive into the Jutten group along the eastern margin of the Savant Lake volcanosedimentary belt.

The Jutten Batholith is comprised of a marginal trondhjemite to locally granodiorite phase which shows a gradual change to the east and southeast to granodiorite then quartz monzonite. The trondhjemite shows a concordant to discordant contact with few apophyses into the mafic metavolcanics. Table 4 presents pertinent data on the phases of the Jutten Batholith.

In contrast to the Lewis Lake Batholith the rocks of the Jutten Batholith have been metamorphosed. They are likely older than rocks of the Lewis Lake Batholith and may be time equivalents of the Fairchild Lake Intrusions.

## FELSIC TO INTERMEDIATE SYN-TO POST-TECTONIC INTRUSIVE ROCKS

### WIGGLE CREEK STOCK

The Wiggle Creek Stock (Bond, 1977) is a predominantly porphyritic granodiorite circular-elongate stock exposed north of Whimbrel Lake and extending into Benner Township. No apophyses of this intrusion extend into the country rocks. The rock is characterized by the presence of 5 to 8 percent megacrysts of microcline that attain lengths of 6 cm. The stock consists of homogeneous granodiorite with an average mineralogy of microcline (megacrysts) set in a matrix of plagioclase ($An_{13}$ to $An_{17}$), quartz, minor microcline, biotite, minor chlorite, muscovite, and epidote and accessories: opaque minerals and

titanite. The stock is massive and is likely a late post-tectonic intrusion.

DICKSON LAKE STOCK

The Dickson Lake Stock (Breaks, 1980, Bond, 1980; Breaks and Bond, 1976) is a predominantly granodiorite intrusion situated at Dickson Lake. It locally is variable to quartz monzonite and trondhjemite. It is fine to medium grained and massive to weakly foliated to slightly cataclastic along its southern margin. The contact with the Jutten group is sharp and smooth, and no xenoliths are present within the intrusion. Minor aplite and pegmatite dikes occur within the margin of the intrusion. No apophyses extend into the country rocks. Typical mineralogy is plagioclase + quartz + microcline and biotite. Accessories are titanite, apatite, and opaque minerals. The pluton has a similar style of intrusion, composition, and position at the contact zone between the English River and Wabigoon Subprovinces as does the Heron Lake Stock. It is, however, unrecrystallized to weakly recrystallized in contrast to the Heron Lake Stock which has been strongly metamorphosed. It is, therefore, likely of a younger age than the Heron Lake Stock and may be a late syn- to post-tectonic intrusion.

GREBE LAKE STOCK

The Grebe Lake Stock (Bond, 1979) is a predominantly granodiorite, epizonal intrusion emplaced in the north-central part of Conant Township. It was emplaced along the contact between

metasediments to the north and felsic to intermediate metavolcanics to the south. The stock is generally massive to locally foliated along its southeast margin. Xenoliths of intermediate pyroclastic rocks and rarely of mafic metavolcanics are common within the border zone of the stock. Aplite dikes are common near the margins of the stock while granodiorite dikes locally intrude the country rocks. The composition is predominantly granodiorite with local quartz monzonite zones. A leucocratic phase occurs along the southern margin of the stock. Typical mineralogy is plagioclase ($An_{17}$) quartz + microcline + biotite and hornblende. Accessories are epidote, chlorite, titanite, and zircon.

SMYE TOWNSHIP STOCK

The Smye Township Stock (Bond, 1979) is a quartz monzonite intrusion emplaced at the contact between the Jutten group and the Jutten Batholith northwest of Smye Lake. The stock is comprised of medium to coarse-grained massive quartz monzonite, variable to granite along its southwestern flank, with mineralogy of plagioclase (oligoclase) + microcline + quartz + biotite + minor muscovite. Accessories are titanomagnetite and epidote. It exhibits a sharp contact with the Jutten group, xenoliths of which are present in the stock. Though it also contains xenoliths of the Jutten Batholith the contact has generally a gradational appearance.

YETT LAKE STOCK

The Yett Lake Stock (Trusler, 1981) extends from the western limits of the Handy Lake Volcanic group to the western boundary

of the map-area and beyond. It is predominantly comprised of hornblende-biotite granodiorite to granite. Within a contact metamorphic aureole that is from 100 to 300 metres wide the supracrustal rocks have been metamorphosed to lower amphibolite rank.

The granodiorite-granite weathers white to pink and is generally coarse grained. The mineral assemblage consists of quartz + microcline + plagioclase + biotite + minor hornblende. Accessories are apatite, sericite, epidote and magnetite. The foliation trend varies considerably.

The stock is locally cut by numerous dikes that are identical in composition to the stock. Its southern boundary to the Lewis Lake Batholith is marked by a xenolithic zone, the xenoliths being supracrustal rocks of the Handy Lake group.

## Regional Stratigraphy of the Savant Lake Volcanosedimentary Belt

### JUTTEN GROUP

The Jutten group is comprised of three main lithostratigraphic units and one intrusive suite. They are respectively: (1) the Jutten Tholeiitic Basalts that consist predominantly of homogeneous tholeiitic basaltic flows with minor tuffs and comprises upwards of 90 to 95 percent of the Jutten group; (2) the Jutten Ultramafic intrusions; (3) the Jutten Chert Ironstone and (4) the Jutten Volcanogenic Sediments and Tuffs.

JUTTEN GROUP - JUTTEN THOLEIITIC BASALTS

The Jutten Tholeiitic Basalts consist of a thick sequence of dominantly pillowed and massive flows, minor porphyritic flows and autoclastic breccia; and rare interflow tuffs. Small varioles of devitrification type occur predominantly in the upper 4000 m of the eastern exposed section of the Jutten group.

On the east side of Savant Lake the rocks face northwest and have an exposed apparent thickness in excess of 11,500 metres. It is possible that the thickness seen reflects either transgressive volcanism or tectonic thickening produced either by gravity sliding prior to regional deformation and/or by subsequent thrusting.

West of Armit Lake the Jutten Tholeiitic Basalts are represented by enclaves of mafic metavolcanics in granitoids of the Fairchild Lake Intrusion, English River Subprovince (Bond, 1980, Trusler, 1982).

North of Kashaweogama Lake the Jutten Tholeiitic Basalts have been folded about an east-northeast-trending east-plunging axis. The south limb is interrupted by the Dickson Lake Pluton and Heron Lake Stock. It faces north to northeast from the northeastern part of McCubbin Township to west of the Dickson Lake Pluton. The entire structure is shown on Map 2442 (Breaks, 1980).

Minor repetition by folding has also occurred in the eastern section where the axial plane trace of a synclinal fold trends east-west between Leg and Pride Lakes.

Samples were collected for petrographic studies and chemical analyses. A suite of samples was selected from the thickest (Savant Lake-Silver Lake) section of the Jutten Tholeiitic Basalts (Fig. 3). For comparative purposes, samples were also collected from the Armit (Fig. 4) and Neverfreeze Lakes (Fig. 5) areas. Previously collected samples of the Jutten Tholeiitic Basalts from Boucher Township (Trowell, 1978) and north of Kashaweogama Lake (personal communication, F.W. Breaks and W.D. Bond, 1978) are incorporated in the present study.

Table 5 presents the raw chemical data, calculated normative mineralogy thin section mineralogy and textural descriptions of the samples from the Savant Lake-Silver Lake section through the Jutten Tholeiitic Basalts. Tables 6, 7, 8 and 9 provide similar data for the samples from respectively Armit Lake, Neverfreeze Lake, Boucher Township (Trowell, 1981) and from Breaks and Bond (personal communication, 1978). Table 10 gives the averages and ranges, calculated from the raw chemical data, of samples from the various localities. Plots using the chemical data are shown on Fig. 6. Figure 7 shows the variation with stratigraphic height of major and minor oxides and selected trace elements of samples from the Savant Lake-Silver Lake section.

Figure 7 illustrates that despite the variation in the oxides and trace elements there is hardly any appreciable difference between the composition of units at the base of the section versus those at the top. It should also be noted that material might have been removed from both the base and top respectively by emplacement of the Jutten Batholith and by erosion prior to deposition of the Savant Narrows Formation.

Similar to the chemistry, there was no apparent relationship between pillow size and selvage thickness and vesicularity to stratigraphy.

## Geochemistry of the Jutten Tholeiitic Basalts

Samples collected by the author, assistants, and colleagues were analyzed by the Geoscience Laboratories, Ontario Geological Survey. Wherever possible, samples of fine-grained massive to weakly foliated metavolcanic flows were collected. The Jutten Tholeiitic Basalts, however, are dominantly pillowed and most are foliated, such that collected samples do not in all cases meet the optimum criteria.

Several plots using the chemical data were done to illustrate specific chemical features of the metavolcanics. Fig. 6 shows data from the Savant Lake-Silver Lake section (there are too few points from the other areas to provide representative sections).

The $Na_2O + K_2O$ versus $SiO_2$ and normative colour index versus normative plagioclase plots (after Irvine and Baragar, 1971) indicate (Figure 6.1, 6.2) the subalkalic nature of the basalts. The large scatter of points on Fig. 6.2 is interpreted to reflect variable metamorphic rank, carbonatization and minor albitization (spilitization) of individual rock units. AFM (after Irvine and Baragar, 1971) and Cation (Jensen, 1976) plots (Figures 6.3 and 6.4) indicate the basalts are indeed tholeiitic.

On an $Al_2O_3$ versus $FeO_{total}/FeO_{total} + MgO$ plot (after Naldrett and Goodwin, 1976) most points (Figure 6.5)

fall into the field of intermediate tholeiites (terminology of Naldrett and Goodwin, 1976). In reference to their chemical affinity, their low $TiO_2$ content, is not incompatible with ascribing a komatiitic affinity to them (Naldrett and Goodwin, 1976) provided that they can be shown to be associated with true komatiites.

An ultramafic flow of possible komatiitic affinity is present near the assumed base of the Jutten group at Armit Lake. It is possible to speculate that substantial amounts of komatiitic metavolcanics were removed during emplacement of the surrounding granitoids and by subsequent erosion. At the present time, the author prefers to refer to the Jutten Tholeiitic Basalts as simply tholeiites rather than speculate that they may be differentiates of, or comagmatic with a now-missing komatiitic suite.

The above plots though useful in a general sense are hampered by the fact that with the apparent exception of perhaps Ti and Al all the other elements are known to be mobile under various conditions (Garcia, 1978). Even Ti and Al have been shown to be mobile in progressively altered rocks (Fyon, 1980). Individual units may therefore be incorrectly classified using these plots and primary magmatic differences may be obscured by deuteric and later superimposed alterations. Though the chemical data as presented in the tables were not prescreened, an examination of the volatile content ($H_2O^+ + H_2O^- + CO_2 + S$) of the samples gives an approximate idea of those samples that may have been substantially altered. Following the approach of Gelinas et

al. (1976) those samples having a volatile content greater than 3.8 weight percent may be suspect if used to determine petrogenetic affinities.

Additional plots using elements that are supposedly relatively immobile (Ti, Cr, Zr, and Y) were done to further refine the classification of the Jutten Tholeiitic Basalts. Many of these additional plots were originally developed to illustrate the chemistry of recent volcanics and the various fields delimited refer to the plate tectonic environment in which these volcanics formed. The author is not implying, by using these plots, that a plate tectonic regime was active during the Archean, though it may have been. Rather, that the relative position where various sequences of Archean volcanics do plot allows for comparison of the sequences, and may aid in interpreting Archean volcano-tectonic environments.

The samples were initially screened following the guidelines of Pearce and Cann (1973). The plot (Fig.6.6) of Ti versus Zr versus Y * 3 (Pearce and Cann, 1973) indicates that the majority of the analysed samples fall in the field of 'ocean floor' tholeiitic basalt with some overlap into the 'within plate' and 'low-k' tholeiitic basalt fields. Similarly (Fig. 6.7) on the Ti/100 versus Zr versus Sr/2 plot (Pearce and Cann, 1973) they fall into the field of 'ocean-floor' and 'low-k' tholeiitic basalt. On a T versus Y versus C plot (Davies et al., 1979) they follow the Archean tholeiite trend (Fig. 6.8) with a tendency to cluster in the field of their (Davies et al., 1979) magnesian suites. On the Ti versus Cr logarithmic plot (Pearce, 1975) they

cluster about the dividing line with the majority however falling into the field of island-arc tholeiites (Fig. 6.9). Similarly on a Ti versus Zr plot (Pearce and Cann, 1973; Garcia, 1978) they plot predominantly in the field of island arc tholeiites (Fig. 6.10). On the Ti versus Cr plot (Pearce, 1975; Garcia, 1978) there is a scatter of data perhaps with a slight tendency to plot in the field of ocean floor basalts (Fig. 6.11). On the CaO versus MgO plot (Humphris and Thompson, 1978) the scatter indicates that some samples suffered relative addition/depletion of MgO and CaO (Fig. 6.12). How this data can or should be interpreted is well stated by Gill (1979):

> "The bulk of Archean basalts are found to be relatively magnesium-poor, low-K tholeiites, broadly similar to modern low-K basalts from oceanic and circum-oceanic regions. More detailed examination shows, however, that none of the individual low-K basalt types that can be distinguished today provides in all respects a satisfactory analogy for the Archean tholeiite suite, whose geochemistry seems to be an ambiguous composite of mid-ocean ridge tholeiite, island--arc tholeiite and marginal basin basalt trends. It seems therefore that little will be learned from comparisons which are confined to one of these modern associations, until the petrogenetic differences between these modern types themselves are understood more fully. The failure to find an appropriate modern analogue of the Archean tholeiite suite casts considerable doubt on the applicability of most geochemical discriminant functions, developed from

compilations of Phanerozoic basalt analyses, to determine the magmatic or tectonic affinity of greenstone belt basalts."

JUTTEN ULTRAMAFICS

Ultramafic units, predominantly intrusive sills are exposed at the south end of Armit Lake (Hudec, 1965; Trowell et al., 1977). Enclaves of ultramafic rock are reported (Trusler, 1982; Bond, 1980) west of Armit Lake in granitic rocks of the Fairchild Lake Intrusion. Trusler (1982) reports that a xenolith of talc-serpentine rock locally exhibits polygonal fractures similar to those seen in ultramafic flow rocks. Figure 4 gives the sample locations and Table 11 presents the chemistry, calculated normative mineralogy and petrography of the Jutten ultramafics. Figure 9 shows the area of mapped exposure of the ultramafic units which consist of both peridotite and pyroxenite. They are of komatiitic (Ultramafic Komatiite) affinity (Fig. 8) but spinifex textures were not recognized. The observed outcrop gradation from peridotite to pyroxenite suggests differentiation in situ though cumulate textures are not apparent. These rock units have been variably deformed and are recrystallized to amphibolite facies rank mineralogies. In thin section olivine was only preserved in samples from massive to weakly foliated outcrops.

In the field peridotite was recognized by: the presence of serpentine; it is slightly magnetic; and is weakly to moderately carbonatized. Pyroxenite contains tremolite-actinolite, is non-magnetic, and is not to weakly carbonatized. Small veinlets of

cross-fibre asbestos 1 to 3 mm wide accompanied by magnetite is locally present in the peridotite. Variably coloured tremolite-actinolite comprise 1 cm bands within the pyroxenite. The banding may be due to re-crystallization accompanying shearing and alteration of these units.

These ultramafic units are concordant with and separated by mafic metavolcanic flows, banded tuffaceous units and an unusual diopside-rich unit (see below). They are up to 120 m thick and were intermittently traced in outcrop for several hundred metres along strike. The configuration of these units (Fig. 9) is likely indicative of local folding in the Armit Lake area.

A distinctive coarse-grained rock consisting almost entirely of bright apple-green diopside comprises two zones adjacent to the ultramafics. Both zones extend 600 to 900 m along strike. The rock consists of diopside crystals to 1.5 cm in length with minor interstitial clear to white carbonate. A flake of molybdenite was seen in one outcrop. This unit is tentatively interpreted to be a metamorphosed chert-carbonate chemical sediment. The MgO component of the diopside could have originally come from the ultramafics.

These ultramafics occur near the same stratigraphic level as the Jutten Chert-Ironstone, and Volcanogenic Metasediment and Tuff units.

## JUTTEN CHERT-IRONSTONE

An unit of intercalated chert and magnetite ironstone discontinuous in extent as well as exposure, is near the base of the Jutten group in the Armit Lake area through to the

Neverfreeze-Elwood Lakes area. The author has used slightly reverse logic in correlating and interpreting this unit. Firstly scattered exposures of intercalated chert and magnetite ironstone are correlated because they occur near the base of the Jutten group in the various localities. Secondly since this unit was found at the base of the Jutten group at Armit Lake, its occurrence elsewhere is used to define the base of the sequence at Neverfreeze and Elwood Lakes.

At Armit Lake bands of intercalated chert and magnetite ironstone were found at several localities. Though it was not determined whether each occurrence represents a separate band it is considered more likely that one or very few bands have been folded (Trowell et al., 1977) into their present configuration similar to the Jutten ultramafics with which they are spatially associated (Fig. 9).

Table 12 presents the description of three occurrences at Armit Lake.

At Neverfreeze Lake, Moore (1926) reported the presence of two ferruginous units; only one was found during the present survey. This unit consists of intercalated 1 to 2 cm bands of chert with 1 to 3 mm bands of green silicate ironstone intercalated with a zone of pyrite-pyrrhotite ironstone. The sulfide-bearing ironstone contains 1 to 2 cm angular to subangular clasts of graphitic siltstone likely of intraformational breccia origin. Bands of graphitic schist are spatially associated with this band of chert-ironstone.

Bond (1980) traced a chert unit for 442 m along strike from Kashaweogama Lake, where it is 274 m thick, to the northwest

boundary of his map-area where it thins to 61 m. Using the aeromagnetic data (ODM-GSC Maps 1119G,1129G) this unit can be traced to and is interpreted to be correlative to the chert-ironstone unit at Armit Lake. Except for a few magnetite grains this unit contains neither iron sulphides or oxides. A more complete description can be found in Bond (1980). Bond (1980) identified the green silicate mineral as grunerite.

A similar chert-ironstone unit, known as the Kashaweogama Iron Prospect (Shklanka, 1968, p. 443, 444) is situated in unsurveyed territory east of McCubbin Township just west of the present map-area (see Map 2442, Breaks 1980 for location). According to company reports (Shklanka, 1968),there are two separate bands of intercalated chert and magnetite ironstone that can be traced for a 6 km strike length. Descriptions of the Kashaweogama Iron Prospect unit in the company report (Shklanka, 1968) are similar to the descriptions of the chert-ironstone at Armit Lake.

In summary it can be stated that, if the above correlations are correct, the Jutten Chert-Ironstone can be traced from west of Armit Lake to the Neverfreeze-Elwood Lakes area in the east, and perhaps beyond, thus providing a major marker horizon for the lower portion of the Jutten group. Also while the chert component of this unit(s) is continuous local variations in Eh and pH determined whether magnetite, sulphides, iron silicates and associated graphitic sediments accompany the chert. It is likely these local conditions also determined any potential economic value this unit may have.

Jutten Volcanogenic Sediments and Tuffs

In the Armit Lake area a felsic to intermediate tuffaceous or volcanogenic sedimentary unit is spatially associated with the Jutten Ultramafics and Chert-Ironstone unit. This sedimentary unit contains fine grained, felsic to intermediate rocks that contain streaks of a green micaceous mineral, probably fuchsite. Hornblende needles up to 2 cm in length occur in radiating clusters. Streaks of biotite and bands of amphibolite several metres wide are also present.

A likely correlative sequence of intermediate pyroclastics is present in the segment of Jutten Tholeiitic basalts situated between the Dickson and Heron Lakes Stocks.

Savant Narrows Formation

The Savant Narrows formation is a polymictic clast to matrix-supported conglomerate that unconformably overlies the Jutten group. Its main areas of exposure are along the southeast side of Savant Lake and from Kashaweogama Lake in the east to the Marchington River in the west. It was also mapped along the west arm of Savant Lake and in the Neverfreeze-Elwood Lake area (Trowell et al., 1977) (see Fig. 2).

In the Kashaweogama Lake area the conglomerate and associated fine grained clastic rocks face south away from the Jutten group. This back-to-back relationship is best explained by a major unconformity and folding of the Jutten group prior to deposition of the conglomerate. Along the east side of Savant Lake the conglomerate and fine grained clastic rocks face

northwest similar to the underlying Jutten group. The unconformity here is demonstrated by the discordance in attitudes of bedding between these two units.

In the Neverfreeze Lake area an unit of sandstone-siltstone is situated between the Jutten group and overlying conglomerate of the Savant Narrows formation. The conglomerate is present as 0.25 to 3 m lenses in arkosic wacke. It is locally graded and at one location a scour channel was seen (Fig. 10). The clasts are dominantly quartz in composition, with subordinate granitoid, quartz-feldspar porphyry and minor mafic volcanic clasts. Siltstone clasts are rip-ups of previously deposited beds. Clasts are subrounded, poorly sorted, and range from granule to cobble in size. The matrix is arkosic wacke and contains 30 percent quartz. The arkosic wacke occurs in coarse to medium-sand-sized, poorly graded, thick beds. Flame structures were observed in the siltstone interbeds.

Bond (1979) and Shegelski (1978) have described the conglomerate horizon situated along the south arm of Savant Lake. The conglomerate there is structurally unconformable to the underlying Jutten group with differences of up to 45 degrees in their respective trends. Two types of contact were observed: (1) a sheared contact where the overlying conglomerate contains predominantly mafic volcanic clasts and (2) an unsheared irregular erosional (?) surface between the Jutten group and the conglomerate. At the erosional contact the basal conglomerate contains clasts of fine-grained mafic volcanics, mafic feldspar porphyry, gabbro, minor felsic clasts and sulphidic chert. It is poorly sorted and the clasts range in size from 5 mm to 1.6 m.

Overall the conglomerate occurs in variably packed, poorly bedded to bedded, ungraded to graded or stratified horizons intercalated with wacke layers that increase in frequency from bottom to top. Upwards in the conglomerate clasts of trondhjemite, rhyolite, quartz porphyry, milky quartz, chert and chloritic shale increase in abundance relative to mafic volcanic clasts. There are as well lateral variations in the clast population (Bond, 1979; Trowell, 1981). Clast-supported conglomerate dominates over matrix supported. The maximum exposed thickness is 242 m.

In the area of the North Arm of Savant Lake, Shegelski (1978) recognized three separate conglomerate units that together attain thickness of about 300 metres and which can be traced along strike for 2500 metres. These conglomerates occur in graded or stratified layers and are variably matrix- and clast-supported. Clasts are rounded to subrounded to locally angular. There is an overall fining upwards sequence exhibited by a change from conglomerate at the base to fine conglomerate and wacke-siltstone at the top. The majority of the clasts consist of coarse-grained, equigranular, quartz-plagioclase aggregates with minor quartz-feldspar porphyry, aphanitic felsic metavolcanic, muddy chert, chloritic mudstone and quartz-feldspar wacke. Quartz porphyritic felsic volcanic clasts are characteristically present at the top. The matrix is a coarse-grained quartz-feldspar wacke (arkosic wacke). The conglomerate units are generally well-sorted, locally well graded and the pebbles and cobbles are well rounded and variably packed. Coarse sand-sized

and pebbly wacke beds averaging 20 cm but up to 6 m thick occur between the conglomerates. The wacke beds are stratified to graded and locally contain shale chips. The conglomerates and wackes are interbedded with siltstone and mudstone layers. Over a distance of 18 km along the North Arm of Savant Lake these sediments are overlain by mafic metavolcanic flows and breccia and by porphyritic mafic crystal tuff of the Savant Lake volcanic formation.

Westwards in the Whimbrel Lake area the conglomerates of the North Arm of Savant Lake show a lateral facies change to a thick sequence of pyroclastics intercalated with felsic to intermediate massive and vesicular flows (Whimbrel Lake formation, see below). Faulting locally obscures the exact nature of the contact.

To the west in the Kashaweogama Lake area the Whimbrel Lake formation shows a facies change back to a clast-supported conglomerate that (Savant Narrows Formation) attains thicknesses of 150-430 m. The clasts are well-rounded and consist of fine-grained and quartz porphyritic felsic metavolcanics, fine-grained mafic metavolcanics and trondhjemite. Trondhjemite clasts in the conglomerate decrease in abundance and size to the east and west away from the contact with the Heron Bay Stock. Though faulting has occurred along this contact it is possible the Heron Bay Stock was the source of the trondhjemite clasts (see Heron Bay Stock, this report). Detailed descriptions of the conglomerate of four locations on Kashaweogama Lake are given in Table 13.

Further to the west the Savant Narrows formation is exposed along Fairchild Lake, the Marchington River and Schist Lake

(Trusler, 1982). The conglomerate there also contains dominantly leucotrondhjemite clasts.

Discordances between the strikes of the Jutten Group and the Savant Narrows formation in the northern and western parts of the map-area are generally on the order of 1 to 3 degrees. The contact between them is sharp, though generally marked by a zone of shearing, the Kashaweogama Lake Fault.

The Savant Narrows formation was likely deposited as alluvial fans or shallow water fanglomerates (Shegelski, 1978) in a mechanism similar to the alluvial fan origin proposed by Turner and Walker (1973) for the Ament Bay Formation in the Sioux Lookout area. Mafic volcanic clasts likely come from the Jutten group while the granitoid clasts likely represent a resedimented facies (Walker, 1967) derived from intrusions such as the Heron Lake Stock. Felsic metavolcanic clasts, that are seen to increase in abundance upwards in the conglomerate likely were derived from degradation of contemporaneoous volcanic sources, specifically, the Whimbrel Lake formation.

### Whimbrel Lake Formation

The Whimbrel Lake formation shows a facies change to and is interbedded with the Savant Narrows formation, both to the east and west of Whimbrel Lake. It is dominantly of felsic to intermediate composition and pyroclastic in origin. Minor flows are present. Bond (1977) reported that the composition of these rocks ranges from andesite to rhyolite (visual inspection only) but are generally uniformly dacite in composition. Bond (1977)

interpreted some of the well-bedded tuffs to have been deposited subaerially. Clasts petrographically identical to those in the Whimbrel Lake formation are found in the Savant Narrows formation.

Intermediate to mafic porphyritic and amygdaloidal flows, and fragmentals overlie the Whimbrel Lake formation in the Whimbrel Lake area. Correlative mafic flows that overlie the Savant Narrow formation north of Whimbrel Lake, are referred to in this report as the Savant Lake formation. Shegelski (1978) correlates the Whimbrel Lake formation as being the base of the Handy Lake group. Bond (1980) suggests this correlation but states there is no definitive evidence to support it.

Savant Lake Formation

The Savant Lake formation has its main exposure along the central portion of Savant Lake and extending to the west of Whimbrel Lake. It consist dominantly of flows with some fragmentals near Whimbrel Lake. The flows are amygdaloidal and commonly pillowed. They overlie the Savant Narrows formation and thus are likely correlative with the lower units of the Savant Group and probably also with lower units of the Handy Lake group. The author does however consider them to be a separate and discrete sequences on the basis of their composition, texture, and structure. Table 14 and Figure 11 give the chemical data and plots respectively for four samples from this unit. Figure 12 shows their location. Sample 77-2628, of ultramafic affinity, is from a serpentized peridotite, possibly a flow, that

directly overlies the Savant Narrows formation. The Savant Lake volcanic rocks face south and overlies the Whimbrel Lake formation.

Savant Group

The Savant group consists of fine clastic and associated ferruginous chemical metasediments. They are interbedded with but dominantly overlie the Savant Narrows formation but overlap and postdate the formation and subsequent degradation of the Handy Lake group. Shegelski (1978) has, in fact, presented extensive evidence that indicates that both the clastic and chemical metasediments were derived or by erosion and redeposition of dominantly tuffaceous rocks of the Handy Lake group and from iron-bearing solutions of volcanic origin.

The clastic metasediments consist of well-bedded and graded wackes and siltstones. Pelitic material or mudstone is not prevalent. Sedimentary structures observed include load clasts, flame structures, convolute lamination, scour structures, amalgamated bedding and locally abundant sandstone dikes and related soft-sedimentary deformation features. These structures, in conjunction with variations in measured bed thicknesses led Shegelski (1978) and Bond (1978) to interpret that these metasediments were deposited by turbidity currents into a progressively sinking basin.

The ferruginous chemical sediments, dominantly chert and magnetite iron-stone, rarely siderite ironstone, formed from iron and silica compounds that along with minor fine pelitic material represented the background sedimentation within the basin. They

were deposited above the upper pelitic interval (Division E) of the typical turbidite bed. Some cases may comprise Division E. These ironstone beds or intervals are up to 15 cm thick but generally occur in 0.3 to 0.03 mm laminations. Greater thicknesses of individual ironstone units likely were deposited when there was a greater interval of time between individual turbidity currents. The iron mineral now is dominantly magnetite with minor hematite and pyrite.

Tuffaceous units represent detritus deposited from periodic wide-spread volcanism of the Handy Lake group that saturated the basin with volcanic debris.

Shegelski (1978) studied both the Savant group and the Handy Lake group to determine the provenance of the sediments. He determined that the diameters of the grains of the conglomerate matrix are in the same range as the grain diameters of crystals in the felsic volcanic porphyries; those of the wackes are in the same range as the crystal fragments from the porphyries and tuffs. This information coupled with other textural information and grain shape studies and detailed chemical studies led Shegelski (1978) to conclude that the clastic metasediments owe their provenance to the Handy Lake group. Shegelski (1978) also interprets the iron and silica of the ironstones as of volcanic exhalative origin, and that after mixing with basinal waters they were deposited as ferro-silicate precipitates in deep water in the absence of sulphate-reducing bacteria.

Handy Lake Group

The Handy Lake group is a complex sequence of east and northwest-facing flows, pyroclastic rocks, and volcanogenic metasediments that range from mafic, even ultramafic, to felsic in composition. Volcanism was interrupted by extensive deposition of turbiditic wacke-siltstone and intercalated chemical metasediments exposed south of Conant Lake. These metasediments are likely equivalent to some of the metasediments of the Savant group and their presence indicates an overlap in time of volcanism and sedimentation. The author has subdivided the Handy Lake group into a lowermost Evans Lake formation below the metasediments and an upper unit, the Conant Lake formation above them. These formations are in turn divisible into informal lithostratigraphic members.

The basal member of the Evans Lake formation consists of east-facing mafic metavolcanics situated west of Harris Lake at the bottom of the map-sheet. They consist of massive flows, pillowed flows, porphyritic flows and thin fragmental zones. Thin interflow tuffaceous and fine clastic metasedimentary beds are locally present between flows. The flows are dominantly high-magnesian tholeiitic basalts (Table 15, Sample Numbers 29,27,23, and 21, Fig. 14). To the west this member thins and has been disrupted by intrusive phases of the Lewis Lake Batholith. Farther to the west a correlative sequence of mafic metavolcanics is present.

Mafic metavolcanic flow units can be readily demarcated. Subdividing the intermediate and felsic predominantly fragmental rocks into discrete eruptive units is not possible at the present

scale of mapping (see Bulmer, 1976 for example of detailed subdivision of Handy Lake Volcanic group in the Evan's Lake area) due to lack of visible contacts and the apparent wide variation in clast and matrix components with respect to size, relative abundance, shape and composition.

Overlying the mafic metavolcanics is a complexly intercalated sequence of felsic to intermediate flows and pyroclastics, and thin mafic to intermediate flows and tuffs. Mafic intrusions and the Patterson Lake Porphyritic Intrusion are possibly comagmatic synvolcanic intrusions.

The coarsest pyroclastic rocks are situated in the area north of Evans Lake. To the west, finer distal fragmentals are found. To the south and east there is an intercalation of fine pyroclastic rocks and volcanogenic metasediments dominantly of sand size but locally containing significant amounts of silty to muddy material. The size distribution of pyroclastic rocks indicates that the Evans Lake area marks the site of former volcanic vent(s). The volcanogenic metasediments suggest that the volcanic edifice was degraded as it was forming.

The upper member of the Evans Lake formation is predominantly mafic metavolcanic flows and minor pyroclastics with some interflow beds of volcanogenic metasediments east and south of Evans Lake.

Clastic metasediments, dominantly wacke and siltstone separate the lowermost and upper metavolcanic formations. They were likely deposited by turbidity currents, during a pause in volcanism. Minor chemical metasediments consist of intercalated

laminae to beds of magnetite ironstone, chert, and silicate minerals. They pinch out west of Hough Lake.

The Conant Lake formation consists predominantly of felsic to intermediate pyroclastic rocks. Minor amounts of mafic metavolcanics are present south of Conant Lake and northwest of Hough Lake. A thin unit of wacke-siltstone and iron formation present north of Staunton Lake marks a local hiatus in volcanism. The coarsest pyroclastic rocks are found just south of Conant Lake. The Handy Lake Porphyritic Sills and perhaps the Conant Lake Intrusion are possibly synvolcanic intrusions that define a former vent.

While there is some evidence that some of the felsic pyroclastic material was deposited subaerially (Cooke, 1976) the wacke-siltstone was deposited in relatively deep water below wave base. These two facts suggest the volcanic edifice was variably emergent and submergent.

Figure 13 shows the location of samples collected from the Handy Lake Volcanic group. Table 15 presents the chemical data for these samples and Fig. 14 presents a series of plots to show the chemical affinities of these samples. Fig. 14.1 illustrates that with one exception all samples are subalkalic. Figure 14.2 indicates that they range from rhyolite to basalt, and are predominantly of calc-alkalic affinity. Some units, noticeably the basal member of the lowermost formation, are tholeiitic. The calc-alkalic sequence appears to be complete from basalt to rhyolite with no appreciable gaps (Fig. 14.3). Most of the tholeiites fall near to but on the magnesium side of, the

high-iron, high-magnesium tholeiitic dividing line (Fig. 14.4). Sample 117 plots in the field of basaltic komatiite. It is from a flow that lies at approximately the same stratigraphic level as the anthophyllitic flows (see below) of possible ultramafic affinity.

Table 16 gives the chemical and petrographic data for the anthophyllitic flows (Trowell, 1981) while Fig. 15 indicates that they plot in the komatiitic field.

Bond (1980) has presented chemical data of the Handy Lake group in the Hough-Houghton Lakes area. His data (Bond, 1980) show similar chemical affinities as are presented here.

Wellmer (1982) has subdivided the Handy Lake group into three volcanic cycles (cycles A to C, Fig. 13a).

> "Cycle A starts with mafic flows and tuffs and ends with rhyodacitic and dacitic tuffs and agglomerates.
>
> Cycle B can probably be considered to be two incomplete cycles. It starts with mafic to intermediate flows and tuffs and is followed by a sedimentary horizon with sulfidic and partially oxidic iron formation, which, to the north-west, grades laterally into and is partially overlain by dacitic tuffs.
>
> Cycle C also starts with mafic to intermediate flows and tuffs which contain frequent repetitions of interflow sediments with sulfidic iron formation and graphitic pelites, i.e. the conductive unit. To the south cycle C interfingers with the sediments of the Sturgeon Lake area. This suggests that while volcanism continued in the Savant Lake

area there was a hiatus in the Sturgeon Lake area where only exhalative activity continued."

The extent of the Evans Lake and Conant Lake formation are shown in Fig. 13a for comparison.

The maximum thickness of the metavolcanics of the Handy Lake group, specifically of Wellmer's Cycle C, are essentially found along the northeast-trending anticlinal axis that extends from Evans Lake through to Conant Lake. If this thickening of the metavolcanics in this area is real this means that the maximum thickness of the metavolcanics coincides with the overlying iron formation horizon(s). One explanation of this coincidence is by a reversal of relief in that the location where the greatest thickness of volcanics accumulated was also the location of the greatest amount of subsidence. Wellmer (1982) would ascribe this phenomenon to be due to caldera collapse (Fig. 13b).

LATE PRECAMBRIAN

Mafic Intrusive Rocks

Four occurrences of diabase dikes are known in the map-area (see Bond, 1977 for detailed description).

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE

RECENT

The bedrock of the map-area is covered by an extensive though generally thin mantle of Pleistocene deposits comprised of

till and glaciofluvial deposits. A rough approximation of the overburden thickness can be obtained from the drill holes plotted on the Data Series Maps.

During the Pleistocene Epoch the map-area was covered by several ice masses (Prest, 1970) the last being the Patricia Ice Mass (Zoltai, 1965) or Wisconsin Sheet which retreated between 14,000 and 13,000 years ago (Prest, 1970). Between 10,000 and 10,300 years the ice sheet had retreated to a position just north of the map-area (Prest, 1970) which was then covered by glacial Lake Agassiz (Zoltai, 1965).

Two eskers (glaciofluvial deposits) are present in the Kashaweogama-Houghton and Hough Lakes area (Bond, 1980). They locally have braided courses and are packed with kettles. They are comprised of sandy till and large boulders. A major esker trends approximately south-southwest, east of Harris and Harold Lakes.

Glacial striae indicate the general direction of the last ice movement to be toward the south-southwest. Fluting also has its long-axis subparallel to the direction of the ice movement.

Transverse ribbed moraines and associated drumlinoid forms are found at Whimbrel and Savant Lakes and in McGillis Township (Bond, 1977).

RECENT

Recent accumulations consist of sand, silt, and gravel deposited by streams, and swamp and muskeg deposits.

J.A. Elson (1961) gives a brief description of the soil types present in the Lake Agassiz region.

## METAMORPHISM AND ALTERATION

Portions of the Savant Lake volcanosedimentary belt have been subjected to at least three major and several minor periods or types of metamorphism/metasomatism/alteration.

Regional metamorphism that is a result of sinking of the volcanosedimentary belt due to gravitational instability to a level of higher temperature accompanied by emplacement of the surrounding granitic masses has produced the typical lower amphibolite-middle greenschist facies rank rocks from the border to the interior of the belt, respectively.

Contact metamorphic aureoles are present around some of the late felsic to intermediate, and to a lesser extent, mafic intrusions.

In the Evans Lake area the author has interpreted the development of aluminosilicate minerals such as kyanite, andalusite, etc. (also see Lefebvre et al. 1978) in the Handy Lake Volcanic group to be due to: (1) initial hydrothermal activity that effected a leaching of $Na_2O$ from the fragmental rocks leaving an excess of alumina, (2) metamorphism to the amphibolite rank producing such indicator minerals as kyanite, sillimanite, clinopyroxene, cordierite, diopside also cummingtonite and anthophyllite and (3) a retrograde metamorphic event as indicated by chlorite and tremolite-actinolite assemblages. Further discussion of the economic significance of this alteration/metamorphic zone is given under Economic Geology.

Structural Geology and Regional Synthesis

A regional compilation of the Savant Lake area is presented in Figure 2. It shows the general lithological/stratigraphic breakdown of the supracrustal rocks and the major structural elements of the area.

The Jutten group is the basal supracrustal sequence in the area. North of Kashaweogama Lake it is folded about a east-trending, steeply east-plunging synclinal axis. The southern limb of this synclinal structure has been interrupted by the Heron Lake and Dickson Lake Stocks. To the east of Savant Lake, the Jutten group is a predominantly north to northwest facing monoclinal sequence, though minor synclinal folding is present near Leggo Lake.

It has been previously suggested in this report that the mafic metavolcanic, chert, chert-ironstone, and trondhjemite clasts within the conglomerates of the Savant Narrows formation are similar to lithological units of the Jutten group; and Heron Lake Stock, respectively.

This fact plus the fact that the Heron Lake Stock disrupts foliations of the Jutten group suggests that the Jutten group was intruded by the Heron Lake Stock and both were subsequently deformed prior to deposition of the Savant Narrows formation.

The deformation might have been gravity induced due to the Jutten group sinking under its own weight in a similar manner as that proposed by Gorman et al. (1978). Gravity sliding with attendant repetition of stratigraphy could account for the very large measured thickness of the Jutten group. Marginal faults

generated during this initial deformation could have provided the scarp relief for the rapid local buildup of the Savant Narrows formation. Finer clastic sediments would have been deposited in the central deeper basin produced by the downsagging of the Jutten Group. Generation of the Whimbrel Lake formation and Handy Lake group, perhaps by partial melting of the Jutten Group, and their subsequent degradation could have provided a continuous source of fine clastic metasediments. Emplacement of the late batholithic masses and intrabelt intrusions produced the multiply-oriented compression that deformed the Handy Lake and Savant groups against the more rigid blocks of Jutten group. Later reactivation of the earlier marginal faults produced late brittle deformation along the Kashaweogama and Savant Lake Faults.

## MINERAL EXPLORATION

Descriptions of individual properties are not given in this report. For further information the reader may consult the Data Series Maps covering the area, and the Assessment Files Research Office, Toronto and the Sioux Lookout Regional Geologist's Files, Ministry of Northern Development and Mines, Sioux Lookout. For information on/and ownership the reader should consult the Mining Recorder's Office at Sioux Lookout or Toronto. In the following section on Economic Geology and Suggestions for Mineral Exploration, discussion of commodities within the area and mention of specific deposits are referenced to previous reports.

## Economic Geology and Suggestions for Mineral Exploration

With the exception of the iron deposits, there are two main types of showings in the Savant Lake volcanosedimentary belt. These are: (1) quartz veins, containing Au and/or Au-Ag accompanied by minor amounts of base metal sulphides, generally within the mafic to intermediate metavolcanic sequences; and (2) base metal sulphides either as disseminations, veins, or semi-cordant bands or lenses, or some combination of the three, situated predominantly within the felsic to intermediate metavolcanics that comprise the Evans Lake formation of the Handy Lake group.

The quartz veins, within the sheared, non to very weakly carbonatized mafic metavolcanics, are predominantly situated in the Jutten group east of Savant Lake. Bond (1979) suggested that the mineralizing fluids may have had their source in the trondhjemitic to granodioritic rocks situated to the southeast of the main occurrences of mineralized quartz veins.

The author would suggest two possible modifications to these ideas: (1) that precious and base metals were initially concentrated at specific interflow boundaries perhaps accompanied by siliceous chemical volcanogenic sediments and during regional metamorphism these sediments and contained precious and base metals were reconstituted into quartz veins injected into favourable structural sites; and/or (2) during regional metamorphism quartz veins and their contained base and precious metals were precipitated, in favourable structural sites, in greenschist facies rank rocks from solutions driven off during metamorphism

of the outer volcanics to the amphibolite facies rank. Any fluids from the bordering granitic rocks could have been involved in any further upgrading of these mineralized zones.

Campbell (1980) reports that sulphide bodies in the Evans Lake area comprise semi-massive to massive aggregates consisting of various combinations of pyrite, pyrrhotite, sphalerite, chalcopyrite and galena. These bodies are in general situated concordant with their metavolcanic host rocks. Campbell (1980) while interpreting these bodies to be of volcanogenic origin has proposed four possible mechanisms to explain why these bodies do not have alteration zones beneath them. These are: (1) the effects of metamorphism and metasomatism; (2) original stratiform sulphides were melted during metamorphism and were redeposited into their present position; (3) they are slumped bodies mechanically removed from their original site of emplacement; and (4) the alteration pipes and stringer zones were tectonically displaced from beneath the bodies.

It should be noted that the area has suffered multiple folding with subsidiary folds having developed coaxial to the main anticlinal fold axial trace that transects the area. It is possible that the sulphide bodies were themselves highly folded with fold limbs being highly attenuated, even separated such that these bodies are now represented by approximate pipe-like bodies oriented parallel to major and/or minor fold axes. Slip along bedding planes and/or transposition of bedding by foliation could explain the separation of sulphide bodies and any alteration zone originally present.

It should be noted that the geology of the Evans Lake area is similar to that of the Marshall Lake area (MacDonald, 1978) with respect to metamorphic rank, degree of deformation and proximity to the Wabigoon-English River Subprovinces interface.

Two of these sulphide bodies, at the Savant Occurrence and the Hadley deposit have been previously described (Trowell, 1981). Table 17 presents additional geochemical data on the Savant Occurrence while the work of Turner (Turner, 1978), Campbell (Campbell, 1980), and Kusin (Kusin, 1981) has given additional data for the Hadley deposit for which an updated discussion is herein included.

The Hadley deposit is situated within a thick sequence of locally bedded felsic to intermediate tuffs with minor lapilli tuffs and rare tuff breccia. Possible felsic to intermediate flows and local quartz porphyry synvolcanic intrusions are also present. The units strike approximately north and dip steeply east. Granitic rocks of the Lewis Lake Batholith are situated approximately 1200 m to the southwest.

The deposit itself consists of a lenticular pod of massive sphalerite and galena with minor chalcopyrite, pyrite and pyrrhotite. Turner (1978) reports the presence of secondary marcasite and covellite. The deposit extends for approximately 4.5 m along strike and is approximately 1 m wide. The hanging wall and footwall are reworked intermediate tuffaceous units with a siliceous or cherty horizon along the hanging wall contact.

Turner (1978) reports that the hangingwall contains sillimanite + muscovite + chlorite + quartz + biotite, the footwall

the same plus almandine. Plagioclase is also present. A diopside-tremolite-forsterite plus carbonate and titanite assemblage occurs as a pod in contact with the western extension of the mineralization and extends as a blocky discontinuous unit along the silicified footwall-mineralization contact.

Turner (1978) interprets four periods of deformation and metamorphism after formation of this sulphide mass. They are in order: (1) a major metamorphic event, evidence for which is both the metamorphic grade of the host rocks and also the annealing of sphalerite and pyrite grains with galena in the sulphide mass; (2) a late-stage cooling event indicated by exsolution textures of chalcopyrite and pyrrhotite; (3) a later deformation event and (4) a later retrograde metamorphic event indicated by the alteration of the ferromagnesian minerals to chlorite and the formation of covellite and marcasite. Turner (1978) explains the lack of an alteration zone as due to sampling not intersecting this zone. The author has previously suggested (Trowell, 1981) that the sulphide mass may be a large clast. Kusin (1981) in a follow-up discussion of Turner's description (Turner, 1978) has described the mineralized zone as a pseudo-tactite assemblage.

In addition to the base metals present in the Hadley deposit and Savant Occurrence both mineralized zones contain anomalous amounts of Hg and Sn (Table 17, Trowell, 1981). Consideration should be given to using Hg as an element indicator for other possible base metal sulphide occurrences in the Evans Lake area.

As discussed under the section on Metamorphism and Alteration the author considers that the metavolcanic rocks in

the Evans Lake area were subjected to intensive hydrothermal alteration prior to being metamorphosed. Development of aluminosilicates such as kyanite and andalusite is similar to that reported from the footwall of the Mattabi Mine (Franklin et al., (1975) though there is no corresponding carbonate alteration zone. Local occurrences of anthophyllite and cummingtonite ± cordierite in the more mafic lithologies is somewhat comparable to that developed in the footwall of the Millenbach Mine (Riverin and Hodgson, 1980) in the Noranda Mining Camp. Detailed mapping is needed in the Savant Lake area to separate what the author inteprets to be a widespread hydrothermal alteration zone from local zones of alteration where fluid flow was focused and an alteration pipe formed perhaps with development of base metal massive sulphides.

The author considers the Jutten Chert-Ironstone unit to be a favourable prospecting target for precious and perhaps base metal mineralization. This unit formed by relatively quiet sedimentation processes during a pause in mafic volcanism. The presence locally of tuffs and volcanogenic metasediments at approximately the same stratigraphic level indicate that intermediate to felsic volcanism occurred. With the further association of locally carbonatized ultramafic intrusions and one known flow at Armit Lake, this stratigraphic width encompassing these lithologies should be regarded favourably as to its potential especially for gold but perhaps also for base-metal mineralization.

The ultramafic masses at Armit Lake probably deserve a further look as to their nickel, copper and platinoid group metal contents. A wider area of search for further ultramafic flows

near the base of the Jutten group is warranted due to the well-known spatial association of gold mineralization and carbonatized ultramafic rocks. The anthophyllitic flows in the Handy Lake group should also be examined.

The Patterson Lake sills should be examined as to their potential for disseminated copper mineralization. Bond (1980) reports trace to minor amounts of copper, lead, silver, and molybdenum are present within these intrusions and the author observed disseminated chalcopyrite mineralization in these sills in roadcuts of the newly constructed Marchington River Road.

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## LEGEND

PHANEROZOIC
- CENOZOIC
  - QUATERNARY
    - RECENT
      - Swamp and stream deposits, local lake deposits (unconsolidated)
    - PLEISTOCENE
      - Silt, sand and gravel, boulders

UNCONFORMITY

PRECAMBRIAN
- LATE PRECAMBRIAN
  - MAFIC INTRUSIVE ROCKS
    - 10 Diabase

INTRUSIVE CONTACT

- EARLY PRECAMBRIAN (ARCHEAN)
  - MASSIVE UNMETAMORPHOSED FELSIC INTRUSIVE ROCKS
    - 9 Unsubdivided
    - 9a Granodiorite, quartz monzonite
    - 9b Granodiorite
    - 9c Quartz monzonite
    - 9d Xenolithic granitic rocks
    - 9e Aplite

INTRUSIVE CONTACT

  - METAMORPHOSED FELSIC INTRUSIVE ROCKS
    - 8 Unsubdivided
    - 8a Trondhjemite
    - 8b Granodiorite
    - 8c Porphyritic Trondhjemite
    - 8d Granodiorite, quartz monzonite
    - 8e Porphyritic granodiorite
    - 8f Xenolithic granitic rocks
    - 8g Quartz diorite
    - 8h Aplite
    - 8j Pegmatite

INTRUSIVE CONTACT

  - METAMORPHOSED FELSIC TO INTERMEDIATE PORPHYRITIC INTRUSIONS
    - 7 Unsubdivided
    - 7a Quartz and feldspar porphyry
    - 7b Xenolithic porphyritic rocks

INTRUSIVE CONTACT

LEGEND (Cont'd)

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS
- 6 Unsubdivided
- 6a Diorite, quartz diorite
- 6b Gabbro, feldspar-phyric gabbro
- 6c Xenolithic mafic intrusive rocks
- 6d Peridotite, pyroxenite

INTRUSIVE CONTACT

METASEDIMENTS

CHEMICAL METASEDIMENTS
- 5 Unsubdivided
- 5a Quartz-magnetite iron formation
- 5b Jasper iron formation
- 5c Chert

FINE CLASTIC METASEDIMENTS
- 4 Unsubdivided
- 4a Sandstone
- 4b Siltstone, mudstone
- 4c Siliceous siltstone
- 4d Tuffaceous metasediments

CONGLOMERATIC METASEDIMENTS
- 3 Unsubdivided
- 3a Volcanic-clast conglomerate
- 3b Granitoid-clast conglomerate

FELSIC TO INTERMEDIATE METAVOLCANICS
- 2 Unsubdivided
- 2a Flows
- 2b Tuff
- 2c Lapilli-tuff
- 2d Tuff-breccia
- 2e Autoclastic breccia
- 2f Porphyritic flows
- 2g Volcanogenic sandstone
- 2h Debris flow deposits
- 2j Porphyritic metavolcanics

MAFIC TO INTERMEDIATE METAVOLCANICS
- 1 Unsubdivided
- 1a Flows
- 1b Pillowed flows
- 1c Porphyritic flows
- 1d Tuff, lapilli-tuff, tuff-breccia
- 1e Autoclastic breccia
- 1f Amygdaloidal flows
- 1g Variolitic flows
- 1h Volcanic conglomerate

## MINERAL PRODUCTION AND RESOURCES

Occurrences of iron, gold, silver, and the base metals copper, lead, and zinc are present in the Savant Lake area. Iron deposits occur in both the Jutten Volcanic group and the Savant Sedimentary group. They are not exploitable at present. Gold and gold-silver mineralization, locally accompanied by minor amounts of base metals, occur in quartz veins and silicified zones in the Jutten Volcanic group. Base metal massive sulphide occurrences are present near the exposed base of the Handy Lake Volcanic group. Sand and gravel deposits in the area are used for road construction and maintenance.

## SOURCES OF INFORMATION

Geology is not tied to surveyed lines.

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Final maps: Map 2357, Map 2424, Map 2398, Map 2431.

Base maps derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch.

Magnetic declination in the area was approximately 2°East, 1977.

Geology by N.F. Trowell and assistants, 1976, 1977.

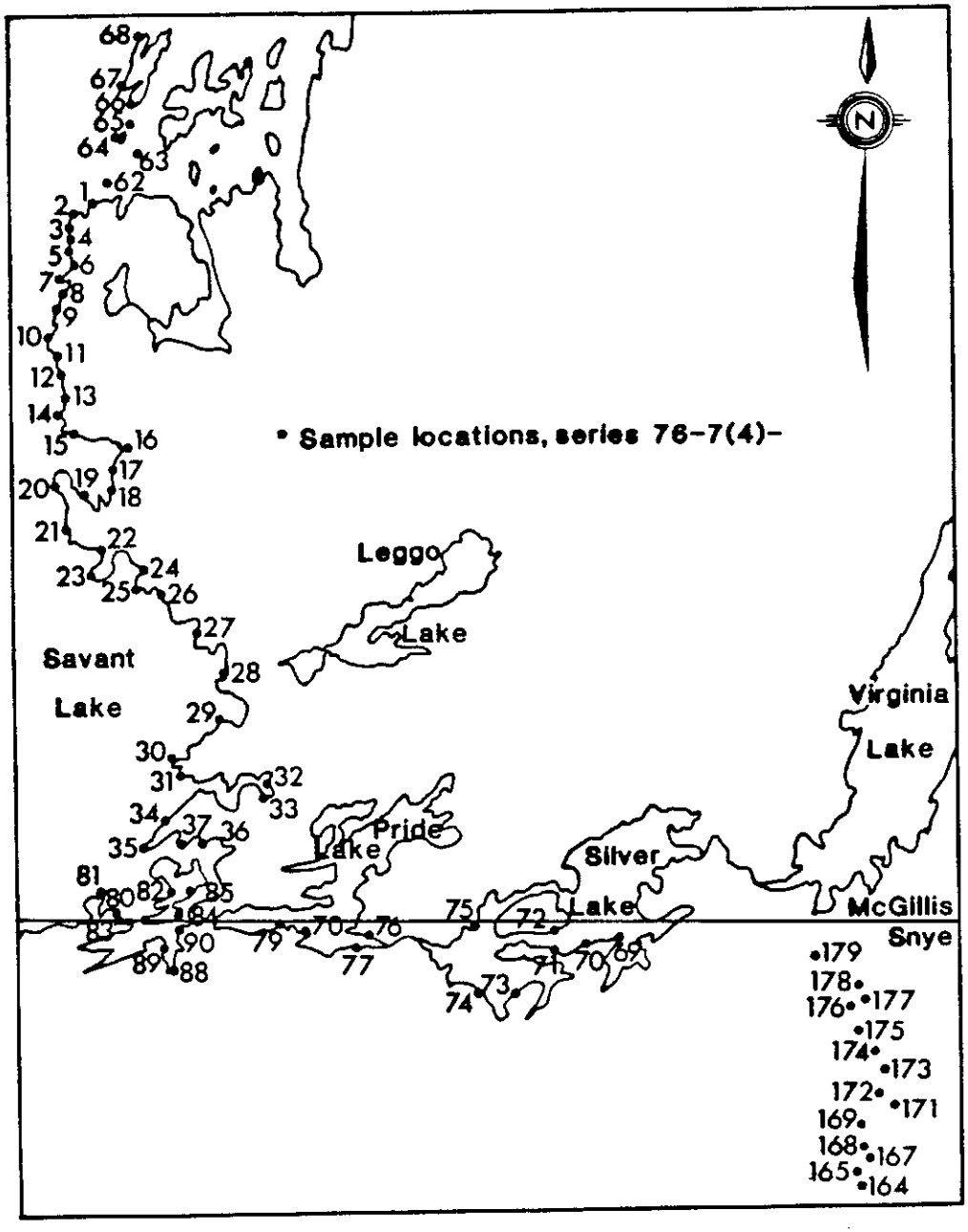



**Figure 3. Location of samples, Savant Lake Area, Savant Lake-Silver Lake Section**

**Scale 1:63 360**

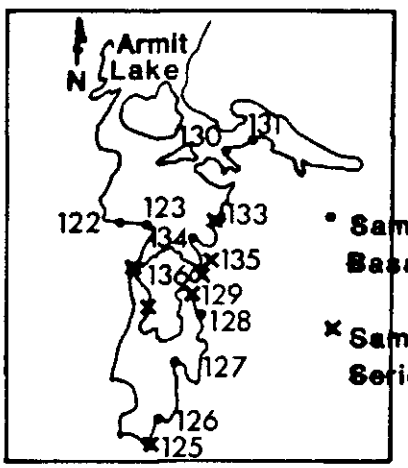



**Figure 4. Location of samples, Jutten Tholeiitic Basalts and Jutten Ultramafics, Armit Lake Area**

**Scale 1:63 360**

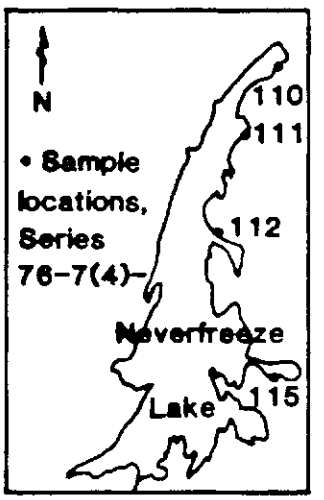



Figure 5. Location of samples, Jutten Tholeiitic Basalts, Neverfreeze Lake Area

Scale 1:63 360

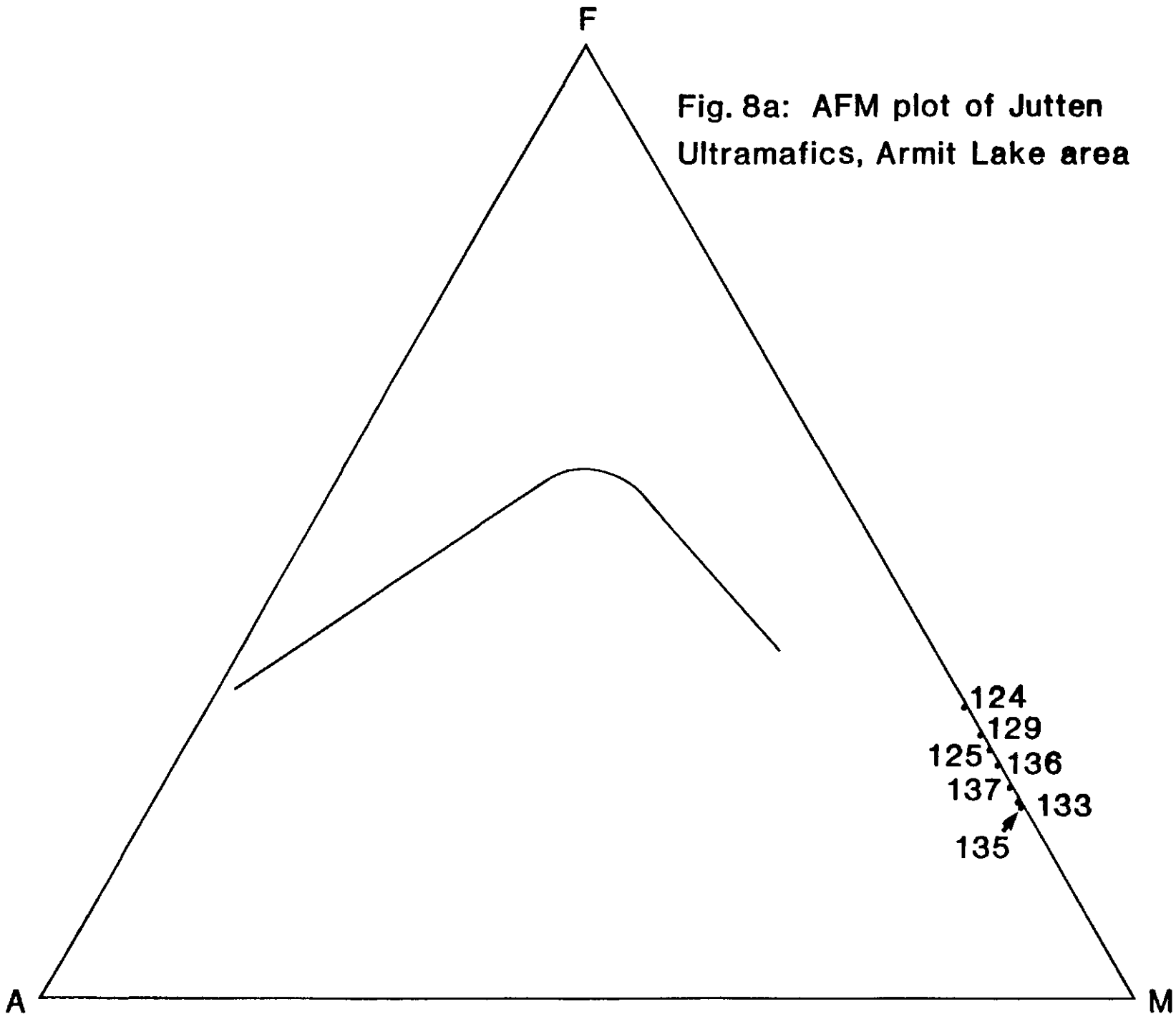



Fig. 8a: AFM plot of Jutten Ultramafics, Armit Lake area

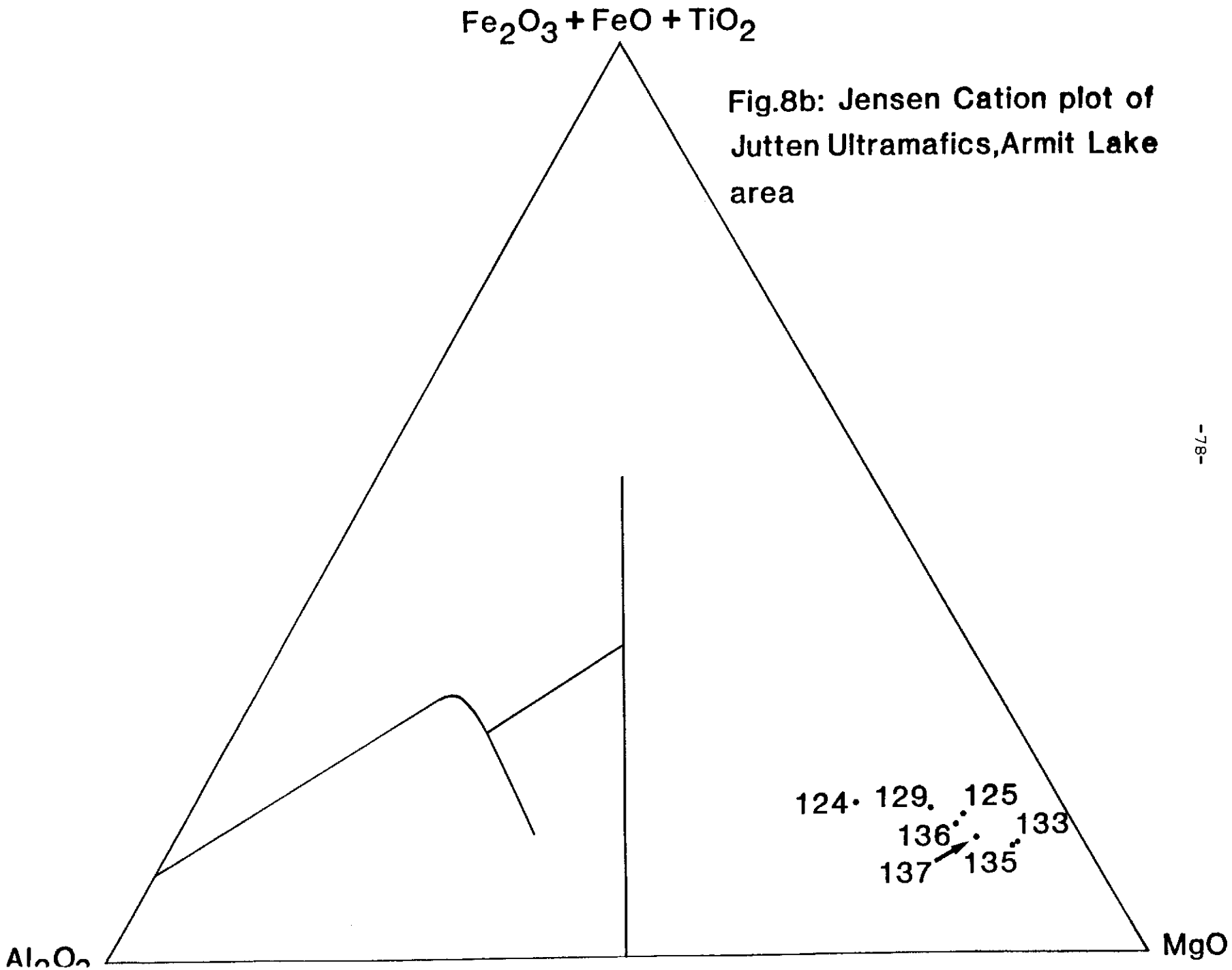
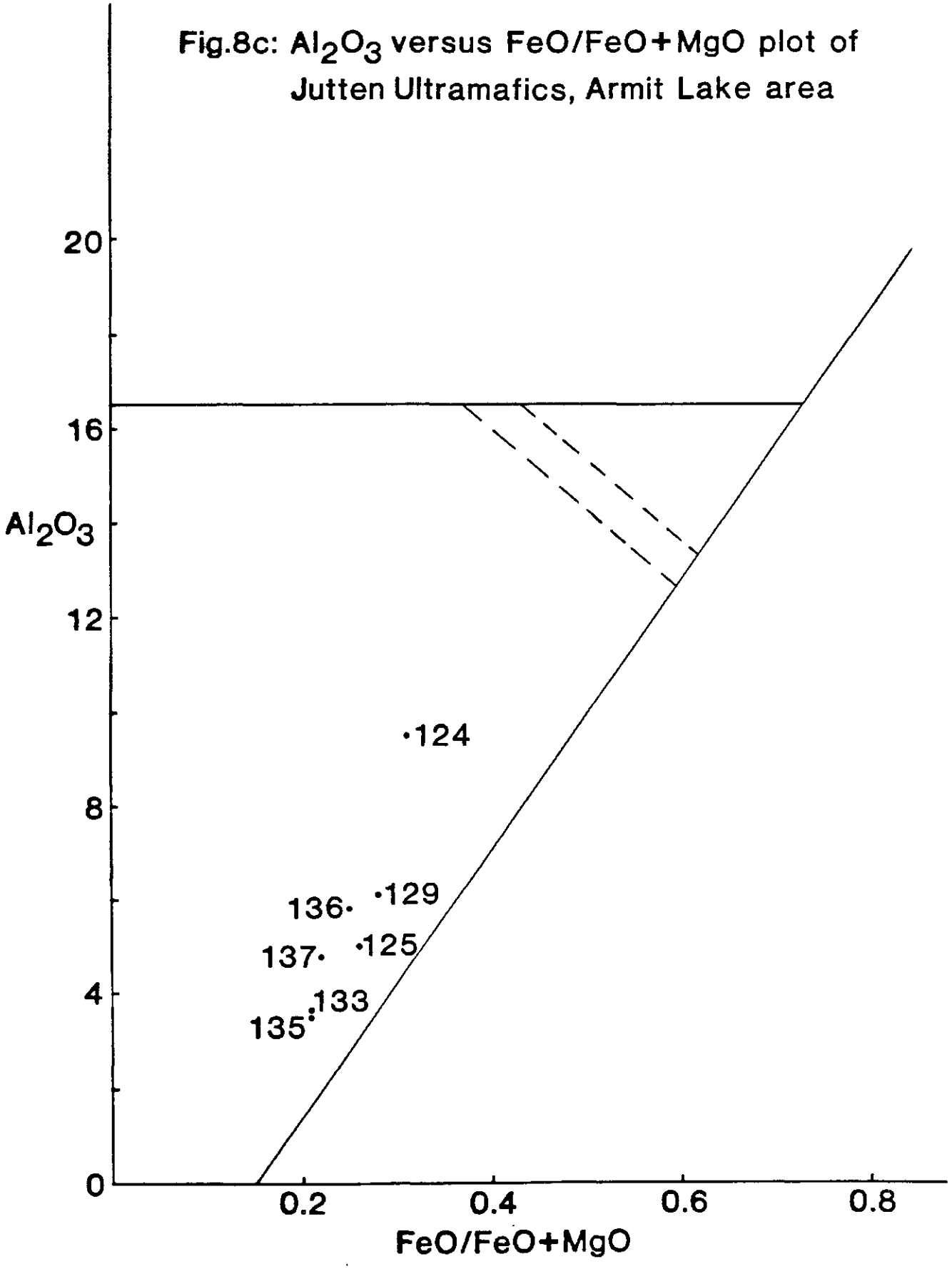
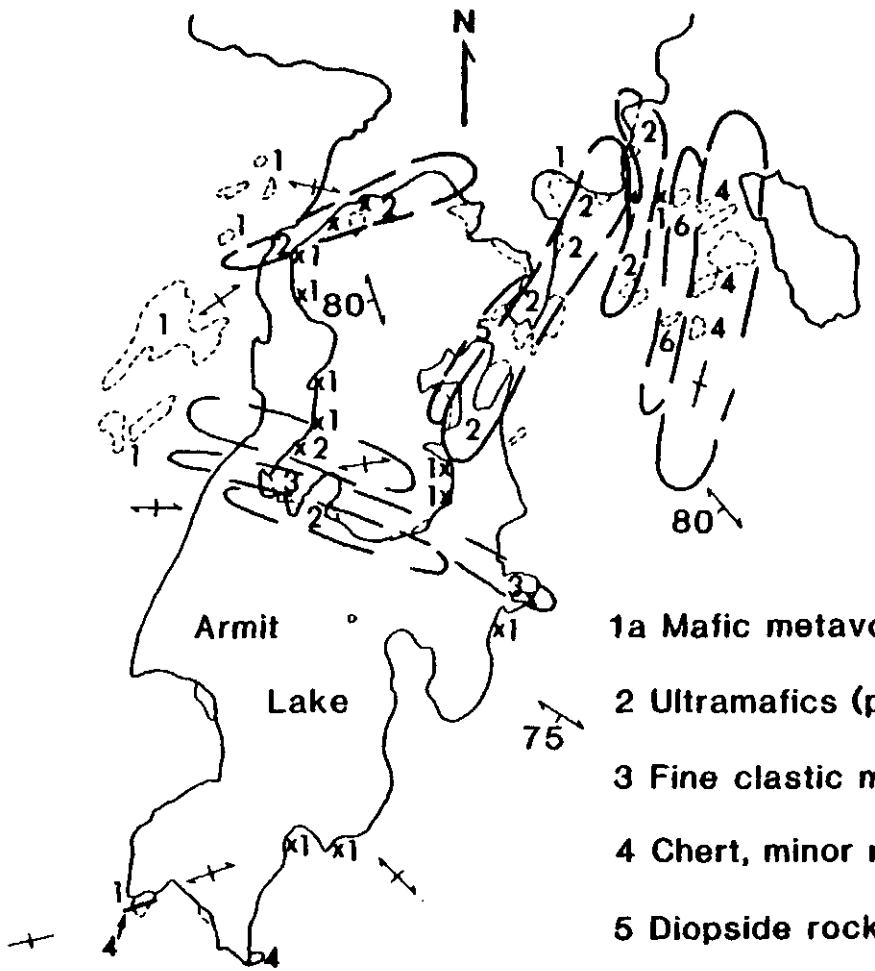



Fig.8b: Jensen Cation plot of Jutten Ultramafics, Armit Lake area

Fig.8c: $Al_2O_3$ versus FeO/FeO+MgO plot of Jutten Ultramafics, Armit Lake area






1a Mafic metavolcanics (amphibolite)

2 Ultramafics (pyroxenite/peridotite)

3 Fine clastic metasediments

4 Chert, minor magnetite ironstone

5 Diopside rock

6 Intermediate to felsic metavolcanics

Fig. 9. Geology of Armit Lake Area Scale 1:15 840

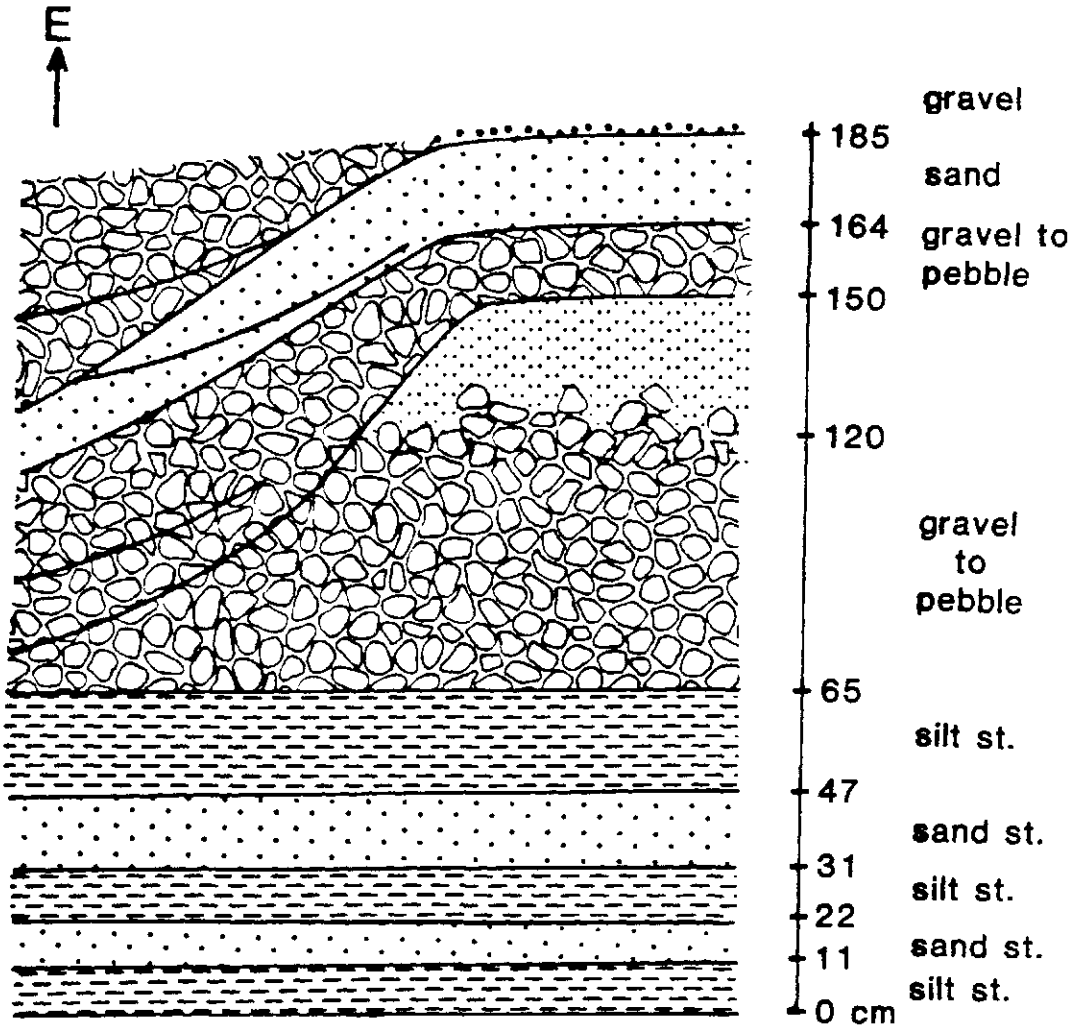



Fig. 10. Schematic sketch of scour channel in Savant Narrows Formation, Neverfreeze Lake

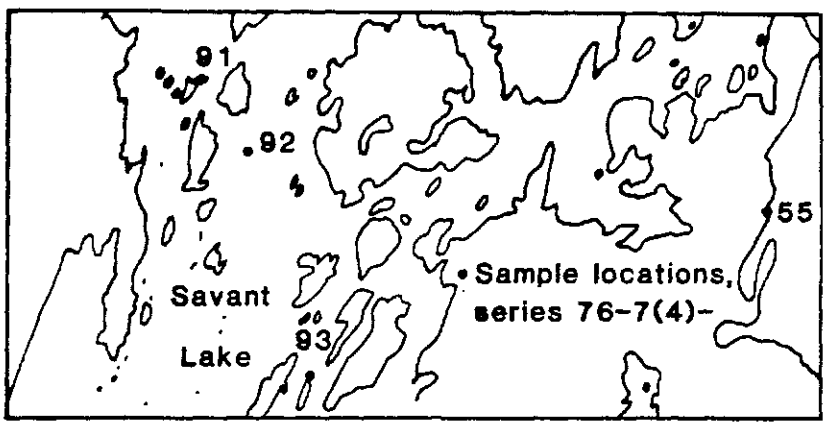



**Figure 11. Location of samples, Savant Lake Formation**
**Scale 1:63 360**

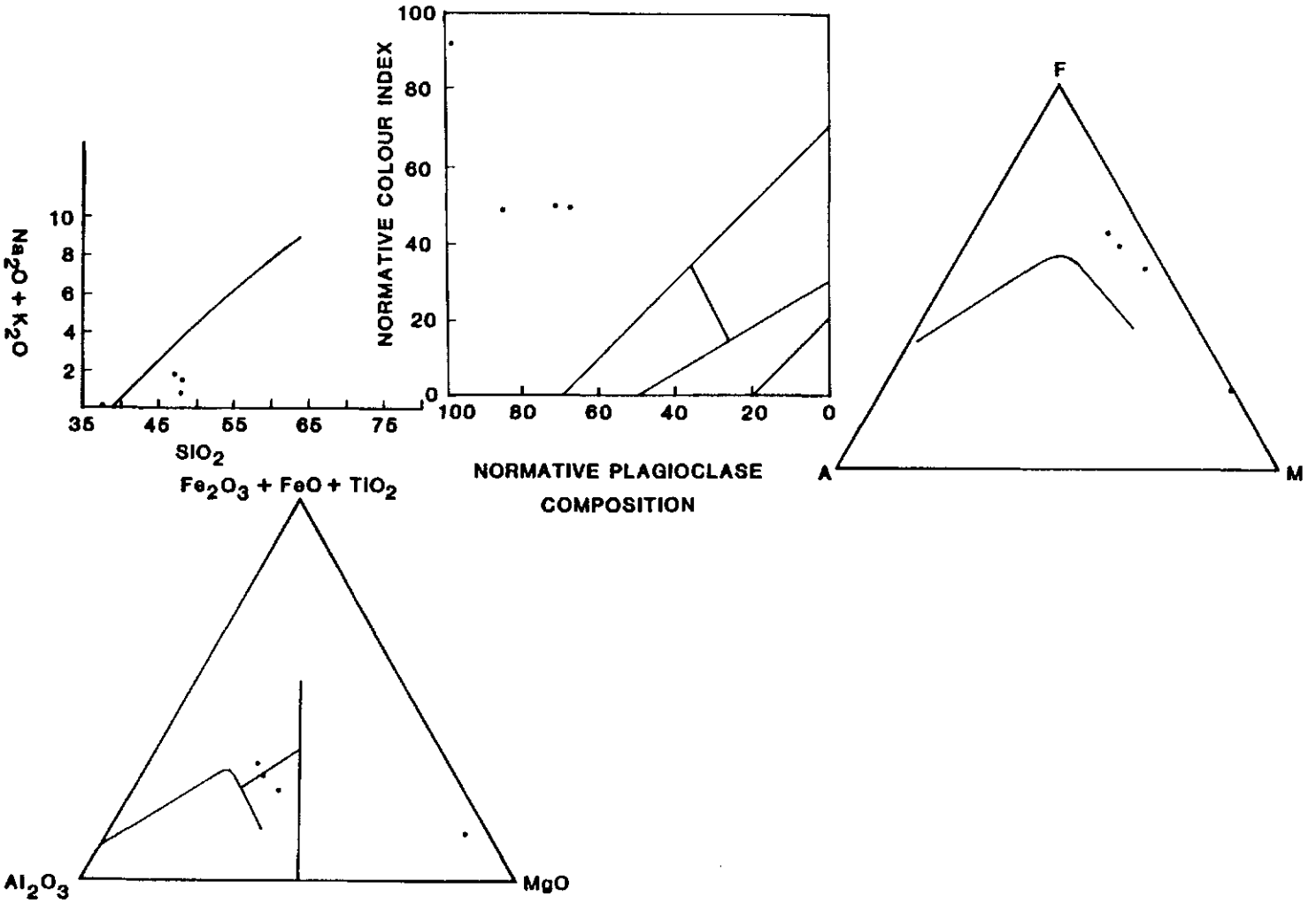
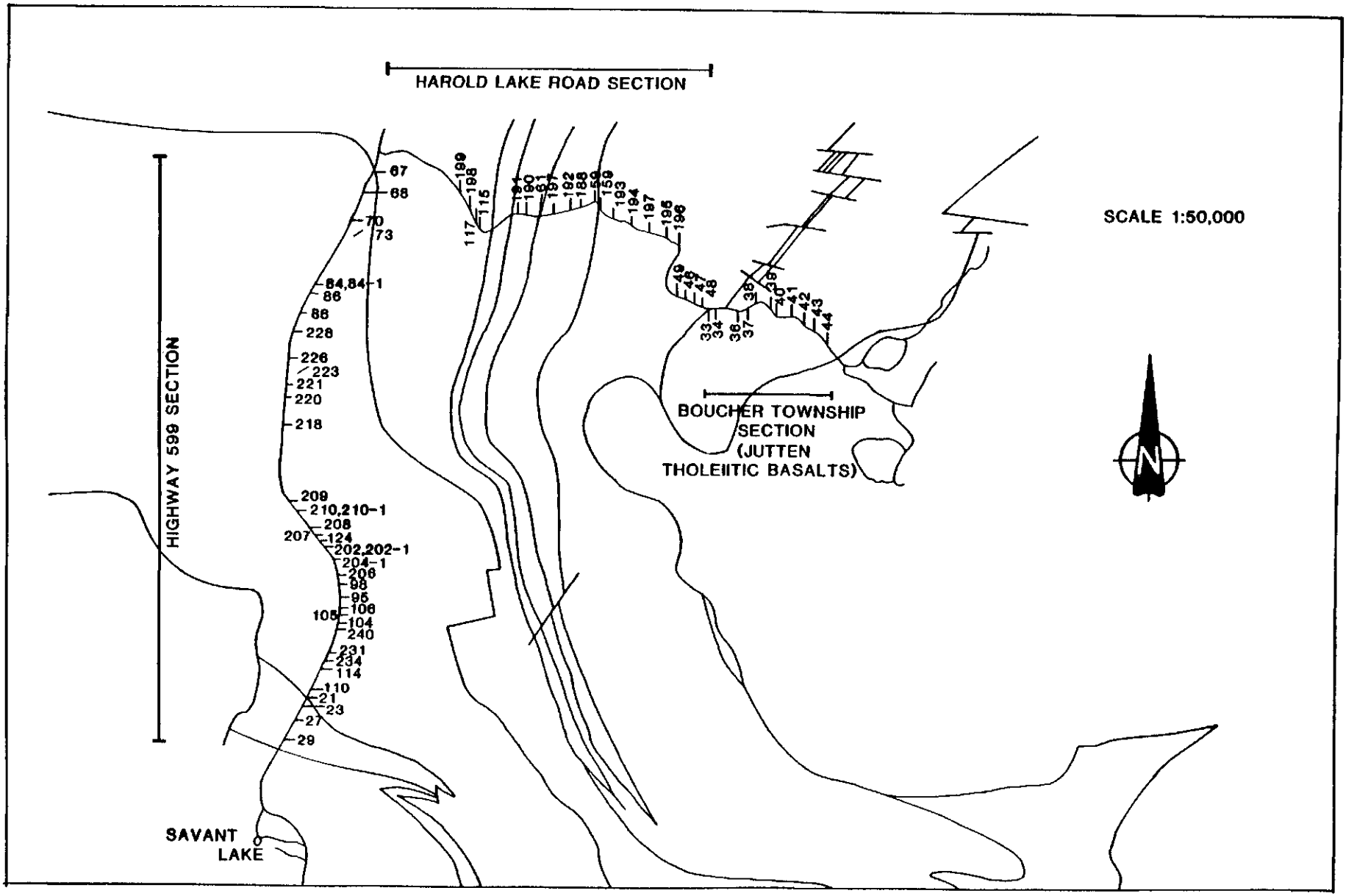



Fig. 12 Chemical plots of Savant Lake Formation

FIG. 13. LOCATION OF SAMPLES, HANDY LAKE GROUP, SAVANT LAKE AREA



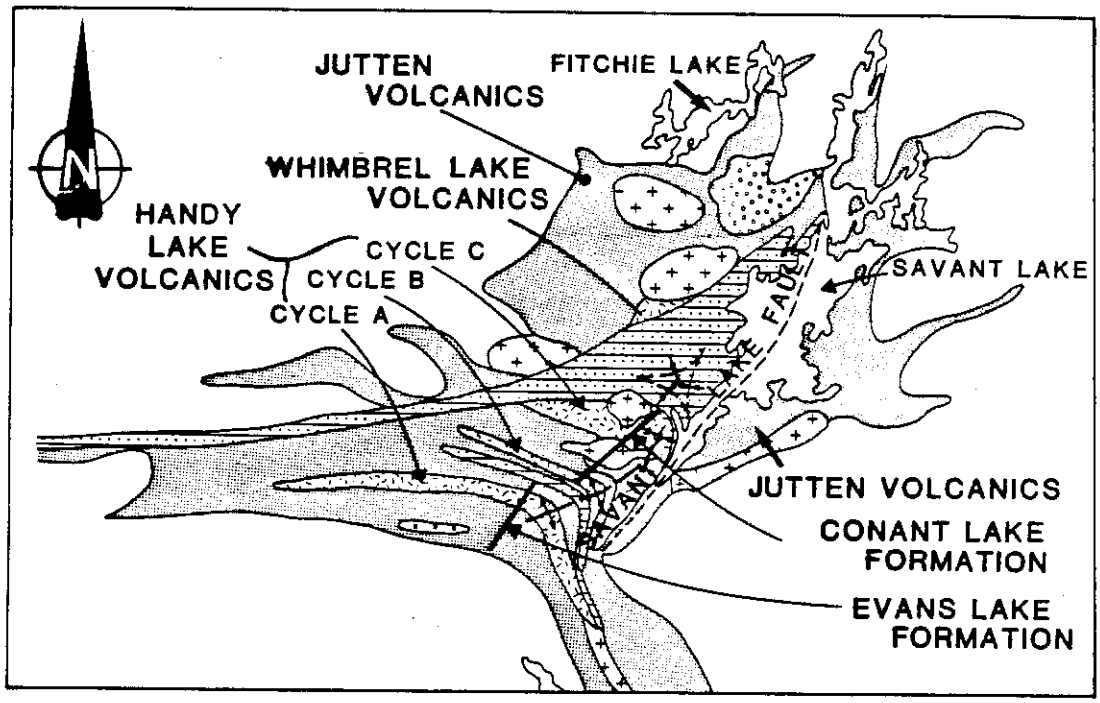



Fig. 13a: Metavolcanic cycles and formation of the Handy Lake group (after Wellmer, 1982)

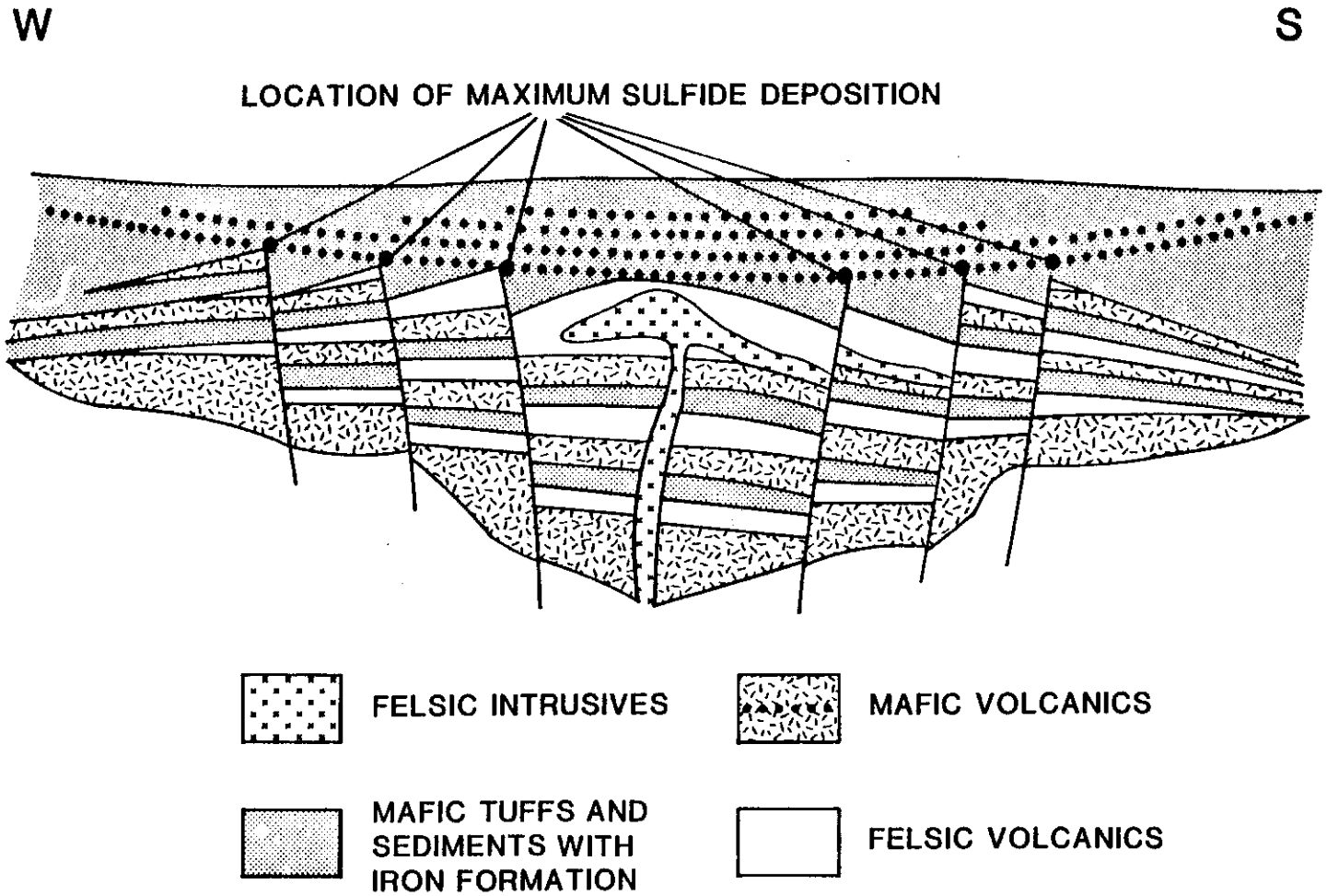



Fig. 13b: Caldera concept for the Handy Lake group (from Wellmer, 1982)

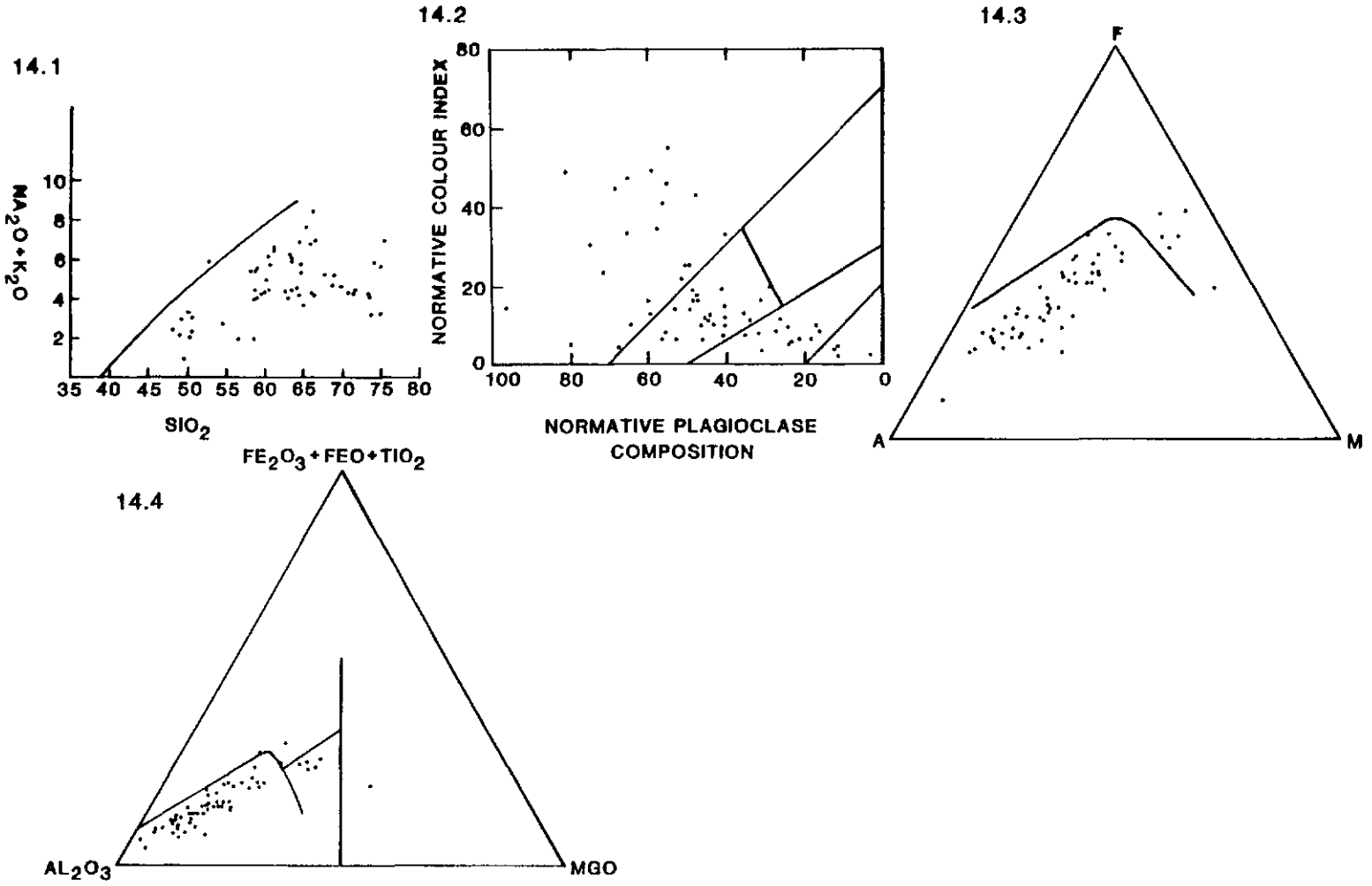



Fig. 14. Chemical plots of the Handy Lake Group

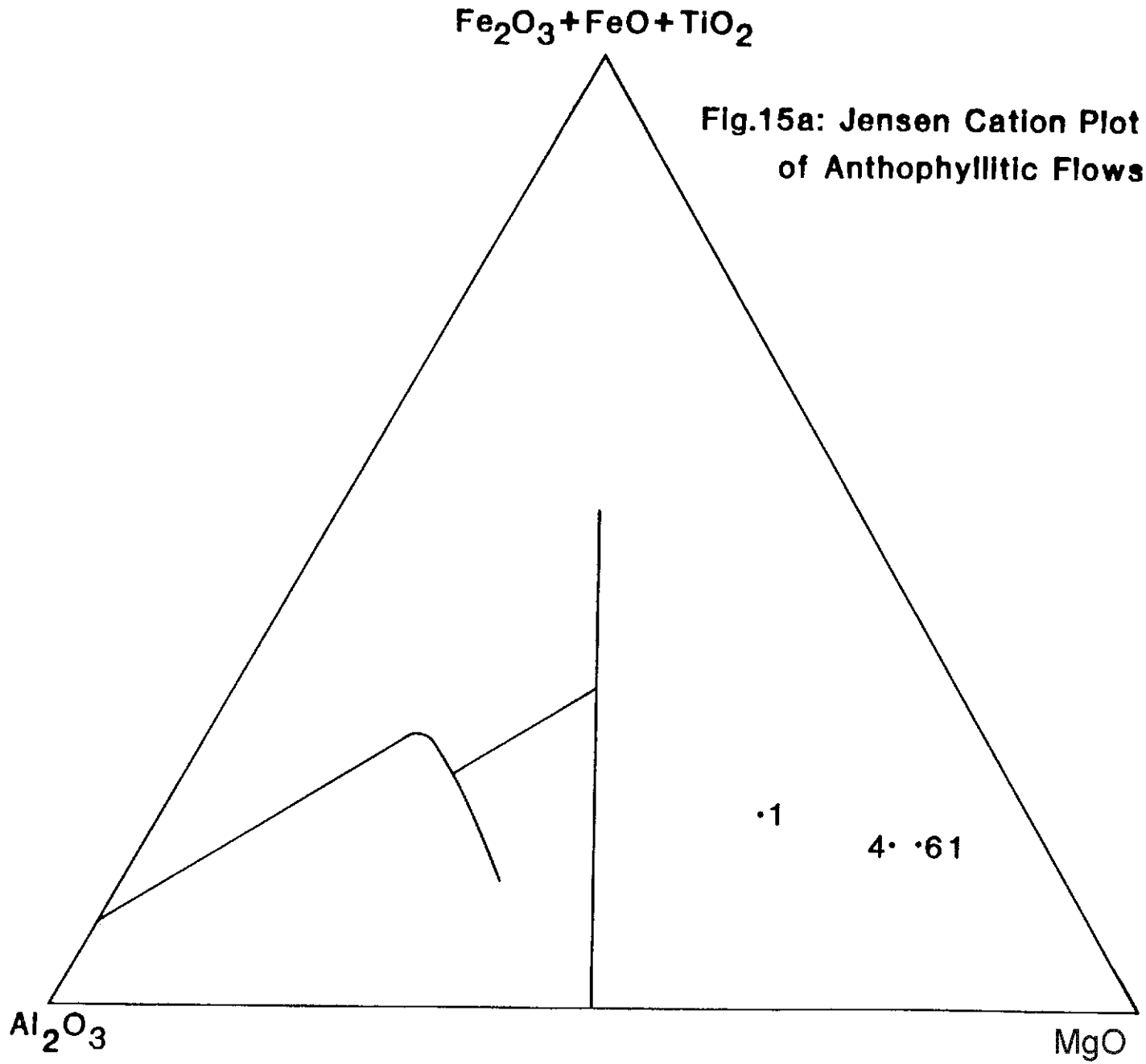



**Fig.15a: Jensen Cation Plot of Anthophyllitic Flows**

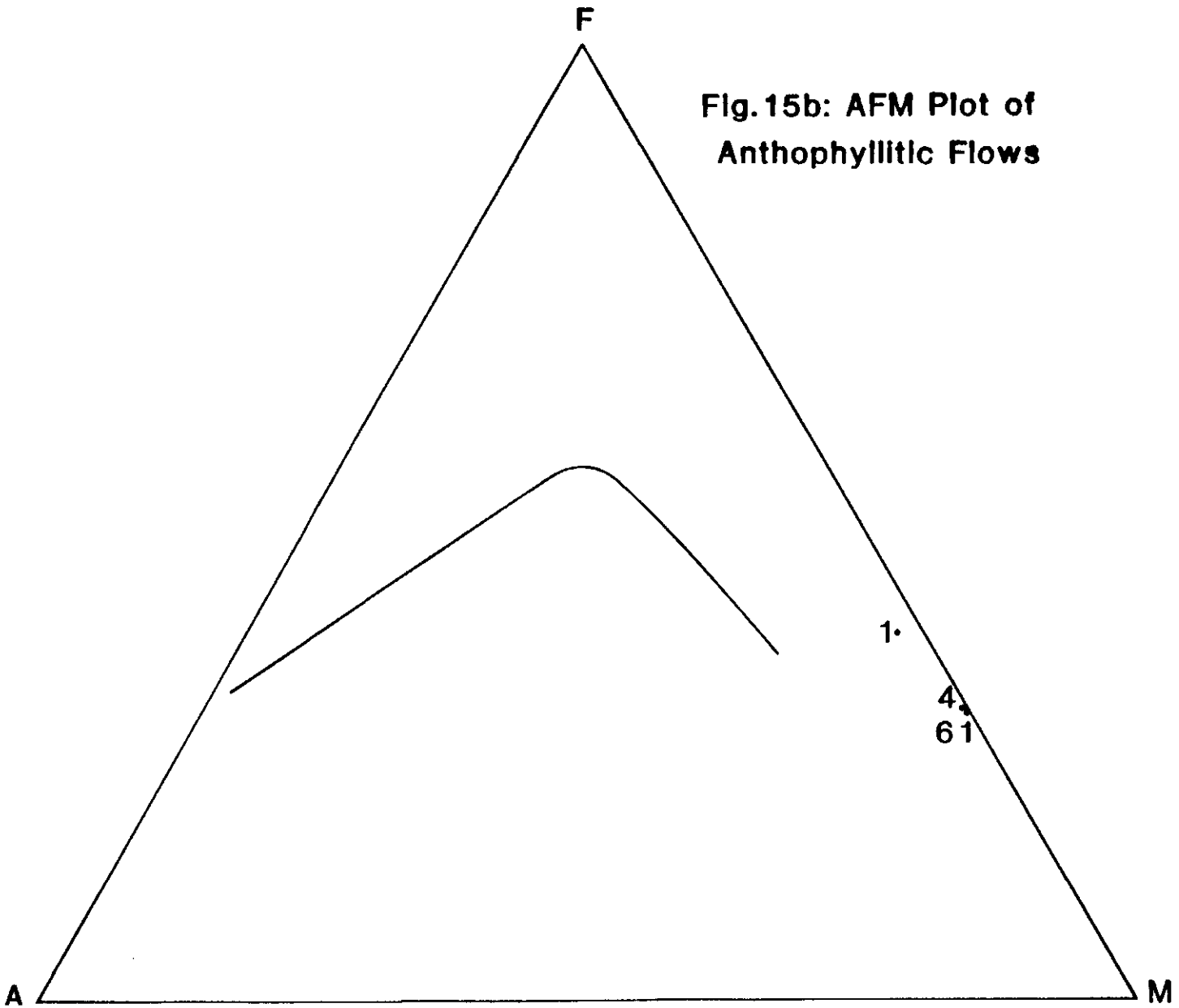



Fig. 15b: AFM Plot of Anthophyllitic Flows

Table 1: Table of Lithologic Units for the Savant Lake Area

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT

Swamp and stream deposits, lake deposits

PLEISTOCENE

Silt, sand, gravel and boulders

Unconformity

PRECAMBRIAN

LATE PRECAMBRIAN

MAFIC INTRUSIVE ROCKS

Diabase[a]

EARLY PRECAMBRIAN (ARCHEAN)

MASSIVE FELSIC INTRUSIVE ROCKS

Granodiorite, quartz monzonite; porphyritic granodiorite; quartz monzonite; xenolitic granitic rocks; aplite

Intrusive Contact

METAMORPHOSES FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Trondhjemite; granodiorite; porphyritic trondhjemite; granodiorite; quartz monzonite; porphyritic granodiorite; xenolithic granitic rocks; quartz diorite; aplite, pegmatite

Intrusive Contact

METAMORPHOSED FELSIC TO INTERMEDIATE PORPHYRITIC INTRUSIVES

Quartz porphyry, feldspar porphyry, quartz-feldspar porphyry, feldspar-quartz porphyry; xenolithic porphyritic rocks

Intrusive Contact

MAFIC INTRUSIVE ROCKS

Diorite; gabbro; peridotite, pyroxenite

Intrusive Contact

METASEDIMENTS

CHEMICAL METASEDIMENTS

Chert-magnetite iron formation; jasper iron formation

FINE CLASTIC METASEDIMENTS

Sandstone; siltstone, mudstone; cherty sandstone; tuffaceous metasediments

CONGLOMERATIC METASEDIMENTS

Polymictic conglomerate (volcanic clasts); polymictic conglomerate (granitoid clasts)[b]

FELSIC TO INTERMEDIATE METAVOLCANICS

Flows, tuff; lapilli-tuff; tuff-breccia; autoclastic breccia; porphyritic flows; volcanogenic sandstone; debris flow deposits; porphyry[c]

MAFIC TO INTERMEDIATE METAVOLCANICS

Flows; pillowed flows; porphyritic flows; tuff, lapilli tuff, tuff-breccia; autoclastic breccia; amygdaloidal flows; variolitic flows; volcanic conglomerate

a - occurs as small dike only

b - conglomerates defined by dominant clast type

c - may be of either intrusive or extrusive origin

Table 2: History of Stratigraphic Nomenclature Savant Lake Area

| Moore, E.S. (1928) | Rittenhouse (1936) | Skinner (1969) | Bond (1978) | Shegelski (1978) | This Report |
|---|---|---|---|---|---|
| PRECAMBRIAN | | | FELSIC INTRUSIVES | | FELSIC INTRUSIONS |
| KEWEENAWAN: Diabase dikes | KEWEENAWAN(?) Diabase dikes | KEWEENAWAN (?) Diabase dikes | MAFIC INTRUSIVES | | MAFIC INTRUSIONS |
| ALGOMAN: Granitic Intrusives | Granitic Intrusives / BASIC INTRUSIVES | Granitic Intrusives; gneisses | PORPHYRITIC INTRUSIVES | | PORPHYRITIC INTRUSIONS |
| SAVANT GROUP: TIMISKAMING: Complex series of interbanded acid, intermediate, and basic lava flows, agglomerates, tuffs, arkoses, greywacke, banded iron formation and conglomerate and derived gneisses | SAVANT SERIES: HANDY LAKE VOLCANICS felsic to intermediate volcanics; Upper Greywacke member; Upper Iron-bearing member; Lower Greywacke member; Lower Iron-bearing member; Upper Conglomerate member; Lower Conglomerate member | SAVANT GROUP: HANDY LAKE VOLCANICS; Timiskaming(?) Metasediments; Pyroclastics | SAVANT GROUP: Ferruginous and Arenaceous Metasediments: conglomerates and related metasediments | POISSON FORMATION (greywacke, siltstone, iron formation) | CONANT LAKE FORMATION (metavolcanic rocks with intercalated clastic and chemical metasediments) — SAVANT GROUP (ferruginous and wacke-arenite metasediments) |
| | | | HANDY LAKE VOLCANIC SEQUENCE: Mafic, intermediate and felsic Metavolcanics with minor interlayered Ferruginous and Arenaceous Metasediments | SAVANT GROUP: SAVANT NARROWS FORMATION (conglomerate, greywacke); HANDY LAKE FORMATION (volcanic rocks) | EVANS LAKE FORMATION (predominantly metavolcanic rocks with minor volcanogenic metasediments) |
| | | | | | SAVANT LAKE FORMATION — Savant Narrows Formation; WHIMBERLL LAKE FORMATION |
| | | | | | JUTTEN GROUP: JUTTEN THOLEIITIC BASALT; JUTTEN ULTRAMAFICS; JUTTEN CHERT-IRONSTONE; JUTTEN TUFFS AND VOLCANOGENIC METASEDIMENTS |
| KEEWATIN: Greenstone, intermediate to mafic metavolcanics | JUTTEN VOLCANICS: Mafic to intermediate metavolcanics | GREENSTONE: Mafic to intermediate metavolcanics | JUTTEN VOLCANIC SEQUENCE: Mafic Metavolcanics with interlayered cherty Metasediments | JUTTEN GROUP (predominantly mafic volcanic basement complex) — INTRUSIVE GNEISSIC CONTACT | |

TABLE 3: Granitic Phases of the Heron Lake Stock (Compiled from Bond, 1977; Kusmirski, 1977)

| PHASE | FABRIC | TEXTURE | MINERALOGY | COMMENTS |
|---|---|---|---|---|
| 1) Trondhjemite | Massive to well foliated | Medium-grained; holocrystalline equigranular to allotriomorphic granular to seriate | Plagioclase + quartz + microcline + chlorite + biotite + epidote + accessories: muscovite, sphene, allanite, carbonate, opaques | Occurs in central and northern parts of stock |
| 2) Fine-grained Trondhjemite | Massive to weakly foliated to sheared | Fine-grained; holocrystalline, hypidiomorphic granular | Plagioclase + quartz + biotite + chlorite + microcline + epidote + accessories: sphene, muscovite, carbonate, pyrite | Chilled border phase; occurs along south margin of stock and also as inclusions in medium-grained trondhjemite |
| 3) Granodiorite | Massive to weakly foliated | Medium-grained; holocrystalline inequigranular to hypidiomorphic granular to seriate | Plagioclase + potash feldspar + quartz + biotite + chlorite + eqpidote + sphene + carbonate | Potash feldspar replaces plagioclase |
| 4) Leucocratic Quartz Monzonite | Massive | Fine- to medium-grained, holocrystalline to hypidiomorphic granular | Potash feldspar + plagioclase + quartz + biotite + epidote (?) | Associated with potassic dikes that cut trondhjemite |
| 5) Quartz Diorite - Diorite | Massive | Holocrystalline, hypidiomorphic granular | Plagioclase + hornblende + quartz + biotite + accessories: sphene, chlorite, epidote | Small rounded plugs intrusive into trondhjemite; may represent discrete intrusive event |
| 6) Quartz Andesite | Massive | Holocrystalline, hypidiomorphic inequigranular | Plagioclase + biotite + epidote + potash feldspar + pyrite | Hypabyssal dike |

Table 4: Granitic phases of the Jutten Batholith (Compiled from Bond, 1977, 1979; Trowell, 1981).

| PHASE | FABRIC | TEXTURE | MINERALOGY | COMMENTS |
|---|---|---|---|---|
| 1) (Biotite) Trondhjemite | Foliated to sheared | Medium to coarse-grained, equigranular, clotty biotite | Plagioclase + quartz + biotite + accessories: chlorite, muscovite, carbonate, magnetite, sphene, zircon, rutile | Locally xenolithic; highly sheared and brecciated zone has conglomeratic appearance |
| 2) Aplite | Massive | Aphanitic | Quartz + plagioclase + chlorite | Cuts the bordering mafic metavolcanics |
| 3) Granodiorite, porphyritic granodiorite | Foliated | Medium-grained, equigranular to porphyritic | Plagioclase + quartz + microcline + biotite + hornblende + accessories: sphene, magnetite, epidote, sericite-muscovite, epidote, monzonite | Locally contains mafic xenolithic lenses |
| 4) Granodiorite-quartz monzonite | Foliated | Fine- to medium grained, equigranular to porphyritic | Plagioclase + quartz + microcline + biotite + accessories: sphene, magnetite, epidote, sericite-muscovite | Gradual change to granodiorite, contain scattered mafic metavolcanic xenoliths |

TABLE 5: CHEMICAL ANALYSES OF ROCKS OF THE JUTTEN VOLCANICS, SAVANT LAKE-SILVER LAKE SECTION, SAVANT LAKE AREA

| Laboratory Sample No. | 77-2670 | 77-2671 | 77-2672 | 77-2673 | 77-2674 | 77-2676 | 77-2678 | 77-2677 | 77-2679 | 77-2680 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-164 | 76-7(4)-165 | 76-7(4)-167 | 76-7(4)-168 | 76-7(4)-169 | 76-7(4)-171 | 76-7(4)-173 | 76-7(4)-172 | 76-7(4)-174 | 76-7(4)-175 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 48.90 | 49.80 | 49.30 | 46.40 | 47.70 | 49.00 | 48.30 | 47.60 | 48.10 | 47.60 |
| $Al_2O_3$ | 15.20 | 15.10 | 15.00 | 15.50 | 14.90 | 14.50 | 16.60 | 16.30 | 16.10 | 14.50 |
| $Fe_2O_3$ | 2.75 | 1.20 | 3.90 | 1.89 | 4.15 | 3.36 | 1.83 | 2.69 | 1.96 | 2.56 |
| FeO | 9.50 | 9.90 | 9.10 | 10.10 | 8.69 | 8.77 | 9.42 | 10.10 | 8.86 | 10.30 |
| MgO | 7.19 | 8.42 | 7.41 | 8.12 | 7.89 | 7.33 | 8.04 | 8.18 | 7.75 | 9.89 |
| CaO | 11.10 | 10.90 | 11.10 | 11.60 | 12.40 | 11.90 | 11.60 | 11.10 | 12.80 | 10.10 |
| $Na_2O$ | 2.01 | 1.98 | 2.40 | 2.29 | 1.50 | 2.43 | 1.40 | 1.40 | 1.47 | 1.90 |
| $K_2O$ | 0.25 | 0.34 | 0.23 | 0.46 | 0.24 | 0.18 | 0.07 | 0.04 | 0.07 | 0.11 |
| $TiO_2$ | 0.85 | 0.80 | 1.00 | 0.89 | 0.83 | 0.91 | 0.83 | 0.88 | 0.73 | 0.85 |
| $P_2O_5$ | 0.07 | 0.06 | 0.07 | 0.06 | 0.07 | 0.07 | 0.06 | 0.07 | 0.06 | 0.06 |
| S | 0.07 | 0.04 | 0.01 | 0.09 | 0.15 | 0.05 | 0.20 | 0.11 | 0.12 | 0.11 |
| MnO | 0.21 | 0.20 | 0.21 | 0.22 | 0.22 | 0.21 | 0.20 | 0.22 | 0.19 | 0.21 |
| $CO_2$ | 0.04 | 0.10 | 0.08 | 0.12 | 0.01 | 0.15 | 0.03 | 0.22 | 0.04 | <0.01 |
| $H_2O+$ | 0.48 | 0.48 | 0.45 | 1.79 | 0.16 | 0.20 | 0.32 | 0.15 | 0.19 | 1.42 |
| $H_2O-$ | 0.24 | 0.29 | 0.27 | 0.20 | 0.43 | 0.42 | 0.42 | 0.42 | 0.43 | 0.44 |
| TOTAL | 98.90 | 99.60 | 100.50 | 99.70 | 99.30 | 99.50 | 99.30 | 99.50 | 98.90 | 100.10 |
| Specific Gravity | 3.03 | 3.02 | 3.05 | 3.05 | 3.05 | 3.01 | 3.03 | 3.08 | 3.03 | 3.01 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2681 | 77-2682 | 77-2683 | 77-2684 | 77-2610 | 77-2611 | 77-2606 | 77-2607 | 77-2608 | 77-2609 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-176 | 76-7(4)-177 | 76-7(4)-178 | 76-7(4)-179 | 76-7(4)-73 | 76-7(4)-72 | 76-7(4)-69 | 76-7(4)-70 | 76-7(4)-71 | 76-7(4)-72 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 48.20 | 47.70 | 49.30 | 45.70 | 47.30 | 48.30 | 50.10 | 48.20 | 46.60 | 48.50 |
| $Al_2O_3$ | 15.00 | 15.30 | 15.20 | 17.20 | 14.90 | 15.00 | 13.30 | 14.10 | 14.90 | 14.10 |
| $Fe_2O_3$ | 2.68 | 2.83 | 2.50 | 1.21 | 2.94 | 2.88 | 2.61 | 2.69 | 3.78 | 2.35 |
| FeO | 10.10 | 9.34 | 10.80 | 9.26 | 10.40 | 9.82 | 9.97 | 8.53 | 9.26 | 10.30 |
| MgO | 8.60 | 6.22 | 8.10 | 3.72 | 7.26 | 7.23 | 6.47 | 6.13 | 7.85 | 8.36 |
| CaO | 10.40 | 11.70 | 9.16 | 10.40 | 11.10 | 10.60 | 11.40 | 11.00 | 10.40 | 10.20 |
| $Na_2O$ | 2.12 | 3.24 | 2.08 | 2.26 | 1.81 | 2.03 | 1.60 | 2.97 | 2.04 | 1.97 |
| $K_2O$ | 0.05 | 0.15 | 0.12 | 0.66 | 0.10 | 0.08 | 0.06 | 0.06 | 0.02 | 0.10 |
| $TiO_2$ | 0.98 | 1.05 | 1.21 | 1.05 | 1.05 | 1.09 | 0.86 | 1.03 | 0.96 | 0.77 |
| $P_2O_5$ | 0.07 | 0.08 | 0.09 | 0.09 | 0.08 | 0.08 | 0.05 | 0.05 | 0.07 | 0.06 |
| S | 0.06 | 0.02 | 0.01 | 0.03 | 0.08 | 0.02 | 0.02 | <0.01 | 0.02 | <0.01 |
| MnO | 0.20 | 0.21 | 0.20 | 0.29 | 0.22 | 0.18 | 0.25 | 0.29 | 0.21 | 0.20 |
| $CO_2$ | 0.16 | 1.40 | 0.04 | 4.96 | 0.10 | 0.12 | 2.32 | 1.88 | 0.11 | 0.04 |
| $H_2O+$ | 1.14 | 0.25 | 1.35 | 3.63 | 1.90 | 2.00 | 2.31 | 2.40 | 2.70 | 2.12 |
| $H_2O-$ | 0.31 | 0.28 | 0.30 | 0.29 | 0.17 | 0.30 | 0.23 | 0.20 | 0.31 | 0.18 |
| TOTAL | 100.10 | 99.80 | 100.50 | 100.70 | 99.40 | 99.70 | 99.50 | 99.60 | 99.30 | 99.30 |
| Specific Gravity | 3.02 | 3.01 | 2.99 | 2.97 | 3.06 | 3.03 | 2.91 | 2.95 | 3.03 | 3.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2612 | 77-2613 | 77-2614 | 77-2625 | 77-2616 | 77-2626 | 77-2627 | 77-2620 | 77-2621 | 77-2622 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-75 | 76-7(4)-76 | 76-7(4)-77 | 76-7(4)-88 | 76-7(4)-79 | 76-7(4)-89 | 76-7(4)-90 | 76-7(4)-83 | 76-7(4)-84 | 76-7(4)-85 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 48.90 | 50.40 | 48.30 | 47.90 | 48.40 | 47.50 | 48.00 | 46.60 | 49.10 | 43.00 |
| $Al_2O_3$ | 14.10 | 14.50 | 15.30 | 15.40 | 15.20 | 14.80 | 14.30 | 14.60 | 14.00 | 12.70 |
| $Fe_2O_3$ | 2.68 | 1.75 | 3.87 | 2.91 | 3.85 | 2.60 | 4.01 | 3.52 | 3.15 | 1.29 |
| FeO | 9.42 | 9.66 | 8.13 | 10.40 | 8.29 | 9.34 | 10.10 | 10.60 | 10.40 | 10.10 |
| MgO | 7.91 | 4.65 | 7.18 | 7.12 | 7.00 | 8.16 | 6.71 | 6.78 | 7.38 | 8.82 |
| CaO | 11.20 | 6.88 | 11.70 | 9.46 | 10.30 | 10.10 | 10.90 | 12.00 | 10.40 | 8.98 |
| $Na_2O$ | 1.21 | 3.56 | 1.33 | 2.09 | 1.51 | 2.31 | 0.67 | 1.76 | 1.68 | 1.62 |
| $K_2O$ | 0.05 | 0.02 | 0.01 | 0.19 | 0.00 | 0.06 | 0.00 | 0.02 | 0.04 | 0.00 |
| $TiO_2$ | 0.72 | 1.30 | 0.85 | 1.16 | 0.97 | 0.97 | 0.96 | 1.01 | 1.02 | 0.72 |
| $P_2O_5$ | 0.05 | 0.09 | 0.07 | 0.09 | 0.08 | 0.06 | 0.08 | 0.08 | 0.08 | 0.07 |
| S | 0.06 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.04 | 0.18 | 0.21 |
| MnO | 0.20 | 0.23 | 0.20 | 0.21 | 0.16 | 0.18 | 0.20 | 0.23 | 0.21 | 0.20 |
| $CO_2$ | 0.06 | 3.84 | 0.14 | 0.05 | 0.54 | 1.16 | 0.28 | 0.42 | 0.34 | 5.28 |
| $H_2O+$ | 1.99 | 3.65 | 2.14 | 1.99 | 2.63 | 2.50 | 2.85 | 2.24 | 2.16 | 5.39 |
| $H_2O-$ | 0.40 | 0.31 | 0.38 | 0.45 | 0.34 | 0.41 | 0.46 | 0.39 | 0.31 | 0.42 |
| TOTAL | 99.00 | 100.80 | 99.60 | 99.40 | 99.30 | 100.20 | 99.50 | 100.30 | 100.50 | 98.70 |
| Specific Gravity | 3.05 | 2.78 | 3.05 | 3.00 | 3.00 | 2.98 | 3.04 | 3.06 | 3.02 | 2.79 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2619 | 77-2617 | 77-2618 | 77-2623 | 77-2624 | 77-2598 | 77-2596 | 77-2597 | 77-2595 | 77-2594 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-82 | 76-7(4)-80 | 76-7(4)-81 | 76-7(4)-86 | 76-7(4)-87 | 76-7(4)-35 | 76-7(4)-33 | 76-7(4)-34 | 76-7(4)-32 | 76-7(4)-31 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 46.10 | 47.90 | 48.80 | 48.40 | 48.10 | 47.60 | 48.70 | 49.90 | 47.20 | 46.20 |
| $Al_2O_3$ | 14.50 | 14.70 | 13.80 | 14.70 | 15.60 | 15.10 | 15.20 | 15.00 | 15.10 | 14.60 |
| $Fe_2O_3$ | 5.24 | 3.48 | 4.96 | 2.85 | 2.92 | 2.83 | 3.13 | 2.52 | 3.69 | 2.17 |
| FeO | 8.29 | 9.18 | 10.50 | 8.69 | 9.42 | 8.53 | 10.20 | 9.33 | 9.10 | 8.77 |
| MgO | 6.31 | 7.65 | 5.26 | 8.17 | 7.54 | 8.47 | 6.27 | 8.23 | 6.93 | 8.28 |
| CaO | 9.28 | 10.40 | 10.30 | 12.00 | 9.46 | 10.60 | 7.78 | 12.10 | 11.70 | 8.63 |
| $Na_2O$ | 1.36 | 2.10 | 1.49 | 1.51 | 1.97 | 2.26 | 3.67 | 1.22 | 1.65 | 1.99 |
| $K_2O$ | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 |
| $TiO_2$ | 0.95 | 0.89 | 1.98 | 0.76 | 0.84 | 0.80 | 1.16 | 0.92 | 0.96 | 0.80 |
| $P_2O_5$ | 0.08 | 0.07 | 0.19 | 0.05 | 0.06 | 0.06 | 0.08 | 0.07 | 0.07 | 0.05 |
| S | 0.05 | 0.18 | 0.18 | 0.03 | 0.15 | 0.03 | 0.08 | 0.05 | 0.14 | 0.01 |
| MnO | 0.19 | 0.19 | 0.23 | 0.20 | 0.20 | 0.19 | 0.20 | 0.20 | 0.20 | 0.18 |
| $CO_2$ | 2.48 | 0.14 | 0.05 | 0.23 | 0.71 | 0.07 | 0.07 | 0.06 | 0.07 | 4.32 |
| $H_2O+$ | 3.89 | 2.25 | 2.64 | 2.00 | 3.11 | 2.49 | 3.18 | 2.60 | 2.94 | 4.75 |
| $H_2O-$ | 0.39 | 0.35 | 0.40 | 0.40 | 0.40 | 0.38 | 0.37 | 0.39 | 0.30 | 0.35 |
| TOTAL | 99.10 | 99.40 | 100.70 | 100.10 | 100.40 | 99.50 | 100.10 | 100.60 | 100.00 | 101.20 |
| Specific Gravity | 2.88 | 3.00 | 3.05 | 3.05 | 2.96 | 3.01 | 2.96 | 3.08 | 3.06 | 2.77 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2593 | 77-2592 | 77-2591 | 77-2590 | 77-2589 | 77-2588 | 77-2587 | 77-2586 | 77-2585 | 77-2581 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-30 | 76-7(4)-29 | 76-7(4)-28 | 76-7(4)-27 | 76-7(4)-26 | 76-7(4)-25 | 76-7(4)-24 | 76-7(4)-23 | 76-7(4)-22 | 76-7(4)-18 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 47.10 | 48.50 | 48.00 | 45.80 | 47.10 | 47.30 | 47.70 | 48.40 | 47.70 | 47.30 |
| $Al_2O_3$ | 14.80 | 14.40 | 14.50 | 12.70 | 14.40 | 14.70 | 14.80 | 13.50 | 14.40 | 15.00 |
| $Fe_2O_3$ | 3.47 | 2.10 | 3.15 | 2.05 | 4.11 | 4.40 | 3.54 | 3.59 | 3.43 | 3.48 |
| FeO | 9.02 | 8.29 | 10.10 | 8.61 | 8.77 | 8.29 | 9.10 | 9.98 | 9.10 | 9.18 |
| MgO | 8.57 | 8.15 | 7.06 | 13.60 | 6.98 | 7.52 | 7.67 | 7.38 | 7.35 | 9.09 |
| CaO | 10.80 | 9.44 | 10.00 | 8.50 | 11.90 | 11.30 | 11.30 | 10.60 | 11.40 | 8.22 |
| $Na_2O$ | 1.48 | 1.58 | 2.33 | 1.12 | 0.21 | 1.28 | 1.64 | 2.08 | 1.78 | 1.46 |
| $K_2O$ | 0.04 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 |
| $TiO_2$ | 0.87 | 0.83 | 0.89 | 0.57 | 0.86 | 0.82 | 0.83 | 1.08 | 0.87 | 0.92 |
| $P_2O_5$ | 0.06 | 0.05 | 0.07 | 0.05 | 0.06 | 0.08 | 0.04 | 0.08 | 0.07 | 0.07 |
| S | 0.09 | 0.01 | 0.08 | 0.02 | 0.04 | 0.04 | 0.08 | 0.26 | 0.10 | 0.01 |
| MnO | 0.19 | 0.18 | 0.22 | 0.18 | 0.20 | 0.24 | 0.21 | 0.20 | 0.21 | 0.20 |
| $CO_2$ | 0.05 | 2.08 | 0.21 | 2.10 | 1.70 | 1.27 | 0.16 | 0.09 | 0.15 | 0.66 |
| $H_2O+$ | 3.15 | 3.90 | 3.21 | 4.53 | 3.95 | 3.59 | 3.06 | 1.90 | 1.91 | 3.52 |
| $H_2O-$ | 0.36 | 0.40 | 0.21 | 0.35 | 0.32 | 0.34 | 0.30 | 0.37 | 0.37 | 0.27 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.10 | 100.60 | 101.20 | 100.50 | 99.50 | 98.80 | 99.40 |
| Specific Gravity | 3.04 | 2.89 | 3.01 | 2.85 | 3.01 | 3.00 | 3.04 | 3.04 | 3.05 | 2.94 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2582 | 77-2580 | 77-2579 | 77-2583 | 77-2578 | 77-2577 | 77-2576 | 77-2575 | 77-2574 | 77-2573 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-19 | 76-7(4)-17 | 76-7(4)-16 | 76-7(4)-20 | 76-7(4)-15 | 76-7(4)-14 | 76-7(4)-13 | 76-7(4)-12 | 76-7(4)-11 | 76-7(4)-10 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 48.10 | 47.50 | 47.60 | 49.10 | 48.80 | 47.50 | 48.20 | 47.50 | 47.40 | 48.40 |
| $Al_2O_3$ | 14.70 | 14.60 | 14.70 | 14.20 | 14.70 | 15.00 | 14.40 | 14.60 | 14.70 | 14.70 |
| $Fe_2O_3$ | 3.77 | 3.19 | 3.89 | 3.40 | 3.75 | 4.27 | 3.31 | 3.44 | 3.05 | 3.98 |
| FeO | 9.18 | 8.61 | 8.45 | 8.86 | 8.94 | 8.69 | 9.10 | 9.18 | 9.34 | 8.37 |
| MgO | 8.33 | 7.75 | 7.39 | 7.67 | 8.43 | 8.19 | 6.23 | 8.07 | 8.43 | 6.80 |
| CaO | 9.89 | 12.90 | 12.70 | 11.20 | 10.20 | 11.00 | 12.20 | 11.40 | 10.40 | 11.70 |
| $Na_2O$ | 2.08 | 1.02 | 0.80 | 1.60 | 0.96 | 1.04 | 1.07 | 1.09 | 1.75 | 0.75 |
| $K_2O$ | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 |
| $TiO_2$ | 0.87 | 0.80 | 0.84 | 0.91 | 0.86 | 0.85 | 0.86 | 0.84 | 0.88 | 0.83 |
| $P_2O_5$ | 0.06 | 0.03 | 0.07 | 0.06 | 0.03 | 0.06 | 0.06 | 0.06 | 0.04 | 0.06 |
| S | 0.16 | 0.02 | 0.03 | 0.04 | 0.06 | 0.06 | 0.08 | 0.11 | 0.10 | 0.20 |
| MnO | 0.21 | 0.20 | 0.21 | 0.20 | 0.20 | 0.21 | 0.23 | 0.20 | 0.18 | 0.20 |
| $CO_2$ | 0.06 | 0.11 | 0.12 | 0.08 | 0.11 | 0.10 | 1.53 | 0.08 | 0.82 | 0.96 |
| $H_2O+$ | 2.43 | 2.10 | 1.98 | 2.22 | 2.76 | 2.74 | 2.31 | 2.23 | 2.48 | 2.22 |
| $H_2O-$ | 0.23 | 0.30 | 0.32 | 0.37 | 0.33 | 0.27 | 0.35 | 0.22 | 0.40 | 0.36 |
| TOTAL | 100.10 | 99.20 | 99.10 | 100.00 | 100.10 | 100.00 | 100.00 | 99.00 | 99.90 | 99.50 |
| Specific Gravity | 3.01 | 3.09 | 3.05 | 3.05 | 3.01 | 3.07 | 3.02 | 3.06 | 2.99 | 3.02 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2572 | 77-2571 | 77-2570 | 77-2569 | 77-2568 | 77-2567 | 77-2566 | 77-2564 | 77-2565 | 77-2599 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-9 | 76-7(4)-8 | 76-7(4)-7 | 76-7(4)-6 | 76-7(4)-5 | 76-7(4)-4 | 76-7(4)-3 | 76-7(4)-1 | 76-7(4)-2 | 76-7(4)-62 |
| | | | | | Major Elements in weight percent | | | | | |
| $SiO_2$ | 48.70 | 46.80 | 48.00 | 47.40 | 47.50 | 49.10 | 48.50 | 47.90 | 48.50 | 48.20 |
| $Al_2O_3$ | 14.60 | 14.20 | 14.60 | 14.10 | 14.70 | 14.50 | 15.00 | 14.30 | 14.60 | 16.10 |
| $Fe_2O_3$ | 4.08 | 1.62 | 3.76 | 3.25 | 2.91 | 2.99 | 2.86 | 4.62 | 3.60 | 1.42 |
| FeO | 8.77 | 10.60 | 8.94 | 8.86 | 9.18 | 9.50 | 7.57 | 7.73 | 8.61 | 10.10 |
| MgO | 7.22 | 6.88 | 7.09 | 7.22 | 7.70 | 8.56 | 5.54 | 6.78 | 7.61 | 5.00 |
| CaO | 10.50 | 8.07 | 10.50 | 12.40 | 11.10 | 9.00 | 11.50 | 11.70 | 11.20 | 5.36 |
| $Na_2O$ | 0.28 | 0.00 | 0.76 | 1.04 | 1.74 | 1.95 | 1.28 | 0.14 | 1.29 | 4.29 |
| $K_2O$ | 0.09 | 1.47 | 0.00 | 0.00 | 0.00 | 0.14 | 0.08 | 0.00 | 0.00 | 0.03 |
| $TiO_2$ | 0.85 | 0.85 | 0.86 | 0.81 | 0.85 | 0.90 | 0.86 | 0.83 | 0.84 | 0.97 |
| $P_2O_5$ | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.06 | 0.09 |
| S | 0.07 | 0.02 | 0.02 | 0.05 | 0.03 | 0.02 | 0.04 | 0.11 | 0.04 | 0.01 |
| MnO | 0.20 | 0.18 | 0.22 | 0.21 | 0.21 | 0.20 | 0.21 | 0.22 | 0.20 | 0.19 |
| $CO_2$ | 0.78 | 5.04 | 1.53 | 1.29 | 0.18 | 0.07 | 2.52 | 1.70 | 0.11 | 3.28 |
| $H_2O+$ | 3.25 | 4.58 | 2.99 | 2.29 | 2.61 | 2.40 | 2.62 | 3.06 | 2.28 | 3.80 |
| $H_2O-$ | 0.25 | 0.22 | 0.21 | 0.22 | 0.24 | 0.28 | 0.22 | 0.26 | 0.27 | 0.33 |
| TOTAL | 99.80 | 100.60 | 99.50 | 99.20 | 99.00 | 99.60 | 98.80 | 99.40 | 99.20 | 99.80 |
| Specific Gravity | 3.02 | 2.82 | 2.97 | 3.04 | 3.04 | 2.98 | 2.89 | 3.02 | 3.03 | 2.77 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2600 | 77-2601 | 77-2602 | 77-2603 | 77-2604 | 77-2605 |
|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-63 | 76-7(4)-64 | 76-7(4)-65 | 76-7(4)-66 | 76-7(4)-67 | 76-7(4)-68 |
| | | | Major Elements in weight percent | | | |
| $SiO_2$ | 47.30 | 49.80 | 47.80 | 47.00 | 48.70 | 49.50 |
| $Al_2O_3$ | 14.70 | 13.30 | 14.10 | 13.90 | 15.10 | 15.30 |
| $Fe_2O_3$ | 3.56 | 3.77 | 4.99 | 3.42 | 3.99 | 4.03 |
| FeO | 9.26 | 9.90 | 7.49 | 8.69 | 7.49 | 8.53 |
| MgO | 7.88 | 7.27 | 7.04 | 6.89 | 5.39 | 4.64 |
| CaO | 11.10 | 9.62 | 11.10 | 10.90 | 11.30 | 10.80 |
| $Na_2O$ | 1.14 | 2.18 | 0.51 | 0.00 | 0.09 | 0.16 |
| $K_2O$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $TiO_2$ | 0.86 | 1.10 | 0.86 | 0.83 | 0.87 | 0.89 |
| $P_2O_5$ | 0.06 | 0.08 | 0.06 | 0.06 | 0.07 | 0.06 |
| S | 0.22 | 0.09 | 0.17 | 0.01 | 0.01 | 0.02 |
| MnO | 0.22 | 0.21 | 0.19 | 0.23 | 0.21 | 0.27 |
| $CO_2$ | 0.32 | 0.16 | 1.94 | 4.08 | 2.72 | 2.12 |
| $H_2O+$ | 2.71 | 2.49 | 3.19 | 4.31 | 3.63 | 3.59 |
| $H_2O-$ | 0.24 | 0.26 | 0.33 | 0.34 | 0.31 | 0.27 |
| TOTAL | 99.50 | 100.20 | 99.70 | 100.70 | 99.90 | 100.20 |
| Specific Gravity | 3.00 | 3.01 | 2.96 | 2.89 | 2.93 | 2.97 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2670 | 77-2671 | 77-2672 | 77-2673 | 77-2674 | 77-2676 | 77-2678 | 77-2677 | 77-2679 | 76-2680 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-164 | 76-7(4)-165 | 76-7(4)-167 | 76-7(4)-168 | 76-7(4)-169 | 76-7(4)-171 | 76-7(4)-173 | 76-7(4)-172 | 76-7(4)-174 | 76-7(4)-175 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 60 | 60 | 70 | 70 | 50 | 70 | 40 | 40 | 30 | 40 |
| Co | 50 | 45 | 45 | 45 | 50 | 45 | 50 | 50 | 50 | 55 |
| Cr | 280 | 275 | 370 | 160 | 340 | 360 | 370 | 280 | 360 | 315 |
| Cu | 145 | 60 | 20 | 55 | 140 | 90 | 140 | 65 | 130 | 110 |
| Ga | 10 | 15 | 10 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Li | 10 | 15 | 6 | 10 | 20 | 15 | 8 | 10 | 6 | 10 |
| Ni | 125 | 95 | 145 | 80 | 160 | 150 | 145 | 150 | 160 | 175 |
| Pb | <10 | 155 | 15 | <10 | <10 | <10 | <10 | 15 | 30 | 25 |
| Sc | 35 | 45 | 45 | 25 | 45 | 40 | 40 | 40 | 35 | 40 |
| Sn | <3 | 20 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| Sr | 90 | 70 | 120 | 120 | 90 | 140 | 90 | 90 | 130 | 90 |
| V | 300 | 400 | 450 | 150 | 350 | 300 | 350 | 350 | 300 | 500 |
| Y | 30 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 10 | 10 |
| Zn | 100 | 95 | 95 | 110 | 95 | 90 | 80 | 100 | 80 | 95 |
| Zr | 50 | 50 | 50 | 30 | 40 | 40 | 50 | 50 | 30 | 40 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 76-2681 | 76-2682 | 76-2683 | 76-2684 | 76-2610 | 76-2611 | 77-2606 | 77-2607 | 77-2608 | 77-2609 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-176 | 76-7(4)-177 | 76-7(4)-178 | 76-7(4)-179 | 76-7(4)-73 | 76-7(4)-74 | 76-7(4)-69 | 76-7(4)-70 | 76-7(4)-71 | 76-7(4)-72 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 40 | 40 | 30 | 280 | 40 | 30 | 40 | 40 | 30 | 50 |
| Co | 50 | 45 | 50 | 55 | 45 | 40 | 45 | 35 | 45 | 50 |
| Cr | 335 | 250 | 230 | 310 | 245 | 250 | 75 | 115 | 330 | 165 |
| Cu | 95 | 95 | 70 | 155 | 145 | 105 | 145 | 10 | 105 | 130 |
| Ga | 15 | 15 | 15 | 15 | 15 | 15 | 20 | 15 | 15 | 15 |
| Li | 7 | 6 | 8 | 15 | 8 | 8 | 9 | 8 | 10 | 6 |
| Ni | 140 | 105 | 115 | 140 | 95 | 95 | 45 | 45 | 125 | 120 |
| Pb | <10 | <10 | <10 | 20 | 45 | 25 | <10 | <10 | 25 | <10 |
| Sc | 40 | 40 | 40 | 40 | 45 | 45 | 90 | 50 | 50 | 45 |
| Sn | <3 | <3 | <3 | <3 | 6 | <3 | <3 | <3 | <3 | <3 |
| Sr | 90 | 140 | 90 | 90 | 80 | 130 | 90 | 140 | 100 | 90 |
| V | 450 | 500 | 400 | 450 | 200 | 250 | 300 | 250 | 200 | 200 |
| Y | 20 | 30 | 20 | 20 | 30 | 30 | 20 | 20 | 20 | 20 |
| Zn | 125 | 105 | 105 | 110 | 105 | 105 | 75 | 50 | 90 | 85 |
| Zr | 50 | 60 | 60 | 60 | 60 | 70 | 30 | 40 | 50 | 50 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2612 | 77-2613 | 77-2614 | 77-2625 | 77-2616 | 77-2626 | 77-2627 | 77-2620 | 77-2621 | 77-2622 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-75 | 76-7(4)-76 | 76-7(4)-77 | 76-7(4)-88 | 76-7(4)-79 | 76-7(4)-89 | 76-7(4)-90 | 76-7(4)-83 | 76-7(4)-84 | 76-7(4)-85 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 40 | 40 | 30 | 60 | 30 | 20 | 30 | 20 | 40 | 30 |
| Co | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 50 | 55 | 55 |
| Cr | 270 | 50 | 270 | 160 | 305 | 275 | 125 | 265 | 250 | 210 |
| Cu | 105 | 145 | 150 | 105 | 130 | 155 | 135 | 160 | 165 | 145 |
| Ga | 10 | 20 | 15 | 15 | 15 | 15 | 9 | 15 | 15 | 15 |
| Li | 6 | 7 | 6 | 10 | 6 | 8 | 9 | 5 | 6 | 10 |
| Ni | 95 | 40 | 140 | 75 | 90 | 115 | 55 | 90 | 75 | 210 |
| Pb | 60 | 15 | 55 | <10 | 10 | <10 | 100 | 30 | <10 | <10 |
| Sc | 50 | 60 | 45 | 40 | 45 | 40 | 50 | 50 | 50 | 35 |
| Sn | 6 | <3 | 8 | <3 | <3 | <3 | 10 | <3 | <3 | <3 |
| Sr | 80 | 50 | 100 | 120 | 140 | 110 | 180 | 110 | 90 | 90 |
| V | 200 | 350 | 250 | 250 | 250 | 250 | 300 | 300 | 300 | 200 |
| Y | 20 | 20 | 20 | 20 | 25 | 20 | 20 | 20 | 20 | 20 |
| Zn | 90 | 125 | 90 | 105 | 30 | 90 | 105 | 115 | 100 | 80 |
| Zr | 50 | 80 | 40 | 60 | 90 | 50 | 50 | 50 | 70 | 40 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2619 | 77-2617 | 77-2618 | 77-2623 | 77-2634 | 77-2598 | 77-2596 | 77-2597 | 77-2595 | 77-2594 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-82 | 76-7(4)-80 | 76-7(4)-81 | 76-7(4)-86 | 76-7(4)-87 | 76-7(4)-35 | 76-7(4)-33 | 76-7(4)-34 | 76-7(4)-32 | 76-7(4)-31 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 20 | 40 | 20 | 20 | 30 | 60 | 60 | 60 | 40 | 30 |
| Co | 45 | 50 | 40 | 45 | 45 | 50 | 50 | 50 | 50 | 45 |
| Cr | 225 | 245 | 100 | 355 | 415 | 390 | 180 | 300 | 330 | 280 |
| Cu | 170 | 140 | 65 | 120 | 160 | 145 | 100 | 135 | 160 | 145 |
| Ga | 15 | 15 | 20 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Li | 8 | 6 | 6 | 6 | 8 | 6 | 6 | 7 | 5 | 10 |
| Ni | 80 | 125 | 55 | 140 | 165 | 160 | 95 | 130 | 110 | 140 |
| Pb | 25 | 15 | <10 | 20 | <10 | 25 | <10 | <10 | <10 | 15 |
| Sc | 45 | 45 | 40 | 45 | 45 | 45 | 45 | 45 | 45 | 40 |
| Sn | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| Sr | 120 | 140 | 190 | 100 | 100 | 140 | 90 | 120 | 120 | 50 |
| V | 300 | 250 | 300 | 200 | 250 | 200 | 250 | 250 | 300 | 250 |
| Y | 20 | 30 | 50 | 20 | 20 | 20 | 30 | 20 | 20 | 20 |
| Zn | 100 | 90 | 135 | 85 | 90 | 90 | 110 | 100 | 100 | 75 |
| Zr | 80 | 90 | 180 | 40 | 40 | 40 | 80 | 50 | 70 | 50 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2593 | 77-2592 | 77-2591 | 77-2590 | 77-2589 | 77-2588 | 77-2587 | 77-2586 | 77-2585 | 77-2581 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-30 | 76-7(4)-29 | 76-7(4)-28 | 76-7(4)-27 | 76-7(4)-26 | 76-7(4)-25 | 76-7(4)-24 | 76-7(4)-23 | 76-7(4)-22 | 76-7(4)-18 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 70 | 30 | 50 | 40 | 40 | 70 | 40 | 60 | 50 | 60 |
| Co | 55 | 45 | 50 | 50 | 55 | 55 | 55 | 55 | 50 | 55 |
| Cr | 310 | 390 | 245 | 990 | 240 | 235 | 235 | 200 | 375 | 265 |
| Cu | 250 | 115 | 145 | 70 | 165 | 185 | 145 | 175 | 145 | 145 |
| Ga | 15 | 15 | 15 | 10 | 15 | 15 | 15 | 15 | 15 | 15 |
| Li | 8 | 10 | 6 | 15 | 15 | 20 | 8 | 8 | 6 | 10 |
| Ni | 225 | 155 | 140 | 375 | 130 | 135 | 155 | 70 | 120 | 170 |
| Pb | 10 | <10 | <10 | <10 | <10 | 10 | 15 | <10 | <10 | 20 |
| Sc | 45 | 45 | 45 | 25 | 40 | 50 | 45 | 50 | 50 | 45 |
| Sn | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| Sr | 90 | 90 | 100 | 80 | 100 | 110 | 90 | 100 | 100 | 90 |
| V | 250 | 250 | 250 | 150 | 200 | 300 | 250 | 300 | 250 | 250 |
| Y | 20 | 20 | 20 | 10 | 10 | 20 | 20 | 20 | 20 | 20 |
| Zn | 95 | 85 | 100 | 80 | 105 | 100 | 100 | 105 | 100 | 95 |
| Zr | 50 | 40 | 40 | 50 | 30 | 60 | 50 | 60 | 40 | 40 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2582 | 77-2580 | 77-2579 | 77-2583 | 77-2578 | 77-2577 | 77-2576 | 77-2575 | 77-2574 | 77-2573 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-19 | 76-7(4)-17 | 76-7(4)-16 | 76-7(4)-20 | 76-7(4)-15 | 76-7(4)-14 | 76-7(4)-13 | 76-7(4)-12 | 76-7(4)-11 | 76-7(4)-10 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 30 | 30 | 30 | 60 | 30 | 30 | 80 | 30 | 60 | 60 |
| Co | 55 | 55 | 50 | 50 | 50 | 55 | 50 | 50 | 50 | 50 |
| Cr | 240 | 350 | 350 | 360 | 290 | 290 | 365 | 290 | 290 | 290 |
| Cu | 155 | 155 | 130 | 135 | 155 | 160 | 175 | 140 | 160 | 155 |
| Ga | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Li | 8 | 7 | 6 | 8 | 6 | 6 | 7 | 6 | 8 | 8 |
| Ni | 150 | 145 | 140 | 105 | 155 | 165 | 130 | 165 | 150 | 155 |
| Pb | 10 | 80 | 180 | 130 | <10 | <10 | 470 | <10 | <10 | 75 |
| Sc | 50 | 45 | 50 | 50 | 50 | 50 | 45 | 50 | 45 | 45 |
| Sn | <3 | 7 | 20 | 15 | <3 | <3 | 60 | <3 | <3 | 10 |
| Sr | 140 | 110 | 100 | 130 | 140 | 180 | 70 | 120 | 150 | 110 |
| V | 250 | 250 | 250 | 250 | 300 | 300 | 250 | 250 | 250 | 250 |
| Y | 20 | 20 | 20 | 10 | 20 | 10 | 5 | 20 | 20 | 10 |
| Zn | 95 | 100 | 100 | 95 | 100 | 100 | 95 | 95 | 95 | 95 |
| Zr | 40 | 40 | 40 | 40 | 40 | 50 | 40 | 40 | 30 | 30 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2572 | 77-2571 | 77-2570 | 77-2569 | 77-2568 | 77-2567 | 77-2566 | 77-2564 | 77-2565 | 77-2599 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-9 | 76-7(4)-8 | 76-7(4)-7 | 76-7(4)-6 | 76-7(4)-5 | 76-7(4)-4 | 76-7(4)-3 | 76-7(4)-1 | 76-7(4)-2 | 76-7(4)-62 |
| | | | | | Trace Elements in parts per million | | | | | |
| Ba | 40 | 280 | 30 | 40 | 30 | 40 | 60 | 40 | 40 | 50 |
| Co | 50 | 50 | 50 | 50 | 50 | 55 | 50 | 55 | 50 | 45 |
| Cr | 290 | 280 | 290 | 285 | 290 | 305 | 300 | 380 | 290 | 250 |
| Cu | 145 | 140 | 150 | 155 | 110 | 110 | 165 | 150 | 135 | 180 |
| Ga | 15 | 15 | 20 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Li | 9 | 20 | 8 | 6 | 7 | 8 | 10 | 6 | 4 | 15 |
| Ni | 155 | 155 | 150 | 150 | 150 | 160 | 160 | 120 | 150 | 110 |
| Pb | 20 | 245 | 20 | 20 | 285 | 15 | 260 | 115 | 25 | 15 |
| Sc | 50 | 45 | 50 | 50 | 50 | 50 | 50 | 45 | 45 | 45 |
| Sn | <3 | 30 | <3 | <3 | 35 | <3 | 30 | 15 | <3 | <3 |
| Sr | 170 | 30 | NA | 110 | 110 | 180 | 110 | 140 | 120 | 40 |
| V | 400 | 500 | 400 | 400 | 450 | 450 | 400 | 300 | 300 | 200 |
| Y | 20 | 10 | NA | 10 | 10 | 20 | 10 | 20 | 20 | 20 |
| Zn | 130 | 95 | 100 | 105 | 95 | 100 | 90 | 95 | 100 | 100 |
| Zr | 50 | 50 | NA | 40 | 40 | 40 | 50 | 40 | 50 | 50 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2600 | 77-2601 | 77-2602 | 77-2603 | 77-2604 | 77-2605 |
|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-63 | 76-7(4)-64 | 76-7(4)-65 | 76-7(4)-66 | 76-7(4)-67 | 76-7(4)-68 |
| | | | Trace Elements in parts per million | | | |
| Ba | 50 | 30 | 30 | 30 | 20 | 30 |
| Co | 50 | 40 | 50 | 45 | 50 | 50 |
| Cr | 355 | 170 | 370 | 355 | 290 | 300 |
| Cu | 160 | 165 | 165 | 140 | 135 | 155 |
| Ga | 15 | 15 | 15 | 20 | 15 | 15 |
| Li | 7 | 6 | 6 | 10 | 15 | 8 |
| Ni | 140 | 65 | 125 | 125 | 165 | 165 |
| Pb | 15 | <10 | 15 | 10 | <10 | <10 |
| Sc | 50 | 50 | 45 | 50 | 45 | 50 |
| Sn | <3 | <3 | <3 | <3 | <3 | <3 |
| Sr | 110 | 100 | 200 | 130 | 160 | 130 |
| V | 200 | 250 | 200 | 200 | 200 | 250 |
| Y | 20 | 20 | 20 | 20 | 20 | 30 |
| Zn | 100 | 110 | 90 | 90 | 90 | 95 |
| Zr | 50 | 60 | 40 | 40 | 50 | 50 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2605 | 77-2604 | 77-2603 | 77-2602 | 77-2601 | 77-2600 |
|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-68 | 76-7(4)-67 | 76-7(4)-66 | 76-7(4)-65 | 76-7(4)-64 | 76-7(4)-63 |
| | | | Normative Mineralogy in Molecular Weight | | | |
| Apatite | 0.14 | 0.16 | 0.13 | 0.14 | 0.17 | 0.13 |
| Pyrrhotite | 0.08 | 0.04 | 0.04 | 0.64 | 0.33 | 0.81 |
| Ilmenite | 1.37 | 1.35 | 1.23 | 1.31 | 1.60 | 1.27 |
| Orthoclase | 0.07 | 0.07 | 0.06 | 0.06 | 0.06 | 0.06 |
| Albite | 1.59 | 0.09 | 0.09 | 5.00 | 20.48 | 10.82 |
| Anorthite | 45.39 | 45.49 | 29.83 | 39.44 | 27.74 | 36.96 |
| Corundum | 0.00 | 0.00 | 4.10 | 0.00 | 0.00 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 2.77 | 2.76 | 2.59 | 2.69 | 2.84 | 2.61 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 11.51 | 12.84 | 20.19 | 16.28 | 15.84 | 17.81 |
| Ferrosilite | 11.63 | 9.75 | 13.30 | 10.16 | 10.77 | 10.44 |
| Quartz | 14.67 | 13.56 | 17.47 | 8.24 | 2.82 | 2.64 |
| Diopside | 5.36 | 7.44 | 0.00 | 9.86 | 10.32 | 10.37 |
| Forsterite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fayalite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 5.42 | 5.65 | 0.00 | 6.16 | 7.01 | 6.08 |
| Calcite | 0.00 | 0.00 | 10.96 | 0.00 | 0.00 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2609 | 77-2608 | 77-2607 | 77-2606 | 77-2611 | 77-2610 | 77-2684 | 77-2683 | 77-2682 | 77-2681 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-72 | 76-7(4)-71 | 76-7(4)-70 | 76-7(4)-69 | 76-7(4)-74 | 76-7(4)-73 | 76-7(4)-179 | 76-7(4)-178 | 76-7(4)-177 | 76-7(4)-176 |
| | | | | Normative Mineralogy in Molecular Weight | | | | | | |
| Apatite | 0.13 | 0.15 | 0.11 | 0.11 | 0.17 | 0.18 | 0.19 | 0.19 | 0.17 | 0.15 |
| Pyrrhotite | 0.04 | 0.07 | 0.04 | 0.07 | 0.07 | 0.29 | 0.11 | 0.04 | 0.07 | 0.21 |
| Ilmenite | 1.12 | 1.41 | 1.52 | 1.29 | 1.58 | 1.53 | 1.51 | 1.73 | 1.50 | 1.40 |
| Orthoclase | 0.62 | 0.12 | 0.38 | 0.38 | 0.49 | 0.62 | 4.03 | 0.73 | 0.91 | 0.30 |
| Albite | 18.41 | 19.27 | 28.26 | 15.45 | 18.99 | 16.98 | 20.97 | 19.13 | 27.32 | 19.47 |
| Anorthite | 30.68 | 33.23 | 26.58 | 31.25 | 32.98 | 33.80 | 20.31 | 32.58 | 27.52 | 31.99 |
| Corundum | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.28 | 0.00 | 0.00 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 2.47 | 2.71 | 2.80 | 2.65 | 2.82 | 2.79 | 1.31 | 2.68 | 2.74 | 2.65 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 17.55 | 12.38 | 6.99 | 11.76 | 15.58 | 14.25 | 10.61 | 19.58 | 0.00 | 14.31 |
| Ferrosilite | 10.41 | 7.65 | 4.40 | 6.70 | 9.76 | 9.58 | 12.80 | 11.89 | 0.00 | 7.80 |
| Quartz | 0.00 | 0.00 | 0.00 | 6.94 | 0.56 | 0.00 | 8.91 | 0.75 | 0.00 | 0.00 |
| Diopside | 10.89 | 10.25 | 15.25 | 14.91 | 10.45 | 11.09 | 0.00 | 6.67 | 14.95 | 10.53 |
| Forsterite | 0.77 | 3.97 | 2.49 | 0.00 | 0.00 | 0.86 | 0.00 | 0.00 | 7.63 | 3.53 |
| Fayalite | 0.46 | 2.46 | 1.57 | 0.00 | 0.00 | 0.58 | 0.00 | 0.00 | 5.28 | 1.93 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.55 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 6.46 | 6.34 | 9.61 | 8.49 | 6.55 | 7.46 | 0.00 | 4.05 | 10.35 | 5.74 |
| Calcite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.96 | 0.00 | 0.00 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2581 | 77-2585 | 77-2586 | 77-2587 | 77-2588 | 77-2589 | 77-2590 | 77-2591 | 77-2592 | 77-2593 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-18 | 76-7(4)-22 | 76-7(4)-23 | 76-7(4)-24 | 76-7(4)-25 | 76-7(4)-26 | 76-7(4)-27 | 76-7(4)-28 | 76-7(4)-29 | 76-7(4)-30 |
| | | | | | Normative Mineralogy in Molecular Weight | | | | | |
| Apatite | 0.16 | 0.15 | 0.17 | 0.09 | 0.18 | 0.14 | 0.11 | 0.15 | 0.11 | 0.13 |
| Pyrrhotite | 0.04 | 0.36 | 0.94 | 0.29 | 0.15 | 0.15 | 0.07 | 0.29 | 0.04 | 0.33 |
| Ilmenite | 1.36 | 1.28 | 1.57 | 1.21 | 1.21 | 1.31 | 0.84 | 1.30 | 1.25 | 1.27 |
| Orthoclase | 0.06 | 0.06 | 0.19 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.25 |
| Albite | 13.96 | 16.82 | 19.53 | 15.41 | 12.20 | 2.06 | 10.68 | 21.98 | 15.28 | 13.93 |
| Anorthite | 36.61 | 32.95 | 28.64 | 34.54 | 36.50 | 41.65 | 31.33 | 30.67 | 34.67 | 35.26 |
| Corundum | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 2.69 | 2.61 | 2.82 | 2.55 | 2.58 | 2.69 | 2.28 | 2.63 | 2.37 | 2.60 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 25.05 | 14.97 | 15.04 | 16.22 | 16.58 | 15.74 | 28.01 | 14.27 | 20.03 | 19.47 |
| Ferrosilite | 12.99 | 9.37 | 9.58 | 10.00 | 10.56 | 10.91 | 8.45 | 10.15 | 9.32 | 10.39 |
| Quartz | 2.01 | 0.66 | 0.99 | 0.41 | 2.08 | 7.44 | 0.00 | 0.00 | 4.51 | 0.01 |
| Diopside | 3.34 | 12.77 | 12.54 | 11.89 | 10.94 | 10.54 | 8.07 | 9.83 | 8.43 | 10.67 |
| Forsterite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.88 | 0.97 | 0.00 | 0.00 |
| Fayalite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.77 | 0.69 | 0.00 | 0.00 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 1.73 | 7.99 | 7.99 | 7.33 | 6.97 | 7.31 | 2.43 | 6.99 | 3.93 | 5.70 |
| Calcite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2594 | 77-2595 | 77-2597 | 77-2596 | 77-2598 | 77-2624 | 77-2623 | 77-2618 | 77-2617 | 77-2619 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-31 | 76-7(4)-32 | 76-7(4)-34 | 76-7(4)-33 | 76-7(4)-35 | 76-7(4)-87 | 76-7(4)-86 | 76-7(4)-81 | 76-7(4)-80 | 76-7(4)-82 |
| | | | | Normative Mineralogy in Molecular Weight | | | | | | |
| Apatite | 0.11 | 0.15 | 0.15 | 0.17 | 0.13 | 0.13 | 0.11 | 0.42 | 0.15 | 0.19 |
| Pyrrhotite | 0.04 | 0.51 | 0.18 | 0.29 | 0.11 | 0.55 | 0.11 | 0.67 | 0.65 | 0.19 |
| Ilmenite | 1.15 | 1.41 | 1.33 | 1.68 | 1.16 | 1.23 | 1.10 | 2.94 | 1.30 | 1.47 |
| Orthoclase | 0.06 | 0.06 | 0.06 | 0.12 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 |
| Albite | 18.44 | 15.59 | 11.38 | 34.33 | 21.07 | 18.57 | 14.07 | 14.23 | 19.70 | 13.57 |
| Anorthite | 15.66 | 35.39 | 36.83 | 26.05 | 32.37 | 35.32 | 34.69 | 32.81 | 32.07 | 37.20 |
| Corundum | 6.54 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 2.34 | 2.71 | 2.63 | 2.90 | 2.50 | 2.57 | 2.45 | 3.87 | 2.61 | 2.85 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 23.59 | 14.03 | 17.00 | 8.98 | 12.11 | 18.46 | 16.34 | 11.14 | 16.22 | 16.37 |
| Ferrosilite | 11.56 | 9.23 | 8.80 | 6.76 | 5.92 | 10.99 | 8.59 | 9.88 | 9.61 | 13.00 |
| Quartz | 9.24 | 0.71 | 1.55 | 0.00 | 0.00 | 1.30 | 0.91 | 7.71 | 0.00 | 4.37 |
| Diopside | 0.00 | 12.19 | 13.23 | 6.22 | 11.82 | 6.79 | 14.15 | 8.63 | 10.69 | 5.98 |
| Forsterite | 0.00 | 0.00 | 0.00 | 4.46 | 4.69 | 0.00 | 0.00 | 0.00 | 0.38 | 0.00 |
| Fayalite | 0.00 | 0.00 | 0.00 | 3.36 | 2.29 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 0.00 | 8.02 | 6.85 | 4.68 | 5.78 | 4.04 | 7.44 | 7.65 | 6.33 | 4.74 |
| Calcite | 11.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2573 | 77-2574 | 77-2575 | 77-2576 | 77-2577 | 77-2578 | 77-2583 | 77-2579 | 77-2580 | 77-2582 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-10 | 76-7(4)-11 | 76-7(4)-12 | 76-7(4)-13 | 76-7(4)-14 | 76-7(4)-15 | 76-7(4)-20 | 76-7(4)-16 | 76-7(4)-17 | 76-7(4)-19 |
| | | | | Normative Mineralogy in Molecular Weight | | | | | | |
| Apatite | 0.13 | 0.09 | 0.13 | 0.14 | 0.13 | 0.07 | 0.13 | 0.16 | 0.07 | 0.13 |
| Pyrrhotite | 0.74 | 0.36 | 0.40 | 0.30 | 0.22 | 0.22 | 0.14 | 0.11 | 0.07 | 0.58 |
| Ilmenite | 1.24 | 1.29 | 1.23 | 1.28 | 1.25 | 1.26 | 1.32 | 1.24 | 1.17 | 1.26 |
| Orthoclase | 0.06 | 0.06 | 0.06 | 0.13 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Albite | 7.19 | 16.48 | 10.32 | 10.29 | 9.82 | 9.06 | 15.03 | 7.60 | 9.64 | 19.35 |
| Anorthite | 39.27 | 33.76 | 36.85 | 36.97 | 38.12 | 37.49 | 33.03 | 38.54 | 37.16 | 31.92 |
| Corundum | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 2.60 | 2.61 | 2.58 | 2.64 | 2.58 | 2.59 | 2.63 | 2.59 | 2.53 | 2.57 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 14.66 | 18.61 | 17.78 | 12.12 | 19.03 | 20.48 | 15.94 | 14.75 | 14.79 | 17.49 |
| Ferrosilite | 9.46 | 9.96 | 10.28 | 8.93 | 11.31 | 11.48 | 9.28 | 9.16 | 8.37 | 9.95 |
| Quartz | 6.88 | 0.00 | 2.34 | 5.34 | 2.32 | 4.85 | 2.90 | 3.61 | 1.91 | 0.00 |
| Diopside | 10.79 | 10.53 | 11.42 | 12.60 | 9.50 | 7.97 | 12.36 | 13.68 | 15.47 | 9.44 |
| Forsterite | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.21 |
| Fayalite | 0.00 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.69 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 6.96 | 5.63 | 6.61 | 9.27 | 5.65 | 4.47 | 7.20 | 8.50 | 8.76 | 5.37 |
| Calcite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2680 | 77-2679 | 77-2677 | 77-2678 | 77-2676 | 77-2674 | 77-2673 | 77-2672 | 77-2671 | 77-2670 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-175 | 76-7(4)-174 | 76-7(4)-172 | 76-7(4)-173 | 76-7(4)-171 | 76-7(4)-169 | 76-7(4)-168 | 76-7(4)-167 | 76-7(4)-165 | 76-7(4)-164 |
| | | | | | Normative Mineralogy in Molecular Weight | | | | | |
| Apatite | 0.13 | 0.13 | 0.15 | 0.13 | 0.15 | 0.15 | 0.13 | 0.15 | 0.13 | 0.15 |
| Pyrrhotite | 0.39 | 0.43 | 0.39 | 0.71 | 0.18 | 0.54 | 0.32 | 0.04 | 0.14 | 0.25 |
| Ilmenite | 1.21 | 1.04 | 1.26 | 1.18 | 1.30 | 1.19 | 1.27 | 1.41 | 1.13 | 1.22 |
| Orthoclase | 0.67 | 0.43 | 0.24 | 0.42 | 1.09 | 1.46 | 2.79 | 1.38 | 2.05 | 1.53 |
| Albite | 17.43 | 13.55 | 12.89 | 12.86 | 22.31 | 13.84 | 20.87 | 21.86 | 18.08 | 18.62 |
| Anorthite | 31.38 | 38.13 | 39.07 | 39.70 | 28.77 | 34.15 | 31.48 | 29.92 | 31.85 | 32.72 |
| Corundum | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 2.51 | 2.10 | 2.55 | 1.96 | 2.58 | 2.50 | 2.03 | 2.65 | 1.28 | 2.53 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 14.54 | 14.97 | 18.86 | 17.80 | 8.12 | 12.63 | 0.00 | 10.27 | 14.93 | 14.69 |
| Ferrosilite | 7.12 | 7.85 | 10.99 | 9.45 | 4.87 | 7.56 | 0.00 | 6.63 | 8.71 | 9.28 |
| Quartz | 0.00 | 0.02 | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 |
| Diopside | 10.43 | 14.00 | 8.58 | 9.81 | 15.58 | 14.30 | 13.73 | 12.40 | 11.50 | 11.58 |
| Forsterite | 6.10 | 0.00 | 0.02 | 0.00 | 3.58 | 1.96 | 12.11 | 3.21 | 2.22 | 0.00 |
| Fayalite | 2.99 | 0.00 | 0.01 | 0.00 | 2.15 | 1.17 | 7.09 | 2.07 | 1.30 | 0.00 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 5.11 | 7.35 | 5.00 | 5.21 | 9.33 | 8.56 | 8.04 | 8.01 | 6.71 | 7.32 |
| Calcite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2599 | 77-2565 | 77-2564 | 77-2566 | 77-2567 | 77-2568 | 77-2569 | 77-2570 | 77-2571 | 77-2572 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-62 | 76-7(4)-2 | 76-7(4)-1 | 76-7(4)-3 | 76-7(4)-4 | 76-7(4)-5 | 76-7(4)-6 | 76-7(4)-7 | 76-7(4)-8 | 76-7(4)-9 |
| | | | | | Normative Mineralogy in Molecular Weight | | | | | |
| Apatite | 0.20 | 0.13 | 0.16 | 0.16 | 0.15 | 0.13 | 0.13 | 0.14 | 0.13 | 0.14 |
| Pyrrhotite | 0.04 | 0.15 | 0.42 | 0.15 | 0.07 | 0.11 | 0.19 | 0.07 | 0.07 | 0.26 |
| Ilmenite | 1.46 | 1.23 | 1.26 | 1.31 | 1.31 | 1.25 | 1.21 | 1.30 | 1.25 | 1.28 |
| Orthoclase | 0.19 | 0.06 | 0.06 | 0.52 | 0.86 | 0.06 | 0.06 | 0.06 | 9.19 | 0.57 |
| Albite | 41.64 | 12.21 | 1.37 | 12.56 | 18.25 | 16.48 | 10.00 | 7.39 | 0.09 | 2.71 |
| Anorthite | 26.74 | 35.91 | 41.91 | 38.13 | 31.57 | 33.99 | 36.06 | 39.47 | 8.23 | 41.47 |
| Corundum | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.26 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 1.60 | 2.58 | 2.66 | 2.70 | 2.62 | 2.59 | 2.59 | 2.67 | 1.79 | 2.65 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 7.85 | 16.57 | 15.34 | 10.87 | 20.87 | 16.40 | 14.15 | 17.29 | 20.07 | 18.04 |
| Ferrosilite | 7.72 | 9.84 | 10.12 | 6.95 | 11.36 | 9.57 | 8.84 | 11.69 | 15.14 | 11.99 |
| Quartz | 0.00 | 3.54 | 9.64 | 7.47 | 1.35 | 0.35 | 3.42 | 6.84 | 19.31 | 9.33 |
| Diopside | 1.64 | 11.16 | 10.27 | 11.70 | 7.51 | 12.05 | 14.37 | 7.80 | 0.00 | 6.94 |
| Forsterite | 4.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fayalite | 4.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 1.61 | 6.62 | 6.78 | 7.48 | 4.08 | 7.03 | 8.98 | 5.27 | 0.00 | 4.61 |
| Calcite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.47 | 0.00 |

TABLE 5: (Cont'd)

| Laboratory Sample No. | 77-2622 | 77-2621 | 77-2620 | 77-2627 | 77-2626 | 77-2616 | 77-2625 | 77-2614 | 77-2613 | 77-2612 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Sample No. | 76-7(4)-85 | 76-7(4)-84 | 76-7(4)-83 | 76-7(4)-90 | 76-7(4)-89 | 76-7(4)-79 | 76-7(4)-88 | 76-7(4)-77 | 76-7(4)-76 | 76-7(4)-75 |
| | | | | Normative Mineralogy in Molecular Weight | | | | | | |
| Apatite | 0.16 | 0.18 | 0.18 | 0.18 | 0.13 | 0.18 | 0.20 | 0.15 | 0.20 | 0.11 |
| Pyrrhotite | 0.77 | 0.65 | 0.15 | 0.04 | 0.07 | 0.07 | 0.07 | 0.07 | 0.11 | 0.22 |
| Ilmenite | 1.07 | 1.48 | 1.48 | 1.44 | 1.41 | 1.44 | 1.69 | 1.24 | 1.87 | 1.06 |
| Orthoclase | 0.06 | 0.25 | 0.12 | 0.06 | 0.37 | 0.06 | 1.18 | 0.06 | 0.12 | 0.31 |
| Albite | 15.46 | 15.73 | 16.59 | 6.48 | 21.69 | 14.42 | 19.64 | 12.55 | 32.99 | 11.44 |
| Anorthite | 11.39 | 31.97 | 33.39 | 38.74 | 31.16 | 36.89 | 33.58 | 37.58 | 9.57 | 34.70 |
| Corundum | 7.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.86 | 0.00 |
| Acmite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Magnetite | 1.43 | 2.75 | 2.76 | 2.77 | 2.70 | 2.75 | 2.91 | 2.58 | 1.89 | 2.44 |
| Hematite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wollastonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Enstatite | 25.87 | 16.14 | 10.09 | 15.72 | 13.40 | 16.35 | 17.01 | 15.16 | 13.25 | 17.05 |
| Ferrosilite | 14.16 | 10.71 | 8.03 | 12.76 | 7.02 | 10.05 | 11.46 | 9.28 | 12.58 | 9.98 |
| Quartz | 8.40 | 3.15 | 0.00 | 6.52 | 0.00 | 4.20 | 0.31 | 3.03 | 11.54 | 3.82 |
| Diopside | 0.00 | 10.22 | 12.78 | 8.45 | 10.95 | 8.41 | 7.14 | 11.34 | 0.00 | 11.89 |
| Forsterite | 0.00 | 0.00 | 2.38 | 0.00 | 3.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fayalite | 0.00 | 0.00 | 1.89 | 0.00 | 1.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nepheline | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Leucite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hedenbergite | 0.00 | 6.78 | 10.17 | 6.86 | 5.73 | 5.17 | 4.81 | 6.94 | 0.00 | 6.97 |
| Calcite | 14.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.03 | 0.00 |

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-175 | 77-2680 | Chlorite (5) + Epidote (2) + Hornblende (65) + Magnetite (5) + Plagioclase (10) + Quartz (10) | Porphyritic, Blastic/Ophitic |
| 76-7(4)-174 | 77-2679 | Epidote (5) + Hornblende (60) + Magnetite (10) + Plagioclase (24) + Quartz (1) | Schistose |
| 76-7(4)-172 | 77-2677 | Hornblende (50) + Magnetite (10) + Plagioclase ($AN_{55-35}$) + Quartz (5) | Pilotaxtic, Foliated |
| 76-7(4)-173 | 77-2678 | Hematite (1) + Hornblende (50) + Magnetite (10) + Plagioclase ($AN_{78-40}$) | Schistose |
| 76-7(4)-171 | 77-2676 | * | |
| 76-7(4)-169 | 77-2674 | * | |
| 76-7(4)-168 | 77-2673 | Carbonate (2) + Clinozoisite (2) + Hematite (2) + Hornblende (65) + Potassic Feldspar (<1) + Magnetite (2) + Plagioclase (30) | Schistose |
| 76-7(4)-167 | 77-2672 | Chlorite (1) + Hornblende (50) + Potassic Feldspar (20) + Plagioclase ($AN_{50-27}$) + Sphene (2) | Massive (potassic metasomatism) |
| 76-7(4)-165 | 77-2671 | Epidote (1) + Hematite (1) + Hornblende (65) + Potassic Feldspar (1) + Magnetite (2) + Plagioclase ($AN_{28-30}$) + Quartz (1) | Massive Equigranular (potassic metasomatism) |
| 76-7(4)-164 | 77-2670 | Carbonate (1) + Epidote (1) + Hematite (1) + Hornblende (65) + Magnetite (1) + Plagioclase (30) | Schistose |
| 76-7(4)-72 | 77-2609 | Chlorite (15) + Iron Oxides (6) + Opaques (5) + Quartz (10) + Sphene (4) + Tremolite - Actinolite (35) | Porphyritic (Tremolite Actinolite) |

Notes: * No information available.
++ Total Percent sums to approximately 100.

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-71 | 77-2608 | Carbonate (2) + Clinozoisite (5) + Chlorite (13) + Epidote (13) + Opaques (2) + Plagioclase (20) + Quartz (5) + Tremolite-Actinolite (40) | Equigranular, Massive |
| 76-7(4)-70 | 77-2607 | Carbonate (10) + Chlorite (15) + Epidote (3) + Hornblende (20) + Opaques (1) + Plagioclase (38) + Quartz (15) + Tremolite-Actinolite (1) | Massive, Equigranular |
| 76-7(4)-69 | 77-2606 | Carbonate (1) + Clinozoisite (<1) + Epidote (3) + Hornblende (45) + Plagioclase (38) + Quartz (2) + Sphene (2) | Quench Textures |
| 76-7(4)-74 | 77-2611 | Carbonate (<1) + Chlorite (15) + Clinozoisite (<1) + Hornblende (45) + Magnetite (3) + Plagioclase (10) + Quartz (20) + Sphene (7) | Porphyroblastic (Hornblende) Schistose |
| 76-7(4)-73 | 77-2610 | Chlorite (5) + Cummingtonite (45) + Epidote (2) + Iron Oxides (15) + Opaques (5) + Quartz (18) + Sphene (10) | Porphyroblastic (Cummingtonite), Foliated |
| 76-7(4)-179 | 77-2684 | Carbonate (9) + Chlorite (30) + Clinozoisite (5) + Epidote (1) + Magnetite (5) + Plagioclase (10) + Quartz (40) | Tuffaceous, Foliated |
| 76-7(4)-178 | 77-2683 | Chlorite (30) + Clinozoisite (2) + Epidote (1) + Hematite (5) + Hornblende (25) + Plagioclase (22) + Quartz (15) | Porphyroblastic (Hornblende), Schistose |
| 76-7(4)-177 | 77-2682 | Carbonate (10) + Hornblende (60) + Magnetite (10) + Plagioclase (10) + Quartz (10) | Foliated |
| 76-7(4)-176 | 77-2681 | Carbonate (1) + Chlorite (5) + Clinozoisite (2) + Epidote (2) + Hematite (1) + Hornblende (53) + Magnetite (12) + Plagioclase (25) + Quartz (10) | Porphyroblastic (Hornblende), Schistose |

Notes: ++ Total Percent sums to approximately 100.

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-85 | 77-2622 | Carbonate (30) + Chlorite (35) + Iron Oxides (10) + Quartz (25) | Equigranular |
| 76-7(4)-84 | 77-2621 | Carbonate (4) + Chlorite (25) + Clinozoisite (14) + Epidote (1) + Iron Oxides (4) + Opaques (1) + Plagioclase (10) + Quartz (6) + Sphene (6) + Tremolite-Actinolite (35) | Felted, Foliated |
| 76-7(4)-83 | 77-2620 | Carbonate (7) + Chlorite (5) + Clinozoisite (12) + Epidote (5) + Iron Oxides (13) + Plagioclase (10) + Quartz (5) + Sphene (13) + Tremolite-Actinolite (30) | Schistose |
| 76-7(4)-90 | 77-2627 | Carbonate (20) + Chlorite (15) + Epidote (8) + Iron Oxides (10) + Plagioclase (25) + Sphene (10) + Tremolite-Actinolite (22) | Schistose |
| 76-7(4)-89 | 77-2626 | Carbonate (7) + Chlorite (20) + Hornblende (40) + Iron Oxides (8) + Plagioclase (20) + Sphene (5) | Foliated |
| 76-7(4)-79 | 77-2616 | Carbonate (2) + Chlorite (35) + Clinozoisite (3) + Epidote (15) + Hornblende (7) + Opaques (1) + Quartz (18) + Sericite (2) + Tremolite-Actinolite (15) | Porphyritic or Porphyroblastic (Hornblende), Foliated |
| 76-7(4)-88 | 77-2625 | Carbonate (8) + Chlorite (15) + Epidote (1) + Hornblende (40) + Iron Oxides (5) + Plagioclase (22) + Sphene (10) | Hypidiomorphic Granular, Foliated |
| 76-7(4)-77 | 77-2614 | Carbonate (15) + Chlorite (17) + Clinozoisite (6) + Cummingtonite (38) + Epidote (2) + Iron Oxides (5) + Opaques (2) + Plagioclase (2) + Quartz (4) + Sphene (5) + Zeolite (4) | Equigranular to Porphyroblastic (Cummingtonite), Foliated |

Notes: ++ Total Percent sums to approximately 100.

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-76 | 77-2613 | Carbonate (10) + Chlorite (40) + Plagioclase ($AN_{33-20}$) + Quartz (20) + Sphene (10) | Crystal Tuff |
| 76-7(4)-75 | 77-2612 | Carbonate (20) + Chlorite (25) + Cummingtonite (35) + Iron Oxides (12) + Opaques (1) + Quartz (5) | Felted |
| 76-7(4)-76 | 77-2594 | Carbonate (25) + Chlorite (30) + Epidote (3) + Iron Oxides (20) + Plagioclase (5) + Quartz (10) + Sphene (7) | Schistose |
| 76-7(4)-32 | 77-2595 | * | |
| 76-7(4)-34 | 77-2597 | Clinozoisite (10) + Epidote (8) + Opaques (2) + Plagioclase (10) + Quartz (10) + Tremolite-Actinolite (60) | Schistose |
| 76-7(4)-33 | 77-2596 | Chlorite (10) + Clinozoisite (3) + Epidote (3) + Opaques (1) + Plagioclase (45) + Sphene (8) + Tremolite-Actinolite (30) | Schistose |
| 76-7(4)-35 | 77-2598 | * | |
| 76-7(4)-87 | 77-2624 | Carbonate (10) + Chlorite (5) + Clinozoisite (3) + Iron Oxides (5) + Opaques (4) + Plagioclase (35) + Sphene (5) + Tremolite-Actinolite (35) | Pilotaxitic |
| 76-7(4)-86 | 77-2623 | Carbonate (10) + Clinozoisite (1) + Epidote (3) + Iron Oxides (5) + Opaques (2) + Plagioclase (35) + Quartz (1) + Sphene (2) + Tremolite-Actinolite (40) | Porphyritic (Tremolite-Actinolite) |
| 76-7(4)-81 | 77-2618 | Chlorite (25) + Clinozoisite (15) + Epidote (15) + Opaques (1) + Plagioclase (25) + Quartz (10) + Tremolite-Actinolite (9) | Porphyritic (Plagioclase) |

Notes: ++ Total Percent sums to approximately 100.
* No information available

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-80 | 77-2617 | Carbonate (13) + Clinozoisite (23) + Epidote (2) + Iron Oxides (12) + Opaques (2) + Plagioclase (10) + Quartz (3) + Tremolite -Actinolite (35) | Amygaloidas, Foliated Amygdaloidal |
| 76-7(4)-82 | 77-2619 | Carbonate (14) + Chlorite (50) + Clinozoisite (3) + Epidote (10) + Hematite (1) + Opaques (3) + Quartz (20) | Schistose |
| 76-7(4)-18 | 77-2581 | Carbonate (10) + Chlorite (25) + Clinozoisite (15) + Epidote (5) + Hornblende (20) + Plagioclase (5) + Quartz (15) + Sphene (10) | Porphyritic (Hornblende) |
| 76-7(4)-22 | 77-2585 | Carbonate (5) + Clinozoisite (30) + Epidote (5) + Olivine (3) + Plagioclase + Quartz (3) + Sphene (4) + Tremolite-Actinolite | Porphyroblastic (Tremolite-Actinolite) |
| 76-7(4)-23 | 77-2586 | Chlorite (15) + Cummingtonite (45) + Epidote (5) + Iron Oxides (20) + Opaques (1) + Plagioclase (10) + Quartz (1) + Zoisite (5) | Porphyroblastic (Cummingtonite) |
| 76-7(4)-24 | 77-2587 | Chlorite (50) + Epidote (5) + Plagioclase (40) + Quartz (10) | Schistose |
| 76-7(4)-25 | 77-2588 | Carbonate (5) + Clinozoisite (60) + Epidote (20) + Opaques (1) + Plagioclase (4) + Quartz (10) + Sericite (1) | Schistose |
| 76-7(4)-26 | 77-2589 | Carbonate (12) + Chlorite (40) + Clinozoisite (12) + Epidote (5) + Opaques (18) + Plagioclase (3) + Quartz (5) + Sphene (5) | Pilotaxitic |
| 76-7(4)-27 | 77-2590 | Carbonate (15) + Chlorite (35) + Clinozoisite (23) + Hematite (1) + Iron Oxides (1) + Plagioclase (5) + Quartz (1) + Sphene (3) + Tremolite-Actinolite | Porphyritic (Plagioclase) |

Notes: ++ Total Percent sums to approximately 100.

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-28 | 77-2591 | Carbonate (15) + Chlorite (1) + Clinozoisite (5) + Epidote (2) + Hematite (10) + Iron Oxides (10) + Opaques (1) + Plagioclase (20) + Quartz (1) + Sphene (5) + Tremolite-Actinolite (35) | Ophitic |
| 76-7(4)-29 | 77-2592 | Chlorite (20) + Clinozoisite (30) + Quartz (10) + Sphene (10) + Tremolite-Actinolite (30) | Felted |
| 76-7(4)-30 | 77-2593 | Chlorite (2) + Clinozoisite (8) + Epidote (20) + Hematite (1) + Plagioclase (15) + Quartz (5) + Tremolite-Actinolite | Schistose |
| 76-7(4)-10 | 77-2573 | Carbonate (20) + Epidote (45) + Opaques (5) + Plagioclase (30) + Tremolite-Actinolite (5) | Pilotaxitic |
| 76-7(4)-11 | 77-2574 | Carbonate (5) + Chlorite (2) + Epidote (5) + Opaques (1) + Plagioclase (40) + Quartz (10) + Sphene (5) + Tremolite-Actinolite (30) | Porphyroblastic (Tremolite-Actinolite) |
| 76-7(4)-12 | 77-2575 | Chlorite (30) + Clinozoisite (10) + Epidote (1) + Hornblende (25) + Iron Oxides (2) + Opaques (1) + Plagioclase (20) + Quartz (3) + Sphene (7) | Felted, Quench Textured |
| 76-7(4)-13 | 77-2576 | Carbonate (25) + Chlorite (30) + Clinozoisite (20) + Epidote (2) + Iron Oxides (10) + Magnetite (1) + Quartz (2) + Tremolite-Actinolite (10) | Felted, Masive |
| 76-7(4)-14 | 77-2577 | Carbonate + Clinozoisite (25) + Epidote (28) + Opaques (1) + Quartz (5) + Tremolite-Actinolite (40) | Porphyroblastic (Tremolite-Actinolite), Ophitic |
| 76-7(4)-15 | 77-2578 | Chlorite (20) + Epidote (20) + Plagioclase (25) + Quartz (1) + Sphene (10) + Tremolite-Actinolite (30) | Porphyroblastic (Tremolite-Actinolite), Sheared |

Notes: ++ Total Percent sums to approximately 100.

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-20 | 77-2583 | Chlorite (20) + Cummingtonite (40) + Epidote (4) + Hematite (5) + Opaques (1) + Plagioclase (18) + Quartz (2) + Sphene (10) | Porphyroblastic (Cummingtonite), Ophitic |
| 76-7(4)-16 | 77-2579 | Chlorite (10) + Epidote (7) + Hornblende (3) + Opaques (1) + Plagioclase (15) + Quartz (10) + Sphene (10) + Tremolite-Actinolite (45) | Poikiloblastic (Tremolite-Actinolite), Felted |
| 76-7(4)-17 | 77-2580 | Carbonate (6) + Chlorite (20) + Clinozoisite (25) + Epidote (11) + Iron Oxides (18) + Plagioclase (2) + Quartz (1) + Tremolite-Actinolite (18) | Porphyroblastic (Tremolite-Actinolite), Pilotaxitic |
| 76-7(4)-19 | 77-2582 | Carbonate (6) + Chlorite (42) + Clinozoisite (5) + Epidote (10) + Opaques (1) + Quartz (5) + Tremolite-Actinolite (35) | Schistose |
| 76-7(4)-11 | 77-2574 | Carbonate (5) + Chlorite (2) + Epidote (5) + Opaques (1) + Plagioclase (40) + Quartz (10) + Sphene (5) + Tremolite-Actinolite (30) | Porphyroblastic (Tremolite-Actinolite) |
| 76-7(4)-62 | 77-2599 | * | |
| 76-7(4)-2 | 77-2565 | Carbonate (20) + Chlorite (20) + Epidote (3) + Opaques (12) + Plagioclase (35) + Quartz (10) | Subophitic |
| 76-7(4)-1 | 77-2564 | Chlorite (28) + Clinozoisite (25) + Epidote (20) + Hematite (1) + Magnetite (1) + Quartz (5) + Sphene (7) + Tremolite-Actinolite (15) | Pilotaxitic |
| 76-7(4)-3 | 77-2566 | * | |

Notes: ++ Total Percent sums to approximately 100.
* No information available

TABLE 5: (Cont'd)

| Field Sample No. | Laboratory Sample No. | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-4 | 77-2567 | Clinozoisite (80) + Epidote (10) + Quartz (10) | Schistose |
| 76-7(4)-5 | 77-2568 | * | |
| 76-7(4)-6 | 77-2569 | Carbonate (5) + Chlorite (15) + Epidote (60) + Opaques (10) + Quartz (10) | Felted |
| 76-7(4)-7 | 77-2570 | * | |
| 76-7(4)-8 | 77-2571 | Carbonate (25) + Chlorite (25) + Epidote (45) + Opaques (1) + Plagioclase (5) | Pilotaxitic |
| 76-7(4)-9 | 77-2572 | Carbonate (30) + Chlorite (10) + Epidote (35) + Opaques (15) + Quartz (10) | Pilotaxitic |
| 76-7(4)-108 | 77-2605 | Carbonate (15) + Epidote (10) + Iron Oxides (45) + Quartz (20) | Schistose |
| 76-7(4)-67 | 77-2604 | Carbonate (25) + Chlorite (30) + Clinozoisite (2) + Epidote (10) + Iron Oxides (15) + Opaques (1) + Quartz (15) + Sphene (3) | Schistose |
| 76-7(4)-66 | 77-2603 | Carbonate (20) + Chlorite (30) + Epidote (15) + Iron Oxides (10) + Quartz (20) + Sphene (5) | Felted, Amygdaloidal |
| 76-7(4)-65 | 77-2602 | Carbonate (15) + Chlorite (40) + Clinozoisite (21) + Epidote (10) + Magnetite (2) + Quartz (3) + Sphene (10) | Felted |
| 76-7(4)-64 | 77-2601 | * | |
| 76-7(4)-63 | 77-2600 | Carbonate (5) + Chlorite (10) + Epidote (5) + Iron Oxides (20) + Opaques (1) + Plagioclase (15) + Quartz (9) + Tremolite-Actinolite (35) | Ophitic, Porphyritic (Plagioclase) |

Notes: ++ Total Percent sums to approximately 100.
* No information available

Table 6: Chemical analyses of the Jutten Volcanics, Armit Lake Section, Savant Lake area.

| Laboratory Sample Number | 77-2640 | 77-2641 | 77-2644 | 77-2645 | 77-2646 | 77-2648 | 77-2649 | 77-2651 |
|---|---|---|---|---|---|---|---|---|
| Field Sample Number | 76-7(4)-122 | 76-7(4)-123 | 76-7(4)-126 | 76-7(4)-127 | 76-7(4)-128 | 76-7(4)-130 | 76-7(4)-131 | 76-(4)-134 |
| | | | | Major elements in weight percent | | | | |
| $SiO_2$ | 48.80 | 48.70 | 49.10 | 47.70 | 48.20 | 48.90 | 47.70 | 49.10 |
| $Al_2O_3$ | 15.20 | 15.20 | 14.40 | 14.70 | 13.70 | 15.20 | 10.80 | 14.80 |
| $Fe_2O_3$ | 2.76 | 2.26 | 1.90 | 1.82 | 2.46 | 2.62 | 1.65 | 2.58 |
| FeO | 9.58 | 9.59 | 10.90 | 11.60 | 13.90 | 9.98 | 10.40 | 10.10 |
| MgO | 7.55 | 8.10 | 7.43 | 7.44 | 5.89 | 7.78 | 15.70 | 7.29 |
| CaO | 11.40 | 11.60 | 11.40 | 11.00 | 10.20 | 11.00 | 8.48 | 11.10 |
| $Na_2O$ | 1.83 | 1.91 | 1.90 | 2.70 | 2.94 | 1.49 | 0.53 | 1.62 |
| $K_2O$ | 0.28 | 0.14 | 0.20 | 0.14 | 0.25 | 0.45 | 0.28 | 0.22 |
| $TiO_2$ | 0.88 | 0.82 | 0.99 | 0.90 | 1.66 | 0.87 | 0.60 | 0.84 |
| $P_2O_5$ | 0.07 | 0.05 | 0.08 | 0.07 | 0.13 | 0.07 | 0.05 | 0.06 |
| S | 0.02 | 0.05 | 0.15 | 0.14 | 0.18 | 0.11 | < 0.01 | 0.22 |
| MnO | 0.21 | 0.20 | 0.23 | 0.23 | 0.24 | 0.21 | 0.20 | 0.21 |
| $CO_2$ | 0.03 | < 0.01 | 0.11 | 0.05 | 0.03 | 0.04 | 0.06 | 0.14 |
| $H_2O+$ | 0.47 | 0.30 | 0.47 | 0.43 | 0.31 | 0.56 | 1.95 | 0.54 |
| $H_2O-$ | 0.22 | 0.23 | 0.20 | 0.20 | 0.24 | 0.29 | 0.36 | 0.34 |
| TOTAL | 99.30 | 99.10 | 99.50 | 99.10 | 100.30 | 99.60 | 98.80 | 99.20 |
| Specific Gravity | 3.02 | 3.03 | 3.04 | 3.06 | 3.10 | 3.03 | 3.04 | 3.03 |

Notes:
< Less than

Table 6:

| Laboratory Sample Number | 77-2640 | 77-2641 | 77-2644 | 77-2645 | 77-2646 | 77-2648 | 77-2649 | 77-2651 |
|---|---|---|---|---|---|---|---|---|
| Field Sample Number | 76-7(4)-122 | 76-7(4)-123 | 76-7(4)-126 | 76-7(4)-127 | 76-7(4)-128 | 76-7(4)-130 | 76-7(4)-131 | 76-(4)-134 |
| | Trace elements in parts per million | | | | | | | |
| Ba | 60 | 30 | 50 | 50 | 80 | 80 | 50 | 40 |
| Co | 45 | 50 | 45 | 55 | 50 | 50 | 70 | 50 |
| Cr | 245 | 305 | 330 | 195 | 155 | 225 | 1040 | 260 |
| Cu | 60 | 145 | 140 | 155 | 105 | 165 | 160 | 205 |
| Ga | 15 | 10 | 10 | 10 | 15 | 10 | 10 | 15 |
| Li | 12 | 7 | 4 | 20 | 10 | 20 | 35 | 20 |
| Ni | 90 | 155 | 110 | 115 | 75 | 135 | 350 | 110 |
| Pb | < 10 | < 10 | 10 | <10 | <10 | 11 | <10 | <10 |
| Sc | 45 | 45 | 45 | 45 | 40 | 45 | 35 | 45 |
| Sn | < 3 | < 3 | < 3 | < 3 | < 3 | < 3 | < 3 | < 3 |
| V | 200 | 300 | 300 | 200 | 350 | 300 | 200 | 300 |
| Zn | 105 | 100 | 105 | 105 | 130 | 105 | 90 | 90 |

< Less than

Table 6:

| Field Sample Number | Laboratory Sample Number | Apatite | Pyrrhotite | Ilmenite | Orthoclase | Albite | Anorthite | Corundum | Acmite | Magnetite | Hematite | Wollastonite | Enstatite | Ferrosilite | Quartz | Diopside | Forsterite | Fayalite | Nepheline | Leucite | Hedenbergite | Calcite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 76-7(4)-122 | 77-2640 | 0.15 | 0.07 | 1.26 | 1.70 | 16.88 | 33.33 | 0.00 | 0.00 | 2.56 | 0.00 | 0.00 | 14.97 | 9.16 | 0.00 | 12.07 | 0.30 | 0.19 | 0.00 | 0.00 | 7.38 | 0.00 |
| 76-7(4)-123 | 77-2641 | 0.11 | 0.18 | 1.17 | 0.85 | 17.53 | 33.22 | 0.00 | 0.00 | 2.42 | 0.00 | 0.00 | 13.85 | 7.59 | 0.00 | 13.06 | 1.86 | 1.02 | 0.00 | 0.00 | 7.16 | 0.00 |
| 76-7(4)-126 | 77-2644 | 0.17 | 0.54 | 1.42 | 1.22 | 17.52 | 30.99 | 0.00 | 0.00 | 2.04 | 0.00 | 0.00 | 14.75 | 10.09 | 0.02 | 12.62 | 0.00 | 0.00 | 0.00 | 0.00 | 8.63 | 0.00 |
| 76-7(4)-127 | 77-2645 | 0.15 | 0.50 | 1.28 | 0.85 | 24.79 | 28.21 | 0.00 | 0.00 | 1.95 | 0.00 | 0.00 | 2.76 | 2.06 | 0.00 | 12.44 | 9.02 | 6.73 | 0.00 | 0.00 | 9.28 | 0.00 |
| 76-7(4)-128 | 77-2646 | 0.28 | 0.64 | 2.37 | 1.51 | 27.03 | 24.01 | 0.00 | 0.00 | 2.63 | 0.00 | 0.00 | 4.50 | 4.78 | 0.00 | 10.45 | 5.19 | 5.51 | 0.00 | 0.00 | 11.10 | 0.00 |
| 76-7(4)-130 | 77-2648 | 0.15 | 0.39 | 1.24 | 2.74 | 13.75 | 34.39 | 0.00 | 0.00 | 2.55 | 0.00 | 0.00 | 16.76 | 10.06 | 0.99 | 10.61 | 0.00 | 0.00 | 0.00 | 0.00 | 6.37 | 0.00 |
| 76-7(4)-131 | 77-2649 | 0.11 | 0.04 | 0.86 | 1.70 | 4.90 | 27.03 | 0.00 | 0.00 | 1.77 | 0.00 | 0.00 | 33.19 | 11.03 | 0.00 | 9.57 | 4.97 | 1.65 | 0.0 | 0.00 | 3.18 | 0.00 |
| 76-7(4)-134 | 77-2651 | 0.13 | 0.79 | 1.21 | 1.35 | 15.04 | 33.59 | 0.00 | 0.00 | 2.53 | 0.00 | 0.00 | 15.19 | 9.62 | 2.17 | 11.36 | 0.00 | 0.00 | 0.00 | 0.00 | 7.13 | 0.00 |

Table 6:

| Field Sample Number | Laboratory Sample Number | Thin Section Mineralogy (Estimated percent)[h] | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-122 | 77-2640* | | |
| 76-7(4)-123 | 77-2641 | Hornblende (50) + opaques (1) + plagioclase (48) + quartz (2) | Porphyroblastic (Hornblende) massive |
| 76-7(4)-126 | 77-2644 | Biotite (1) + clinozoisite (2) + epidote (2) + hornblende (35) + opaques (3) + plagioclase (55) + quartz (1) + sericite (1) | Porphyroblastic (Hornblende, Biotite) |
| 76-7(4)-127 | 77-2645 | Chlorite (15) + hornblende (35) + plagioclase(47) + sericite (3) | Porphyroblastic (Hornblende) foliated |
| 76-7(4)-128 | 77-2646* | | |
| 76-7(4)-130 | 77-2648 | Carbonate(1) + epidote(1) + hornblende(45) + opaques(2) + plagioclase(40) + quartz (13) | Elongate-granoblastic, foliated |
| 76-7(4)-131 | 77-2649 | Chlorite(52) + hornblende(43) + opaques(2) + plagioclase(53) | Porphyroblastic, foliated |
| 76-7()-134 | 77-2651 | Clinozoisite(1) + hornblende(50) + opaques(2) + plagioclase(43) + quartz(3) + sericite(1) | Poikiloblastic (hornblende) to granoblastic massive |

Notes:

* No information available
[h] Total sums approximately to 100

Table 7: Chemical analyses of rocks of the Jutten Volcanics, Neverfreeze Lake Section, Savant Lake Area.

| Laboratory Sample Number | 77-2636 | 77-2637 | 77-2638 | 77-2639 |
|---|---|---|---|---|
| Field Sample Number | 76-7(4)-110 | 76-7(4)-111 | 76-7(4)-112 | 76-7(4)-115 |
| | Major elements in weight percent | | | |
| $SiO_2$ | 48.70 | 48.50 | 46.50 | 51.20 |
| $Al_2O_3$ | 18.30 | 15.30 | 14.00 | 18.90 |
| $Fe_2O_3$ | 1.28 | 1.51 | 2.30 | 2.25 |
| FeO | 9.02 | 10.80 | 11.80 | 7.25 |
| MgO | 8.07 | 7.22 | 11.40 | 3.90 |
| CaO | 11.00 | 12.60 | 8.85 | 6.59 |
| $Na_2O$ | 2.11 | 1.02 | 1.64 | 4.51 |
| $K_2O$ | 0.07 | 0.08 | 0.40 | 2.56 |
| $TiO_2$ | 0.80 | 0.89 | 0.99 | 0.98 |
| $P_2O_5$ | 0.06 | 0.06 | 0.06 | 0.39 |
| S | 0.03 | 0.08 | 0.30 | <0.01 |
| MnO | 0.17 | 0.22 | 0.22 | 0.13 |
| $CO_2$ | 0.14 | 0.11 | 0.03 | 0.04 |
| $H_2O^+$ | 0.30 | 0.05 | 0.30 | 0.39 |
| $H_2O^-$ | 0.40 | 0.43 | 0.33 | 0.26 |
| Total | 100.40 | 98.90 | 99.10 | 99.40 |
| Specific Gravity | 3.03 | 3.04 | 3.18 | 2.84 |

Notes:
< Less than

Table 7:

| Laboratory Sample Number | 77-2636 | 77-2637 | 77-2638 | 77-2639 |
|---|---|---|---|---|
| Field Sample Number | 76-7(4)-110 | 76-7(4)-111 | 76-7(4)-112 | 76-7(4)-115 |
| | Trace elements in parts per million | | | |
| Ba | 60 | 40 | 90 | 560 |
| Co | 50 | 45 | 75 | 30 |
| Cr | 480 | 360 | 960 | 110 |
| Cu | 50 | 130 | 310 | 70 |
| Ga | 15 | 15 | 15 | 15 |
| Li | 10 | 10 | 15 | 20 |
| Ni | 215 | 135 | 500 | 65 |
| Pb | 10 | 15 | <10 | 15 |
| Sc | 60 | 50 | 35 | 20 |
| Sn | <3 | <3 | <3 | <3 |
| V | 250 | 200 | 200 | 150 |
| Zr | 115 | 100 | 105 | 105 |

Notes:
< Less than

Table 7: Normative Mineralogy in Molecular Percent

| Field Sample Number | Laboratory Sample Number | Normative Mineralogy in Molecular Percent | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Apatite | Pyrrhotite | Ilmenite | Orthoclase | Albite | Anorthite | Corundum | Acmite | Magnetite | Hematite | Wollastonite | Enstatite | Ferrosilite | Quartz | Diopside | Forsterite | Fayalite | Nepheline | Leucite | Hedenbergite | Calcite |
| 76-7(4)-110 | 77-2636 | 0.13 | 0.10 | 1.12 | 0.42 | 19.00 | 40.40 | 0.00 | 0.00 | 1.34 | 0.00 | 0.00 | 11.97 | 6.52 | 0.00 | 7.24 | 5.08 | 2.76 | 0.00 | 0.00 | 3.94 | 0.00 |
| 76-7(4)-111 | 77-2637 | 0.13 | 0.29 | 1.29 | 0.49 | 9.50 | 38.32 | 0.00 | 0.00 | 1.64 | 0.00 | 0.00 | 14.63 | 10.64 | 2.19 | 12.10 | 0.00 | 0.00 | 0.00 | 0.00 | 8.80 | 0.00 |
| 76-7(4)-112 | 77-2638 | 0.13 | 1.06 | 1.40 | 2.40 | 14.95 | 30.13 | 0.00 | 0.00 | 2.44 | 0.00 | 0.00 | 14.63 | 6.79 | 0.0 | 7.69 | 10.12 | 4.69 | 0.00 | 0.00 | 3.57 | 0.00 |
| 76-7(4)-115 | 77-2639 | 0.82 | 0.04 | 1.37 | 15.21 | 35.24 | 23.91 | 0.00 | 0.00 | 2.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.87 | 7.05 | 5.54 | 3.30 | 0.00 | 2.26 | 0.00 |

Table 7:

| Field Sample Number | Laboratory Sample Number | Number Thin Section Mineralogy (Estimated Percent)[h] | Texture (Thin Section) |
|---|---|---|---|
| 76-7(4)-110 | 77-2636 | Biotite(10) + hornblende(10) + opaques(2) + plagioclase(55) + quartz(3) + tremolite-actinolite(20) | Equigranular, massive |
| 76-7(4)-111 | 77-2637* | | |
| 76-7(4)-112 | 77-2638 | Biotite(10) + hornblende(40) + opaques(5) + plagioclase(45) | Porphyroblastic (Hornblende, biotitte) Massive |
| 76-7(4)-113 | 77-2639 | Biotite(25) + clinozoisite(2) + epidote(2) + hornblende(15) + plagioclase(15) + quartz(23) | Poikiloblastic (Plagioclase) massive |

Notes: * No information available
[h] Total sums approximately to 100

Table 8: Chemical analyses of rocks of the Jutten Volcanics, Boucher Township Section, Savant Lake Area.

| Field Sample Number | 6T-44 | 6T-43 | 6T-42 | 6T-41 | 6T-40 | 6T-39 | 6T-38 | 6T-37 | 6T-36 | 6T-33 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | | | |
| $SiO_2$ | 50.40 | 56.90 | 56.10 | 55.80 | 49.50 | 49.40 | 47.10 | 49.00 | 50.00 | 49.70 |
| $Al_2O_3$ | 14.80 | 13.50 | 12.50 | 14.20 | 15.20 | 15.40 | 16.20 | 15.40 | 15.80 | 15.80 |
| $Fe_2O_3$ | 2.00 | 1.53 | 2.16 | 1.63 | 2.20 | 1.80 | 1.30 | 1.80 | 2.20 | 1.50 |
| FeO | 9.73 | 8.61 | 8.05 | 6.36 | 9.58 | 9.16 | 10.70 | 9.10 | 9.23 | 9.88 |
| MgO | 6.55 | 5.32 | 3.26 | 7.52 | 8.06 | 7.81 | 7.65 | 7.62 | 6.64 | 8.13 |
| CaO | 11.90 | 9.02 | 9.74 | 9.57 | 11.30 | 12.60 | 13.10 | 12.90 | 11.40 | 9.81 |
| $Na_2O$ | 1.51 | 2.54 | 4.07 | 3.59 | 1.96 | 1.53 | 1.31 | 1.50 | 1.50 | 2.82 |
| $K_2O$ | 0.17 | 0.19 | 0.38 | 0.09 | 0.17 | 0.41 | 0.23 | 0.17 | 0.80 | 0.16 |
| $TiO_2$ | 0.89 | 1.31 | 1.91 | 0.77 | 0.83 | 0.79 | 0.89 | 0.85 | 0.88 | 0.94 |
| $P_2O_5$ | 0.09 | 0.14 | 0.19 | 0.25 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| S | 0.12 | < 0.01 | 0.02 | 0.01 | 0.01 | 0.08 | 0.17 | 0.07 | 0.31 | 0.10 |
| MnO | 0.21 | 0.19 | 0.19 | 0.18 | 0.23 | 0.18 | 0.21 | 0.18 | 0.20 | 0.17 |
| $CO_2$ | 0.11 | 0.07 | 1.50 | 0.07 | 0.07 | 0.10 | 0.10 | 0.07 | 0.09 | 0.06 |
| $H_2O+$ | 0.52 | 0.43 | 0.32 | 0.44 | 0.73 | 0.71 | 0.86 | 0.37 | 1.14 | 0.56 |
| $H_2O-$ | 0.36 | 0.37 | 0.40 | 0.31 | 0.29 | 0.28 | 0.24 | 0.25 | 0.22 | 0.28 |
| TOTAL | 99.40 | 100.10 | 100.80 | 100.80 | 100.20 | 100.30 | 100.20 | 99.40 | 100.60 | 100.00 |

Notes:
< Less than

Table 8:

| Field Sample Number | 6T-44 | 6T-43 | 6T-42 | 6T-41 | 6T-40 | 6T-39 | 6T-38 | 6T-37 | 6T-36 | 6T-33 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Trace elements in parts per million | | | | | | | | | |
| Ba | 60 | 50 | 90 | 110 | 60 | 80 | 40 | 50 | 90 | 40 |
| Co | 50 | 40 | 35 | 30 | 45 | 50 | 50 | 55 | 55 | 50 |
| Cr | 240 | 90 | 90 | 330 | 180 | 375 | 310 | 315 | 310 | 340 |
| Cu | 260 | 25 | 20 | 5 | 80 | 100 | 205 | 370 | 220 | 110 |
| Ga | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Li | 10 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 10 | 10 |
| Ni | 130 | 60 | 45 | 105 | 130 | 145 | 150 | 155 | 165 | 135 |
| Pb | <10 | 10 | 10 | 10 | 10 | 20 | 30 | 10 | 50 | 10 |
| Sc | 50 | 50 | 40 | 30 | 50 | 45 | 45 | 45 | 40 | 50 |
| Sn | <3 | <3 | <3 | <3 | <3 | 4 | 4 | <3 | 10 | <3 |
| V | 400 | 450 | 400 | 150 | 350 | 300 | 350 | 350 | 300 | 400 |
| Zn | 95 | 110 | 110 | 115 | 110 | 110 | 120 | 90 | 90 | 95 |

Notes:
< Less than

Table 8: Normative Mineralogy in Molecular Percent

Normative Mineralogy in Molecular Weight

| Field Sample Number | Apatite | Pyrrhotite | Ilmenite | Orthoclase | Albite | Anorthite | Corundum | Acmite | Magnetite | Hematite | Wollastonite | Enstatite | Ferrosilite | Quartz | Diopside | Forsterite | Fayalite | Nepheline | Leucite | Hedenbergite | Calcite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6T-44 | 0.20 | 0.43 | 1.28 | 1.04 | 14.04 | 34.28 | 0.00 | 0.00 | 2.17 | 0.00 | 0.00 | 12.48 | 8.53 | 4.57 | 12.47 | 0.00 | 0.00 | 0.00 | 0.00 | 8.52 | 0.00 |
| 6T-43 | 0.30 | 0.04 | 1.87 | 1.15 | 23.40 | 25.53 | 0.00 | 0.00 | 1.64 | 0.00 | 0.00 | 10.57 | 7.71 | 12.21 | 9.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.57 | 0.00 |
| 6T-42 | 0.41 | 0.07 | 2.75 | 2.32 | 37.70 | 15.19 | 0.00 | 0.00 | 2.33 | 0.00 | 0.00 | 2.43 | 2.30 | 7.60 | 13.71 | 0.00 | 0.00 | 0.00 | 0.00 | 13.00 | 0.00 |
| 6T-41 | 0.52 | 0.04 | 1.07 | 0.53 | 32.05 | 22.25 | 0.00 | 0.00 | 1.70 | 0.00 | 0.00 | 13.88 | 5.28 | 4.03 | 13.53 | 0.00 | 0.00 | 0.00 | 0.00 | 5.14 | 0.00 |
| 6T-40 | 0.19 | 0.04 | 1.18 | 1.02 | 17.90 | 32.74 | 0.00 | 0.00 | 2.34 | 0.00 | 0.00 | 16.01 | 8.98 | 0.00 | 12.15 | 0.42 | 0.23 | 0.00 | 0.00 | 6.81 | 0.00 |
| 6T-39 | 0.19 | 0.28 | 1.12 | 2.47 | 13.97 | 34.53 | 0.00 | 0.00 | 1.91 | 0.00 | 0.00 | 14.58 | 8.01 | 0.18 | 14.70 | 0.00 | 0.0 | 0.00 | 0.00 | 8.07 | 0.00 |
| 6T-38 | 0.19 | 0.60 | 1.27 | 1.39 | 12.02 | 34.49 | 0.00 | 0.00 | 1.39 | 0.00 | 0.00 | 9.39 | 6.30 | 0.00 | 13.10 | 4.23 | 2.84 | 0.00 | 0.00 | 8.79 | 0.00 |
| 6T-37 | 0.19 | 0.25 | 1.21 | 1.03 | 13.79 | 35.64 | 0.00 | 0.00 | 1.93 | 0.00 | 0.00 | 14.01 | 7.79 | 0.71 | 15.07 | 0.00 | 0.00 | 0.00 | 0.00 | 8.38 | 0.00 |
| 6T-36 | 0.19 | 1.10 | 1.25 | 4.84 | 13.78 | 34.81 | 0.00 | 0.00 | 2.35 | 0.00 | 0.00 | 13.10 | 7.70 | 2.90 | 11.32 | 0.00 | 0.00 | 0.00 | 0.00 | 6.65 | 0.00 |
| 6T-33 | 0.19 | 0.35 | 1.32 | 0.95 | 25.52 | 30.23 | 0.00 | 0.00 | 1.58 | 0.00 | 0.00 | 10.30 | 5.91 | 0.00 | 9.27 | 5.76 | 0.00 | 0.00 | 0.00 | 5.32 | 0.00 |

Table 8:

| Field Sample Number | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|
| 6T-44 | Carbonate(3) + chlorite(5) + hornblende(65) + opaques(2) + plagioclase(20) + quartz(5) | Equigranular, massive |
| 6T-43 | Epidote(5) + hornblende(50) + opaques(3) + plagioclase(35) + quartz(7) | Equigranular foliated |
| 6T-42 | Carbonate(5) + chlorite(5) + epidote(2) + hornblende(35) + plagioclase(48) + quartz(5) | Porphyroblastic (hornblende), foliated |
| 6T-41 | Chlorite(3) + hornblende(50) + opaques(2) + plagioclase(40) + quartz(5) | Porphyroblastic (hornblende), weakly foliated |
| 6T-40 | Hornblende(65) + opaques(2) + plagioclase(30) + quartz(3) | Porphyroblastic to poikiloblastic (hornblende), massive |
| 6T-39 | Epidote(2) + hornblende(60) + opaques(2) + plagioclase(30) + quartz(5) | Equigranular, massive |
| 6T-38 | Carbonate(22) + chlorite(5) + epidote(2) + hornblende(50) + opaques(2) + plagioclase(35) + quartz(5) | Poikiloblastic (plagioclase), massive |
| 6T-37 | Epidote(7) + opaques(3) + plagioclase(25) + quartz(5) + tremolite-actinolite(60) | Porphyroblastic (tremolite-actinolite), massive |
| 6T-36 | Epidote(13) + hornblende(50) + opaques(2) + plagioclase(30) + quartz(5) | Poikiloblastic (plagioclase) Porphyroblastic (hornblende), massive |
| 6T-33 | Opaques(2) + plagioclase(25) + quartz(3) + sericite(5) + tremolite-actinolite(65) | Porphyroblastic (tremolite-actinolite), weakly foliated |

++ Total sums approximately to 100

Table 9: Chemical analyses of rocks of the Jutten Volcanics, Savant Lake Area, (Source: Breaks and Bond, 1976)

| Laboratory Sample Number | 77-1277 | 77-1274 | 77-1275 | 77-1276 | 77-1280 |
|---|---|---|---|---|---|
| Field Sample Number | 41-17-1 | 40-16-1 | 40-16-4 | 40-16-5 | 40-18-7 |
| | Major elements in weight percent | | | | |
| $SiO_2$ | 48.90 | 48.60 | 50.20 | 49.20 | 47.10 |
| $Al_2O_3$ | 15.40 | 15.00 | 16.20 | 12.80 | 17.30 |
| $Fe_2O_3$ | 0.39 | 1.43 | 1.29 | 0.82 | 2.20 |
| FeO | 10.10 | 10.70 | 9.02 | 9.27 | 8.29 |
| MgO | 8.58 | 7.51 | 7.26 | 10.80 | 8.27 |
| CaO | 11.90 | 10.70 | 9.72 | 12.30 | 11.50 |
| $Na_2O$ | 1.86 | 2.61 | 3.45 | 1.27 | 1.81 |
| $K_2O$ | 0.10 | 0.14 | 0.09 | 0.16 | 0.27 |
| $TiO_2$ | 0.72 | 1.00 | 0.99 | 0.71 | 0.77 |
| $P_2O_5$ | 0.06 | 0.08 | 0.11 | 0.06 | 0.06 |
| S | 0.05 | < 0.01 | 0.03 | 0.01 | 0.01 |
| MnO | 0.18 | 0.23 | 0.18 | 0.19 | < 0.01 |
| $CO_2$ | 0.12 | 0.06 | 0.06 | 0.05 | 0.16 |
| $H_2O^+$ | 0.69 | 0.58 | 0.26 | 1.06 | 0.05 |
| $H_2O^-$ | 0.22 | 0.14 | 0.17 | 0.21 | 0.68 |
| Total | 99.30 | 98.80 | 99.00 | 98.90 | 98.80 |
| Specific Gravity | 3.03 | 3.05 | 2.99 | 3.04 | 3.10 |

Notes: < Less than

Table 9:

| Laboratory Sample Number | 77-1274 | 77-1274 | 77-1275 | 77-1276 | 77-1280 |
|---|---|---|---|---|---|
| Field Sample Number | 40-16-1 | 40-16-1 | 40-16-4 | 40-16-5 | 40-18-7 |
| | Trace elements in parts per million | | | | |
| Ba | 80 | 120 | 80 | 60 | 80 |
| Co | 45 | 45 | 45 | 45 | 50 |
| Cr | 370 | 330 | 310 | 1220 | 305 |
| Cu | 185 | 25 | 140 | 95 | 85 |
| Li | 6 | 10 | 6 | 8 | 20 |
| Ni | 150 | 130 | 115 | 175 | 180 |
| Pb | 15 | 10 | <10 | 15 | 10 |
| Zn | 80 | 110 | 105 | 10 | 70 |

Notes:
< Less than

Table 9:

| Laboratory Sample Number | 77-1279 | 77-1335 | 77-1278 |
|---|---|---|---|
| Field Sample Number | 40-18-6 | 40-18-8 | 40-18-5 |
| | Major elements in weight percent | | |
| $SiO_2$ | 47.50 | 49.10 | 49.30 |
| $Al_2O_3$ | 16.50 | 15.30 | 14.80 |
| $Fe_2O_3$ | 1.62 | 1.60 | 0.97 |
| FeO | 9.27 | 10.00 | 9.67 |
| MgO | 8.18 | 8.49 | 9.06 |
| CaO | 12.40 | 10.80 | 11.10 |
| $Na_2O$ | 1.61 | 2.45 | 2.39 |
| $K_2O$ | 0.09 | 0.14 | 0.15 |
| $TiO_2$ | 0.76 | 0.90 | 0.73 |
| $P_2O_5$ | 0.06 | 0.06 | 0.06 |
| S | 0.01 | 0.09 | 0.01 |
| MnO | 0.20 | 0.20 | 0.20 |
| $CO_2$ | 0.07 | 0.10 | 0.05 |
| $H_2O^+$ | 0.63 | 0.70 | 0.66 |
| $H_2O^-$ | 0.18 | 0.32 | 0.20 |
| Total | 99.10 | 100.20 | 99.30 |
| Specific Gravity | 3.04 | 3.04 | 3.03 |

Table 9:

| Laboratory Sample Number | 77-1279 | 77-1335 | 77-1278 |
|---|---|---|---|
| Field Sample Number | 40-18-6 | 40-18-8 | 40-18-5 |
| Trace elements in parts per million | | | |
| Ba | 90 | 70 | 90 |
| Co | 45 | 50 | 45 |
| Cr | 405 | 390 | 390 |
| Cu | 135 | 150 | 155 |
| Li | 6 | 10 | 6 |
| Ni | 160 | 135 | 125 |
| Pb | 15 | 10 | 10 |
| Zn | 85 | 100 | 85 |

Table 10: Jutten Volcanics - Averages and Ranges for Major and Minor Oxides and Trace Elements for Chemical Sections

| Major and Minor Oxides (weight percent) | Neverfreeze L. Section (N = 4) | | | Boucher Township Section (N = 10) | | | Armit Lake Section (N = 8) | | | Savant Lake-Silver Lake Section (N = 76) | | | Data from Breaks & Bond (1976) (N = 9) | | | Data from Bond (1977, 1979) (N = 7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average | Range | | Average | Range | | Average | Range | | Average | Range | | Average | Range | | Average | Range | |
| $SiO_2$ | 48.70 | 46.50 | 51.20 | 51.40 | 47.10 | 56.90 | 48.50 | 47.70 | 49.10 | 47.90 | 43.00 | 50.40 | 48.70 | 47.10 | 50.20 | 50.80 | 46.00 | 53.80 |
| $Al_2O_3$ | 16.60 | 14.00 | 18.90 | 14.90 | 12.50 | 15.80 | 14.30 | 10.80 | 15.20 | 14.70 | 12.70 | 17.20 | 15.40 | 12.80 | 17.30 | 15.40 | 13.30 | 21.00 |
| $Fe_2O_3$ | 1.84 | 1.28 | 2.30 | 1.81 | 1.30 | 2.20 | 2.58 | 1.65 | 2.76 | 3.14 | 1.20 | 5.24 | 1.31 | 0.39 | 2.20 | 2.04 | 1.28 | 2.46 |
| FeO | 9.71 | 7.25 | 11.80 | 9.04 | 6.35 | 10.70 | 10.76 | 9.58 | 13.90 | 9.21 | 7.49 | 10.60 | 9.66 | 8.29 | 10.70 | 8.65 | 5.79 | 12.10 |
| MgO | 7.65 | 3.90 | 11.40 | 6.86 | 3.26 | 8.13 | 8.40 | 5.89 | 15.70 | 7.45 | 3.72 | 13.60 | 8.41 | 7.26 | 10.80 | 5.79 | 4.39 | 9.50 |
| CaO | 9.76 | 6.59 | 12.60 | 11.13 | 9.02 | 13.10 | 10.77 | 8.98 | 11.60 | 10.66 | 5.86 | 12.90 | 11.24 | 9.72 | 12.40 | 10.43 | 8.57 | 12.90 |
| $Na_2O$ | 2.32 | 1.02 | 4.51 | 2.23 | 1.31 | 4.07 | 1.87 | 0.53 | 2.94 | 1.60 | 0.00 | 4.29 | 2.23 | 1.27 | 3.45 | 2.01 | 1.21 | 3.18 |
| $K_2O$ | 0.78 | 0.07 | 2.56 | 0.28 | 0.09 | 0.80 | 0.25 | 0.14 | 0.45 | 0.07 | 0.00 | 1.41 | 0.14 | 0.09 | 0.27 | 0.40 | 0.02 | 0.39 |
| $TiO_2$ | 0.92 | 0.80 | 0.99 | 1.01 | 0.79 | 1.91 | 0.96 | 0.60 | 1.66 | 0.91 | 0.57 | 1.17 | 0.84 | 0.71 | 1.00 | 0.79 | 0.41 | 1.07 |
| $P_2O_5$ | 0.14 | 0.06 | 0.19 | 0.12 | 0.09 | 0.25 | 0.07 | 0.05 | 0.11 | 0.07 | 0.03 | 0.19 | 0.07 | 0.06 | 0.11 | 0.07 | 0.04 | 0.10 |
| S | 0.11 | <0.01 | 0.30 | 0.08 | <0.01 | 0.31 | 0.11 | 0.02 | 0.22 | 0.07 | <0.01 | 0.26 | 0.03 | <0.01 | 0.09 | 0.08 | 0.03 | 0.15 |
| MnO | 0.19 | 0.13 | 0.22 | 0.19 | 0.18 | 0.23 | 0.22 | 0.20 | 0.24 | 0.21 | 0.18 | 0.29 | 0.18 | <0.01 | 0.23 | 0.25 | 0.13 | 0.37 |
| $CO_2$ | 0.08 | 0.03 | 0.14 | 0.22 | 0.06 | 1.50 | 0.06 | <0.01 | 0.14 | 0.92 | 0.05 | 4.96 | 0.08 | 0.05 | 0.12 | 0.62 | 0.05 | 2.10 |
| $H_2O+$ | 0.26 | 0.05 | 0.39 | 0.61 | 0.32 | 1.14 | 0.63 | 0.30 | 1.95 | 2.46 | 0.14 | 5.39 | 0.58 | 0.05 | 1.06 | 2.57 | 1.14 | 3.88 |
| $H_2O-$ | 0.35 | 0.26 | 0.43 | 0.31 | 0.24 | 0.40 | 0.26 | 0.20 | 0.35 | 0.32 | 0.17 | 0.46 | 0.25 | 0.14 | 0.68 | 0.17 | 0.14 | 0.22 |

< Less than

Table 10:

Trace Elements
(ppm)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ba | 188 | 40 | 260 | 67 | 40 | 110 | 55 | 30 | 80 | 47 | 20 | 280 | 88 | 60 | 120 | 73 | 50 | 110 |
| Co | 50 | 30 | 75 | 46 | 30 | 55 | 52 | 45 | 70 | 49 | 35 | 55 | 46 | 45 | 50 | 49 | 30 | 60 |
| Cr | 478 | 110 | 960 | 258 | 90 | 375 | 344 | 155 | 1040 | 289 | 75 | 990 | 450 | 305 | 1220 | 200 | 130 | 250 |
| Cu | 140 | 50 | 310 | 140 | 5 | 370 | 142 | 60 | 205 | 134 | 10 | 250 | 110 | 25 | 185 | 116 | 70 | 160 |
| Ga | 15 | 15 | | 10 | 10 | | 12 | 10 | 15 | 15 | 9 | 20 | | | | 16 | 15 | 20 |
| Li | 14 | 10 | 20 | 8 | 5 | 10 | 16 | 4 | 35 | 8 | 5 | 20 | 9 | 6 | 20 | 11 | 8 | 20 |
| Ni | 229 | 65 | 500 | 122 | 45 | 165 | 143 | 75 | 350 | 131 | 40 | 375 | 144 | 115 | 180 | 124 | 65 | 190 |
| Pb | 9 | <10 | 15 | 17 | <10 | 50 | 6 | <10 | 11 | 38 | <10 | 470 | 11 | <10 | 15 | <10 | | <10 |
| Sc | 41 | 20 | 60 | 45 | 30 | 50 | 43 | 35 | 45 | 45 | 25 | 90 | | | | 40 | 25 | 45 |
| Sn | < 3 | < 3 | | 3 | < 3 | 10 | < 3 | < 3 | | 5 | < 3 | 60 | | | | | | |
| Sr | | | | | | | | | | 119 | 25 | 290 | | | | | | |
| V | 200 | 150 | 250 | 345 | 150 | 400 | 269 | 200 | 350 | 285 | 150 | 500 | | | | 214 | 180 | 260 |
| Y | | | | | | | | | | 23 | 10 | 60 | | | | | | |
| Zn | 106 | 15 | 105 | 24 | 20 | 50 | 104 | 90 | 130 | 97 | 50 | 135 | 92 | 70 | 110 | 96 | 60 | 120 |
| Zr | | | | | | | | | | 63 | 30 | 180 | | | | | | |

< Less than

Table 11: Chemical analyses of the Jutten Ultramafics, Armit Lake Section, Savant Lake area.

| Field Sample Number | 76-7(4)-124 | 76-7(4)-125 | 76-7(4)-129 | 76-7(4)-133 | 76-7(4)-135 | 76-7(4)-136 | 76-7(4)-137 |
|---|---|---|---|---|---|---|---|
| Laboratory Sample Number | 77-2642 | 77-2643 | 77-2647 | 77-2650 | 77-2652 | 77-2653 | 77-2654 |
| | Major elements in weight percent | | | | | | |
| $SiO_2$ | 43.20 | 39.00 | 44.70 | 38.30 | 44.90 | 42.80 | 41.80 |
| $TiO_2$ | 0.35 | 0.23 | 0.30 | 0.18 | 0.12 | 0.27 | 0.21 |
| $Al_2O_3$ | 9.47 | 4.96 | 6.13 | 3.58 | 3.48 | 5.82 | 4.84 |
| $Fe_2O_3$ | 1.81 | 2.75 | 1.68 | 6.21 | 3.12 | 2.07 | 3.89 |
| FeO | 9.18 | 7.97 | 9.02 | 3.78 | 5.31 | 8.13 | 4.99 |
| MgO | 24.40 | 29.70 | 27.20 | 36.30 | 31.80 | 30.70 | 29.70 |
| CaO | 5.14 | 3.06 | 3.97 | 0.48 | 5.49 | 1.37 | 5.52 |
| $Na_2O$ | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| $K_2O$ | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| $P_2O_5$ | 0.00 | 0.01 | 0.02 | 0.01 | 0.13 | 0.01 | 0.01 |
| S | 0.01 | 0.07 | 0.02 | 0.01 | 0.03 | 0.07 | 0.05 |
| MnO | 0.17 | 0.17 | 0.21 | 0.14 | 0.16 | 0.14 | 0.16 |
| $CO_2$ | 0.04 | 5.23 | 0.96 | 0.12 | 0.16 | 1.75 | 0.92 |
| $H_2O+$ | 4.76 | 5.75 | 4.81 | 9.56 | 5.09 | 5.55 | 6.86 |
| $H_2O-$ | 0.26 | 0.31 | 0.30 | 0.60 | 0.51 | 0.45 | 0.50 |
| TOTAL | 98.80 | 99.20 | 99.30 | 99.30 | 100.30 | 99.10 | 99.50 |

Table II:

Normative Mineralogy in Molecular Weight

| Laboratory Sample Number | Field Sample Number | Apatite | Pyrrhotite | Ilmenite | Orthoclase | Albite | Anorthite | Corundum | Acmite | Magnetite | Hematite | Wollastonite | Enstatite | Ferrosilite | Quartz | Diopside | Forsterite | Fayalite | Nepheline | Leucite | Hedenbergite | Calcite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 77-2642 | 76-7(4)-124 | 0.02 | 0.04 | 0.50 | 0.06 | 0.09 | 25.98 | 0.14 | 0.00 | 1.93 | 0.00 | 0.00 | 33.44 | 6.31 | 0.00 | 0.00 | 26.51 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 77-2643 | 76-7(4)-125 | 0.02 | 0.26 | 0.34 | 0.06 | 0.10 | 14.31 | 0.00 | 0.00 | 1.92 | 0.00 | 0.00 | 24.35 | 3.64 | 0.00 | 1.22 | 46.62 | 6.98 | 0.00 | 0.00 | 0.18 | 0.00 |
| 77-2647 | 76-7(4)-127 | 0.04 | 0.07 | 0.43 | 0.06 | 0.09 | 16.96 | 0.00 | 0.00 | 1.79 | 0.00 | 0.00 | 41.29 | 6.95 | 0.00 | 2.03 | 25.63 | 4.32 | 0.00 | 0.00 | 0.34 | 0.00 |
| 77-2650 | 76-7(4)-133 | 0.02 | 0.04 | 0.26 | 0.06 | 0.09 | 2.38 | 3.03 | 0.00 | 6.66 | 0.00 | 0.00 | 36.55 | 0.53 | 0.00 | 0.00 | 49.67 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 |
| 77-2652 | 76-7(4)-135 | 0.27 | 0.10 | 0.17 | 0.06 | 0.09 | 9.29 | 0.00 | 0.00 | 3.22 | 0.00 | 0.00 | 33.89 | 2.33 | 0.00 | 12.53 | 34.81 | 2.39 | 0.00 | 0.00 | 0.86 | 0.00 |
| 77-2653 | 76-7(4)-136 | 0.02 | 0.25 | 0.38 | 0.06 | 0.09 | 6.88 | 3.71 | 0.00 | 2.21 | 0.00 | 0.00 | 47.06 | 5.97 | 0.00 | 0.00 | 29.62 | 3.76 | 0.00 | 0.00 | 0.00 | 0.00 |
| 77-2654 | 76-7(4)-137 | 0.02 | 0.18 | 0.30 | 0.06 | 0.04 | 13.48 | 0.00 | 0.00 | 4.17 | 0.00 | 0.00 | 28.76 | 1.69 | 0.00 | 11.01 | 37.41 | 2.19 | 0.00 | 0.00 | 0.64 | 0.00 |

Table 11:

| Field Sample Number | 76-7(4)-124 | 76-7(4)-125 | 76-7(4)-129 | 76-7(4)-133 | 76-7(4)-135 | 76-7(4)-136 | 76-7(4)-137 |
|---|---|---|---|---|---|---|---|
| Laboratory Sample Number | 77-2642 | 77-2643 | 77-2647 | 77-2650 | 77-2652 | 77-2653 | 77-2654 |
| | Trace elements in parts per million | | | | | | |
| Ba | 40 | 30 | 30 | 20 | 30 | 30 | 40 |
| Co | 60 | 85 | 75 | 90 | 75 | 80 | 85 |
| Cr | 3320 | 4400 | 2640 | 2400 | 1760 | 2820 | 2600 |
| Cu | 7 | 25 | 8 | 6 | 15 | 20 | 30 |
| Ga | 6 | 4 | 4 | 2 | 1 | 3 | 3 |
| Li | 4 | <3 | <3 | 3 | 3 | <3 | <3 |
| Ni | 1000 | 1300 | 1220 | 1860 | 1240 | 1020 | 1520 |
| Pb | <10 | 15 | <10 | <10 | 20 | <10 | <10 |
| Sc | 30 | 15 | 25 | 15 | 15 | 20 | 20 |
| Sn | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| V | 150 | <100 | 100 | 60 | 70 | 100 | 90 |
| Zn | 90 | 75 | 125 | 55 | 60 | 85 | 65 |

Notes:
< Less than

Table 11:

| Field Sample Number | Laboratory Sample Number | Thin Section Mineralogy# (Estimated Mineralogy) |
|---|---|---|
| 76-7(4)-124 | 77-2642 | Chlorite(50) + opaques(1) + sericite(1) + talc(9) + tremolite- actinolite(40) |
| 76-7(4)-125 | 77-2643 | Carbonate(15) + chlorite(50) + opaques(5) + talc(30) |
| 76-7(4)-129 | 77-2647 | Carbonate(8) + chlorite(50) + opaques(2) + talc(10) + tremolite-actinolite(30) |
| 76-7(4)-133 | 77-2650 | Chlorite(25) + olivine(15) + opaques(5) + serpentine(30) + tremolite-actinolite(25) |
| 76-7(4)-135 | 77-2652 | Chlorite(45) + olivine(23) + opaques(2) + serpentine(5) + tremolite-actinolite(25) |
| 76-7(4)-136 | 77-2653 | Carbonate(8) + chlorite(35) + opaques(2) + serpentine(5) + talc(20) + tremolite-actinolite(30) |
| 76-7(4)-137 | 77-2654 | Chlorite(25) + olivine(20) + opaques(5) + serpentine(50) |

# Total approximately sums to 100

Table 12: Description of Jutten Chert-Ironstone for three localities on Armit Lake.

| Location | Thickness | Description |
|---|---|---|
| A | >30 m | Intercalated, generally bedded chert beds (50 percent of section); 0.3 to 0.5 cm magnetite ironstone beds (40 percent of section) and green silicate laminae (10 percent of section) |
| B | >110 m | Massive chert (90 percent of section) with 10 percent thin streaks of magnetite ironstone and green silicate that define a banding; 1 cm bands of pyrite + pyrrhotite ironstone and 1 m bands of amphibolite similar to mafic metavolcanics of the area are also present. |
| C | <2 m | Interbedded chert and magnetite ironstone situated between amphibolitized mafic metavolcanic flows (Likely a separate and distinct unit from main Jutten Chert-Ironstone described at localities A and B) |

Table 13: Description of Savant Narrows Formation for four locations on Kashaweogama Lake

| Location | Latitude | Longitude | Description (From Base Upwards) |
|---|---|---|---|
| 1) North shore of Kashaweogama Lake | 50°23'20'N | 90°51'00"W | Sheared mafic metavolcanics to the north are in sharp contact with sheared conglomerate to the south. The basal 2 m is comprised of angular 1.5 cm feldspar grains and rounded to subangular quartz granules in a sheared chloritic matrix. The matrix to clast ratio is variable and the conglomerate varies from matrix to clast-supported. Clast types in order of decreasing abundance are: medium-grained pink to buff leucotrondhjemite, banded carbonate-silicate rock, mafic volcanic clasts (difficult to distinguish from matrix), quartz, banded chert, gneissic granite. The conglomerate is poorly sorted and the clasts range in size from 1 cm to greater than 2 m. Some of the trondhjemite clasts are quite angular. One large block of trondhjemite (greater than 2 m) contains mafic volcanic inclusions and has an inhomogeneous migmatitic texture. A large (1 by 2 m) block of banded sericitic chert is believed to be derived from the Jutten Chert-Ironstone unit. Two metres above the base the matrix charges to a coarse gritty arkose with up to 4 mm quartz grains comprising 25 percent of the matrix. Clasts are predominantly carbonate-silicate rock and trondhjemite. |
| 2) Small island in Kashaweogama Lake | 50°45'10"W | 90°25'13"W | Sheared plagioclase-phyric mafic metavolcanics in contact with conglomerate (10 cm gully separates two lithologies). Conglomerate matrix contains 30 to 40 percent angular to subangular quartz grains. Remainder of matrix is well foliated sericite. Clasts are |

Table 13:

| | | |
|---|---|---|
| | | of equigranular medium-grained trondhjemite, quartz, banded chert, and mafic metavolcanic. Trondhjemite is the most abundant clast type. Conglomerate is matrix supported containing 40 percent clasts. |
| 3) North shore of Kashaweogama Lake | 50°24'10"N 90°48'40"W | Foliated mafic metavolcanics separated from sheared conglomerate by 1.5 m thick unit of banded carbonate-chert. The banding is defined by alternating dark/light bands 1 cm thick of sedimentary origin. It's possible the banded carbonate-chert is a large lenticular fragment. The conglomerate contains well rounded clasts of equigranular medium-grained leucotrondhjemite. Some highly stretched felsite clasts are also visible. Other clast types have been obliterated by shearing. The matrix is a sericite-chlorite schist with a very low quartz content. |
| 4) Peninsula on North shore of Kashaweogama Lake | 50°45'10"N 90°25'15"W | Contact between mafic meta-volcanics and conglomerate is intensely sheared. Conglomerate is also intensely sheared to 2 m from contact and clasts or matrix can not be distinguished. |

Table 14: Chemical Analyses of Rocks of the Savant Lake Formation, Savant Lake Area.

| Field Sample Number | 76-7(4)-91 | 76-7(4)-92 | 76-7(4)-93 | 76-7(4)-55 |
|---|---|---|---|---|
| Laboratory Sample Number | 77-2629 | 77-2630 | 77-2631 | 77-2628 |
| | Major Elements in Weight Percent | | | |
| $SiO_2$ | 48.20 | 48.00 | 47.20 | 37.60 |
| $TiO_2$ | 0.82 | 0.71 | 0.84 | 0.12 |
| $Al_2O_3$ | 14.70 | 14.90 | 14.60 | 3.20 |
| $Fe_2O_3$ | 3.32 | 2.91 | 3.45 | 5.32 |
| FeO | 9.26 | 8.37 | 10.40 | 4.67 |
| MnO | 0.22 | 0.17 | 0.23 | 0.10 |
| MgO | 7.31 | 9.20 | 6.68 | 35.90 |
| CaO | 12.00 | 10.40 | 11.00 | 1.43 |
| $Na_2O$ | 1.42 | 0.75 | 1.71 | 0.00 |
| $K_2O$ | 0.04 | 0.00 | 0.03 | 0.00 |
| $P_2O_5$ | 0.06 | 0.05 | 0.07 | 0.01 |
| $CO_2$ | 0.11 | 0.60 | 0.25 | 1.65 |
| S | 0.03 | 0.08 | 0.07 | 0.04 |
| $H_2O^+$ | 1.71 | 2.75 | 2.19 | 9.27 |
| $H_2O^-$ | 0.40 | 0.42 | 0.37 | 0.50 |
| Total | 99.60 | 99.30 | 99.10 | 99.90 |

Table 14:

| Field Sample Number | 76-7(4)-91 | 76-7(4)-92 | 76-7(4)-93 | 76-7(4)-55 |
|---|---|---|---|---|
| Laboratory Sample Number | 77-2629 | 77-2630 | 77-2631 | 77-2628 |
| | Trace Elements in Parts per Million | | | |
| Ba | 30 | 30 | 30 | 40 |
| Co | 45 | 55 | 55 | 93 |
| Cr | 225 | 330 | 105 | 1920 |
| Cu | 125 | 95 | 160 | 14 |
| Ga | 15 | 15 | 15 | 2 |
| Li | 5 | 6 | 6 | 5 |
| Ni | 145 | 265 | 85 | 1940 |
| Pb | 135 | 85 | 20 | 30 |
| Sc | 40 | 30 | 50 | 10 |
| Sn | <3 | <3 | <3 | <3 |
| Sr | 150 | 100 | 100 | 45 |
| V | 200 | 200 | 250 | 50 |
| Y | 30 | 20 | 30 | <10 |
| Zn | 100 | 85 | 110 | 25 |
| Zr | 70 | 60 | 80 | 20 |

Notes:
< Less than

Table 14:

Normative Mineralogy in Molecular Weight

| Field Sample Number | Laboratory Sample No. | Apatite | Pyrrhotite | Ilmenite | Orthoclase | Albite | Anorthite | Corundum | Acmite | Magnetite | Hematite | Wollastonite | Enstatite | Perrosilite | Quartz | Diopside | Forsterite | Fayalite | Nepheline | Leucite | Hedenbergite | Calcite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 76-7(4)-91 | 77-2629 | 0.13 | 0.11 | 1.19 | 0.25 | 13.33 | 35.17 | 0.00 | 0.00 | 2.54 | 0.00 | 0.00 | 14.65 | 9.60 | 1.67 | 12.90 | 0.00 | 0.00 | 0.00 | 0.00 | 8.45 | 0.00 |
| 76-7(4)-92 | 77-2630 | 0.11 | 0.29 | 1.05 | 0.06 | 7.13 | 39.47 | 0.00 | 0.00 | 2.45 | 0.00 | 0.00 | 22.80 | 10.24 | 4.52 | 8.19 | 0.00 | 0.00 | 0.00 | 0.00 | 3.68 | 0.00 |
| 76-7(4)-93 | 77-2631 | 0.16 | 0.26 | 1.24 | 0.19 | 16.28 | 34.02 | 0.00 | 0.00 | 2.59 | 0.00 | 0.00 | 14.40 | 11.69 | 0.48 | 10.32 | 0.00 | 0.00 | 0.00 | 0.00 | 8.38 | 0.00 |
| 76-7(4)-55 | 77-2628 | 0.02 | 0.14 | 0.17 | 0.24 | 0.09 | 7.25 | 0.64 | 0.00 | 1.75 | 0.00 | 0.00 | 15.81 | 1.77 | 0.00 | 0.00 | 64.83 | 7.27 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 14:

| Field Sample Number | Laboratory Sample Number | Thin Section Mineralogy (Estimated Percent)# | Texture (Thin Section |
|---|---|---|---|
| 76-7(4)-91 | 77-2629 | Chlorite(15) + clinozoisite(1) + epidote(6) + opaques(24) + plagioclase(30) + tremolite-actinolite(25) | Subophitic |
| 76-7(4)-92 | 77-2630 | Carbonate(5) + chlorite(21) + clinozoisite(3) + epidote(20) + opaques(1) + plagioclase(20) + sphene(8) + tremolite-actinolite(20) | Subophitic |
| 76-7(4)-93 | 77-2631 | Carbonate(2) + chlorite(17) + clinozoisite(8) + epidote(8) + opaques(14) + plagioclase(5) + sphene(6) + tremolite-actinolite(40) | Pilotaxitic |
| 76-7(4)-55 | 77-2628 | Carbonate(5) + opaques(20) + serpentine(65) + talc(10) | Subophitic |

Notes:
# Total sums approximately to 100

Table 15: Chemical analyses of Handy Lake Group, Highway 599 Section, Savant Lake Area.

| Sample Number | 29 | 27 | 23 | 21 | 110 | 114 | 234 | 231 | 240 | 104 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | | | |
| $SiO_2$ | 50.50 | 50.30 | 49.20 | 49.00 | 71.80 | 54.50 | 69.90 | 70.90 | 71.60 | 73.80 |
| $Al_2O_3$ | 14.90 | 15.00 | 16.50 | 15.60 | 14.40 | 15.60 | 15.40 | 15.20 | 15.70 | 15.20 |
| $Fe_2O_3$ | 0.90 | 2.60 | 2.10 | 2.40 | 0.72 | 1.99 | 0.42 | 0.64 | 0.76 | 0.47 |
| FeO | 9.88 | 10.80 | 10.10 | 9.94 | 2.45 | 7.84 | 1.61 | 1.96 | 1.05 | 1.47 |
| MgO | 8.01 | 5.53 | 7.83 | 7.88 | 1.44 | 5.98 | 2.46 | 1.57 | 1.45 | 1.60 |
| CaO | 10.70 | 11.70 | 8.90 | 10.80 | 2.92 | 8.72 | 3.40 | 2.60 | 2.86 | 2.74 |
| $Na_2O$ | 2.48 | 1.67 | 2.75 | 1.95 | 3.89 | 2.50 | 2.61 | 1.06 | 1.70 | 2.04 |
| $K_2O$ | 0.53 | 0.32 | 0.18 | 0.14 | 1.54 | 0.23 | 2.01 | 3.22 | 2.64 | 2.08 |
| $H_2O+$ | 0.54 | 1.14 | 0.32 | 0.71 | 0.21 | 0.62 | 0.69 | 0.67 | 1.03 | 0.40 |
| $H_2O-$ | 0.29 | 0.28 | 0.25 | 0.28 | 0.38 | 0.33 | 0.17 | 0.23 | 0.14 | 0.29 |
| $CO_2$ | 0.06 | 0.10 | 0.10 | 0.23 | 0.29 | 0.08 | 0.12 | 0.15 | 0.18 | 0.10 |
| $TiO_2$ | 0.81 | 1.01 | 1.08 | 1.01 | 0.36 | 1.07 | 0.25 | 0.45 | 0.21 | 0.27 |
| $P_2O_5$ | 0.09 | 0.11 | 0.07 | 0.11 | 0.10 | 0.26 | 0.09 | 0.12 | 0.09 | 0.10 |
| S | 0.02 | 0.02 | 0.16 | 0.01 | <0.01 | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 |
| MnO | 0.18 | 0.24 | 0.20 | 0.25 | 0.04 | 0.15 | 0.03 | 0.05 | 0.03 | 0.03 |
| TOTAL | 99.90 | 100.80 | 99.70 | 100.30 | 100.50 | 99.90 | 99.20 | 98.80 | 99.40 | 100.60 |

Notes:
< Less than

Table 15:

| Sample Number | Description |
|---|---|
| 29 | Dark green, fine to medium-grained massive flow |
| 27 | Dark green, porphyritic pillowed flow |
| 23 | Dark green, medium to fine-grained massive flow |
| 21 | Dark green, fine-and coarse-grained massive flow |
| 110 | Quartz porphyry flow/intrusive |
| 114 | Fine-grained grey-green massive flow/intrusive |
| 234 | Medium-grained quartz porphyry flow/intrusive |
| 231 | Medium-grained, buff brown, slightly porphyritic flow |
| 240 | Pink, brown, grey, fine to medium-grained flow/sill |
| 104 | Fine tuff/flow |

Table 15: Chemical analyses of Handy Lake Group, Highway 599 Section, Savant Lake Area.

| Sample Number | 105 | 106 | 95 | 98 | 206 | 204-1 | 202 | 202-1 | 124 | 207-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | | | |
| $SiO_2$ | 59.00 | 78.50 | 66.00 | 64.40 | 74.90 | 62.80 | 73.80 | 66.30 | 64.80 | 64.30 |
| $Al_2O_3$ | 17.10 | 11.70 | 16.50 | 17.10 | 14.60 | 17.30 | 18.40 | 16.50 | 16.60 | 16.90 |
| $Fe_2O_3$ | 1.32 | 0.45 | 1.34 | 1.29 | 0.64 | 0.69 | 0.82 | 1.47 | 1.43 | 1.19 |
| FeO | 5.81 | 1.33 | 2.80 | 3.57 | 1.61 | 1.96 | 0.56 | 3.36 | 3.01 | 3.43 |
| MgO | 4.31 | 0.60 | 2.34 | 3.56 | 1.25 | 2.25 | 0.33 | 2.23 | 2.07 | 2.22 |
| CaO | 4.76 | 1.04 | 3.30 | 3.91 | 1.62 | 6.12 | 0.41 | 4.07 | 4.26 | 4.39 |
| $Na_2O$ | 2.30 | 4.01 | 4.67 | 2.16 | 0.73 | 1.79 | 0.97 | 2.53 | 4.25 | 2.85 |
| $K_2O$ | 3.23 | 1.37 | 2.07 | 2.08 | 2.46 | 2.64 | 2.20 | 1.73 | 1.48 | 1.70 |
| $H_2O+$ | 0.82 | 0.30 | 0.39 | 0.78 | 1.11 | 0.83 | 1.02 | 0.73 | 0.60 | 1.01 |
| $H_2O-$ | 0.25 | 0.23 | 0.30 | 0.31 | 0.23 | 0.23 | 0.12 | 0.10 | 0.28 | 0.20 |
| $CO_2$ | 0.33 | 0.45 | 0.29 | 0.10 | 0.09 | 1.82 | 0.09 | 0.10 | 0.69 | 0.55 |
| $TiO_2$ | 0.80 | 0.11 | 0.46 | 0.46 | 0.32 | 0.47 | 0.53 | 0.45 | 0.49 | 0.48 |
| $P_2O_5$ | 0.17 | 0.04 | 0.12 | 0.12 | 0.08 | 0.12 | 0.13 | 0.12 | 0.12 | 0.12 |
| S | 0.01 | 0.03 | <0.01 | 0.01 | 0.07 | 0.05 | 0.22 | 0.20 | <0.01 | <0.01 |
| MnO | 0.08 | 0.04 | 0.05 | 0.07 | 0.04 | 0.18 | 0.01 | 0.08 | 0.06 | 0.06 |
| TOTAL | 100.30 | 100.20 | 100.60 | 99.90 | 99.80 | 99.30 | 99.60 | 100.00 | 100.10 | 99.40 |

Notes:
< Less than

Table 15:

Trace elements in parts per million

| Sample Number | 105 | 106 | 95 | 98 | 206 | 204-1 | 202 | 202-1 | 124 | 207 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ba | 200 | 80 | 180 | 100 | 120 | 180 | 280 | 140 | 180 | 180 |
| Be | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Co | 25 | <5 | 15 | 10 | 5 | 5 | <5 | 10 | 15 | 10 |
| Cr | 25 | <5 | 35 | 25 | <5 | 30 | 25 | 25 | 35 | 30 |
| Cu | 30 | 10 | 5 | 190 | 15 | 20 | 10 | 60 | 5 | <5 |
| Ga | 15 | 10 | 15 | 15 | 9 | 10 | 10 | 10 | 15 | 10 |
| Li | 30 | 10 | 15 | 20 | 5 | 5 | 10 | 5 | 20 | 10 |
| Mo | <1 | 3 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ni | 65 | <5 | 25 | 35 | <5 | 20 | 10 | 30 | 30 | 25 |
| Pb | 10 | 20 | 10 | 20 | 10 | 50 | 10 | 10 | 40 | 10 |
| Sc | 25 | <5 | 10 | 10 | 7 | 10 | 8 | 10 | 10 | 10 |
| Sn | <3 | <3 | <3 | <3 | 4 | 10 | <3 | <3 | 6 | <3 |
| Sr | 200 | 100 | 200 | 100 | 100 | 100 | 100 | 200 | 300 | 300 |
| V | 200 | <5 | 60 | 60 | 20 | 90 | 100 | 90 | 80 | 80 |
| Y | 25 | 30 | 10 | 10 | 25 | 10 | 15 | 15 | 15 | 10 |
| Zn | 120 | 45 | 40 | 25 | 25 | 40 | 10 | 15 | 55 | 25 |
| Zr | 150 | 150 | 80 | 90 | 250 | 150 | 150 | 150 | 200 | 150 |

Notes:
< Less than

Table 15:

| Sample Number | Description |
|---|---|
| 105 | Dark grey, fine-grained tuff/flow |
| 106 | Pink, white, brown, fine-grained massive flow/tuff |
| 95 | Fine tuff/intrusive clasts, of feldspar porphyry |
| 98 | Grey to buff, medium to fine-grained tuff |
| 206 | White, fine to very fine tuff |
| 204-1 | Brown, fine-grained tuff/tuffaceous metasediments |
| 202 | Fine, white, tuff |
| 202-1 | White to brown, medium to fine tuff/flow |
| 124 | Grey to buff, medium tuff/flow |
| 207-1 | Grey fine tuff/tuffaceous metasediment |

Table 15: Chemical analyses of Handy Lake Group, Highway 599 Section, Savant Lake Area.

| Sample Number | 208 | 210 | 210-1 | 209 | 212 | 218 | 220 | 221 | 223 | 226 | 228 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | | | | |
| $SiO_2$ | 65.60 | 62.90 | 65.10 | 64.40 | 60.00 | 66.60 | 63.60 | 60.50 | 60.30 | 64.80 | 58.70 |
| $Al_2O_3$ | 16.80 | 17.90 | 16.50 | 16.90 | 16.90 | 16.30 | 15.60 | 17.80 | 18.00 | 17.70 | 15.80 |
| $Fe_2O_3$ | 1.10 | 1.70 | 1.38 | 1.57 | 1.43 | 1.29 | 1.22 | 0.92 | 1.01 | 1.34 | 2.26 |
| FeO | 2.66 | 3.36 | 3.36 | 2.73 | 5.40 | 3.99 | 3.36 | 4.06 | 4.34 | 2.52 | 6.94 |
| MgO | 1.74 | 2.81 | 2.78 | 1.43 | 3.23 | 2.03 | 2.45 | 3.10 | 3.20 | 2.00 | 3.96 |
| CaO | 2.60 | 4.62 | 4.28 | 3.51 | 5.26 | 2.58 | 5.20 | 5.69 | 5.12 | 3.62 | 5.13 |
| $Na_2O$ | 6.32 | 2.43 | 1.96 | 5.50 | 2.85 | 1.89 | 1.85 | 1.99 | 2.96 | 2.40 | 1.06 |
| $K_2O$ | 1.25 | 1.59 | 1.65 | 1.34 | 1.49 | 2.22 | 2.55 | 2.39 | 1.92 | 2.92 | 3.34 |
| $H_2O+$ | 0.63 | 0.96 | 1.04 | 0.72 | 2.00 | 1.09 | 1.35 | 1.03 | 0.86 | 0.65 | 0.72 |
| $H_2O-$ | 0.18 | 0.14 | 0.20 | 0.18 | 0.23 | 0.26 | 0.20 | 0.19 | 0.22 | 0.23 | 0.19 |
| $CO_2$ | 0.22 | 0.09 | 0.09 | 0.91 | 0.17 | 0.28 | 1.60 | 0.94 | 0.35 | 0.28 | 0.29 |
| $TiO_2$ | 0.48 | 0.55 | 0.48 | 0.49 | 0.85 | 0.62 | 0.53 | 0.60 | 0.74 | 0.60 | 0.82 |
| $P_2O_5$ | 0.11 | 0.14 | 0.12 | 0.12 | 0.24 | 0.16 | 0.13 | 0.14 | 0.17 | 0.13 | 0.20 |
| S | <0.01 | 0.01 | 0.03 | 0.01 | <0.01 | 0.38 | 0.11 | 0.02 | 0.02 | <0.01 | <0.01 |
| MnO | 0.03 | 0.11 | 0.08 | 0.11 | 0.14 | 0.08 | 0.07 | 0.09 | 0.07 | 0.05 | 0.11 |
| TOTAL | 99.70 | 99.30 | 99.10 | 99.30 | 100.20 | 99.80 | 99.80 | 99.50 | 99.30 | 99.20 | 99.50 |

Notes:
< Less than

Table 15:

Trace elements in parts per million

| Sample Number | 208 | 210 | 210-1 | 209 | 212 | 218 | 220 | 221 | 223 | 226 | 228 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ba | 100 | 200 | 180 | 130 | 190 | 180 | 180 | 100 | 120 | 250 | 160 |
| Be | <1 | <1 | <1 | <1 | 2 | <1 | <1 | <1 | <1 | <1 | <1 |
| Co | 10 | 15 | 10 | 10 | 15 | 15 | 20 | 10 | 20 | 10 | 25 |
| Cr | 25 | 45 | 25 | 30 | 20 | 30 | 45 | 45 | 50 | 50 | 160 |
| Cu | 5 | 30 | 50 | 10 | <5 | 50 | 40 | 15 | 95 | 15 | 60 |
| Ga | 8 | 15 | 8 | 10 | 8 | 15 | 8 | 9 | 10 | 9 | 9 |
| Li | 10 | 10 | 10 | 5 | 15 | 25 | 15 | 10 | 15 | 15 | 25 |
| Mo | <1 | <1 | <1 | <1 | 1 | <1 | <1 | <1 | <1 | <1 | 10 |
| Ni | 20 | 25 | 25 | 25 | 15 | 30 | 35 | 40 | 50 | 20 | 80 |
| Pb | 10 | 10 | 20 | 20 | 130 | 140 | 150 | 50 | 20 | 20 | 30 |
| Sc | 7 | 9 | 8 | 9 | 25 | 15 | 20 | 20 | 30 | 20 | 25 |
| Sn | <3 | <3 | <3 | 4 | 10 | 20 | 20 | 6 | 3 | 4 | 4 |
| Sr | 300 | 200 | 200 | 300 | 200 | 200 | 200 | 200 | 400 | 300 | 500 |
| V | 100 | 90 | 100 | 100 | 200 | 90 | 100 | 100 | 200 | 100 | 200 |
| Y | 15 | 10 | 5 | 15 | 25 | 20 | 25 | 25 | 20 | 25 | 25 |
| Zn | 45 | 15 | 10 | 55 | 80 | 45 | 50 | 60 | 70 | 60 | 100 |
| Zr | 150 | 150 | 200 | 150 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |

Notes:
< Less than

Table 15:

| Sample Number | Description |
|---|---|
| 208 | Pink, buff, medium-grained, feldspar porphyritic flow |
| 210 | Light grey brown, fine-grained tuff/tuffaceous metasediment |
| 210-1 | Light grey, medium to fine-grained flow/tuff |
| 209 | Pink, grey, medium-grained tuff/hyabyssal intrusive |
| 212 | Grey, medium to fine-grained tuff/tuffaceous metasediment |
| 218 | Grey brown, fine grained massive flow/intrusive |
| 220 | Brown, medium-grained flow/crystal tuff |
| 221 | Grey, buff, medium-to fine-grained massive flow |
| 223 | White, medium- to fine-grained matrix of breccia unit |
| 226 | Grey, buff, medium- to fine-grained porphyritic flow |
| 228 | Grey, fine tuff/tuffaceous metasediment |

Table 15: Chemical analyses of Handy Lake Group, Highway 599 Section, Savant Lake Area.

| Sample Number | 88 | 86 | 84 | 84-1 | 73 | 70 | 68 | 67 |
|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | |
| $SiO_2$ | 58.30 | 78.80 | 73.50 | 60.70 | 69.10 | 59.50 | 59.10 | 61.30 |
| $Al_2O_3$ | 17.80 | 11.60 | 17.60 | 17.70 | 15.80 | 50.60 | 16.30 | 16.10 |
| $Fe_2O_3$ | 1.33 | 0.75 | 0.89 | 1.68 | 0.58 | 1.79 | 1.95 | 2.35 |
| FeO | 5.81 | 0.84 | 0.98 | 4.20 | 2.45 | 5.60 | 5.66 | 4.41 |
| MgO | 2.73 | 0.92 | 0.58 | 2.53 | 1.15 | 4.68 | 4.56 | 2.69 |
| CaO | 5.65 | 1.58 | 0.44 | 4.86 | 3.62 | 6.53 | 7.13 | 4.05 |
| $Na_2O$ | 3.18 | 0.39 | 0.73 | 3.64 | 3.88 | 2.80 | 3.09 | 4.33 |
| $K_2O$ | 2.25 | 3.01 | 3.40 | 2.03 | 1.34 | 1.40 | 0.89 | 2.04 |
| $H_2O+$ | 0.64 | 0.34 | 0.87 | 0.28 | 0.53 | 0.04 | 0.38 | 0.38 |
| $H_2O-$ | 0.30 | 0.45 | 0.41 | 0.45 | 0.45 | 0.52 | 0.51 | 0.58 |
| $CO_2$ | 1.03 | 0.10 | 0.10 | 0.45 | 0.18 | 0.09 | 0.08 | 0.86 |
| $TiO_2$ | 0.92 | 0.09 | 0.72 | 0.87 | 0.54 | 0.85 | 0.81 | 0.77 |
| $P_2O_5$ | 0.23 | 0.05 | 0.18 | 0.23 | 0.16 | 0.21 | 0.23 | 0.17 |
| S | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | 0.01 |
| MnO | 0.11 | 0.03 | 0.02 | 0.07 | 0.10 | 0.11 | 0.13 | 0.11 |
| TOTAL | 100.30 | 99.00 | 100.40 | 99.70 | 99.90 | 99.70 | 100.80 | 100.20 |

Notes:
< Less than

Table 15: Chemical analyses of Handy Lake Group, Highway 599 Section, Savant Lake Area.

| Sample Number | 199 | 198 | 117 | 115 | 190 | 191 | 187 | 192 | 188 | 59 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | | | |
| $SiO_2$ | 58.80 | 58.80 | 48.00 | 50.10 | 66.90 | 68.10 | 50.50 | 49.50 | 56.60 | 58.60 |
| $Al_2O_3$ | 16.90 | 15.80 | 12.70 | 15.20 | 15.70 | 15.70 | 13.90 | 13.50 | 15.40 | 14.20 |
| $Fe_2O_3$ | 7.60 | 1.99 | 1.50 | 1.70 | 1.21 | 0.93 | 1.50 | 1.71 | 0.98 | 1.36 |
| FeO | 0.42 | 5.80 | 8.82 | 9.94 | 1.89 | 1.96 | 10.10 | 8.54 | 5.95 | 8.32 |
| MgO | 3.62 | 3.97 | 13.90 | 8.78 | 1.21 | 1.05 | 8.49 | 6.27 | 4.53 | 5.19 |
| CaO | 5.29 | 6.77 | 10.30 | 8.70 | 2.43 | 2.38 | 10.10 | 14.00 | 10.80 | 8.47 |
| $Na_2O$ | 3.82 | 3.32 | 2.21 | 3.22 | 4.37 | 5.10 | 2.13 | 0.86 | 1.29 | 1.77 |
| $K_2O$ | 1.60 | 0.69 | 0.14 | 0.11 | 2.53 | 1.98 | 0.19 | 0.07 | 0.58 | 0.17 |
| $H_2O+$ | 1.12 | 0.64 | 1.18 | 0.66 | 0.52 | 0.58 | 0.45 | 0.78 | 0.56 | 0.57 |
| $H_2O-$ | 0.23 | 0.17 | 0.31 | 0.33 | 0.16 | 0.14 | 0.16 | 0.11 | 0.24 | 0.42 |
| $CO_2$ | 0.25 | 0.10 | 0.02 | 0.08 | 0.58 | 0.70 | 0.25 | 3.60 | 1.94 | 0.47 |
| $TiO_2$ | 0.89 | 0.84 | 0.53 | 1.07 | 0.39 | 0.38 | 1.41 | 0.61 | 0.61 | 0.64 |
| $P_2O_5$ | 0.22 | 0.19 | 0.09 | 0.11 | 0.14 | 0.16 | 0.12 | 0.09 | 0.08 | 0.07 |
| S | <0.01 | <0.01 | 0.01 | 0.01 | 0.14 | <0.01 | 0.07 | 0.02 | <0.01 | <0.01 |
| MnO | 0.09 | 0.13 | 0.20 | 0.17 | 0.05 | 0.05 | 0.17 | 0.43 | 0.18 | 0.26 |
| TOTAL | 100.80 | 99.20 | 99.90 | 100.20 | 98.20 | 99.20 | 99.50 | 100.10 | 99.70 | 100.50 |

Notes:
< Less than

Table 15: Chemical analyses of Handy Lake Group, Highway 599 Section, Savant Lake Area.

| Sample Number | 189 | 193 | 57 | 194 | 197 | 197-1 | 195 | 196 | 49 | 46 | 47 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Major elements in weight percent | | | | | | | | | | | |
| $SiO_2$ | 75.50 | 68.70 | 66.40 | 63.20 | 68.40 | 52.80 | 60.40 | 61.30 | 74.90 | 63.40 | 67.80 | 74.30 |
| $Al_2O_3$ | 14.00 | 15.40 | 16.60 | 16.50 | 15.40 | 13.90 | 14.10 | 15.70 | 13.00 | 16.30 | 15.30 | 13.20 |
| $Fe_2O_3$ | 0.58 | 0.67 | 1.12 | 1.43 | 0.78 | 4.24 | 1.67 | 1.87 | 0.68 | 1.68 | 1.01 | 0.73 |
| FeO | 0.28 | 1.54 | 2.93 | 1.96 | 1.12 | 6.09 | 2.94 | 3.57 | 1.61 | 2.73 | 2.52 | 1.61 |
| MgO | 0.52 | 1.26 | 1.77 | 1.07 | 0.55 | 3.43 | 2.72 | 1.85 | 0.78 | 3.34 | 2.01 | 0.81 |
| CaO | 0.42 | 4.24 | 1.91 | 4.78 | 3.47 | 7.64 | 6.30 | 4.58 | 2.39 | 4.05 | 4.25 | 2.33 |
| $Na_2O$ | 4.72 | 1.70 | 4.59 | 4.06 | 3.88 | 2.71 | 3.91 | 2.63 | 3.79 | 3.46 | 2.51 | 3.79 |
| $K_2O$ | 2.15 | 2.95 | 3.76 | 2.13 | 2.01 | 3.12 | 2.17 | 3.86 | 1.81 | 2.50 | 2.70 | 2.01 |
| $H_2O+$ | 0.74 | 0.83 | 0.44 | 0.73 | 0.65 | 0.58 | 0.62 | 1.11 | 0.12 | 0.19 | 0.19 | 0.14 |
| $H_2O-$ | 0.21 | 0.28 | 0.44 | 0.14 | 0.22 | 0.20 | 0.05 | 0.11 | 0.45 | 0.44 | 0.46 | 0.43 |
| $CO_2$ | 0.08 | 0.97 | 0.60 | 2.20 | 1.78 | 3.75 | 3.74 | 2.08 | 0.44 | 0.50 | 0.55 | 0.44 |
| $TiO_2$ | 0.12 | 0.33 | 0.48 | 0.47 | 0.47 | 0.43 | 0.46 | 0.73 | 0.33 | 0.50 | 0.39 | 0.33 |
| $P_2O_5$ | 0.06 | 0.12 | 0.18 | 0.18 | 0.20 | 0.19 | 0.21 | 0.36 | 0.10 | 0.37 | 0.16 | 0.09 |
| S | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03 | 0.23 | 0.01 | 0.43 | 0.01 | 0.01 |
| MnO | 0.01 | 0.03 | 0.03 | 0.06 | 0.04 | 0.12 | 0.05 | 0.10 | 0.05 | 0.08 | 0.08 | 0.05 |
| TOTAL | 99.40 | 99.00 | 100.40 | 98.90 | 99.00 | 99.20 | 99.40 | 100.10 | 100.50 | 100.00 | 99.90 | 100.30 |

Notes:
< Less than

Table 15:

Trace elements in parts per million

| Sample Number | 88 | 86 | 84 | 84-1 | 73 | 70 | 68 | 67 |
|---|---|---|---|---|---|---|---|---|
| Ag | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ba | 220 | 200 | 220 | 200 | 190 | 290 | 110 | 120 |
| Be | 2 | <1 | <1 | <1 | 3 | <1 | <1 | 2 |
| Co | 25 | 5 | 5 | 20 | 5 | 25 | 25 | 20 |
| Cr | 195 | 5 | 30 | 35 | 10 | 100 | 85 | 55 |
| Cu | 10 | 5 | 20 | 5 | 5 | 60 | 60 | 45 |
| Ga | 15 | 20 | 15 | 10 | 15 | 15 | 10 | 15 |
| Li | 20 | 5 | 10 | 10 | 5 | 10 | 5 | 10 |
| Mo | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ni | 90 | 5 | 10 | 25 | 5 | 70 | 65 | 40 |
| Pb | 20 | 10 | 20 | 20 | 20 | 10 | 10 | 10 |
| Sc | 25 | 5 | 10 | 20 | 10 | 30 | 25 | 20 |
| Sn | <3 | 4 | <3 | <3 | <3 | <3 | <3 | <3 |
| Sr | 400 | 100 | 100 | 300 | 300 | 400 | 300 | 400 |
| V | 150 | 5 | 100 | 100 | 15 | 150 | 150 | 100 |
| Y | 30 | 5 | 20 | 35 | 30 | 25 | 30 | 25 |
| Zn | 80 | 25 | 20 | 80 | 70 | 85 | 85 | 85 |
| Zr | 150 | 70 | 90 | 100 | 100 | 100 | 150 | 200 |

Notes:
< Less than

Table 15:

Trace elements in parts per million

| Sample Number | 199 | 198 | 117 | 115 | 190 | 191 | 187 | 192 | 188 | 59 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ba | 200 | 160 | 60 | 40 | 1000 | 700 | 80 | 50 | 180 | 60 |
| Be | <1 | <1 | <1 | <1 | 1 | 2 | <1 | <1 | <1 | <1 |
| Co | 25 | 25 | 65 | 45 | 15 | 5 | 45 | 50 | 45 | 50 |
| Cr | 70 | 70 | 240 | 260 | 20 | 45 | 390 | 320 | 500 | 980 |
| Cu | 45 | 25 | 45 | 105 | 35 | 15 | 45 | 95 | 10 | 10 |
| Ga | 8 | 5 | 7 | 10 | 20 | 20 | 15 | 15 | 15 | 10 |
| Li | 5 | 10 | 15 | 10 | 50 | 15 | 10 | 10 | 15 | 5 |
| Mo | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ni | 40 | 50 | 360 | 115 | 15 | 15 | 185 | 70 | 70 | 145 |
| Pb | 100 | 50 | 220 | 110 | 20 | 20 | 20 | 220 | 20 | <10 |
| Sc | 25 | 30 | 30 | 40 | 10 | 9 | 30 | 80 | 70 | 60 |
| Sn | 15 | 10 | 20 | 15 | <3 | <3 | <3 | 20 | <3 | <3 |
| Sr | 600 | 400 | 200 | 200 | 900 | 1000 | 200 | 200 | 200 | 100 |
| V | 200 | 200 | 200 | 300 | 60 | 60 | 250 | 350 | 350 | 400 |
| Y | 30 | 30 | 15 | 25 | <10 | <10 | 20 | 25 | 15 | 20 |
| Zn | 90 | 85 | 85 | 100 | 75 | 115 | 150 | 350 | 110 | 80 |
| Zr | 200 | 200 | 100 | 100 | 100 | 90 | 100 | 80 | 40 | 60 |

Notes:
< Less than

Table 15:

Trace elements in parts per million

| Sample Number | 189 | 193 | 57 | 194 | 197 | 197-1 | 195 | 196 | 49 | 46 | 47 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ba | 680 | 560 | 870 | 720 | 500 | 360 | 580 | 500 | 390 | 820 | 660 | 360 |
| Be | 2 | 2 | 3 | <1 | 2 | <1 | 2 | 2 | 3 | 3 | 3 | 2 |
| Co | 5 | 5 | 10 | 10 | 5 | 45 | 10 | 25 | 10 | 10 | 10 | 5 |
| Cr | 10 | 25 | 55 | 40 | 80 | 95 | 65 | 90 | 35 | 95 | 105 | 40 |
| Cu | <5 | 10 | 5 | 5 | 5 | 110 | 20 | 55 | 10 | 25 | 5 | 10 |
| Ga | 15 | 15 | 15 | 9 | 8 | 7 | 7 | 7 | 10 | 20 | 15 | 10 |
| Li | 15 | 20 | 20 | 20 | 15 | 25 | 20 | 15 | 10 | 35 | 20 | 10 |
| Mo | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ni | <5 | 5 | 25 | 10 | <5 | 95 | 15 | 25 | 10 | 30 | 35 | 15 |
| Pb | 20 | 660 | 30 | 230 | 300 | 190 | 130 | 110 | 20 | 20 | 20 | 20 |
| Sc | <5 | <5 | 8 | 8 | <5 | 40 | 10 | 20 | 6 | 10 | 10 | 6 |
| Sn | <3 | 30 | <3 | 20 | 25 | 20 | 15 | 15 | <3 | <3 | <3 | <3 |
| Sr | 400 | 400 | 400 | 800 | 700 | 600 | 2500 | 1000 | 300 | 1500 | 900 | 350 |
| V | <5 | 40 | 70 | 70 | 70 | 60 | 100 | 150 | 40 | 90 | 90 | 40 |
| Y | <10 | <10 | <10 | <10 | 10 | 10 | 10 | 20 | 10 | 20 | <10 | 15 |
| Zn | 35 | 40 | 55 | 60 | 30 | 290 | 75 | 65 | 55 | 85 | 55 | 55 |
| Zr | 60 | 90 | 100 | 80 | 200 | 150 | 150 | 150 | 45 | 150 | 90 | 70 |

Notes:
< Less than

Table 15:

| Sample Number | Description |
|---|---|
| 88 | Grey, buff, medium- to fine-grained feldspar porphyry flow |
| 86 | Grey, white, fine-grained tuff |
| 84 | Grey, medium- to fine-grained tuff/flow |
| 84-1 | Buff, medium-grained massive flow |
| 73 | White, grey, lapilli tuff to tuff breccia |
| 70 | Grey green, fine-grained massive flow |
| 68 | Green, medium-grained, flow/tuff |
| 67 | Buff grey, medium-grained, feldspar porphyritic flow/crystal tuff |

Table 15:

| Sample Number | Description |
|---|---|
| 199 | Grey, medium to fine-grained flow/tuff |
| 198 | White to buff, medium-grained flow/intrusive |
| 117 | Black to green, fine to medium-grained massive flow |
| 115 | Dark grey green, fine-grained massive flow |
| 190 | White tuff/tuffaceous metasediment |
| 191 | White tuff to lapilli tuff (Lithic-crystal) |
| 187 | Dark green, medium to fine-grained massive flow |
| 192 | Dark green, medium to fine-grained massive flow |
| 188 | Grey green, medium grained massive flow |
| 59 | Grey green, medium to fine-grained flow/tuff |

Table 15:

| Sample Number | Description |
|---|---|
| 189 | White to buff aphanitic flow/tuff |
| 193 | White to buff fine tuff/tuffaceous metasediment |
| 57 | White medium-grained flow |
| 194 | White, fine, minor lapilli, tuff/tuffaceous metasediment |
| 197 | Fine to very fine tuffaceous band |
| 197-1 | Medium, possible lapilli, tuffaceous band |
| 195 | White to creamy, fine, tuffaceous metasediment |
| 196 | White to buff, fine, tuffaceous metasediment |
| 49 | White to pink medium-grained volcanic dike |
| 46 | Grey, slightly pink, medium tuff/tuffaceous metasediment |
| 47 | Grey, slightly pink, medium tuff/tuffaceous metasediment |
| 48 | White to light pink medium crystal tuff/flow |

Table 15:

Trace elements in parts per million

| Sample Number | 29 | 27 | 23 | 21 | 110 | 114 | 234 | 231 | 240 | 104 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ba | 100 | 80 | 60 | 40 | 360 | 60 | 220 | 250 | 290 | 160 |
| Be | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 2 | <1 |
| Co | 45 | 50 | 55 | 45 | 10 | 35 | <5 | 5 | 5 | 5 |
| Cr | 335 | 115 | 260 | 335 | 10 | 205 | <5 | 25 | 5 | 5 |
| Cu | 40 | 30 | 140 | 15 | 5 | 45 | <5 | 10 | 5 | 5 |
| Ga | 10 | 10 | 10 | 10 | 15 | 15 | 10 | 15 | 15 | 15 |
| Li | 5 | 5 | 5 | 5 | 15 | 15 | 10 | 10 | 15 | 10 |
| Mo | <1 | <1 | <1 | <1 | <1 | 2 | <1 | <1 | <1 | <1 |
| Ni | 105 | 60 | 215 | 125 | 10 | 125 | <5 | 15 | 10 | <5 |
| Pb | 20 | 40 | <10 | 60 | 20 | 40 | 10 | <10 | 20 | 10 |
| Sc | 45 | 45 | 40 | 35 | 8 | 35 | <5 | 10 | 5 | <5 |
| Sn | <3 | <3 | 5 | <3 | <3 | 7 | <3 | <3 | <3 | <3 |
| Sr | 100 | 100 | 100 | 200 | 300 | 300 | 100 | 100 | 400 | 200 |
| V | 350 | 350 | 300 | 250 | 40 | 300 | 25 | 60 | 30 | 20 |
| Y | 25 | 25 | 25 | 25 | 15 | 35 | 10 | 15 | <10 | 10 |
| Zn | 70 | 70 | 120 | 100 | 50 | 100 | 25 | 35 | 25 | 30 |
| Zr | 70 | 70 | 70 | 70 | 100 | 200 | 150 | 200 | 150 | 80 |

Notes:
< Less than

Table 16: Chemical analyses of Samples of Anthophyllitic Flows/Tuffs, Handy Lake Group, Savant Lake Area.

| Field Sample Number | 6T-1 | 6T-4 | 6T-61 |
|---|---|---|---|
| Major elements in weight percent | | | |
| $SiO_2$ | 48.90 | 46.00 | 42.40 |
| $Al_2O_3$ | 9.28 | 6.87 | 5.39 |
| $Fe_2O_3$ | 2.62 | 1.60 | 3.06 |
| FeO | 8.26 | 10.40 | 8.68 |
| MgO | 16.30 | 27.00 | 26.30 |
| CaO | 10.60 | 0.79 | 4.09 |
| $Na_2O$ | 0.43 | 0.09 | 0.10 |
| $K_2O$ | 0.22 | 0.00 | 0.00 |
| $TiO_2$ | 0.38 | 0.32 | 0.24 |
| $P_2O_5$ | 0.09 | 0.06 | 0.05 |
| S | 0.45 | 0.15 | 0.07 |
| $MnO_2$ | 0.27 | 0.14 | 0.18 |
| $CO_3$ | 0.22 | 3.16 | 9.50 |
| $H_2O^+$ | 1.64 | 3.71 | 1.34 |
| $H_2O^-$ | 0.41 | 0.34 | 0.49 |
| TOTAL | 100.10 | 100.60 | 101.90 |

Table 16:

| Field Sample Number | 6T-1 | 6T-4 | 6T-61 |
|---|---|---|---|
| Trace elements in parts per million | | | |
| Ba | 80 | 20 | 40 |
| Co | 65 | 105 | 100 |
| Cr | 1260 | 3220 | 2140 |
| Cu | 70 | 45 | 45 |
| Ga | 7 | 5 | 3 |
| Li | 10 | 5 | 3 |
| Ni | 460 | 880 | 860 |
| Pb | 20 | 20 | <10 |
| Sc | 35 | 30 | 25 |
| Sn | 10 | 6 | <3 |
| Sr | 100 | 30 | 200 |
| V | 200 | 150 | 100 |
| Y | 15 | <10 | <10 |
| Zn | 340 | 110 | 310 |
| Zr | 40 | 30 | 25 |

Notes:
< Less than

Table 16:

| Field Sample Number | Normative Mineralogy in Molecular Weight | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Apatite | Pyrrhotite | Ilmenite | Orthoclase | Albite | Anorthite | Corundum | Acmite | Magnetite | Hematite | Wollastonite | Enstatite | Perrosilite | Quartz | Diopside | Forsterite | Fayalite | Nepheline | Leucite | Hedenbergite | Calcite |
| 6T-1 | 0.19 | 1.58 | 0.54 | 1.31 | 3.90 | 22.97 | 0.00 | 0.00 | 1.99 | 0.00 | 0.00 | 33.70 | 8.13 | 0.00 | 19.05 | 1.66 | 0.40 | 0.00 | 0.00 | 4.59 | 0.00 |
| 6T-4 | 0.13 | 0.53 | 0.45 | 0.00 | 0.82 | 3.59 | 6.04 | 0.00 | 1.71 | 0.00 | 0.00 | 63.35 | 12.11 | 0.00 | 0.00 | 9.46 | 1.81 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6T-61 | 0.11 | 0.26 | 0.35 | 0.00 | 0.95 | 15.01 | 0.00 | 0.00 | 1.91 | 0.00 | 0.00 | 34.39 | 6.53 | 0.00 | 4.04 | 30.00 | 5.69 | 0.00 | 0.00 | 0.77 | 0.00 |

Table 16:

| Field Sample Number | Thin Section Mineralogy (Estimated Percent)++ | Texture (Thin Section) |
|---|---|---|
| 6T-1 | Chlorite(25) + opaques(3) + serpentine(10) + tremolite-actinolite(55)* + tourmaline(7) | Schistose, amygdaloidal |
| 6T-4 | Carbonate(10) + opaques(3) + serpentine(32) + tremolite-actinolite(55) | Schistose |
| 6T-61 | Carbonate(10) + chlorite(25) + opaques(5) + talc(5) + tremolite-actinolite(55) | Nematoblastic (Anthophyllite) schistose |

++ Total sums approximately to 100

* Though anthophyllite was identified in X-ray, petrographic features are more compatible with tremolite perhaps indicating a tremolite-actinolite to anthophyllite solid solution series.

Table 17: Trace Element Analyses - Savant Occurrence.

| LITHOLOGY | Trace Elements+ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ag | Au* | Cu | Hg | Mn | Pb | Sn | Zn |
| Host rocks | 4 | <10 | 260 | 20 | 1750 | 30 | 15 | 360 |
| (intermediate | <1 | <10 | 50 | <20 | 870 | <10 | 5 | 450 |
| tuffs and | 1 | <10 | 65 | <20 | 1210 | 30 | 6 | 580 |
| metasediments | 1 | <10 | 5 | <20 | 350 | 20 | 10 | 55 |
| 7 samples) | <1 | <10 | 40 | <20 | 1120 | <10 | 7 | 155 |
| | 1 | <10 | 110 | 20 | 2020 | 110 | 20 | 380 |
| | 2 | <10 | 30 | 20 | 3420 | <10 | 10 | 160 |
| MINERALIZED ZONE 1 | 110 | 200 | 8800 | 100 | 2120 | 6600 | 650 | 2.0** |
| (2 samples) | 15 | 40 | 1940 | 30 | 1020 | 640 | 150 | 1000 |
| MINERALIZED ZONE 2 | 10 | 10 | 1220 | 1350 | 1280 | 500 | 200 | 1.7** |
| (2 samples) | 15 | 10 | 2080 | 1580 | 780 | 5000 | 250 | 1.7** |

+ Parts per million
* Parts per billion
** Percent
< Less than

# GEOLOGICAL AND MINING SYMBOLS

## INSTRUCTIONS

This list of symbols replaces all previous lists and contains some significant changes and omissions. It should be used in conjunction with Instructions to Authors. The introduction of a symbol not contained in this list is costly and requires the direct authorization of the Chief Geologist. Except where indicated in the side notes the text accompanying a symbol cannot be changed.

## NOTES

A Show the dip of a structure, contact etc. by a short bar (or arrow to indicate top determination) drawn from the symbol. Do not use a separate detached strike and dip symbol. The actual dip reading may be shown

Example: ~~~ not ~~~

B When submitting a preliminary or final map manuscript, check off, in the OCCURS box, symbols used on the map face

C. Cartographers must note that if symbols 1-38 including type are not found on the master symbols strip film positives, they must be scribed or stuck up to match map face treatment.

D Type style and size in blocks a to h is not an authority for map face use

## SYMBOLS THAT MUST BE LABELLED ON MAP FACE.

### DO NOT REPEAT IN SYMBOL LIST. (SEE NOTE D)

| | | | OCCURS (Note B) |
|---|---|---|---|
| a | Pit | Test pit. | ☐ |
| b | Trench / Trenches | Exploration trenching. | ☐ |
| c | Adit | Adit. | ☐ |
| d | Esker / Delta | Sand or gravel feature. Label the specific feature. Use to delineate eskers at large scales | ☐ |
| e | Shoreline | Raised or ancient shoreline. Shown in colour mostly on Pleistocene series | ☐ |
| f | Shear / Shear zone | Name major shear zones. If absolutely no room, abbreviate shear to S.Z. and explain in symbol list, but try to avoid | ☐ |
| g | Quarry | Open cut, quarry etc. Label precisely | ☐ |
| h | Dump | Mine dump. Label | ☐ |

## SYMBOLS AND TEXT THAT APPEAR IN SYMBOL LIST (SEE NOTES)

| | | | OCCURS (Note B) |
|---|---|---|---|
| 1. | | *Glacial striae.* | ☐ |
| 2. | | *Glacial fluting. Drumlin.* | ☐ Delete inappropriate text |
| 3. | | *Outwash fan.* | ☐ Printed in colour on Pleistocene series only. |
| 4. | | *Hummocky topography.* | ☐ Printed in colour on Pleistocene series only |
| 5. | | *Esker.* | ☐ Use when map scale prohibits sand pattern (symbol d). May be in colour. Arrowhead shows direction of deposition. |
| 6. | | *Small bedrock outcrop.* | ☑ |
| 7. | | *Area of bedrock outcrop.* | ☑ |
| 8. | | *Bedding, horizontal.* | ☐ |
| 9. | | *Bedding, top unknown; (inclined, vertical).* | ☑ If top is known use symbol 10. To draw attention to vertical case show 90°. |
| 10. | | *Bedding, top indicated by arrow; (inclined, vertical, overturned).* | ☑ In overturned case loop indicates dip. |
| 11. | | *Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).* | ☑ In overturned case loop indicates dip |
| 12. | | *Bedding, top (arrow) from cross bedding; (inclined, vertical, overturned).* | ☐ In overturned case loop indicates dip. |
| 13. | | *Bedding, top (arrow) from relationship of cleavage and bedding; (inclined overturned).* | ☐ In overturned case loop indicates dip |
| 14. | | *Lava flow; top (arrow) from pillows shape and packing.* | ☑ |
| 15. | | *Schistosity; (horizontal, inclined, vertical).* | ☑ |
| 16. | | *Gneissosity. (horizontal, inclined, vertical).* | ☑ |
| 15a 16a | | *Foliation; (horizontal, inclined, vertical).* | ☐ General term embracing schistosity and gneissosity but not bedding. Strike without dip may not be used. May only be used if 15a or 16 are NOT used. |
| 17. | | *Banding; (horizontal, inclined, vertical).* | ☐ The structure of rocks having parallel bands of different textures, colours, or minerals, without implication of origin, origin; may be dealt with in the report |
| 18. | | *Lineation with plunge.* | ☐ This symbol may NOT be combined with others, but should be adjacent. |
| 19. | | *Geological boundary, observed.* | ☑ See note A |
| 20. | | *Geological boundary, position interpreted.* | ☑ This symbol may often be the only boundary shown on maps. See note A. |
| 21a. | | *Geological boundary, deduced from geophysics.* | ☐ Alternative to 21b. |
| 21b. | | *Magnetic contour, value in gammas.* | ☐ Alternative to 21a. Use if contours are also (in places) geological boundaries. |
| 22. | | *Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.* | ☑ Usually in black. Usually alternative to 23a. See note A. |
| 23a. | | *Lineament or fault.* | ☐ Usually in overprint colour (blue, red). Reserved for compiled maps. Line broken. Usually alternative to 22, always to 23b. See note A. Special cases exist. |
| 23b. | | *Lineament.* | ☑ Black only. Alternative to 23a. No assumed symbol. |
| 24. | | *Jointing; (horizontal, inclined, vertical).* | ☐ |
| 25. | | *Drag folds with plunge.* | ☐ Symbols are conventionalized. If exact shape of fold is important on map, advise Chief Cartographer in writing. |
| 26. | | *Anticline, syncline, with plunge.* | ☐ |
| 27. | | *Bedrock contour.* | ☐ Usually in colour. Less definite contours are shown broken but without explanation. |
| 28. | | *Drill hole; (vertical, inclined).* | ☐ Dip must appear in vertical case. May be numbered, space permitting. |
| 29a. | | *Drill hole; (projected vertically, projected up dip). Overburden shown.* | ☐ Use when no colour in drill holes. Alternative to 29b. |
| 29b. | | *Drill hole; (projected vertically, projected up dip). Overburden shown.* | ☐ Use on large scale maps only with prior approval of Chief Geologist. Carry colour. Alternative to 29a |
| 30. | | *Vein, vein network. Width in inches. Width in feet.* | ☐ Delete inappropriate text. Red or black according to printing limitations. |
| 31. | Ag | *Orebody projected to surface.* | ☐ Shown in red only. Use with caution. State metal (or mineral) recovered |
| 32. | | *Shaft; depth in feet.* | ☐ If possible, add word Shaft and omit from symbol list. Align with type applies on small scale maps but orient to mine shaft at large scales, if alignment of all shafts is known. |
| 33. | | *Quarry.* | ☐ Small scales only. Not a mine. |
| 34. | | *Gravel pit.* | ☐ Small scales only. Not a test pit |
| 35. | MA | *Magnetic attraction.* | ☐ Follow map face for type style. |
| 36. | RA | *Radioactivity.* | ☐ Not "reddish alteration." Follow map face for type style. |

## SYMBOLS THAT SHOULD APPEAR BELOW THE LEGEND.

| | | | |
|---|---|---|---|
| 37. | | *Breccia.* | ☐ |
| 38. | | *Carbonatized rock.* | ☐ |

## MINERAL REFERENCE TO APPEAR BELOW THE LEGEND.

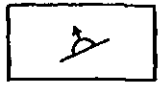
| | |
|---|---|
| Au | *Gold* |
| q | *Quartz* |
| qc | *Quartz-carbonate* |
| U | *Uranium* |

Selected typical examples. See Instructions to Authors for complete list.
Detailed sulphide mineralization of secondary significance may be indicated on preliminary maps. On final maps black S will be substituted or in rare cases the elemental symbol of the occurrence is described in detail in the report. Compilation maps require selective treatment. Metals of lowest lows all mines must be shown but in major camps simple production tables may be substituted.

GEOLOGICAL AND MINING SYMBOLS
(Supplement to lists on sheet O. D. M. 1779)

SYMBOLS AND TEXT THAT APPEAR IN SYMBOL LIST.

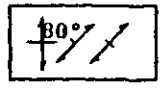
Add:

14a  Lava flow; top in direction of arrow. ☐ For all top determinations other than by pillow shapes, which is 14. Note elongation of line beyond half circle.

14b Direction of palaeocurrent. ☐

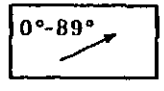
Delete symbol 15a/16a and all accompanying notes in red.

Substitute:

16a 

Foliation; (horizontal, inclined, vertical). ☑ Note the half arrows distinguishing this symbol from schistosity

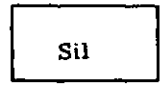
Substitute for symbol 18 in block. Delete all accompanying notes in red and substitute.

18 

Lineation with plunge. ☐ Horizontal to almost vertical indicated by degree number. If vertical special symbol permitted. This symbol may not be combined with others, but should be adjacent.

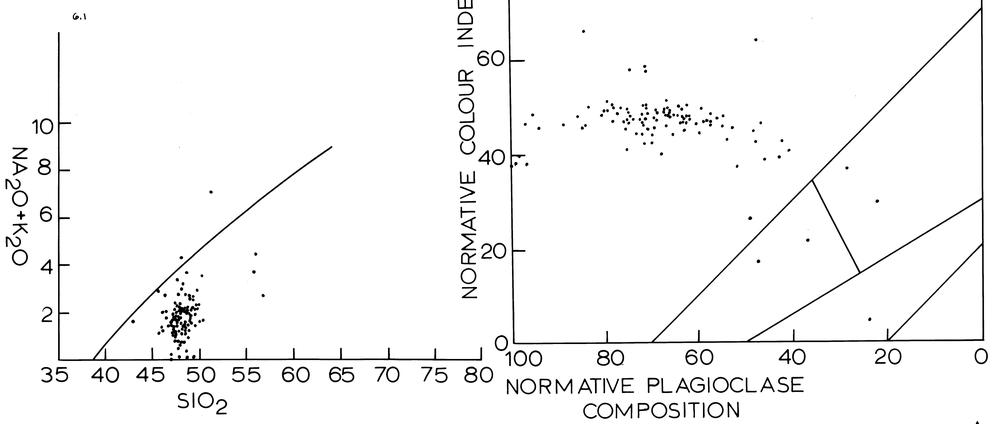
SYMBOL THAT SHOULD APPEAR BELOW THE LEGEND.

Add:

39 

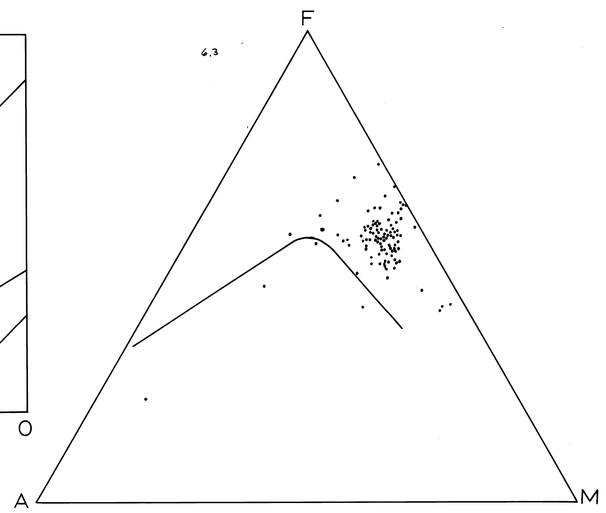
Silicified zone. ☐

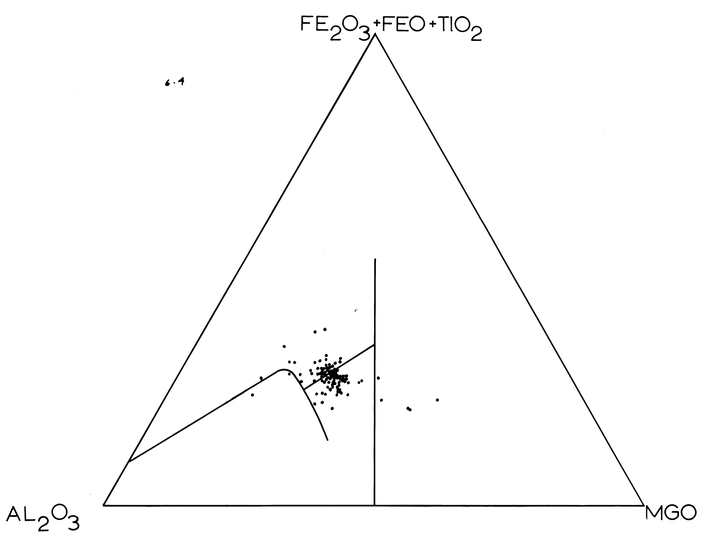
3268
ISSN 0826-9580
ISBN 0-7729-1698-5

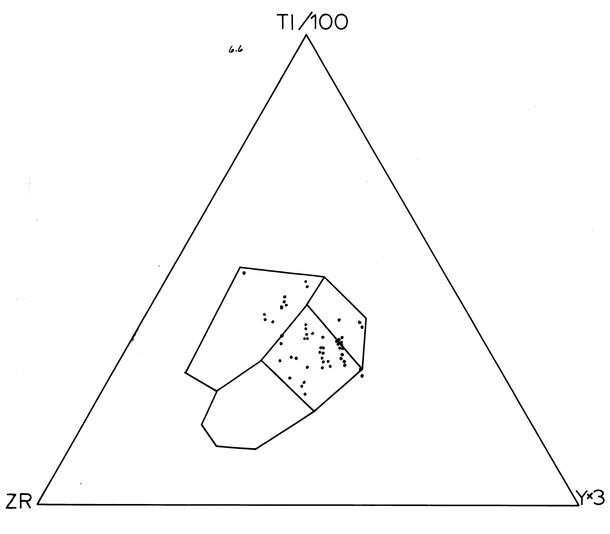


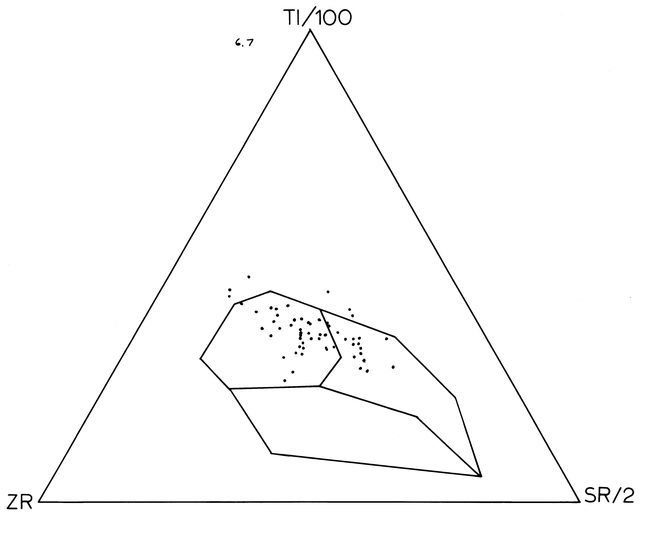


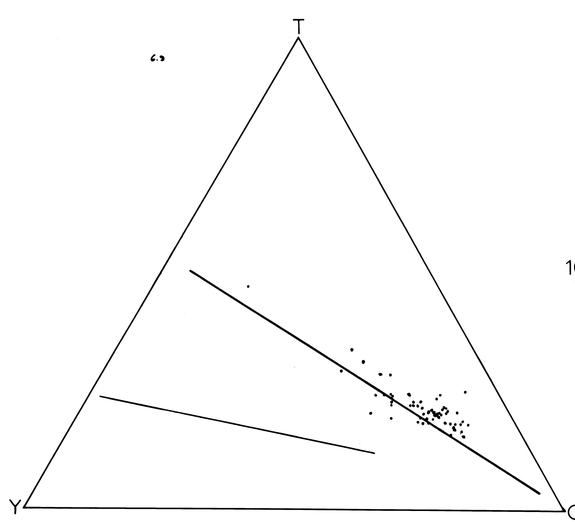


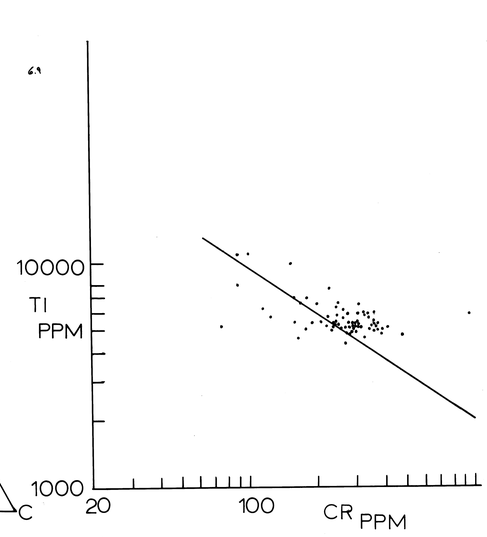


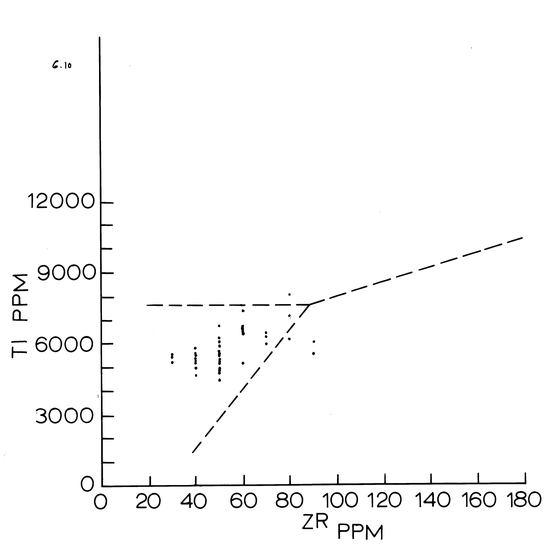



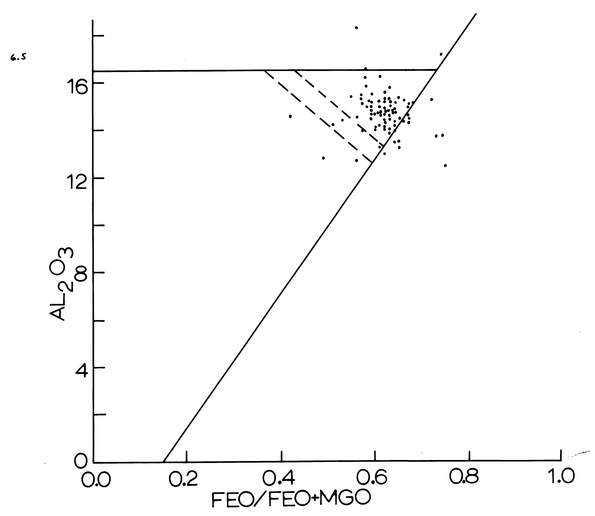



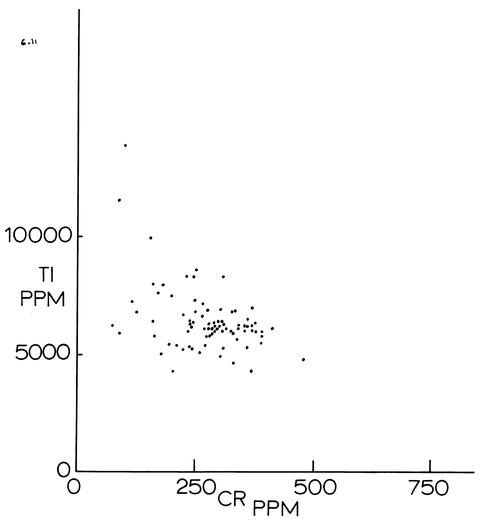



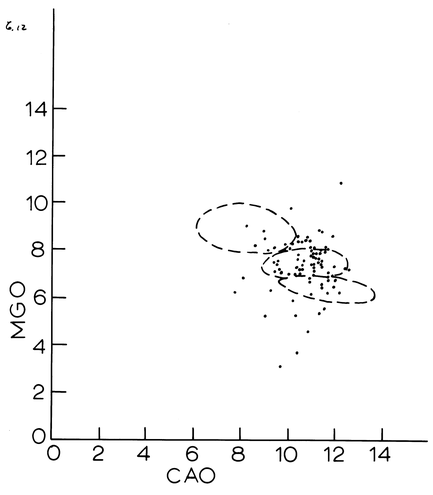




# JUTTEN VOLCANICS

Fig 6 Chemical plot of Jutten Tholeiitic Basalts, Jarvet Lake - Willow Lake Section

LEGEND

Handy Lake Volcanic Group (H.L.V.G.)
Savant Sedimentary Group (S.S.G.)
Savant Lake Volcanic Formation (S.L.V.F.)
Whimbrel Lake Volcanic Formation (W.L.V.F.)
Savant Narrows Formation (S.N.F.)
Jutten Volcanic Group

Lewis Lake Batholith (L.L.B.)
Handy Lake Sills (H.L.S.)
Mafic Intrusion (M.I.)

Scale 1:50,000

Fig. 2. Stratigraphic Nomenclature of the Savant Lake Area

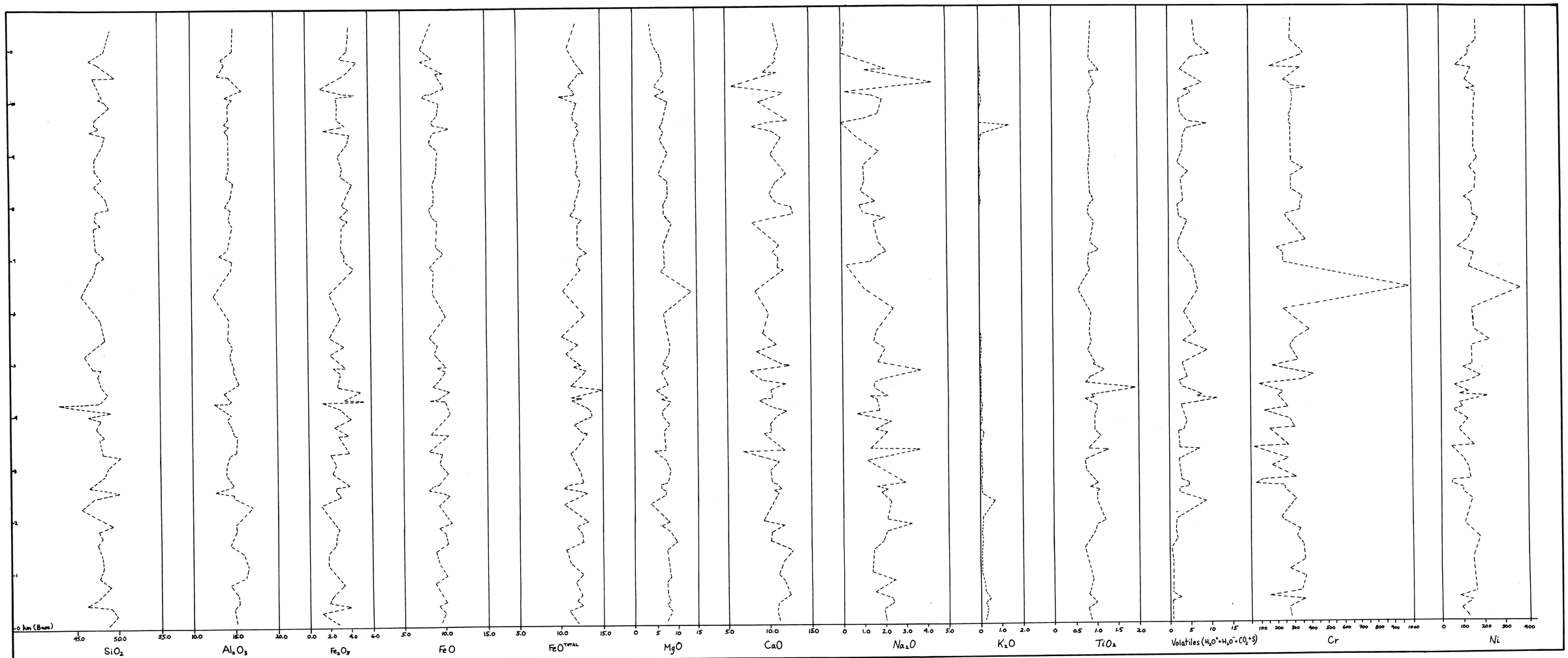



Fig 7 Chemical plot versus stratigraphic height, Julian Tholeiitic Basalts, Sawmill Lake–Silver Lake Section

SAVANT LAKE AREA - EAST
PROJECT 76-7 SMC 13578
SCALE 1:50 000

OFR 5606

SAVANT LAKE AREA - WEST
PROJECT 76-7 SMC 13578
SCALE 1:50 000