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Carbonatite - Alkalic Rock Complexes in Ontario:
Nemegosenda Lake Alkalic Rock Complex
District of Sudbury

by R.P. Sage

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Foreword

The Nemegosenda Lake Alkalic Rock Complex was examined as part of a project, begun in 1974, to study alkalic rock - carbonatite complexes in Ontario. The study describes the rock types and mineralogy of the complex and outlines the history of the mineral exploration efforts within the complex.

V.G. Milne
Director
Ontario Geological Survey

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CHART (back pocket)

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS.

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note. Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in cooperation with the Coal Association of Canada.

GEOLOGY OF CARBONATITE – ALKALIC ROCK COMPLEXES IN ONTARIO

Nemegosenda Lake Alkalic Rock Complex

DISTRICT OF SUDBURY

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Manuscript approved for publication, June 8, 1983, by John Wood, Chief Geologist, Ontario Geological Survey. Published with the permission of V.G. Milne, Director, Ontario Geological Survey.

Abstract

The Nemegosenda Lake Alkalic Rock Complex is located at Latitude 48°00'N, Longitude 83°06'W, about 30 km northeast of Chapleau. It lies within the Kapuskasing Subprovince of the Superior Province of the Canadian Shield.

The complex consists of arcuate rings and partial rings of gabbro, ijolite, fenite, nepheline syenite, carbonatite, malignite, syenite, and mafic syenite. The intrusion has been cut by numerous alkalic dike rocks.

The body is of Late Precambrian age and has been dated by rubidium-strontium isotopic techniques at 1015 ± 63 Ma.

In 1956 Dominion Gulf Company outlined, by diamond drilling, 20,000,000 tons of 0.47 percent Nb_2O_5 to a depth of 180 m in the northeast corner of the complex. Niobium mineralization is also known to occur at several locations along the east flank of the intrusion. The complex offers potential for a future source of niobium.

RESUME

Le complexe rocheux alcalin du lac Nemegosenda est situé à 48° de latitude nord et 83°06' de longitude ouest, à environ 30 km au nord-est de Chapleau. Il s'étend dans la sous-province de Kapuskasing de la province supérieure du bouclier canadien.

Ce complexe se compose d'anneaux arqués et d'anneaux partiels formés de gabbro, d'ijolite, de fénite, de syénite néphéline, de carbonatite, de malignite, de syénite et de syénite mafique. L'intrusion est entrecoupée de nombreuses roches alcalines.

Le massif date du précambrien supérieur que l'on a pu dater grâce à des procédés isotopiques au rubidium-strontium à 1015 ± 63 Ma.

En 1956, Dominion Gulf Company a découvert, par forage au diamant, 20 000 000 tonnes de Nb_2O_5 à 0,47 pour 100 à une profondeur de 180 mètres dans l'angle nord-est du complexe. On a également découvert des gisements de niobium minéralisé à plusieurs endroits le long du flanc est de l'intrusion. Ce complexe offre des possibilités d'approvisionnement futur en niobium.

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Introduction

The Nemegosenda Lake Alkalic Rock Complex is one of several alkalic intrusions emplaced into the rocks of the Kapuskasing Subprovince of the Superior Province. The Kapuskasing Subprovince is characterized by rocks metamorphosed to the amphibolite and granulite facies rank of regional metamorphism (Bennett *et al.* 1967; Thurston *et al.* 1977). The Kapuskasing Subprovince is an upthrusted block or horst which strikes northeast across the regional east-west structural trends found within the bounding subprovinces.

The Nemegosenda Lake Alkalic Rock Complex was prospected by Gulf Minerals Canada Limited (formerly Dominion Gulf Company) between 1954 and 1959, and a large tonnage of niobium mineralization was discovered. The property is still retained by the company.

As part of a province-wide investigation of alkalic rock - carbonatite complexes, the Nemegosenda complex was revisited to collect samples for thin section examination and chemical analysis. The complex had been previously mapped by Parsons (1961).

ACKNOWLEDGMENTS

The complex was originally mapped by Parsons (1961), and his report and map were invaluable aids to the present project. Parsons report is now out of print, and some material from that report, particularly concerning economic geology, has been incorporated in the present report. Parsons' map was used as a base map for this project, and much information from his map has been incorporated in the present map. (See also "Previous Geological Work").

The author was assisted in mapping by W. Wright, C. Higgins, and P. Chamois. Mr. Wright, senior geological assistant, mapped the west side of the complex and completed several traverses east of the complex. The author mapped the east shore of Nemegosenda Lake within the alkalic complex and the logging-access road approximately 1 mile east of the complex.

Mr. Walter H. Thompson and Gulf Minerals Canada Limited gave permission to sample diamond-drill core which had been stored at the site since the drilling during the 1950s. The core was a source of valuable samples for petrographic and analytical study of the complex, since outcrops are scarce.

Mr. and Mrs. George Mains of Chapleau Outpost furnished accommodations, meals, boats, and motors to the field crew. Air transportation to and from Nemegosenda Lake was provided by the Ministry of Natural Resources regional office at Timmins. Mr. Robert Elliot, Regional Fire Control, Ministry of Natural Resources, provided logistical support.

LOCATION AND ACCESS

The Nemegosenda Lake Alkalic Rock Complex (Figure 1) lies principally in Chewett Township, but extends into Collins, Pattinson, and McGee Townships. The complex is centred at approximately 48°00'N Latitude and 83°06'W Longitude. Nemegosenda Lake covers the core area of the body.

Highway 129 passes within 5 km of the complex and a logging-access road which was passable at the time of the project approaches within 2 km of the eastern shore of the lake. The most convenient access to the complex is by float-equipped fixed-wing aircraft, which can be chartered in Chapleau approximately 24 km south of the complex. A lodge on the southwest corner of the lake can provide boats, accommodations, and meals.

The complex is slightly elongated in a north-south direction, and its general shape is interpreted to be oval from aeromagnetic maps 2233G and 2232G (ODM-GSC 1963a,b; see Figure 2). The complex has a surface area of approximately 18 km^2.

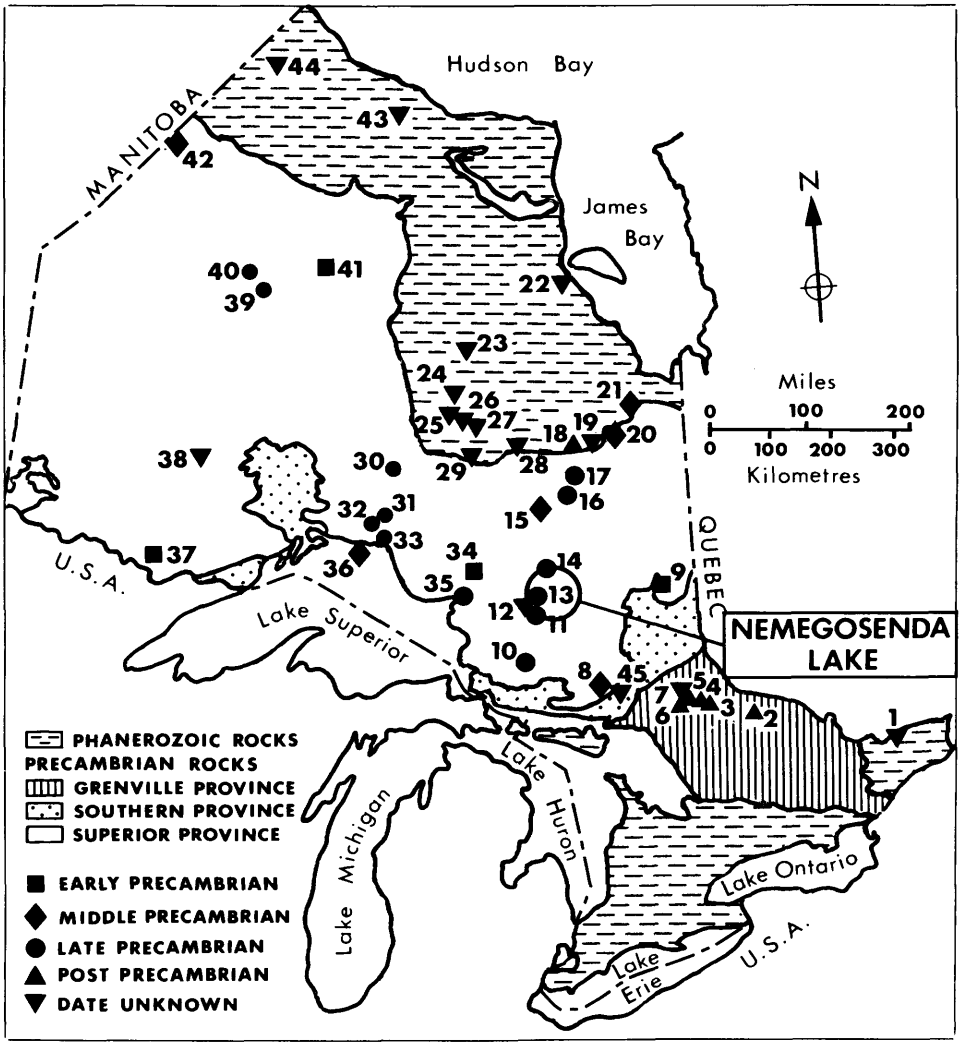

Figure 1. *Key map showing location of carbonatite – alkalic rock complexes in Ontario.*

1. *Eastview*
2. *Brent*
3. *Callander B.*
4. *Manitou Is.*
5. *Burritt Is.*
6. *Iron Is.*
7. *Lavergne*
8. *Spanish R.*
9. *Otto Stock*
10. *Seabrook L.*
11. *Lackner L.*
12. *Borden L.*
13. ***Nemegosenda L.***
14. *Shenango Tp.*
15. *Cargill Tp.*
16. *Teetzel Tp.*
17. *Clay-Howells*
18. *Hecla-Kilmer*
19. *Valentine Tp.*
20. *Goldray*
21. *Argor*
22. *Lawashi R.*
23. *Poplar R.*
24. *Albany Forks*
25. *L. Drowning R.*
26. *Kingfisher R. W.*
27. *Kingfisher R. E.,*
28. *Martison L.*
29. *Nagagami R.*
30. *Chipman L. (dikes)*
31. *Killala L.*
32. *Prairie L.*
33. *Port Coldwell*
34. *Herman L.*
35. *Firesand R.*
36. *Slate Is.*
37. *Poohbah L.*
38. *Sturgeon Narrows & Squaw L.*
39. *Schryburt L.*
40. *Big Beaver House*
41. *Wapikopa L.*
42. *"Carb" L.*
43. *Gooseberry Br.*
44. *Niskibi L.*
45. *Nemag L. & Lusk L.*

FIELD METHODS

Outcrop mapping was plotted on acetate overlays on 1:15,840 airphotos obtained from the Air Photo Library, Ministry of Natural Resources. Data were then transferred to the base cronaflex at 1:7920 scale. The base cronaflex was an enlargement of Ontario Department of Mines Map 2007 (Parsons 1961). A limited number of pace and compass traverses at a scale of 1:2400 were completed over the northwest corner of the complex.

PREVIOUS GEOLOGICAL WORK

Sargent (1957) completed the first study of the alkalic rocks on Nemegosenda Lake. Westrick and Parsons (1957) published a description of the exploration leading to the discovery of niobium at Nemegosenda Lake. Temple (1959) published a brief abstract outlining his conclusions from studies of the niobium mineralization within the complex. Parsons (1961) prepared a report and map covering the complex for the Ontario Department of Mines. Some of the outcrops on Nemegosenda Lake were examined by the author during Operation Chapleau (Thurston *et al.* 1977).

Bottriell (1975) discussed the significance of a Rb-Sr isochron age determination on outcrop samples collected from the complex.

Bell and Blenkinsop (1980) have completed rubidium-strontium isotopic studies on the complex.

The author finds little disagreement with the previous work of Parsons (1961) and work by the author has been confined largely to data addition. Any changes to the original work are largely extensions of Parsons' (1961) earlier observations. Parsons' map-units have been recoded in sequence of oldest to youngest, on the basis of field relationships observed by the author at Nemegosenda Lake and on the basis of relationships observed by the author at other alkalic rock - carbonatite intrusions within the Province. The author has not changed the distribution of the lithologies established by Parsons (1961) nor attempted to re-interpret magnetic and drill hole data. Parsons' map-units 8 and 6 were combined by the author in the process of recoding.

PHYSIOGRAPHY

The area underlain by the Nemegosenda Lake Alkalic Rock Complex is generally gently rolling. Relief generally does not exceed an estimated 15 m. Outcrop on the complex is scarce, being confined principally to the shoreline of Nemegosenda Lake. Nemegosenda Lake is elongated north-south, parallel to an inferred fault, and there is a steep slope near the shoreline at a number of locations along the east shore of the lake.

LABORATORY TECHNIQUES

All thin sections prepared from samples submitted for complete rock analysis were partially stained for potassium feldspar to facilitate the distinction of feldspar types. Specimens not suitable for analysis were not stained. Over 100 thin sections were very briefly examined. The tabulated analyses are presented in the appendix of this report. Time was insufficient to do detailed textural and mineralogical studies.

NOMENCLATURE

The various lithologic units of the complex were originally classified and named by Parson (1961). The author has used a somewhat different nomenclature in the present report, in conformity with the nomenclature used in describing other alkalic rock - carbonatite complexes in northern Ontario. For the alkalic rocks, the author prefers to use mineralogic, colour, or textural modifiers, which are familiar to all readers, rather than unfamiliar rock names. Alkalic rock nomenclature is cumbersome, due in large part to the profusion of unfamiliar rock names. Consequently, as an aid to the reader, the use of less familiar rock names will be limited. The rock terms retained by the author and the way they are used are given below.

Ijolite. A nepheline-pyroxene rock with a nepheline content between 30 and 70 percent. Rocks containing more than 70 percent nepheline are classified as urtite and those with less than 30 percent as melteigite. Some specimens may contain significant amounts of biotite in place of pyroxene. Potassium feldspar content is 10 percent or less and those rocks with 10 percent or less nepheline are classified as pyroxenite.

Malignite. A melanocratic nepheline syenite. In general, nepheline, pyroxene and potassium feldspar occur in roughly equal proportions. The potassium feldspar content must exceed 10 percent or the rock is classified as belonging to the ijolite suite. Both the nepheline and pyroxene content must exceed 10 percent or the rock would be classified with the syenites. This rock group is transitional between the ijolites and overlaps the syenitic rock groups.

Sovite. A carbonatite rock composed of 50 percent or more calcite. Various mineralogic modifiers are used to classify the sovite, for example, apatite-magnetite sovite, olivine-amphibole sovite, etc.

Silicocarbonate. A carbonatite rock containing 50 percent or more oxide and silicate minerals. Where the silicate or oxide mineralogy exceeds 90 percent various other rock names are applied; i.e. ijolite, biotite, pyroxenite, etc.

Syenite. This term is restricted to a quartz-free rock consisting primarily of alkali feldspars. Various mafic minerals and nepheline may be present and form a significant component of the rock. The syenites are named on the basis of their mineralogy, i.e., pyroxene-nepheline syenite, biotite-amphibole syenite, etc. The syenites are gradational into malignites.

There is no standard subdivision of the ijolite suite into ijolite, urtite, and melteigite. Bailey (1974) classified urtites as having more than 70 percent nepheline, however he uses the term ijolite to apply only to those rocks containing between 50 and 70 percent nepheline. The author finds this range to be too restricted for field use and prefers the 30 to 70 percent range given by Williams *et al.* (1954, p.70).

Malignite from the Poohbah Lake Complex in northwestern Ontario was originally defined by Lawson (1896) as an alkali-rich rock containing pyroxene, and potassium feldspar, with or without nepheline, garnet and amphibole. The author has examined the malignite of this complex in the field and in a large number of thin sections. The malignites are melanocratic and contain pyroxene, nepheline, orthoclase, garnet, and amphibole. The nepheline content of the type location is relatively low compared with the definition given above. For field work and to better emphasize the gradational nature of malignite into ijolites and syenites without the use of cumbersome terminology, a broader usage of the term has been applied by the author. Williams *et al.* (1954, p.65-66) described a number of malignites of varying mineralogy.

The Poohbah Lake type location for malignite was re-investigated by Mitchell and Platt (1978) and malignite was redefined by them as a nepheline syenite containing oikocrystic potassium feldspar. The author considers the definition of Mitchell and Platt too restrictive. In this report, the term malignite is used, as defined by Sorensen (1974, p.27), for a melanocratic nepheline syenite.

The definitions of sovite and silicocarbonatite are modified from Heinrich (1966, p.12). The author has found Heinrich's subdivision of the carbonate-rich carbonatitic rocks generally suitable for field usage when modified to a two-fold subdivision at about 50 percent oxide and silicate mineral contents. The two-fold subdivision is more convenient than the four-fold subdivision of Heinrich (1966) because carbonatites show extreme variations in mineral content over distances of less than a few centimetres. It is difficult to rigorously classify such heterogeneous rocks.

General Geology

The Nemegosenda Lake Alkalic Rock Complex lies within the Kapuskasing Subprovince of the Superior Province of the Canadian Shield. This subprovince is a northeast-striking horst consisting of rocks metamorphosed to upper amphibole to granulite facies rank. Faulting associated with this structure likely controlled the location of the Nemegosenda Lake Alkalic Rock Complex.

The Nemegosenda Lake Alkalic Rock Complex (Figures 2 and 3) consists largely of fine- to medium-grained, syenitic to malignitic rocks which are bordered along the southern margin of the complex by an arcuate mass of coarse-grained nepheline syenite. The complex is enclosed within a fenitized envelope produced by metasomatism by alkali-iron-rich aqueous fluids from the crystallizing alkaline magma (Parsons 1961). Ijolitic rocks occur in the northwest corner of the complex, and gabbro forms a mass along the northwest margin and an isolated band along the east flank. Parsons (1961) noted the fresh unmetamorphosed nature of the gabbro units but classified them as part of the country rocks. The author believes that they are an early phase of the alkalic magmatism perhaps analogous to the gabbroic margins observed by the author at the Port Coldwell and Killala Lake complexes located north of the northeast corner of Lake Superior.

The alkalic rocks of the complex are cut by numerous unsubdivided lamprophyric dikes, porphyritic syenite dikes, and rusty brown-weathering carbonate dikes. Rocks marginal to the carbonate dikes are bleached and altered and the carbonate dikes may, in part, occupy fractures or shear zones within the complex.

Parsons (1961) interpreted the main area of mineralization, located at the north end of the complex, to be representative of contact phenomena between the intrusive syenite and fenitized wall rock. The mineralization resulted from metasomatic alteration accompanying the intrusion of mafic malignitic rocks into a breccia zone along the syenite-fenite contact (Parsons 1961). The brecciated nature of this mineralized zone is readily seen on samples lying on the waste dump at the mouth of the adit driven into the mineralized zone and is well illustrated by diagrams in the report by Parsons (reproduced here as Figure 7). The workings were inaccessible to the author.

Thin section studies combined with field observations imply an increasing degree of silica saturation from the perimeter of the complex to its core. The broad general spatial distribution of rock units, gabbro rim to syenite core, is somewhat analogous to the rock distribution at the Port Coldwell and Killala Lake intrusions (Puskas 1967; Coates 1970). While cross-cutting relations between the major lithologic phases were not observed, the author has assumed that the trend towards more silica saturation in the core rocks is a reflection of decreasing age, from rim to core, of more highly differentiated intrusive phases. The sequence of major divisions in the map legend (Figure 3, Chart A, back pocket) reflects this assumed age relationship.

Bottriell (1975) reported a Rb-Sr whole-rock isochron of 910 ± 65 Ma for the Nemegosenda Lake complex, and Bell and Blenkinsop (1980) reported a Rb-Sr whole-rock isochron of 1015 ± 63 Ma.

Table 1 lists the lithologic units of the Nemegosenda Lake Alkalic Rock Complex.

EARLY PRECAMBRIAN (ARCHEAN)

ORTHOGNEISS

The Nemegosenda Lake Alkalic Rock Complex is enveloped by Early Precambrian gneissic rocks. The author considers the assemblage to be of igneous parentage and thus orthogneiss. The original identity of the gneissic rocks was obliterated by metamorphic and tectonic events. The possibility that some of these units are former sedimentary rocks cannot be totally discounted.

At the northeast end of Nemegosenda Lake, an outcrop of gabbroic anorthosite (unit 1a), displays a well developed gneissosity with elliptical clots of mafic minerals up to 1 cm in length enclosed within grey-white plagioclase. The exposures are extensively fenitized (Photo 1). The fenitization has imparted a brec-

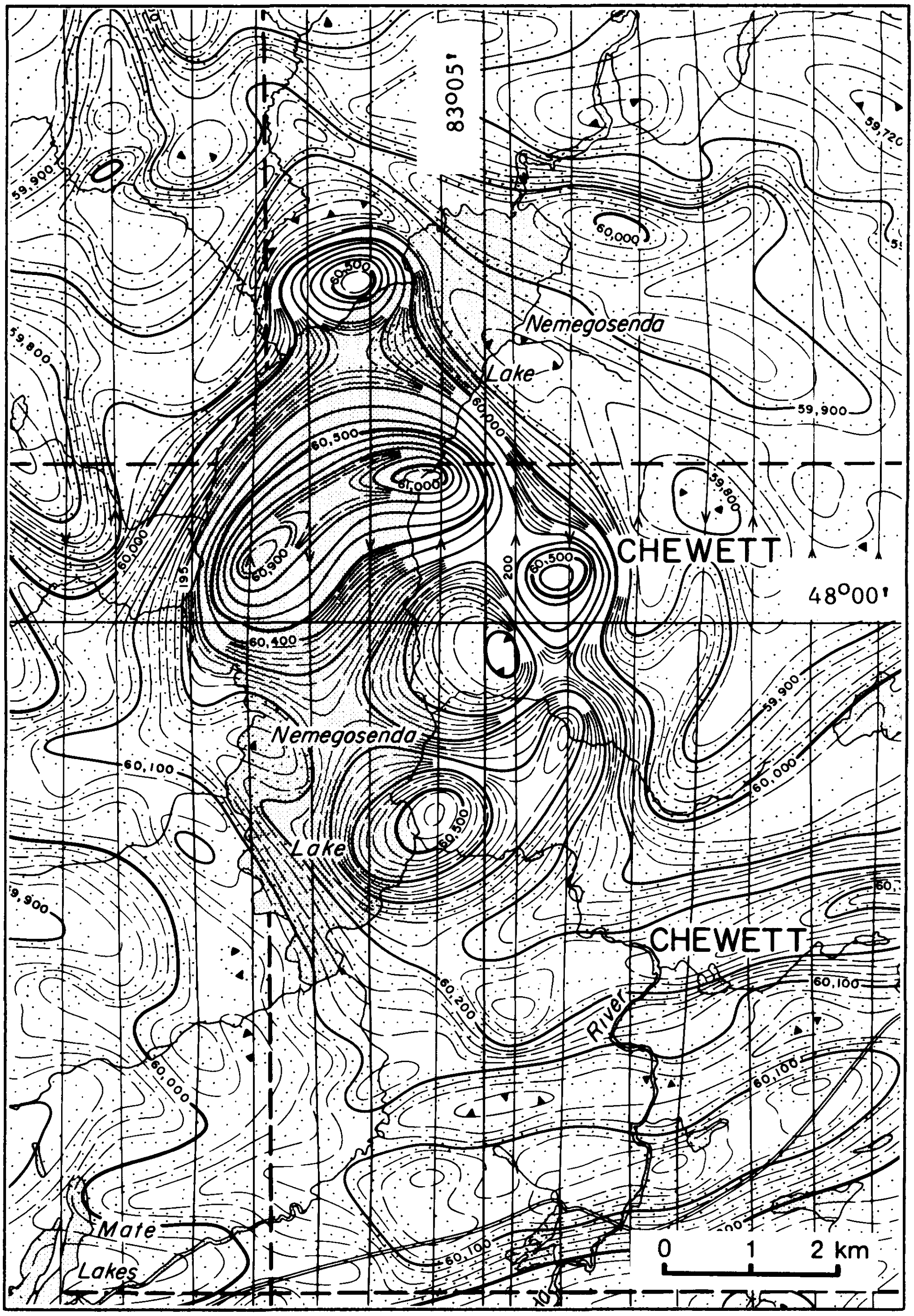

Figure 2. *Aeromagnetic map of the Nemegosenda Lake Alkalic Rock Complex. From aeromagnetic maps 2232G, 2233G (ODM-GSC 1963).*

TABLE 1. LITHOLOGIC UNITS FOR THE NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX.

CENOZOIC
QUATERNARY
RECENT
Swamp and stream deposits.
PLEISTOCENE
Glacial drift, varved clay, boulders, gravel, sand and silt.
Unconformity
LATE PRECAMBRIAN (PROTEROZOIC)
NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX
DIKE ROCKS
Carbonatite, lamprophyre, feldspar-porphyritic syenite.
Intrusive Contact
CARBONATITE ROCKS
Sovite, biotite-magnetite sovite, silicocarbonatite.
Intrusive Contact
INNER SYENITIC ROCKS
Nepheline Syenite
Nepheline syenite, biotite-nepheline syenite.
Intrusive Contact
Malignite and Mafic Syenite
Biotite malignite, biotite – aegirine-augite malignite, nepheline-bearing mafic (biotite, amphibole, aegirine-augite) syenites.
Intrusive Contact
OUTER SYENITIC ROCKS
Malignite and Aegirine-Augite Syenite
Oikocrystic malignite, aegirine-augite syenite, malignite, biotite-feldspar pegmatite, biotite-wollastonite rock, garnet-cancrinite-biotite rock, melteigite.
Intrusive Contact
IJOLITE
Ijolite, ijolite breccia.
Intrusive Contact
GABBRO
Gabbro.
Intrusive Contact
FENITES
Red alkalic fenite, pyroxenitic fenite.
Intrusive Contact
EARLY PRECAMBRIAN (ARCHEAN)
ORTHOGNEISS
Gneissic gabbroic anorthosite, banded amphibolite, quartz diorite to trondhjemite gneiss, trondhjemite to granodiorite pegmatite, trondhjemite dikes, garnet-hornblende-plagioclase gneiss.

Note: The alkalic rocks are listed approximately in order of formation. However certain types may have been introduced at more than one time-period. Order revised after Parsons (1961).

ciated pattern to the rock surface because of metasomatic alteration along fractures. Fractures within the gabbroic anorthosite are filled with fine- to coarse-grained biotite, pyroxene, carbonate and radiating clusters of green apatite.

In thin section, the freshest-appearing gabbroic anorthosite is fine to medium grained, inequigranular-seriate, allotriomorphic, with lobate to serrate grain boundaries. Interstitial anhedral perthite is present and all feldspars show very fine-grained myrmekitic intergrowths and have serrate grain boundaries. The pyroxene is very pale green (slightly sodic) and forms anhedral to subhedral irregular grains

Photo 1. *Fenetized gabbroic anorthosite at north end of Nemegosenda Lake. Location P-1 on Figure 3.*

with abundant subhedral biotite inclusions. The biotite forms very fine- to fine-grained crystal aggregates in addition to its occurence as poikilitic inclusions in clinopyroxene. Biotite also commonly occurs marginally to pyroxene grains, where it may have formed by alteration of the pyroxene to biotite. Epidote is present in very minor amounts.

A thin section of the fenitized gabbroic anorthosite displays similar textures but with more curved grain boundaries. Nepheline is present as blocky, interstitial, subhedral to euhedral crystals with tiny, optically unresolvable inclusions which are oriented parallel to the "C" crystallographic axis. Cancrinite is present as anhedral interstitial grains. Brown to reddish-brown, anhedral to subhedral biotite is common. Dark green aegirine-augite is present. Plagioclase (An_{40}) forms anhedral grains interlocked with nepheline.

The rock is identical to exposures of the Shawmere Anorthosite Complex observed by the author during Operation Chapleau (Thurston *et al.* 1977). The Shawmere Anorthosite Complex is located immediately to the northeast of the Nemegosenda Lake Alkalic Rock Complex. The author considers this occurrence to be part of the Shawmere Anorthosite Complex. Parsons (1961) indicated that other exposures of this rock are present along the east flank of the complex but these were not examined by the author.

At the southern extremity of mapping along the abandoned logging road east of the complex, is an outcrop of garnet-hornblende-quartz-plagioclase gneiss (unit 1g). Reddish-brown garnet up to 1 cm in diameter composes an estimated 15 to 20 percent of the rock. Quartz content is estimated at 20 to 25 percent, hornblende at

20 to 25 percent, and plagioclase at 40 to 60 percent. This garnet-rich rock is also typical of exposures of the Shawmere Anorthosite Complex and the author has tentatively correlated this exposure with that intrusive complex. The outcrop contains lit-par-lit leucocratic stringers of trondhjemite, possibly intrusive into the gneiss.

At the south end of Nemegosenda Lake is a prominent ridge of banded amphibolite (unit 1b). Amphibolite also occurs at numerous locations along the logging access road east of the complex. The rock is fine to medium grained and is black on both weathered and fresh surfaces. The bands within the amphibolite vary in width from several millimetres up to 1 m. Leucocratic medium-grained trondhjemite has intruded in lit-par-lit fashion into the amphibolite. The amphibolite has a reddish-brown colour on those exposures closest to the alkalic rock complex, possibly due to some addition of iron to the rock from fenitizing solutions. Visually, the rock is composed of roughly equal proportions of plagioclase and hornblende. In addition to quartz, which locally may exceed an estimated 20 percent, tiny red garnet crystals 1 mm in diameter or less were noted in several areas.

In thin section the rock is fine to medium grained, massive, equigranular, allotriomorphic, granoblastic, with curved grain boundaries. Amphibole is pleochroic, brown to yellow-brown, anhedral hornblende. Plagioclase of labradorite composition forms anhedral interlocking grains. The plagioclase grains have been intensely saussuritized though clear cores are present in one section from the south end of Nemegosenda Lake. In the same section, minor potassium feldspar is interstitial to the plagioclase, and epidote forms a minor component. Quartz is present in an amphibolite sample from the north end of the abandoned logging road east of the complex. Biotite is locally present as brown anhedral grains.

One of the most common rock types bordering the Nemegosenda Lake Alkalic Rock Complex is gneiss of trondhjemite to quartz diorite composition (units 1c and 1f). On weathered surface these rocks are grey, buff, grey-white, and on fresh surface the same colours, sometimes with a pinkish tint.

In thin section the rocks are medium grained, equigranular, allotriomorphic, granoblastic, with curved grain boundaries. The hornblende-rich units (unit 1c) contain more than 10 percent amphibole, 15 percent biotite, 25-35 percent quartz, and 50-60 percent plagioclase (An_{31-38}). The hornblende-poor units (unit 1f) contain less than 10 percent hornblende, 10-15 percent biotite, 10-15 percent microcline, and 40-45 percent plagioclase (An_{30-32}).

At numerous locations along the logging access road east of the complex, medium-grained trondhjemitic dike rocks (unit 1d) cross-cut the gneisses and intrude them in lit-par-lit fashion. These dikes are generally more leucocratic than the enclosing gneiss. In a few places the dikes are foliated parallel to foliation in the enclosing gneiss. The dikes are irregular in form and trend and mostly consist of irregular stringers of trondhjemite rarely exceeding 0.3 m in width.

At several locations along the logging-access road east of the complex, coarse-grained to very coarse-grained trondhjemite to granodiorite pegmatite (unit 1e) cut the gneisses. These dikes are irregular in width and lack any clearly defined trends. They weather buff to very pale pink and have similar colours on fresh surfaces.

LATE PRECAMBRIAN (PROTEROZOIC) NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX

FENITES

The fenites are, in part, Early Precambrian rocks altered by metasomatizing fluids during emplacement of the Late Precambrian alkalic magma and are, in part, altered earlier phases of the Late Precambrian alkalic rocks.

Parsons (1961) showed three fenite zones at Nemegosenda Lake. From the perimeter inward, these zones are ijolitic breccia fenite, red alkalic fenite, and pyroxenitic fenite.

The ijolitic breccia fenite shown on Parsons' map occurs only in the northwest corner of the complex. The rocks examined by the author in this area consist of three types: ijolite, gabbro, and gneiss. The earlier phases of alkalic magmatism represented by olivine gabbro and ijolite may have undergone some metasomatism (fenitization) from fluids derived from later pulses of syenitic magma. Metasomatized blocks of gabbro and gneiss occur within the ijolitic rocks. Presumably the ijolite magma has been emplaced into the gabbroic rocks. The more xenolithic-appearing areas also contain ijolite pegmatitic segregations within the equigranular ijolitic rocks. The ijolite is a nepheline-pyroxene rock wherein the two minerals occur in roughly equal proportions. The coarser-grained phases contain radiating clusters of light green apatite crystals up to 4 cm in length, euhedral aegirine-augite crystals, euhedral biotite crystals up to several centimetres in diameter, and calcite. The author observed sodalite in one thin section from samples collected from the northeast corner. See the sections "Ijoltite" and "Gabbro" for additional descriptions.

Pyroxenitic Fenite

Pyroxenitic fenite (unit 2a) lies between the red alkaline fenite and syenitic rocks of the core and envelopes the eastern flank of the complex. This pyroxenite fenite unit is not exposed in outcrop and therefore was not examined in the field by the author. The following description is abstracted from Parsons (1961, p.36-39). Pyroxenitic fenite is dark green, massive, foliated, pyroxene-rich, and contains xenolithic fragments. The massive, least-foliated rocks are fine grained and contain soda-orthoclase phenocrysts. Nepheline and feldspar are major components of the rock which could therefore be classified as ijolite to malignite. Xenolithic phases contain abundant garnet, wollastonite, and magnetite within the matrix, in addition to pyroxene. Higher niobium and rare earth values occur in rocks that contain garnet and wollastonite. Hydrated feldspar has been replaced by aegirine-augite along grain boundaries and the hydrated material has recrystallized as nepheline. Garnet and magnetite follow nepheline in replacing pyroxene, with the garnet content being inversely proportional to the pyroxene content. On the basis of a partial chemical analysis, the garnet is an andradite.

In the samples examined by the author, feldspar replacement by aegirine-augite could not be established. Garnet and magnetite may be alteration products of the pyroxene.

Red Alkalic Fenite

The red alkalic fenite (unit 3a) is the dominant fenite. It occurs along the west, north and east flanks of the Nemegosenda Lake Alkalic Rock Complex. As with most lithologic units within the complex it is poorly exposed.

The rock is red on fresh and weathered surfaces. In outcrop it displays a weak foliation with variable trend which conforms generally to the shape of the complex. Parsons (1961, p.36) reported that this unit is consistently radioactive and generally contains more than 0.2 percent Nb_2O_5. The weathered outcrops locally display feldspar or green pyroxene phenocrysts, up to 0.5 cm in length.

In thin section, orthoclase, microcline, albite, aegirine-augite, biotite, nepheline, and cancrinite are present. A zeolite may be present in minor amounts. Trace amounts of carbonate, apatite, and wollastonite are present. Parsons (1961, p.36) also reported the presence of scapolite and fluorite.

The minerals are often clouded and turbid making identification difficult. The microcline has the spotty quadrille twinning typical of microcline. In a single grain, the quadrille twinning of microcline is gradational into clear untwinned areas of feldspar identified as orthoclase. The potassium feldspars are anhedral in form. Albite forms subhedral to euhedral, turbid grains which are difficult to determine optically. The aegirine-augite occurs in euhedral to subhedral grains of a dark green colour and poikilitically contains feldspar inclusions. The nepheline forms subhedral to anhedral grains largely altered to sericite. Cancrinite occurs as anhedral grains and poikilitically contains inclusions of pyroxene and altered nepheline. The rock likely contains very fine-grained, dusty hematite which would account for its red colour and the turbid or clouded nature of some of the mineral phases. Parsons (1961, p.36) reported that some of the potassium feldspar may be anorthoclase.

The rock is too variable in composition to give an accurate estimate of the mode. The rock is dominantly composed of aegirine-augite, orthoclase, and albite. The aegirine-augite forms nearly half of the mineral assemblage.

The red alkaline fenite reaches widths of 1.2 km on the north flank. The fenite appears magmatic and may represent a rheomorphic envelope to the complex as has been proposed by Parsons (1961, p.34). This interpretation is similar to Eckermann's (1948) interpretation of some of the alkalic rock enclosing the Alno Carbonatite Complex, Sweden.

These ultrafenites are a product of pervasive alkaline metasomatism. The metasomatism took place at temperatures and pressures high enough to cause the rock to behave plastically, perhaps as a crystal mush, and to crystallize with a texture analogous to an igneous rock of strictly magmatic origin (Eckermann 1948, 1966).

GABBRO

Gabbro (unit 4) occurs in the northeast corner of the complex, and as a narrow strip along the east flank of the complex. These rocks were noted by Parsons (1961, p.35) who considered them to be part of the wall rocks and thus likely unrelated to the Nemegosenda Alkalic Rock Complex. The fresh unmetamorphosed appearance of the rock was noted by Parsons (1961, p.35).

The author was unable to locate outcrops of this rock on the east side of the complex. The large outcrop of gabbro in the northwest corner of the complex was relocated and sampled.

The rock weathers bluish grey with black mottling. On fresh surface it is a mottled grey and black. The rock is estimated to contain 25 to 30 percent pyroxene, and the remainder is plagioclase with a trace of biotite. The texture is subophitic. The outcrop shows trachytoidal texture, defined by the subparallel orientation of the platey plagioclase feldspars. The outcrop is cut by a 15 cm wide dike composed of coarse-grained aegirine-augite and calcite. The aegirine-augite crystals are dark green, euhedral, and up to 3 cm in length.

In thin section the gabbro is fine to coarse grained, massive, equigranular, allotriomorphic to hypidiomorphic, with curved to straight grain boundaries.

Plagioclase is of andesine to labradorite composition and forms tabular, subhedral crystals. The larger plagioclase crystals are locally bent, likely by protoclastic deformation.

Pyroxene is augite, anhedral in outline and interstitial to the plagioclase. The pyroxene grains are polycrystalline and in places display kelyphytic rims next to the plagioclase. Some olivine grains have well developed kelyphytic rims next to plagioclase but lack such rims when adjacent to pyroxene. Several pyroxene grains display schiller structure.

Olivine forms rounded grains intergranular to the plagioclase and is poikilitically enclosed in both pyroxene and plagioclase. The olivine has kelyphytic rims: a fresh olivine core is surrounded by a thin rim of talc, surrounded in turn by a turbid or cloudy zone that is optically unresolvable. The turbid zone is, on average, approximately 10 times wider than the talc rim. Olivine grains poikilitically enclosed within the pyroxene lack kelyphitic rims. The best developed reaction rims are between olivine and plagioclase grains.

Amphibole forms anhedral, brown, partial rims to some pyroxene grains. Minor anhedral magnetite is present possibly after olivine. Several patches of very fine-grained, brown, alteration material are present. This alteration material is minor and the original mineral is not recognizable.

In a sample of gabbro collected close to the ijolite, brown anhedral grains of biotite form approximately 10 percent of the rock. The pyroxene crystals have pale green rims, implying that the crystals are zoned and have undergone sodic metasomatism by solutions from the intruding ijolite. Minor accessory apatite is present in some thin sections.

On the basis of texture and mineralogy this gabbro is similar to gabbros collected and examined by the author from the Killala Lake and Port Coldwell Alkalic Rock Complexes (Sage 1983a, and unpublished data). The general arcuate distribution of rock types at Nemegosenda Lake is also similar to that at the Killala Lake and Port Coldwell complexes. Neither the Killala Lake complex nor the Port Coldwell complex have the ijolitic-malignitic silica undersaturated rocks found at Nemegosenda Lake (Sage 1983a, and unpublished data).

IJOLITE

Ijolitic rocks (unit 5) are largely confined to the northwest corner of the complex. The author has examined a number of ijolitic occurrences in Ontario as well as the one at Nemegosenda Lake and is of the opinion that they are of magmatic origin. The author would thus restrict the term *ijolitized fenite breccia* as defined by Parsons (1961) to the metasomatized contact and xenolithic rocks found in the northwest corner of the complex, and would not extend it to ijolites of magmatic origin. Parsons' (1961) ijolitized fenite breccia is part of this author's pyroxenitic fenite.

Clean, xenolith-free ijolite is difficult to obtain in the northwest corner of the complex, however, the lack of exposure prevents sampling anywhere else. Samples of ijolite taken for thin section study and analysis were restricted to medium-grained homogeneous samples. The reader should refer to the section "Fenites" for a discussion of the more heterogeneous rock types.

On outcrop, the ijolite weathers dark green, dark green-black, or grey green-black. The fresh surfaces are similar colours.

In thin section the rock is fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Nepheline is moderately altered, anhedral in outline, and may comprise as much as 50 percent of the rock. Most of the other 50 percent of the rock consists of anhedral grains of dark green aegirine-augite, which partly encloses some nepheline grains or is interlocked with them. Locally, aegirine-augite poikilitically encloses tiny grains of biotite and carbonate. Carbonate as anhedral, interstitial grains forms a minor but ubiquitous component. Biotite as red-brown to brown-red, anhedral, interstitial grains ocurs in very minor amounts. Apatite and trace amounts of potassium feldspar are also present.

OUTER SYENITIC ROCKS

Malignite and Aegirine-Augite Syenite

This rock group (unit 6) rarely occurs in outcrop but it has been retained from the earlier work of Parsons (1961). Thin sections of this unit were prepared from small samples of diamond drill core of Gulf Minerals Canada Limited.

Thin sections show that the rocks logged during the drill program as malignite consist of mafic aegirine-augite syenite and malignite (unit 6b). Most are syenite. Carbonate forms a minor but significant accessory component of this rock group. A suite of samples logged as melteigite were thin sectioned and these also were found to consist of aegirine-augite syenite and malignite. In thin section, the author interpreted the rocks logged as malignite and melteigite to be essentially the same. The 'melteigite' is generally more mafic than the 'malignite', but it contains too much potassium feldspar to be classified as melteigite which is a mafic pyroxene-nepheline rock. Of five samples logged as foyaite, four were classified by the author as malignite and one as mafic aegirine-augite syenite. The terms foyaite, malignite, and melteigite, as they appear on the logs of Gulf Minerals Canada Limited, have been applied to rocks which have approximately the same composition. Considering the generally fine-grained nature of the rocks and the absence of close thin section control on the original logging, such variation in nomenclature is to be expected.

The two subdivisions discussed below are likely gradational into each other, however, they are discussed separately.

Aegirine-Augite Syenite (Mafic). With increasing nepheline content, the mafic aegirine-augite syenites are gradational into malignite.

In thin section these rocks are fine to medium grained, massive, equigranular, hypidiomorphic. The mode of the rock is estimated to be 40 to 65 percent aegirine-augite, 25 to 45 percent orthoclase and microcline, and 10 to 20 percent carbonate. Minor nepheline, apatite, magnetite, pyrochlore, and biotite are present in amounts generally much less than 5 percent.

Aegirine-augite forms dark green, elongated, anhedral to euhedral grains. Several grains are slightly altered along their edges to a fibrous amphibole, possibly tremolite. Minor alteration to possible chlorite and limonite were noted in one slide.

Potassium feldspar is predominantly clear, anhedral orthoclase. Some potassium feldspar displays Carlsbad twinning. It partially encloses pyroxene and locally it poikilitically encloses pyroxene. Where orthoclase poikilitically encloses pyroxene, the feldspar forms large, clear amoeboid grains probably formed by crystallization of intercumulus liquid. Microcline with well developed quadrille twinning is relatively uncommon but may occur interstitial to the pyroxene. Weak vestiges of the quadrille twinning occur in some feldspars that have been classified as orthoclase and detailed X-ray studies may prove a higher microcline content than estimated. By far, the dominant characteristic of the potassium feldspar in this rock group is that it occurs interstitially to pyroxene.

Carbonate is anhedral and interstitial to the feldspar and pyroxene. One grain of orthoclase contains small round blebs of carbonate.

Magnetite forms anhedral disseminated grains, a few of which are poikilitically enclosed in pyroxene. Nepheline is a minor interstitial phase which, in one instance, appears intergrown with potassium feldspar. The former presence of nepheline is inferred from sericite and zeolitic (?) alteration products. Nepheline was not observed in an unaltered condition. Biotite is red to brown-red in colour and forms anhedral grains. Biotite is marginal to the pyroxene, intergranular between pyroxene, and poikilitically encloses the pyroxene. One thin section contains a biotite grain with two very tiny inclusions. Broad, dark, radioactive bombardment haloes would indicate that the inclusions are likely zircon.

The core samples were from drill holes that were placed to test for niobium mineralization and the presence of pyrochlore is to be anticipated. Pyrochlore was not abundant in the suite of sections examined but nonetheless is of common occurrence. The pyrochlore occurs as zoned red-brown, euhedral crystals poikilitically enclosed within and marginal to the aegirine-augite crystals. The pyrochlore cyrstals marginal to the pyroxene grains appear to be one or two orders of magnitude larger than those crystals occuring poikilitically within the pyroxene. Mafic aegirine-augite syenite is the dominant rock type of the Gulf Minerals Canada Limited zone "D". The exposures examined by Parsons (1961, p.46-49) were not available to the author. Parsons (1961, p.46-49) described this zone as follows:

"The zone lies between an extensive area of fenites to the north, and syenitic contact rocks and the intrusive core to the south. The important ore-bearing rock is a dark-green variety called malignite. It consists of orthoclase and aegiritic augite, the latter being the predominant mineral. Calcite is invariably present, and chemical analyses indicate that it may average about 10 percent. Usually minor amounts of nepheline, magnetite, sulphides, apatite, and always pyrochlore, are present. This rock occurs as nearly flat-lying masses up to 200 feet thick, as dikes of various widths and trends, as irregular stringers, as a matrix to brecciated fenites and feldspathized fenites, and as a replacement of fenites. The larger masses are usually fine to medium grained, although textural variations are common. Some of these textural features are rosettes of acicular pyroxene, patches of acicular pyroxene and orthoclase, vug-like areas with pyroxene and orthoclase growing into a carbonate centre, seams of coarser malignite traversing finer-grained material of similar composition, and relic ghost-like fragments. Some of the dikes have very coarse borders, with acicular pyroxene projecting inwards at right angles to the walls and piercing tabular orthoclase crystals. The middle parts of these dikes are uniformly fine-grained.

"The niobium-bearing rock next in importance in this zone is the red alkaline fenite variously replaced or cut, or both, by thin, narrow seams of aegirine-augite. The niobium content varies more or less directly with the amount of this pyroxene present in seams or as a replacement mineral; it equals the malignite in grade in the upper limits, and fenites in the lower limits.

"A salmon-pink leucocratic feldspathic rock occurs as: (1) fractured and brecciated masses, with the fractures filled with malignite; (2) isolated blocks and fragments in malignite; and (3) as the contacting-altered-wallrock zone along malignite dikes. It is more prevalent in the upper and inner parts of Zone D. This rock consists chiefly of albite and anorthoclase, and replaces the red alkaline fenite. It is low in niobium content, but makes ore if sufficiently traversed by malignite-filled fractures.

"The niobium content is found in a uniformly disseminated resin-coloured pyrochlore, which is readily visible with a hand lens. Chemical tests have proved that the pyrochlore is not locked in the pyroxene or feldspar crystals but is interstitial to them."

Four samples containing niobium mineralization were collected from the rock pile in front of the adit and were examined in thin section. The rocks are fine to coarse grained, massive, inequigranular-seriate, hypidiomorphic. The mode is estimated at 30 to 60 percent aegirine-augite, 20 to 40 percent orthoclase, 0 to 15 percent carbonate, 0 to 30 percent nepheline, and 0 to 15 percent biotite.

Aegirine-augite forms elongated, subhedral to euhedral, dark green crystals. Locally the aegirine-augite is extensively altered to a colourless to pale green tremolite. This alteration mantles the pyroxene and is most prevalent along carbonate-pyroxene grain contacts. The aegirine-augite displays weak alteration or no alteration at feldspar-pyroxene contacts. In samples containing large oikocrystic grains of orthoclase, aegirine-augite may occur as subhedral inclusions poikilitically enclosed within the feldspar.

Orthoclase forms anhedral, irregular, optically clear grains, interstitial to the aegirine-augite. In some samples the orthoclase tends to be oikocrystic with poikilitically enclosed subhedral to euhedral nepheline and pyroxene. The oikocrystic potassium feldspar is interpreted to have formed by crystallization of an intercumulus liquid.

Carbonate forms anhedral interstitial grains. Nepheline forms anhedral to euhedral grains, completely altered to cancrinite and sericite. Nepheline occurs intergranular to orthoclase and also as irregular, anhedral to euhedral, poikilitically enclosed inclusions within larger oikocrystic grains of orthoclase. Larger grains may contain minor fresh relict nepheline. Biotite, where present, forms large, anhedral, red-brown grains generally in close association with the pyroxene. The larger biotite grains may contain anhedral, poikilitically enclosed inclusions of nepheline and aegirine-augite.

Pyrochlore forms euhedral crystals poikilitically enclosed in aegirine-augite and along the edges of the aegirine-augite. The grains that occur along the edges of the pyroxene or intergranular between pyroxene grains appear to be several orders of magnitude larger than the grains that are poikilitic inclusions. On the basis of this very limited sampling, the pyrochlore appears visually to be more abundant in the pyroxene-rich nepheline-poor samples.

Figure 7 (reproduced from Parsons' report) shows sketches of the mineralization of zone "D", prepared when work in the adit was in progress.

Malignite. Rocks containing significant nepheline occur as an integral part of lithologic unit 6. In hand specimen, it is difficult to distinguish malignite from mafic aegirine-augite syenite.

In thin section the malignite is fine to medium grained, equigranular to inequigranular-seriate, hypidiomorphic. The rock is estimated to consist of 30 to 55 percent aegirine-augite, 20 to 30 percent nepheline, 20 to 40 percent orthoclase, with minor to trace amounts of biotite, garnet, carbonate, pyrochlore, magnetite, and apatite. The malignite contains much less carbonate than the aegirine-augite syenite. Pyrochlore occurs only in trace amounts, while in the syenite it occurs in amounts up to 1 percent.

Aegirine-augite is dark green, anhedral to subhedral in outline and locally shows a very minor alteration to tremolite or fibrous amphibole on grain edges.

Orthoclase forms anhedral, irregular, amoeboid grains with poikilitic inclusions of aegirine-augite and altered nepheline. The potassium feldspar is oikocrystic and is interpreted by the author as having formed by the crystallization of an intercumulus liquid of potassic feldspar composition, within a cumulus consisting of pyroxene and nepheline. One thin section contains orthoclase with vestiges of the quadrille twinning of microcline. Detailed X-ray studies of the feldspars may disclose a higher microcline content than has been visually estimated.

Nepheline forms anhedral to euhedral crystals. They range from moderately altered to totally altered. Nepheline tends to be closely associated with pyroxene, more rarely with feldspar. The nepheline appears to be altered to a very fine-grained mixture of sericite, cancrinite and carbonate. The alteration products are too fine-grained to be resolved optically.

Carbonate occurs as a minor anhedral, interstitial component. Biotite, as red to brown-red anhedral grains, occur in one thin section along the margins of the pyroxene crystals. Anhedral, pale brown garnet is present in one thin section. The garnet contains poikilitic inclusions of anhedral aegirine-augite.

The malignite phase (unit 6b) appears to be transitional to the oikocrystic malignite (unit 6a). The main difference between these malignites is that the malignite of unit 6b is associated with mafic aegirine-augite syenite and contains more pyroxene.

Oikocrystic Malignite. Oikocrystic malignite (unit 6a) is a distinctive rock which can easily be distinguished on textural and colour criteria from the other malignites found on the complex. The type location for this rock is the mouth of the adit located at the northeast corner of the complex. This rock was described by Parsons (1961, p. 41) as pulaskite. Several outcrops of this rock also occur along the ridge east of the adit entrance.

The texture and composition of this rock are the most similar that the author has observed to the type locality of malignite at Poohbah Lake, defined by Lawson (1896). Malignites at Poohbah Lake have a characteristic oikocrystic development of the potassium feldspars which poikilitically enclose nepheline and aegirine-augite. The nepheline in the Poohbah Lake malignites occurs as round blebs within, and as complex symplectic intergrowths with, the potassium feldspar, while the nepheline at Nemegosenda Lake forms subhedral to euhedral crystals poikilitically enclosed in the orthoclase. The nepheline content of the Poohbah Lake malignites is subordinate to the potassium feldspar, but occurs in roughly equal proportion with potassium feldspar within the Nemegosenda Lake rocks. The only other major difference between the two occurrences is the presence of significant concentrations of dark brown garnet and dark green sodic amphibole in the Poohbah Lake rocks and the absence of these minerals in the oikocrystic malignites at the Nemegosenda Lake complex.

The lack of exposure prevents any realistic assessment of the distribution of this rock type. The rock unit mapped as syenitic breccia by Parsons (1961) may be equivalent to this unit.

On weathered and fresh surfaces the rock is green-pink. The rock is characterized by oikocrysts of potassium feldspar up to 1.5 cm in diameter with abundant poikilocrysts of pyroxene and nepheline. These large oikocrysts of potassium feldspar are easily identifiable in the field by rotating the samples in bright sunlight and observing the cleavage flashes of the large grains of feldspar.

In thin section the rock is fine to coarse grained, massive, inequigranular-seriate, hypidiomorphic. The mode of this rock is estimated to be 20 to 40 percent nepheline, 0 to 5 percent magnetite, 25 to 45 percent orthoclase, 5 to 35 percent biotite, and 10 to 35 percent aegirine-augite. Olivine, apatite, cancrinite, zeolite (?), sericite and carbonate are minor accessory phases and are present in trace amounts.

Aegirine-augite forms anhedral to subhedral grains of a dark green colour. Rarely the crystals are elongate in form and contain round blebs of altered nepheline. It is not uncommon for the larger grains to have pale, almost colourless cores and dark green rims indicating compositional zoning of the crystals. The pyroxene is closely associated with nepheline and biotite.

Nepheline is closely associated with the aegirine-augite and occurs in anhedral to euhedral crystals. The nepheline varies from fresh to totally altered; the totally altered variety being more common. The alteration products of nepheline are very fine grained and were tentatively identified as cancrinite, zeolites, sericite and clay minerals (?). Precise optical identification of the alteration products is generally not possible due to their fine-grained nature. The most euhedral grains of nepheline occur as poikilitically enclosed inclusions in the orthoclase and the most anhedral are found as intergranular grains in association with the pyroxene.

Biotite forms anhedral, irregular grains of brown, red-brown to brown-red colour. The biotite is closely associated with the pyroxene where it occurs along the margins of the pyroxene grains. The biotite uncommonly contains anhedral, poikilitic inclusions of aegirine-augite and nepheline. Rare inclusions of apatite and magnetite were noted. Commonly, the biotite contains tiny inclusions, probably radioactive zircons, since the inclusions are enclosed within pronounced dark rings suggestive of radioactive bombardment haloes.

The textural relationship of orthoclase to the other mineral components is used to distinguish this rock group from the other malignites. The orthoclase feldspars consist of large, anhedral, amoeboid, clear, optically continuous oikocrysts with poikilitic inclusions of subhedral aegirine and subhedral to euhedral nepheline. Only rarely does biotite form a poikilitic inclusion. Carlsbad twinning is rare. The relative degree of oikocryst-poikilocryst development varies from thin section to thin section. On the basis of the feldspar textures this rock is texturally gradational into maliginite associated with the mafic aegirine-augite syenite.

Other Mafic Syenitic Rocks. The author was unable to obtain samples of biotite-feldspar pegmatite (unit 6c) and the description of this rock is taken from Parsons (1961, p.39).

"The term biotite-feldspar pegmatite is used for a group of coarse-textured rocks consisting of biotite, orthoclase, and anorthoclase, with varying amounts of magnetite, pyroxene, apatite, and calcite. Minor accessory minerals are sulphides, graphite, pyrochlore and zircon. The pyrochlore occurs as a finely disseminated replacement of fenite fragments, or as minute grains generally associated with pyroxene, magnetite, or apatite. These rocks are well developed in the East ore area, and appear to have been formed in, with or without injection into, linear breccia zones in the fenites. Fenite fragments, variously altered and replaced, are common constituents. Chilled contacts with the fenites are non-existent, and books of biotite and acicular feldspar identical to that in the zones themselves, are found as porphyroblasts in the fenite walls."

Map-unit 6d was mapped by Parsons (1961, p.39) as 'jacupirangite'; it was described as consisting of widely varying amounts of apatite, magnetite, pyroxene, and biotite. The author examined thin sections of two samples identified as jacupirangite and two samples identified as pyroxenite in the logs of the Gulf Minerals Canada Limited. These samples disclosed a rather heterogenous mineralogy.

TABLE 2. ELECTRON MICROPROBE AVERAGE ANALYSIS OF PSEUDOLEUCITE AND CONSTITUENT NEPHELINE AND FELDSPAR, NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX (From Watkinson 1973).

	1	2
SiO_2	64.23	64.05
Al_2O_3	18.26	18.17
Na_2O	0.82	0.74
K_2O	14.93	15.57
TOTAL	98.24	98.53

1. Feldspar in groundmass, NL13-3.
2. Feldspar in pseudoleucite, NL13-3.

One sample of 'jacupirangite' is composed predominantly of equal proportions of wollastonite and biotite. A fibrous zeolite (?) most likely after nepheline constitutes an estimated 10 percent of the rock and aegirine-augite another 10 percent. Minor magnetite and purple fluorite are present. The wollastonite forms colourless, stubby, subhedral crystals and the biotite forms dark red anhedral grains which contain abundant poikilitically enclosed grains of zircon with well developed radioactive bombardment haloes. Aegirine-augite forms anhedral grains interstitial to the wollastonite. The fluorite occurs within altered biotite and along cleavages within the biotites. The author would classify the rock as an altered biotite melteigite. The rock may represent an altered xenolith of wall rock as well as an altered alkalic rock from the complex.

The second specimen of 'jacupirangite' also contains roughly equal proportions of biotite and wollastonite. Aegirine-augite and minerals that developed by alteration of nepheline are absent. The rock contains approximately 15 percent interstitial carbonate and 5 percent anhedral apatite. The author classified the rock as an apatite-carbonate-biotite-wollastonite rock.

One specimen of 'pyroxenite' is estimated to be composed of 20 percent pale brown garnet, 30 percent biotite, 20 percent aegirine-augite, 10 percent apatite, and 20 percent nepheline. The garnet forms anhedral grains, the biotite irregular anhedral grains, and the interpreted nepheline is now represented by a very fine-grained, interstitial mass of optically unresolvable alteration products. The pyroxene is anhedral in outline, and the larger grains have almost clear to pale green cores and rims that are a distinctive green. The pyroxenes are interpreted to be zoned aegirine-augite. The author would classify this rock as melteigite. Upon thin section examination, the second specimen of 'pyroxenite' was estimated to be composed of 20 percent biotite, 35 percent cancrinite, 43 percent garnet, and 2 percent aegirine-augite. The biotite forms brown, anhedral grains of ragged outline enclosing the cancrinite which is likely an alteration after nepheline. The garnet occurs as a brown, anhedral polycrystalline aggregate of crystals forming a mesh that encloses cancrinite. The cancrinite forms rounded, polycrystalline aggregates that possibly replace nepheline. The aegirine-augite forms anhedral grains in association with biotite and is zoned from pale green to colourless cores to green rims. The rock is classified by the author as biotite-cancrinite-garnet rock. Considering the possibility that the cancrinite is after nepheline, the rock is analogous to the garnet ijolites found by the author at Prairie Lake (Sage 1983b). Ijolitic rocks composed predominantly of garnet and nepheline with minor biotite occur at the Prairie Lake complex.

Watkinson (1973) observed feldspar-altered nepheline intergrowths, which he interpreted as pseudoleucite, in malignite and wollastonite-bearing rocks. He reported microprobe analyses of the feldspar associated with these intergrowths (Table 2).

INNER SYENITIC ROCKS

Malignite and Mafic Syenite

The inner malignites and mafic syenites are a group of fine- to medium-grained rocks that form the core of the Nemegosenda Lake Alkalic Rock Complex. The rocks have been subdivided into malignite (unit 7a) and nepheline-bearing mafic syenite (unit 7b) on the basis of the presence or absence of nepheline in quantities equal to or greater than 10 percent. They have been previously mapped as malignite, foyaite and pulaskite (Parsons 1961, p.42). As previously noted by Parsons (1961, p.42), this rock unit, exposed on the east side of Nemegosenda Lake, is variable in composition. Thin sections of closely spaced samples, examined by the author, suggest that there is considerable modal variation over relatively short distances. There may be a general decrease in grain size towards the north corresponding with a possible increase in mafic content. The rocks are generally mafic with the mafic content commonly exceeding an estimated 25 percent. Locally leucocratic nepheline-rich phases having a slightly coarser grain size may be present.

In thin section, the rocks are fine- to medium-grained, massive, equigranular, allotriomorphic with curved to straight grain boundaries. Some of the samples are hypidiomorphic. The mode of the rock is estimated to be 0 to 30 percent nepheline, 0 to 35 percent perthite, 5 to 50 percent albite, 10 to 30 percent biotite, 0 to 20 percent aegirine-augite, and 0 to 30 percent sodic amphibole. Fluorite, carbonate, apatite, magnetite and scapolite occur in trace to minor amounts. The rocks were subdivided upon thin section examination into nepheline-bearing (less than 10 volume percent nepheline) biotite-amphibole syenite; nepheline-bearing aegirine-augite syenite; nepheline-bearing amphibole syenite; nepheline-bearing amphibole-biotite syenite; nepheline-biotite syenite; biotite-nepheline syenite; and biotite-aegirine-augite-nepheline syenite. Those samples containing more than 10 percent nepheline can be collectively referred to as malignite.

Nepheline is generally anhedral and interstitial to the feldspars and mafics. One thin section contains some grains of subhedral nepheline. The nepheline is almost always altered to sericite, cancrinite, zeolites, and carbonate. The overall nepheline content appears to decrease from south to north within this unit.

Biotite forms anhedral, irregular grains. The biotite varies in colour from brown, red-brown, to green-brown with brown grains dominant. Very fine-grained, felty mats of biotite locally have replaced pyroxene or some other unidentifiable mafic mineral. This alteration is interpreted by the author to represent deuteric alteration of the pyroxene by late-stage magmatic fluids. The biotite occasionally poikilitically contains an apatite grain. Biotite grains are interlocked with the other mafic minerals.

Amphibole is subhedral in outline and appears to be the major mafic mineral in the more northerly outcrops of this lithology. The amphiboles commonly contain poikilitic inclusions of apatite and rarely biotite and magnetite. The crystals are strongly zoned from pale green-brown cores to green rims and the variation in extinction angle is 5 to 0 degrees from core to rim. The amphibole is likely a sodium-iron-rich variety.

Aegirine-augite forms anhedral, dark green grains and is most abundant in the more southerly outcrops of this lithologic unit. The pyroxene rarely contains poikilitic inclusions of anhedral nepheline, apatite and carbonate, and in one section partial encloses albite grains.

The dominant feldspar is albite (An_{2-12}). The grains are subhedral in outline and some contain patches replaced by potassium feldspar. Albite also rims some of the perthite grains. Perthite form anhedral grains. Generally the perthites are of the patch type but string (subsolvus) perthites are also common. The patch perthites are sometimes antiperthitic with plagioclase content exceeding potassium feldspar. The patch perthite texture is thought by the author to result from late stage deuteric replacement of the plagioclase by potassium feldspar; the stringy texture is thought to be due to subsolvus exsolution.

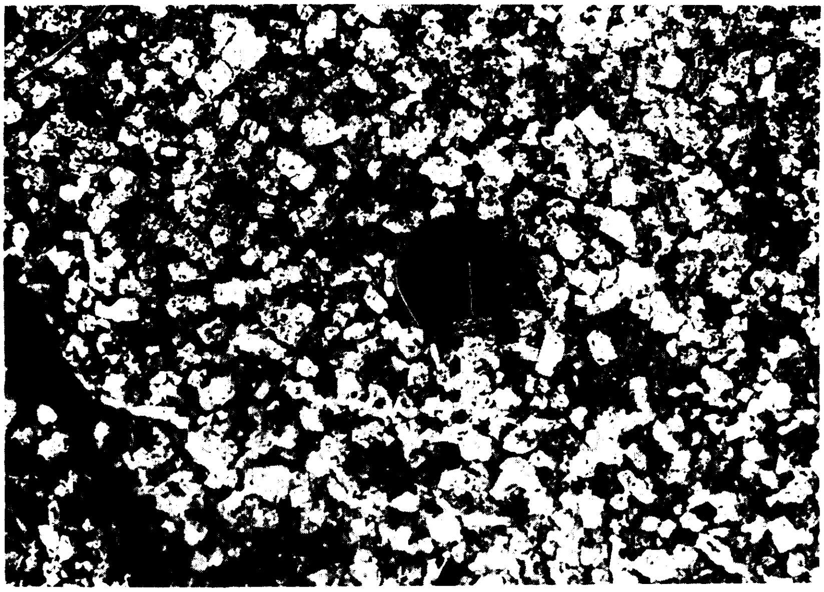

Photo 2. *Typical weathered surface of coarse-grained nepheline. Location P-2 on Figure 3.*

At one location along the east side of Nemegosenda Lake, medium-grained, leucocratic, nepheline syenite occurs. The bright red alteration of the nepheline gives the rock a distinctive appearance. In thin section the rock is fine to medium grained, massive, equigranular, allotriomorphic, with curved grain boundaries. The mode is estimated as 15 percent carbonate, 50 percent antiperthite (albite An_{8-10}) and 35 percent very fine-grained hydronephelinite (?). The antiperthite forms anhedral to subhedral grains which are roughly tabular in form.

Nepheline Syenite

Enveloping the southern part of the Nemegosenda complex and inside of the mafic syenite and malignite envelope is a distinctive coarse-grained nepheline syenite (unit 8a). The unit is exposed on two small islands in the southwest part of Nemegosenda Lake (Photo 2).

This unit is generally leucocratic containing less than an estimated 15 percent biotite as the exclusive mafic mineral component. This unit is coarse-grained (approximately 1 cm grain size), leucocratic, and contains an estimated 40 to 50 percent subhedral to euhedral nepheline. It weathers pink, red-brown, and pink-red, and fresh surfaces are similar colours. The rock has been previously described as juvite (Parsons 1961, p.41-43).

In thin section the rock is medium to coarse grained, massive, equigranular, hypidiomorphic. The mode is estimated to be 5 to 15 percent biotite, 35 to 55 percent nepheline, and 35 to 50 percent orthoclase. Trace to minor amounts of cancrinite, zeolite, magnetite, carbonate, apatite and zircon are present.

Nepheline occurs as anhedral to euhedral crystals and is commonly extensively altered. Fresh nepheline is generally restricted to the cores of the larger crystals. Sericite, cancrinite, carbonate and zeolite (?) are tentatively identified as the dominant alteration products.

Orthoclase is anhedral and generally clear and unaltered. The feldspar is interstitial to the nepheline and partially engulfs the nepheline grains. In one thin section, round blebs of altered nepheline are poikilitically enclosed in feldspar. One section shows vestiges of albite twinning along fractures and spotty areas of

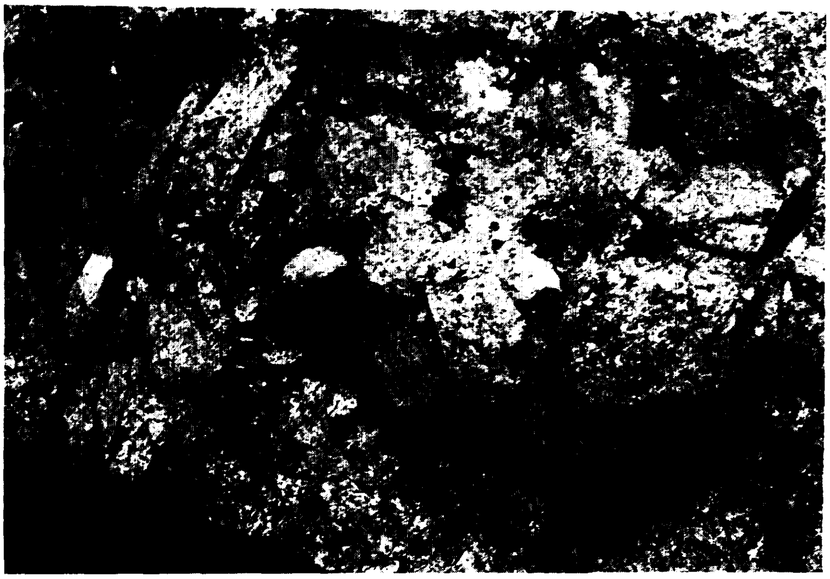

***Photo 3.** Brecciated nepheline syenite. Breccia cement is largely fine-grained biotite and carbonate. Location P-3 on Figure 3.*

alteration composed of unknown mineralogy. Locally, minor spotty saussuritization of the feldspars is present. Biotite is the only mafic constituent present. The biotite forms brown, anhedral grains interstitial to the two main mineral components. Apatite, where present, occurs as poikilitic inclusions within the biotite.

On a point of land projecting into Nemegosenda Lake at the southeast corner of the complex, nepheline syenite has been extensively brecciated (unit 8b, Photo 3). Petrographically the rock is the same as the nepheline syenite unit on the islands in Nemegosenda Lake, however, the biotite displays prominent kink banding of the (001) cleavages. Presumably this kinking is the result of the explosive event that formed the breccia.

The matrix of this breccia is estimated to consist of 25 percent carbonate, 20 percent biotite, 5 to 10 percent cancrinite, 20 percent euhedral, zoned, augite pyroxene, and 25 percent optically unresolvable, very fine-grained matrix. Subhedral crystals of biotite up to 3 and 4 cm in diameter were observed within fragments of the breccia matrix lying on the shore of Nemegosenda Lake. The black matrix weathers down leaving the breccia blocks of nepheline syenite standing in relief. The carbonate occurs as rounded blebs, amygdule-like in form, up to 1 cm in diameter. The weathering of this carbonate leaves a pitted weathered surface to the breccia matrix. The matrix weathers more subdued close to coarse-grained nepheline syenite clasts than it does away from the immediate clast contact, suggesting a decrease in relative carbonate content away from the contact with the clast.

The size of grains, fragments, and xenocrysts increases away from the matrix-clast contact, suggesting that there is a correlation of fragment size with distance away from the contact of breccia matrix and nepheline syenite blocks. Within a large block of brecciated nepheline syenite lying on the beach at the point of land, there is a pronounced gradation of grain, fragment, and xenocrystic size over a distance of 35 cm within the matrix that cements the nepheline syenite blocks. The distribution of clast sizes and xenocrysts varies uniformly with distance from from the contact, implying flow differentiation of the fragments. In the same block, the weathered surface has a pronounced ribbing parallel to borders of the presumed block, possibly due to variation in carbonate content. The pronounced grain size variation in the matrix to the fragments and xenocrysts suggests the possibility that chilling of the intruding breccia matrix along the contact has occurred during emplacement as well as flow differentiation. The chilled contact approaches a width of 6 cm.

Within the center of the large block of brecciated nepheline syenite lying on the shore of Nemegosenda Lake, there are round subhedral crystals with a crude trapezohedral outline. These crystals are up to 2 cm in diameter and may be former pseudo-leucites that have undergone some reabsorption. Euhedral nepheline crystals are also present in the matrix. Detailed mineralogical examination of these crystals was not undertaken because the source of the block could not be precisely located.

While the actual areal extent of the nepheline syenite breccia is unknown, the unit is assumed to be conformable to the trends of the associated lithologies. Only diamond drilling could establish its extent.

CARBONATITE ROCKS

Carbonatite rocks are poorly exposed at the Nemegosenda Lake complex. The areal distribution of the carbonatite rocks as indicated on Parsons' (1961) map has been retained. The carbonatite dikes observed at Nemegosenda cut syenitic phases of the complex and in general appear to be the youngest phase present at Nemegosenda Lake. The same relationship holds true at other carbonatite complexes examined by the author. The position of the carbonatites in Parsons' map legend has been shifted (see Figure 3, Chart A, back pocket) to account for their relatively late position in the petrologic sequence of events. The elongated tabular shapes shown on Parsons' map for the carbonatite bodies along the east flank of the complex implies that they may be dike-like intrusions and should thus be classified as dike rocks. However, critical exposures that would reveal whether or not all the carbonatites are dikes are lacking. The author has subdivided the carbonatite rocks into two groups: a general grouping (unit 9) for the larger bodies of carbonatite, and a grouping for the smaller, widely scattered bodies that are clearly dikes (unit 10a). All but one specimen examined were taken from core samples of Gulf Minerals Canada Limited. The one outcrop sample was from a dike (unit 10a) exposed in a stream bed just east of Nemegosenda Lake (see Figure 3, back pocket).

Sovite (calcite carbonatite) consists of a mosaic of interlocking, anhedral grains of carbonate. Chlorite as small spheres of radiating crystals is present in one thin section. Magnetite, aegirine-augite, albite, apatite, limonite, and possibly quartz occur in amounts varying from trace to 5 percent. Apatite occurring as round sometimes elongated grains is the most common accessory mineral.

Biotite and magnetite sovite have a higher content of silicate and oxide minerals respectively. The rocks are fine to medium grained, massive, equigranular, hypidiomorphic. In these rocks the carbonate retains the form of an interlocking mosaic of anhedral grains. Biotite forms red, brown, and dark red anhedral grains. It occurs commonly along the periphery of the magnetite grains and one sample displays tiny poikilitic inclusions, presumably zircons, with dark radioactive bombardment haloes. Poikilitically enclosed anhedral grains of aegirine-augite are present in several biotite grains in one thin section. Magnetite forms anhedral to subhedral disseminated grains. Aegirine-augite and apatite are common in quantities of 5 percent or less. The aegirine-augite forms subhedral grains of pale to medium green colour and the apatite forms round to elongate-round, bead-like grains.

One thin section contained more than 50 percent silicate and oxide minerals and was thus classified as silicocarbonatite. The mineralogy of this sample is similar to the sovite. Biotite poikilitically contains numerous anhedral inclusions of aegirine-augite. Tiny grains poikilitically enclosed within the biotite have pronounced dark radioactive haloes and are likely zircon. The aegirine-augite forms anhedral to euhedral grains where not poikilitically enclosed in biotite. Apatite is present as round subhedral to euhedral grains.

Parsons (1961, p.40) described sovitic rocks as follows:

"Sovites and Sovitic Breccias. - The term sovite is used for a group of rocks in which the consistent and characteristic minerals are calcite and biotite, with or without pyroxene. They range in habit from true intrusive dike-like masses to replacement types in breccia zones. They have only been encountered in the east and northeast flanks where exploration by diamond-drilling has been concentrated. They correspond to rocks of similar composition in the other complexes except that the typical foliated carbonatite-types are rare. They mostly occur in lenticular-like masses in the fenites.

"One distinctive type consists of red fenite fragments in a sovitic matrix. It is cut by dikes of another very uniformly textured sovitic type. The marginal zones of these dikes are finer-grained than their centres.

"Another type consists of patches of biotite and fine-grained calcite in a matrix of coarse white calcite. Apatite and pyroxene are present locally. A mass of this rock encountered in a drill hole was remarkably uniform in texture and composition. The east or lower contact was banded, and the upper contact, with a steadily increasing content of aegirite and a light mauve-coloured feldspar, graded into a malignitic rock. This type differs from all the other carbonate rocks encountered in that it contains niobium in significant amounts, especially in a zone adjacent to the upper contact."

DIKE ROCKS

Considering the limited area tested by drilling relative to the surface area of the complex and the relative abundance of dikes within the small numbers of outcrops, diking of the major rock types has been extensive.

Carbonatite Dikes. Carbonatite dikes (unit 10a) occur in several places along the east shore of Nemegosenda Lake. These dikes weather white, yellow brown, and buff. They are relatively low in silicate mineral content, and may be composed of two carbonate types; dolomite and calcite. Brown weathering dikes likely contain a ferruginous carbonate. The carbonatite dikes occupy fractures and shear zones within the complex. The joint surfaces of the various syenitic rocks are often coated with carbonate and biotite is sometimes present.

Only one thin section was prepared from these carbonate dikes. This section was prepared from the dike cutting an outcrop of syenite on the east side of the complex located approximately 60 m in from the shoreline. This dike consists of 85 to 90 percent anhedral calcite, 10 percent albite, and 2 to 3 percent apatite. The apatite forms bead-like grains, often elongated. The albite occurs in clusters and may be xenocrystic, having been derived from the enclosing syenite. Trace amounts of sericite and epidote are present. The syenite enclosing the dike appears bleached and altered. In thin section the altered syenite consists of fine-grained albite, potassium feldspar, and altered nepheline.

Biotite-Carbonate Lamprophyre Dikes. This dike set (unit 10b) occurs within and outside the complex. The dikes weather black and weather subdued with respect to the rocks they are cutting. The dikes locally weather with a ribbed surface parallel to the contacts, most likely due to variable carbonate content and grain size variation over the exposed width of the dike. Grain size varies from very fine at chilled contacts to fine or medium at the dike core. The width of the chilled contact exceeds 5 cm on some of the larger dikes. Rounded blebs of carbonate, possibly ocelli, up to 5 mm in diameter have been observed. Where present, xenolithic and xenocrystic material is concentrated towards the dike centers and this may be a function of flow differentiation.

In thin section the dikes are fine grained, equigranular, massive, hypidiomorphic. The mode of the rock is 20 to 40 percent biotite, 10 to 30 percent carbonate, 5 to 20 percent albite (?), and 0 to 15 percent augitic pyroxene. Sericite, magnetite, apatite, and zeolite (?) are also present in very minor amounts. Optically unresolvable groundmass material may comprise 30 percent. The carbonate occurs as *fine-grained*, anhedral, interstitial grains and also as rounded, amygdule-like, crystal aggregates or ocelli. The biotite forms anhedral, brown to dark red-brown grains, some of which are zoned from pale brown cores to dark brown rims. The albite (?) crystals are subhedral where they are in close association with rounded clots of carbonate and in one place they are associated with actinolite. Pyroxene of augitic composition is present as euhedral, elongated, colourless crystals in one thin section.

Feldspar-Porphyritic Syenite Dikes. At several locations along the east shore of Nemegosenda Lake dikes of feldspar porphyry (unit 10c) were observed to cut the syenitic rocks. These dikes do not exceed 6 m in width. The dikes are massive and red in colour on both fresh and weathered surfaces. Feldspar phenocrysts up to 8 mm are present in the dikes. The phenocrysts have a seriate distribution and only rarely approach an estimated 10 percent of the rock. Chilled contacts up to 15 cm wide have been observed on the dikes.

In thin section the rock is fine grained, massive, inequigranular-porphyritic-seriate, hypidiomorphic. The phenocrysts are subhedral perthite composed of more than one grain and are thus glomeroporphyritic. The perthite is of the string type. The groundmass consists of subhedral albite (An_{2-11}) grains with albite twinning. Orthoclase displaying well developed Carlsbad twinning is present in minor amounts within the matrix of one sample studied. One dike contains a sericite alteration which was estimated to constitute 30 percent of the rock. This alteration may be after nepheline but nepheline or its alteration products are absent in a sample taken from a similar dike. Biotite forms anhedral, irregular grains and may occur as very fine-grained crystal aggregates replacing pyroxene. Pyroxene is aegirine-augite and varies from anhedral to euhedral in form. Some grains contain very fine-grained biotite inclusions. In addition to these minerals, magnetite, sphene, sericite, apatite, and fluorite are present in trace to minor amounts.

Included in this group of dikes is a more mafic syenite porphyry dike. This dike, on outcrop surface, has greenish-red feldspar phenocrysts up to 3 mm in length in a very fine-grained, aphanitic ground mass. In thin section the mafic syenite porphyry dike contains an estimated 25 percent brown anhedral biotite, 20 percent anhedral brown to green sodic amphibole, and 55 percent orthoclase with vestiges of albite twinning. Only one dike of this type was observed.

Aphanitic Lamprophyre Dikes. The aphanitic lamprophyre dikes (unit 10d) are black and appear to contain chloritized mafic phenocrysts up to 1 mm in diameter which comprise 10 percent of the dike. The dike was not examined in thin section. Dikes representing this lithology are narrow in width and of minor occurrence.

Other Dike Rocks. The dikes described in this section are not exposed in outcrop and are not coded on the map. These dikes were intersected by diamond drill holes of Gulf Minerals Canada Limited.

"Feldspar-rich rest rock" appears on several diamond drill logs of Gulf Minerals Canada Limited. One thin section of this rock type was prepared from drill core from hole 40. The rock is fine grained, massive, equigranular, allotriomorphic, with curved to lobate grain boundaries. It is estimated to consist of 10 percent interstitial carbonate and 90 percent microcline perthite. The feldspar is turbid, has vestiges of albite twinning, and gives a strong stain for potassium.

"Alkorthositic dikes" appear on a number of logs of Gulf Minerals Canada Limited. Parsons (1961, p.4) indicated that this rock type is composed of 100 percent alkali feldspar. A thin section was prepared from a sample of core from hole 36. The texture of the rock is fine grained, equigranular, hypidiomorphic. In thin section the rock is estimated to consist of 70 percent carbonate and 30 percent albite. The carbonate is anhedral to euhedral with euhedral crystals projecting into the albite.

"Porphyry" is a very distinctive dike rock which has been noted on several logs of Gulf Minerals Canada Limited. This rock has buff phenocrysts up to 1 cm in diameter set in a greenish-pink groundmass. The crystals are euhedral and may compose up to 30 percent of the rock. Samples of this rock were examined from holes 41 and 46 of Gulf Minerals Canada Limited. In thin section the rock is very fine grained, massive, inequigranular-porphyritic-seriate or hiatal, hypidiomorphic. The phenocrysts are of orthoclase and both Carlsbad and Baveno twins are present. Nepheline, totally altered to sericite and possibly some zeolite mineral, composes 30 to 40 percent of the rock. The nepheline is interstitial within the groundmass. Anhedral orthoclase forms the bulk of the remaining groundmass in close association with altered nepheline. The nepheline and groundmass orthoclase occur in roughly equal proportions. Pyroxene (?) altered to carbonate, chlorite, and limonite forms a major groundmass phase in one of the samples.

The term "rheomorphite" appears on several diamond drill logs of Gulf Minerals Canada Limited and one sample of this rock type from hole 37 was examined in thin section. Parsons (1961, p.34) used the term rheomorphic to describe the pyroxenite fenites that he considered to have formed by dehydration and reduction and which cut and fill fractures in the fenite rocks more distal to the centre of alkaline magmatism at Nemegosenda Lake. Parsons (1961) used the term as proposed by Ekermann (1948, 1966). Eckermann applied the term rheomorphic to alkaline rocks proximal to the center of carbonatite intrusion at the Alno Carbonatite Complex, Sweden. He interpreted these rocks to be ultrafenites formed by desilication and alkali metasomatism of wall rocks under pressure and temperature conditions that gave rise to a plastically deforming crystal mush. This mush crystallized to produce textures analogous to rocks crystallizing from a silicate melt. The rock at Nemegosenda Lake is fine grained, equigranular, hypidiomorphic. The mode is estimated to be 10 percent carbonate, 25 percent cancrinite, 10 percent albite (An_{4-10}), and 55 percent orthoclase. The carbonate and cancrinite are interstitial, anhedral, and the cancrinite encloses the feldspars. The orthoclase forms tabular, anhedral to euhedral grains that show Carlsbad twinning. Orthoclase and albite form an interlocking mosaic.

"Alkalic (pulaskite) dikes" are noted on several diamond drill logs of Gulf Minerals Canada Limited. Parsons (1961, p.3) defined pulaskite as a feldspar-rich alkalic syenite with minor amounts of nepheline and mafic minerals. Samples from holes 30 and 33 were examined in thin section and, except for being finer grained, they are identical to the oikocrystic malignite described previously.

The term "alkalic dike" occurs frequently on the diamond drill logs of Gulf Minerals Canada Limited. The term was applied to any fine-grained to aphanitic dike rock. Twelve "alkalic dike" samples were selected at random for thin sectioning. Thin section examination indicates a wide variety of rock types including lamprophyre, pyroxene-biotite syenite, cancrinite-biotite syenite, biotite-pyroxene syenite, porphyritic syenite, and malignite.

The malignite and various syenite dikes are similar in texture to the malignites and nepheline syenites previously described. The dike rocks are much finer grained than non-dike equivalents exposed in outcrop along the east shore of Nemegosenda Lake. The cancrinite in some of these dikes may be an alteration product of former nepheline.

The syenite porphyry dikes appear to be finer-grained microporphyritic varieties of the previously described porphyry dikes. One albite phenocryst ($An_{10?}$) along with the orthoclase phenocrysts was noted.

Three of the 12 dike rocks were classified as lamprophyres, two of which are similar to the previously described lamprophyre dike set (unit 10b). One of these two dikes contains nearly 30 percent fine-grained nepheline and feldspar intergrowths. These intergrowths are interstitial to the biotite and closely associated with the carbonate.

The third lamprophyre dike was classified by the author as monchiquite. Analcite forms rounded, partially absorbed, phenocrystic crystals with broad, very fine-grained, dusty or turbid reaction rims. Subhedral olivine phenocrysts pseudomorphically replaced by chlorite, calcite, and serpentine comprise approximately 15 percent of the dike rock. Very fine-grained apatite, sericite, albite (?), and carbonate are present. The albite (?) is extensively altered to sericite. The matrix, which comprises over 60 percent of the rock, is fine-grained chlorite.

PETROLOGY

Major and minor element chemical analyses were completed on a large suite of samples (Appendix A, Tables A-1, A-2, and A-3). The samples are dominantly from diamond drill core because of the poor exposure. The drilling has been concentrated in the northwest corner of the complex and thus the sample population and chemistry are biased towards the rock types that are present there. Evidence of metasomatic activity is abundant and therefore the chemical data cannot be used to establish possible liquid trends. AFM diagrams (Figure 4) have been plotted for comparative purposes only.

An AFM plot (Figure 4a) of malignite samples from the outer syenites (unit 6b) indicates considerable scatter. The high degree of chemical variability would suggest that the malignite is not equivalent to a simple melt. The sample population for the gabbro unit is too limited for interpretation.

Data points for oikocrystic malignite (unit 6a) are tightly clustered on the AFM diagram (Figure 4b), indicating the that it may be a melt product or that it represents rather extreme homogenization. On the basis of texture, the pyroxene and nepheline are interpreted to be cumulus phases set in intercumulus potassium feldspar. Even though the chemical composition of the unit is relatively homogeneous, the author is skeptical that the composition is representative of an alkalic silicate melt.

Malignite from the inner syenites (unit 7a) displays two clusters on the AFM diagram (Figure 4c), suggesting that there may be two rock types within this group although they have not been separated on petrographic or field criteria. The nepheline-poor rocks of unit 7b cluster towards the Fe apex of the AFM diagram (Figure 4d) and generally do not overlap the rocks of unit 7a (compare Figures 4c and 4d). The main distinction between'rocks in unit 7 is the ratio of alkalies to iron for the MgO content remains relatively the same. Malignite rocks contain more alkalies relative to iron than the nepheline-bearing rocks, which is likely a function of their higher nepheline and lower mafic mineral content.

Samples of nepheline syenite (unit 8a) show an open clustering towards the "A" apex of the AFM diagram (Figure 4e), indicating a high alkali content. The rock displays a well developed hypidiomorphic igneous texture and most likely represents the closest approximation to an alkalic silicate melt of any of the lithologic units studied. More chemical study of this unit is needed to better define its variability.

Carbonatite (unit 9) and ijolite (unit 5) have been plotted on the same AFM diagram (Figure 4f). The ijolites plot towards the center of the diagram but are too few in number for an interpretation of their significance. The carbonatites plot towards the iron apex of the diagram. Current ideas would relate the two rock types by a process of immiscibility followed by a loss of alkalies during the process of fenitization (Freestone and Hamilton 1980; Hamilton *et al.* 1979; LeBas and Handley 1979; Nash 1972). The ijolite, and in particular the carbonatite magma, may therefore be residual.

An AFM plot of the various dike rocks (Figure 4g) displays a large degree of scatter. Some of the dike compositions probably do reflect melt compositions, but additional field, petrographic and mineralogical data is required to interpret these compositions..

Since the complex displays features of both alkalic ring complexes and carbonatites, norms (Appendix A, Table A-4 and A-5) were calculated using both the method outlined by Irvine and Barager (1971) and the method of LeBas (1973). The alkalic norm calculation of LeBas (1973) treats carbonate as a magmatic phase, and in all probability gives a more meaningful method of comparison than the Irvine and Baragar (1971) method which assumes carbonate to be an alteration product.

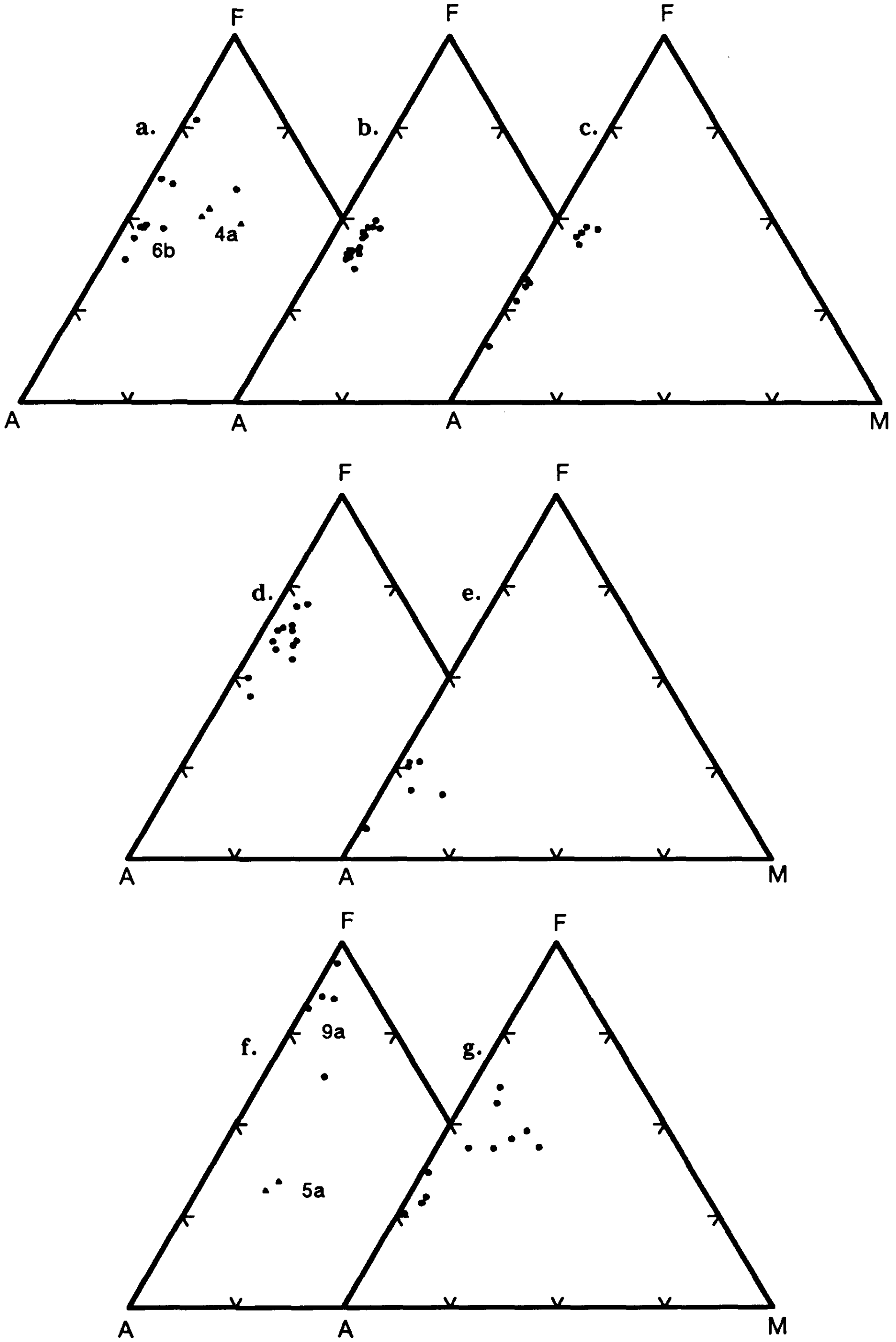

Figure 4. *AFM plots of samples from the Nemegosenda Lake Alkalic Rock Complex. A = Na_2O + K_2O; F = FeO + Fe_2O_3 + 0.98 TiO_2; M = MgO. a. Gabbro (unit 4a) and outer malignite (unit 6b). b. Oikocrystic malignite (unit 6a). c. Inner malignite (unit 7a). d. Inner mafic syenite (unit 7b). e. Nepheline syenite (unit 8a). f. Carbonatite (unit 9a) and ijolite (unit 5a). g. Alkalic dike rocks (unit 10).*

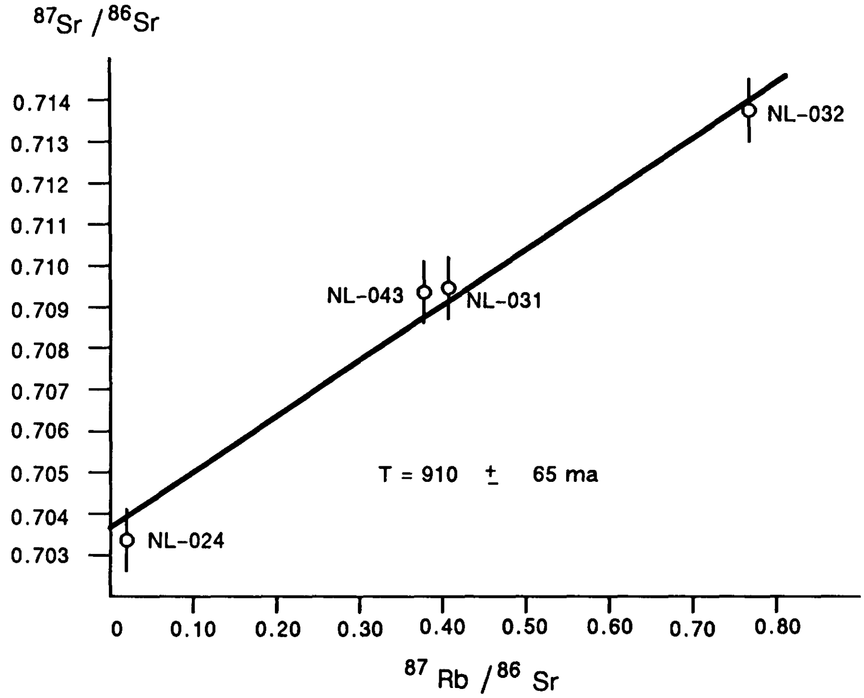

Figure 5. *Rb-Sr isochron plot for samples from the Nemegosenda Lake Alkalic Rock Complex. From Bottriell (1975).*

Parsons (1961, p.34) has proposed that some of the alkalic rocks exposed at Nemegosenda Lake are rheomorphic in keeping with the observations of Eckermann on the Alno Carbonatite Complex, Sweden. These rocks appear magmatic both in the field and in thin section, and the author can add little to the debate as to whether they are igneous or metasomatic in origin. Whatever their origin, they behaved as a melt at the current levels of exposure.

The chemical data for each map-unit were analyzed statistically (Appendix A, Table A-6), using the statistical package of Nie *et al.* (1975).

GEOCHRONOLOGY

The Nemegosenda Lake Alkalic Rock Complex has been dated by potassium-argon techniques (Gittins *et al.* 1967) at 1010 Ma. Bottriell (1975) determined a rubidium-strontium isochron age of 910 ± 65 Ma for the complex. The isochron is reproduced as Figure 5. Bottriell (1975) obtained a low $^{87}Sr/^{86}Sr$ initial ratio indicating a mantle origin for the complex. The location of the samples is unknown. Bell and Blenkinsop (1980) have presented a revised rubidium-strontium isotopic age of 1015 ± 63 Ma using the previous samples of Bottriell (1975) and three others collected during the present survey. The latter are samples 454, 461 and 463 (see Appendix A).

METAMORPHISM

The rocks of the Nemegosenda complex are relatively unmetamorphosed. It is unlikely that the large optically clear grains of orthoclase in the oikocrystic malignite would have been preserved if the complex had undergone a metamorphic event of any significance. The nepheline in the nepheline-bearing rocks is commonly extensively altered. This alteration is pseudomorphic after the nepheline and is found in samples obtained from the deepest diamond drill holes of Gulf Minerals Canada Limited. The nepheline alteration is probably a late stage autometamorphic or deuteric event of the magmatic process, and not representative of an independent metamorphic event.

The formation of patch perthite and replacement of albite by potassium feldspar, in the inner syenitic rocks, are also considered by the author to be an autometamorphic or deuteric metasomatic process. These feldspar textures are also common within other alkalic rock complexes such as at Killala Lake and Port Coldwell (Sage 1983a and unpublished data).

Other than the magmatic-metasomatic processes described above, no independent metamorphic event is recognizable.

Thin sections of the enclosing wall rocks suggest that the enveloping rocks of the Kapuskasing Subprovince have been metamorphosed to at least the amphibolite facies rank of regional metamorphism (Turner and Verhoogen 1960; Turner 1968). Thurston *et al.* (1977, p.95-109), on the basis of regional reconnaissance studies, classified the wall rocks as granulite facies.

STRUCTURAL GEOLOGY

REGIONAL SETTING

The Nemegosenda Lake Alkalic Complex lies within the Kapuskasing Subprovince of the Superior Province. The Kapuskasing Subprovince is a north- to northeast-trending belt of high grade metamorphic rocks (Bennett *et al.* 1967; Thurston *et al.* 1977) characterized geophysically by linear gravity highs and aeromagnetic highs (Innes 1960). This anomalous gravity zone has been interpreted to be due to an upwarp in the Conrad discontinuity caused by regional faulting and the formation of a complex horst structure (Wilson and Brisbin 1965; Bennett *et al.* 1967; Thurston *et al.* 1977, p. 109-113). This large structure extends from the southern end of Hudson Bay to the east side of Lake Superior. The structure becomes broader and more ill-defined as it approaches the east side of Lake Superior.

Regional helicopter mapping by Thurston *et al.* (1977) has indicated that the Nemegosenda Lake Alkalic Rock Complex cuts rocks related to the Shawmere Anorthosite Complex (Thurston *et al.* 1975). Regional lithologic and structural trends of this subprovince are north to northeast striking (Thurston *et al.* 1975).

The emplacement of the Nemegosenda Lake complex was undoubtedly related to the major faulting which is characteristic of the Kapuskasing Subprovince.

INTERNAL STRUCTURES

Parsons (1961) inferred, from geophysical surveys, the presence of a number of faults within the complex. Shearing along the long axis of the lake may be indicated by the greater than 69 m depth of Nemegosenda Lake (G. Mains, lodge owner on Nemegosenda Lake, personal communication), and by an inflection in trends of the gneissic banding in the amphibolites at the south end of the lake. Displacement along this proposed shear zone cannot be assessed because of the lack of marker horizons, and the lack of obvious deflections or trends in the aeromagnetic pattern.

Schistosity and gneissosity in country rocks along the abandoned logging road on the east side of the complex approximately follow the outline of the complex, and dip inward as indicated by Parsons (1961).

An interpretation of the structure by Parsons (1961, p.44), based on drill data, is as follows:

"Foliation in the fenitized rocks encircles the intrusive core and dips steeply inward. Breccia zones with varying types of mineralization such as the jacupirangites, biotite-feldspar pegmatite, and the sovitic rocks, are also found along linear zones or masses elongated parallel to the circular outline of the complex. There is also some evidence of ring-like magnetic zones in the intrusive core. One drill hole indicates that these are due to magnetite in fractured and brecciated zones.

"The only available evidence of the attitude of intrusive core rocks is in the Zone D area on the north flank, where an outward dip is indicated by diamond-drilling.

"The magnetic data indicate several faults cutting and shifting, in particular the rocks of the metasomatic aureole. Generally the magnetic strength and pattern are distinctly different across these magnetic interruptions, possiby indicating considerable vertical movement with a change of rock types."

Parsons (1961, p.49) described structures within the three main zones of mineralization, encountered in driving the adit, as follows:

"Evidence of [post-ore] faulting is very prevalent in the adit and drill core. In the first part of the adit there is a series of strong faults trending northeasterly, parallel to the sharp bluff on the east side of the lake, and cutting off Zone D on its west side. Although a right-hand movement is suspected, the extension of this zone has not yet been located by drilling. In the ore zone proper, the most prevalent type of faulting strikes northwest, accompanied by solutions that chloritized the adjacent rocks and introduced carbonate over widths of tens of feet. This alteration had no effect on the niobium content except the dilution caused by the introduced carbonates."

MAGNETIC DATA

The author has not re-evaluated the interpretation of magnetic data by Parsons (1961, p.44-45), which is as follows:

"Dominion Gulf Company's aeromagnetic survey in the fall of 1954 disclosed an independent circular anomalous area, which is now known to be underlain by the alkaline rocks. The maximum magnetic strength recorded, above that for the immediate area, was only 1,000 gammas. The flight elevation for the survey was 1,000 feet.

"The ground magnetic data proved exceptionally valuable in the company's exploration program. In the early stages, these data, together with the evidence from boulder erratics and sparse outcrops, made it possible to build up a geological picture and to define the best areas for testing by diamond drilling. Later, magnetic data gave valuable clues to the trends of the higher grade niobium-bearing zones in the East ore area.

"The anomalies as detailed by a ground magnetic survey fall into several groups, and the following pattern of types is indicated by exploration so far:

"1. The anomalies in the syenitic contact zone usually tend to be strong isolated 'islands', and their niobium content low and erratic.

"2. The anomalies in the pyroxenitic fenite zone tend to be distinctly linear and locally quite strong. They invariably contain a significant niobium content, although there is no direct relationship between the magnetic intensity and the amount of niobium. These anomalies are due to zones of magnetite with garnet replacing the fenites, dike-like zones of biotite-orthoclase pegmatite rock, or jacupirangite.

"3. The lens-like anomalies in the red alkaline fenite zone are due to sovitic breccia and are very low in niobium content.

"The magnetic intensity is weak over Zone D, which is the major potential ore zone, but strong anomalous conditions in the syenitic contact rocks to the south indicate considerable action. The weak magnetic conditions over the zone itself are due in apart to the flat-lying attitude of the main masses of pyroxenitic rocks, and in part to the lack of much magnetite.

"Some comment on the relationship between geochemical and geophysical data may be useful. From the similar ionic radii of iron (0.67) and niobium (0.69), a geochemical affinity might be expected between the minerals of these elements. This is well exhibited in the Nemegosenda area in the close association of pyrochlore with magnetite and sodic-iron pyroxenes. This association is best developed in the pyroxenitic zone. On the other hand, the magnetite may exist apparently under higher temperature conditions than pyrochlore, and also in sufficient quantity to create anomalous conditions in the syenitic contact rocks. Although pyrochlore may be present in these anomalies, the over-all content is generally low. However, pyrochlore exists in volume farther removed from the intrusive core, and in the red alkaline fenite zone where magnetite is absent, and the iron is in the form of hematite dust, etc.

"The aeromagnetic and detailed ground magnetic data have been published elsewhere [Westrick and Parsons 1957]."

Petrographic examination by the author, of mineralized samples taken from the rock piled in front of the adit cutting zone "D" indicates that the pyrochlore mineralization is closely associated with aegirine-augite pyroxene. Magnetite occurs only sparingly in the mineralized rocks. While magnetic surveys are helpful in establishing lithologic trends, they are not likely to have much value in locating niobium mineralization unless the relationship of lithology and mineralization is known.

RECOMMENDATIONS FOR FUTURE STUDY

The examination of thin sections prepared from samples of the Nemegosenda Lake rocks has been very brief, with emphasis only on major mineralogy. Additional optical work with the universal stage is needed to more precisely identify the mineral phases. Microprobe studies of both the felsic and mafic minerals are advisable. X-ray diffraction studies of the nepheline alteration products are warranted. The fine-grained nature of the nepheline alteration products prevents their precise optical identification. The interpretation that some of the fenitic rocks are rheomorphic warrants additional investigation, in particular, by isotopic methods.

Mineralization other than niobium has not been clearly established at the Nemegosenda Lake complex. Parsons (1961) has suggested that uranium, thorium, rare earths, zirconium, apatite, and magnetite might be recovered as by-products of any niobium extractive operation. The uranium and thorium wcu!d appear to be potentially the most likely by-products since a close relationship between radioactivity and niobium has been established (Parsons 1961, p.45). Parsons (1961, p.45) described the niobium-radioactivity association as follows:

"Early in the Dominion Gulf Company's exploration, it became apparent that there was a marked correlation between the relative amounts of radioactivity and niobium. An exception to this occurred when abnormally high radioactivity was associated with such calcic silicate minerals as green garnet and wollastonite, and the calcium phosphate mineral apatite. In these cases, it was found that in addition to the niobium mineral pyrochlore, thorium-bearing, rare-earth minerals were present.

"Using a Canadian Aviation Electronic scintillometer placed on the rock, a reading of 250 counts per second indicated that the rock could be expected to assay about 0.25 percent Nb_2O_5. The niobium content was generally found to increase in direct proportion to the increase in radioactivity. Invariably, radioactivity of several thousand counts per second, especially if associated with the calcic minerals noted above, and if pyrochlore was not readily visible, was found to be due to rare-earth mineralization.

"Radioactive detection equipment proved an invaluable aid, not only in locating niobium-bearing mineralization in outcrops, boulders, soils, and drill core, but also in estimating the amount of niobium present."

The recovery of rare earths would be likely dependent on the economic recovery of apatite concentrate. The rare earth metals are commonly found in apatite of carbonatite - alkalic rock complexes. There is insufficient apatite in any of the phases examined by the author to justify an operation for apatite extraction, however apatite concentrate might be a possible by-product of a niobium extraction operation. Zircon and magnetite have not been observed in sufficient abundance by the author in any samples to consider them to have potential for extraction and they may not occur in sufficient concentrations to justify their recovery as a by-product of a niobium extraction operation. Parsons (1961) reported the presence of fluorite, barite, galena, sphalerite, and graphite. He concluded that the occurrence of these minerals is of academic interest only and the author concurs with this conclusion.

Parsons (1961, p.36) reported that the red alkalic fenite is consistently radioactive and has a niobium content in excess of 0.2 percent. The large area underlain by this rock group implies that a rather large volume of this very low grade material is present.

Parsons (1961, p.45) described the mineralization at the complex as follows:

"Pyrochlore is the only niobium mineral identified so far. It occurs as a minor constituent of all the alkaline rocks, except some of the late, mafic dikes, carbonate dikes, and veins. Most of the mineral occurs in the rocks between the alkaline intrusives and gneisses. The higher grade concentrations are found in the pyroxene-rich rocks, or in breccia zones rich in other minerals in this rocks. The pyrochlore occurs chiefly as finely disseminated, resinous yellow to brown grains. Occasionally it will rim or replace breccia fragments. The minerals most indicative of higher niobium content are acicular aegirite and aegirite-augite. Both fine magnetite and apatite, as replacement minerals along zones in the pyroxenitic fenites or with jacupirangite-type mineralization, are accompanied by niobium in significant amounts. However, these same minerals have little significance as disseminations or veins in the syenitic contact rocks adjacent to the syenite core, or in the gneisses and adjacent ijolites. Wollastonite and garnet occurring in deformed zones in the pyroxenitic fenites are good indicators of higher grade niobium mineralization; they are often accompanied by rare-earth minerals."

PROPERTY DESCRIPTIONS

GULF MINERALS CANADA LIMITED

A summary of this company's activities was originally prepared by Parsons (1961, p.46). While the company has reviewed its program at Nemegosenda Lake subsequent to the initial work, no major development has been undertaken on the property. A summary of the work completed from 1954 to 1959 is taken from Parsons (1961, p.46) and is as follows:

"Late in 1954 this company completed the aeromagnetic survey that located the complex. Staking was begun in February 1955, and by the fall of that year, 196 claims had been staked; these claims were covered by detailed geological and magnetic surveys. By the fall of 1956 some 35,306 feet of diamond-drilling had been completed in 68 holes. Early in 1958 an adit was driven 580 feet to obtain a bulk sample for metallurgical extraction tests. These tests reached the pilot-plant stage in 1959."

The higher grade niobium zones were described by Parsons as follows:

"[Zone D] straddles the common boundary of Chewett and Collins townships, immediately east of the lake. It was found by cross-sectional drilling carried out to test the contact between the syenite intrusives and the alkaline fenites. No part of the zone is exposed. A total of 19,485 feet of drilling in 35 holes [Figure 3, Chart A, back pocket] has been done on and in the general area of the zone. A 580-foot adit penetrated 235 feet into the zone at approximately lake level. This work has indicated 20,000,000 tons of 0.47 percent Nb_2O_5 material in a block 600 by 800 feet in size and to depths up to 600 feet [Figure 6].

Diamond drill cross-sections and sketches of ore - wall rock relationships were presented by Parsons (1961). These are reproduced as Figures 6 and 7. A sketch of the geology of the adit in Zone D is given in Figure 8.

The petrography of the host rock containing the niobium mineralization has been described under "Malignite and Aegirine-Augite Syenite" (unit 6). Faulting of the mineralized zone has been described under "Structural Geology".

Parsons (1961, p.49) described the origin of the Zone D mineralization as follows:

"Zone D is evidently a contact phenomenon between the intrusive syenite and the red alkaline fenite. The alteration of the red alkaline fenite in this contact zone to a feldspar rock has involved, among other things, the extraction of the pyroxene and pyrochlore-forming ions; these ions accumulated in the rock called malignite. As the intrusive syenite encroached on and absorbed the feldspar rock, the pyroxene-rich and relatively pyrochlore-rich malignite phase moved outward along, and occupied, zones of weakness and openings. The zones of weakness were probably caused by the syenite intrusion understoping the fenites, or by a subsidence in the complex as a whole. The latter is common to late stages in the formation of alkaline complexes."

Parsons described the "East" area of niobium mineralization as follows:

"This ore area embraces a magnetic anomaly, about 4,000 feet long and 1,200 feet wide, in the south half of concession VI and the north half of concession V, lots 8 and 9, Chewett township. Interest in the area was originally stimulated by the presence of numerous radioactive boulders and soils. It has been partially tested by 7,690 feet of diamond-drilling in 19 holes [Figure 3]. This is insufficient to outline definitely the higher-grade niobium zones but, taken with the magnetic data, does indicate the possibilities of the area.

"A brief description of the zones follows. It is not possible to give the true widths of the zones due to lack of data on their dips.

"Zone A. - This is a distinct linear magnetic zone 3,000 feet long. It has been tested in three holes along a 3,000-foot length. These holes gave an average of 0.45 percent Nb_2O_5 over 116 feet of core. The zone is a pyroxenitic fenite type (locally quite fragmental) interbanded with red fenite with or without replacement

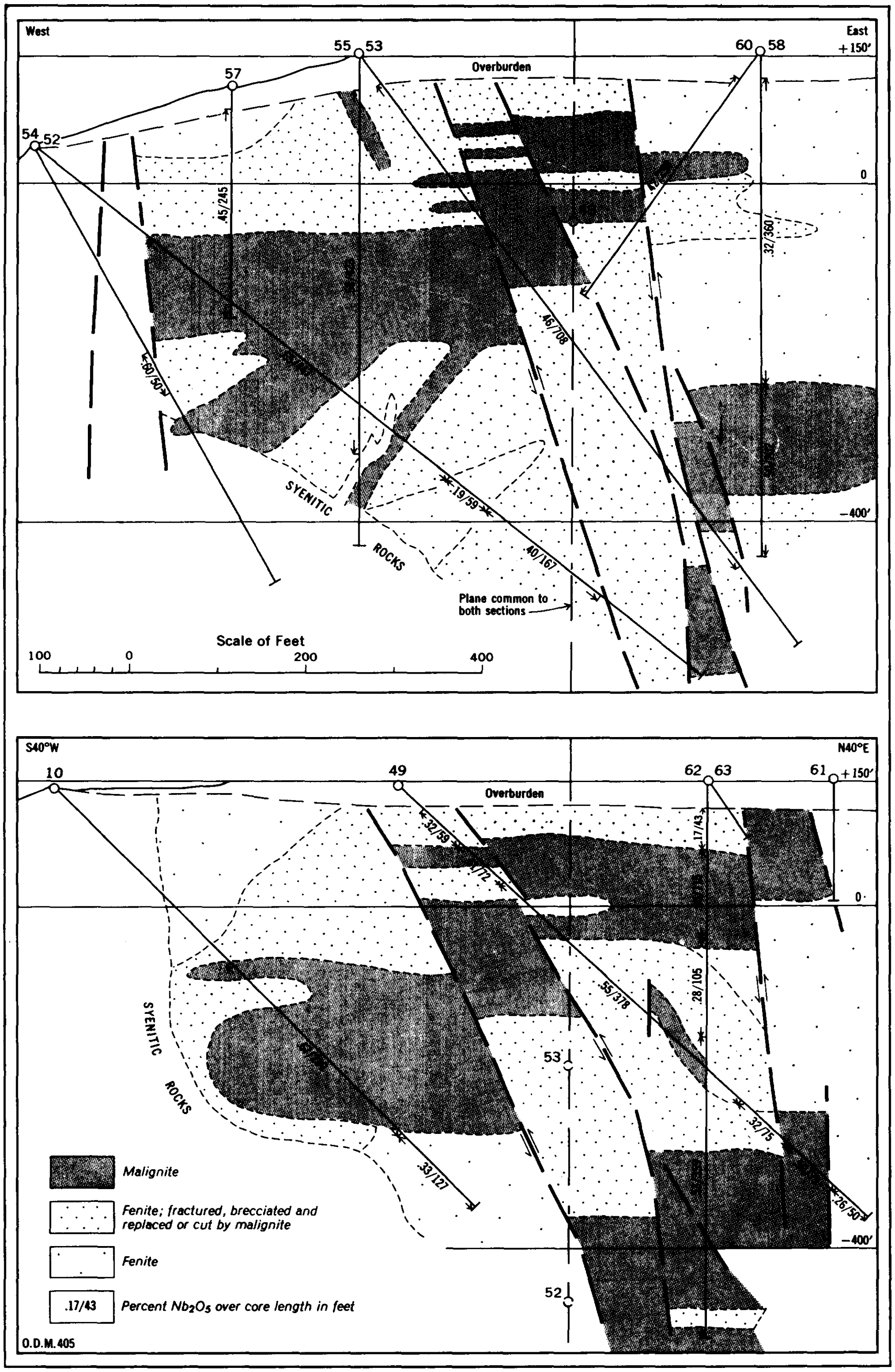

Figure 6. *Vertical sections of mineralized zone D of Gulf Minerals Canada Limited. Reproduced from Parsons (1961).*

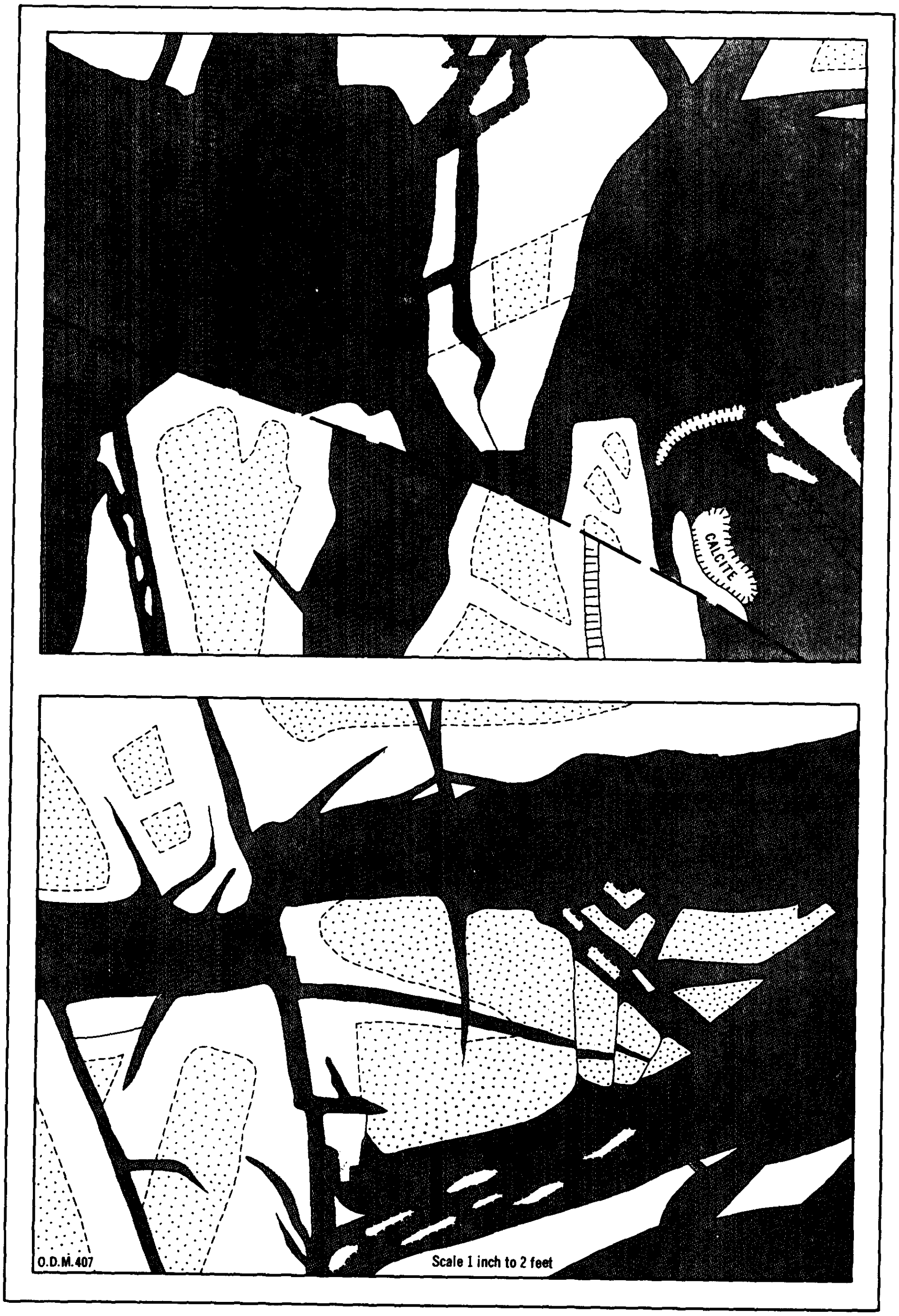

Figure 7. Sketches of malignite breccia structures, exposed in wall of adit in Gulf Minerals Canada Limited's zone D. Stippled areas are red fenite; white areas are feldspathic alteration zones; shaded areas are malignite. Upper sketch shows occurrence of coarse acicular aegirine-augite. Reproduced from Parsons (1961).

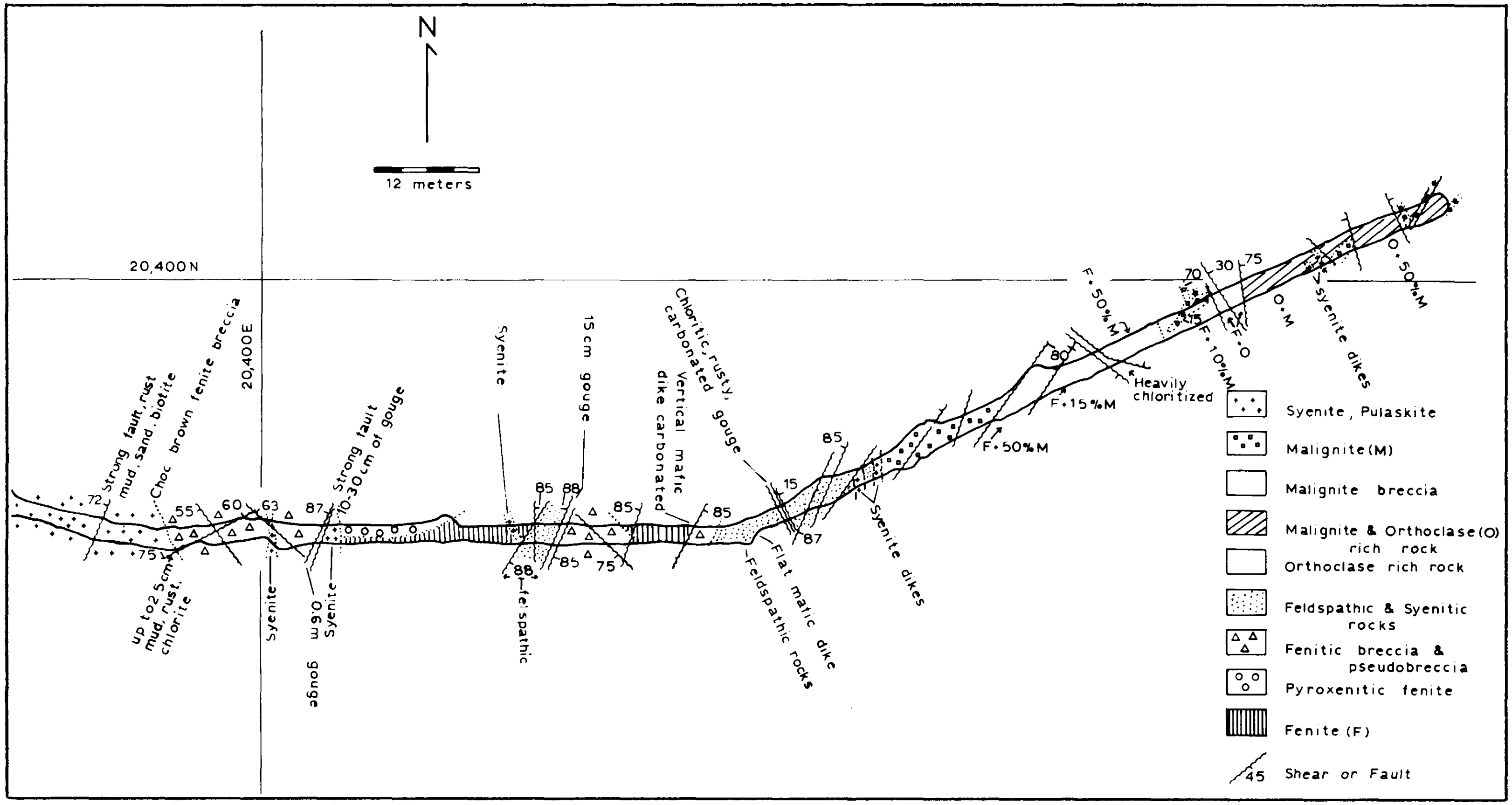

Figure 8. *Sketch of geology of adit in Zone D. Geology by G.E. Parsons, 1958 (from Assessment Files Research Office, Ontario Geological Survey, Toronto).*

by fine magnetite and green garnets. There are narrow sections rich in apatite. Pyrochlore is locally visible as well as the rare-earth mineral, monazite.

"Zone B. - This is a distinct linear magnetic anomaly 400 feet west of Zone A. It has been cut by six holes along its 1,700-foot length; these gave an average of 0.43 percent Nb_2O_5 over 101 feet of core. The mineralization is similar to Zone A except that the central high-grade shoot is normally a jacupirangite.

"Zone E. - This zone lies immediately west of Zone B and has only a weak magnetic expression. It has been cut by four holes, which gave 0.43 percent Nb_2O_5 over 43 feet of core. It is a typical orthoclase-biotite pegmatite zone, having an indicated westward dip of 60 degrees.

"Zone F. - This zone lies west of Zone E and is of similar mineralogical type. It has been cut by three holes along a 1,500 foot length. The grade averaged 0.37 percent Nb_2O_5 over 169 feet of core.

"Zone G. - This zone lies west of Zone F and appears to branch off it. It has been cut in three holes along a 400-foot length and has a magnetic expression 800 feet long. The mineralization is variable, but the chief niobium-bearing rocks are magnetite-bearing pyroxenite, and brecciated pyroxenite in a matrix of biotite and apatite."

CONTINENTAL WOOD PRODUCTS

Parsons (1961, p.50) described this property as follows:

"Continental Wood Products, a subsidiary of Canadian International Paper Company, holds under patent an extensive area to the south of Dominion Gulf Company's holdings. Alkaline rocks are present, or indicated, in the following parcels of this land: lot 10, concession V; the north half of lots 8, 9 and 10, concession IV, Chewett Township; and a strip along the west shore of Nemegosenda Lake in concessions IV, V and VI, McGee Township.

"No mineral exploration has been carried out by the company. Outcrops of red alkaline fenite occur along or near the west shore of Nemegosenda Lake in concession V, McGee township. Radioactivity tests in these outcrops indicate that they contain about 0.20 percent niobium pentoxide, the normal content for that rock type.

"On a point on the east shore of the lake, in the north half of lot 11, concession III, there is a 4-foot-wide pegmatitic dike which consists chiefly of coarse orthoclase and aegirite and contains abundant visible pyrochlore."

The author has been unable to determine if any work has been done on the Continental Wood Products' property.

HYGRADE CORRUGATED CONTAINERS LIMITED [1979]

In 1977, A.C.A. Howe International Limited completed geological, magnetometer and radiometric surveys over that portion of the Nemegosenda Complex lying in Chewett Township. The area covered is likely the former property of Continental Wood Products. No outcrop of the complex was encountered and no follow-up work was completed.

RECOMMENDATIONS TO THE PROSPECTOR

Drilling by the Dominion Gulf Company on the main niobium-bearing zone in the northeast corner of the complex has adequately delineated this mineralization. Additional drilling of niobium-bearing zones along the east flank would not likely add large tonnages. Prospecting of ijolitic and malignitic rocks in the northwest corner of the complex for apatite and niobium may be warranted. The known niobium mineralization occurs in the mafic rocks malignite and ijolite, and in carbonatite, located near the periphery of the complex rather than the core. Dominion Gulf Company completed very little work in the southern and southeastern corner of the complex and additional prospecting in this area for apatite and nepheline in the coarse-grained nepheline syenite phases may be warranted. A sample of apatite-bearing, coarse-grained nepheline syenite, from the larger of the two islands at the south end of Nemegosenda Lake, contained 3.81 percent P_2O_5 and 24.1 percent Al_2O_3 (Thurston et al. 1977). Prospecting for extensions of this apatite-bearing nepheline syenite unit or delineation of similar rocks on the nearby mainland is warranted.

The close association of pyrochlore and pyroxene suggests that the more mafic phases located peripheral to the complex offer the best potential for niobium mineralization. There is no established correlation between magnetite and pyrochlore, thus magnetic surveys are of little value in delineating exploration targets unless pyrochlore-magnetite relationships have been established.

The correlation of radioactivity with pyrochlore mineralization (Parsons 1961, p.45) indicates that the pyrochlore may contain some uranium. Where outcrop, drill core, or regolith soils are present, radioactive surveys will be valuable in locating niobium mineralization; however, if the area to be examined is drift covered, this technique would be of little value.

Appendix A

Petrographic Descriptions, Chemical Analyses, Normative Compositions, and Statistical Compositions of Lithologic Units of the Nemegosenda Lake Alkalic Rock Complex.

TABLE A–1. PETROGRAPHIC DESCRIPTIONS OF WHOLE–ROCK SAMPLES FROM THE NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX.

Map No. 448
Sample No. NR14-1
Ijolite.

Field Description. Medium grained, massive, equigranular. Weathered surfaces are black with bluish-grey mottling. Fresh surfaces are black with pink mottling. Some areas of the outcrop have coarse-grained pegmatitic segregations. Some weathered outcrop surfaces have a crude brecciated pattern. The sample is homogeneous and equigranular. Map-unit 5a.

Petrographic Description. Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Carbonate is anhedral and interstitial. Biotite is reddish-brown, anhedral in outline, encloses green, anhedral aegirine-augite. Nepheline is turbid (from staining for potassium), highly altered, anhedral, and massive. Traces of feldspar form anhedral grains. Aegirine-augite forms dark green anhedral crystals, partly enclosing some nepheline grains and interlocking with them. Aegirine-augite contains poikilitic carbonatite and biotite.

Map No. 449
Sample No. NR14-2
Ijolite.

Field Description. Medium to coarse grained, massive, equigranular. Weathered surfaces are black with bluish-grey mottling. Fresh surfaces are black with pink mottling. The outcrop has coarse-grained pegmatitic segregations and appears to be crudely brecciated. The sample was taken from a homogeneous area of the outcrop. Coarse-grained biotite occurs along some joint surfaces. Map-unit 5a.

Petrographic Description. Medium grained, massive, inequigranular, allotriomorphic, with curved to straight grain boundaries. Pyroxene is dark green aegirine-augite, which forms anhedral, irregular grains partially enclosing nepheline. Nepheline forms anhedral to subhedral, irregular grains interlocking with and enclosed within pyroxene. The nepheline contains turbid areas of alteration. Minor biotite is associated with pyroxene.

Map No. 450
Sample No. NR14-3
Olivine gabbro.

Field Description. Medium to coarse grained, trachytoidal. Weathered surfaces are mottled grey with black. The outcrop is cut by veins of coarse-grained pyroxene and calcite. The sample is homogeneous. Map-unit 4a.

Petrographic Description. Fine to coarse grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Magnetite is anhedral, possibly an alteration product of olivine. Olivine forms anhedral, rounded grains intergranular to plagioclase; it is also poikilitic in pyroxene. There are strong kelyphitic rims on olivine adjacent to plagioclase, and no rims on olivine inclusions totally enclosed within pyroxene. Cores of fresh olivine are surrounded by an inner rim of talc and an outer rim of turbid material. The turbid rim is 10 times wider than the talc rim. Pyroxene is augite, forming anhedral crystals, interstitial to plagioclase. Pyroxene grains are polycrystalline and have reaction rims next to plagioclase. Pyroxene grains do not have talc rims. Minor brown amphibole and biotite are in part after pyroxene. Several areas of turbid, very fine-grained alteration may be after nepheline, others are definitely after pyroxene.

Map No. 451
Sample No. NR22-1C
Biotite - nepheline syenite.

Field Description. Medium grained, equigranular, massive. Weathered and fresh surfaces are speckled pinkish-grey and black. Nepheline weathers to a chalky white. Colour index is approximately 35. Map unit 7a.

Petrographic Description. Fine-grained, massive, equigranular, hypidiomorphic. Nepheline is altered to elongate crystals of zeolite and cancrinite. Apatite forms euhedral crystals poikilitic in amphibole. Carbonate is anhedral, and interstitial to feldspars. Biotite forms brown, anhedral to subhedral grains. Amphibole is euhedral to anhedral in outline and contains poikilitic apatite. Amphibole is zoned from greenish-brown rims to grey rims with extinction angles varying 4-6 degrees. Several grains of albite (An_{10}) are present and show well developed albite twinning. Most feldspar is perthite with distinctly mottled or patchy extinction. Albite twinning is absent, but staining implies intergrowths of potassium and albitic feldspar.

Map No. 452
Sample No. NR22-2A
Nepheline - biotite syenite.

Field Description. Medium grained, massive, equigranular. Colour index is approximately 40. The outcrop is cut by lamprophyre dikes. Weathered and fresh surfaces are mottled pink and black. Map-unit 7a.

Petrographic Description. Fine grained, equigranular, allotriomorphic, with curved to straight grain boundaries. Biotite forms anhedral, irregular crystals, which are ragged and have a turbid or dusty appearance. Nepheline has been altered to cancrinite and possibly to zeolites and carbonate. Nepheline is anhedral and interstitial. Feldspars are dominantly albite ($An_{2\text{-}10}$). Potassium staining is strong along grain boundaries and in isolated patches within the albite-twinned grains. Trace of sodic amphibole and purple fluorite are present.

Map No. 453
Sample No. NR22-4
Aegirine-augite - biotite syenite porphyry.

Field Description. Fine to medium grained, massive, inequigranular-porphyritic-seriate. Feldspar phenocrysts up to 8 mm compose 5 percent of the rock. Weathered and fresh surfaces are red. The sample was taken from a dike 2 m wide. Map-unit 10c.

Petrographic Description. Fine to medium grained, inequigranular-porphyritic-seriate, hypidiomorphic. Biotite forms anhedral, irregular grains. Aegirine-augite forms euhedral to subhedral grains; some contain biotite inclusions. Perthite phenocrysts are glomeroporphyritic and of stringy type. Perthite in the groundmass is the same as the phenocrysts. Sericite in clots is possibly after nepheline.

Map No. 454
Sample No. NR22-5
Nepheline-bearing, biotite - amphibole syenite.

Field Description. Medium grained, massive, equigranular. Colour index is 35 to 40. Weathered and fresh surfaces are mottled buff and black. Some carbonate and biotite occur along joint planes in the rock. Map-unit 7a.

Petrographic Description. Fine grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Subhedral to euhedral grains of sodic amphibole are greenish-brown to green and contain poikilitic apatite. The amphibole crystals are zoned from brownish-green cores to green rims; the extinction angle varies from 5 to 7° between core and rim. Biotite forms anhedral, irregular, brown grains partially engulfing amphibole and containing poikilitic apatite. Albite (An_7) forms a number of grains with fine twinning. Perthite displays patchy extinction, and staining also suggests a patchy mixture of potassium and plagioclase feldspars. Nepheline is interstitial and completely altered. Nepheline is a minor component. Alteration of nepheline is minor and consists of cancrinite with zeolite and carbonate. Some brown alteration may be chlorite. A trace of fluorite is present.

Map No. 455
Sample No. NR22-7B
Melanocratic amphibole - biotite syenite.

Field Description. Fine grained, massive, equigranular. The rock contains elliptical clots of feldspar and calcite, which are up to 2 cm in diameter and comprise less than 1 percent of the rock. The sample was taken from a malignitic dike 2 m wide cutting mafic nepheline syenite. Weathered and fresh surfaces are black. Weathered surfaces are pitted and show isolated grains of feldspar and biotite up to 1 mm diameter. Map-unit 10c.

Petrographic Description. Very fine to fine grained, massive, equigranular, allotriomorphic, with curved grain boundaries. Amphibole is anhedral and brownish green to green. On the basis of pleochroism, the amphibole is sodic in composition. Biotite is anhedral, brown, and interlocking with amphibole and biotite. Apatite is euhedral, and in places is poikilitic in amphibole and biotite; it also forms distinct mineral grains. Staining shows feldspars are potassium-bearing but a number of grains have vestiges of albite twinning. Feldspars form an interlocking mosaic with mafic minerals.

Map No. 456
Sample No. NR22-8b
Nepheline-bearing, amphibole - biotite syenite.

Field Description. Medium grained, equigranular, massive, homogeneous. Weathered and fresh surfaces are red. The outcrop is cut by feldspar porphyry dikes. Map-unit 7a.

Petrographic Description. Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Amphibole is pleochroic in pale to medium green, and is subhedral in outline. Amphibole forms poikilitic inclusions in biotite along with carbonate and apatite. Rims are a more intense green than cores, which are brownish green. Biotite forms ragged, anhedral, brown grains containing poikilitic apatite, carbonate, and amphibole. Nepheline is altered and interstitial. Perthite forms anhedral grains, generally patch perthite with vestiges of albite twinning. Albite forms subhedral grains with patchy potassium replacement.

Map No. 457
Sample No. NR22-9A
Nepheline - biotite - amphibole syenite.

Field Description. Medium grained, massive, equigranular. Colour index is approximately 40. Weathered and fresh surfaces are mottled pink and black. Map-unit 7a.

Petrographic Description. Fine grained, massive, equigranular, hypidiomorphic. Amphibole forms euhedral to subhedral crystals containing poikilitic apatite, magnetite and biotite. Amphibole has brownish green cores and green rims. Nepheline is anhedral, interstitial to feldspars, and completely altered. Alteration is in part to cancrinite. Biotite forms anhedral, interlocking grains with occasional poikilitic apatite. Feldspar is dominantly albite (An_7) of anhedral to euhedral outline. Scattered grains of patch perthite are present. The presence of perthite is indicated by staining for potassium.

Map No. 458
Sample No. NR22-10
Biotite-bearing oikocrystic malignite.

Field Description. Medium grained, massive, inequigranular-seriate. The sample was taken from an outcrop at the mouth of the adit on the northeast shore of Nemegosenda Lake. Oikocrysts of potassium feldspar are up to 1.5 cm in size, with small poikilitic inclusions of pyroxene. Weathered and fresh surfaces are greenish pink to pinkish green. Map-unit 6a.

Petrographic Description. Fine to medium grained, massive, inequigranular-seriate, hypidiomorphic. Apatite forms small euhedral crystals poikilitic in mafic minerals. Nepheline is extensively altered to sericite and fibrous biotite (?). Nepheline is anhedral to euhedral, and commonly is poikilitic in orthoclase. Orthoclase forms large, amoeboid, oikocrystic grains with poikilitic nepheline and aegirine-augite. Aegirine-augite forms anhedral to euhedral grains, which are acicular in form, green, commonly poikilitic in orthoclase, and also interlocking with nepheline. Biotite forms large ragged grains of reddish-brown colour, poikilitically enclosing aegirine and nepheline.

Map No. 459
Sample No. NR22-12
Malignite.

Field Description. Medium grained, massive, inequigranular-seriate. The sample was taken from an outcrop at the crest of a ridge south of the adit. Oikocrysts of potassium feldspar are up to 1.5 cm in size with small poikilitic inclusions of pyroxene. Weathered and fresh surfaces are greenish pink to pinkish green. Map-unit 6a.

Petrographic Description. Fine grained, massive, equigranular, hypidiomorphic. Nepheline forms anhedral, irregular grains totally altered to cancrinite and possibly zeolite. Biotite forms anhedral, irregular grains enclosing aegirine-augite and nepheline. Aegirine-augite forms anhedral, irregular grains dark green in colour; larger grains have very pale green cores. Orthoclase is oikocrystic and contains poikilitic inclusions of altered nepheline crystals and anhedral aegirine-augite.

Map No. 460
Sample No. NR32-4A
Biotite - nepheline syenite

Field Description. Coarse grained, massive, equigranular. Colour index is approximately 5 percent. The sample was taken from the centre of a large clasts in an outcrop of megabreccia. The megabreccia consists of clasts 3 to 5 m in diameter, separated by fine-grained carbonate and biotite-rich matrix. Weathered surfaces are reddish brown; fresh surfaces are pink. Map-unit 8b.

Petrographic Description. Medium to coarse grained, equigranular, hypidiomorphic. Biotite forms anhedral, irregular grains. Kinking of biotite cleavage was noted in some grains. Apatite forms subhedral, rounded grains. Nepheline is highly altered to a very fine-grained material, consisting in part of sericite, cancrinite, zeolite and carbonate. Orthoclase forms anhedral to subhedral, irregular grains.

Map No. 461
Sample No. NR32-6A
Nepheline - biotite syenite.

Field Description. Medium grained, massive, equigranular. Carbonate occurs along joints in the outcrop; the outcrop is locally brecciated. Weathered and fresh surfaces are mottled brownish-black and greenish-black. Map-unit 7a.

Petrographic Description. Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Nepheline occurs interstitially and is totally altered to zeolite, cancrinite, sericite and carbonate. Biotite forms fine-grained, felty masses probably replacing a former mafic mineral. Albite forms anhedral, irregular grains with well developed albite twinning and also occurs as thin rims mantling perthite. Grains of patch and string perthite form an interlocking mosaic. Feldspars show weak patchy saussuritization.

Map No. 462
Sample No. NR32-10A
Leucocratic nepheline syenite.

Field Description. Medium grained, massive, equigranular. Nepheline is altered to bright red hydronephelinite. The area of bright red nepheline alteration is gradational into more typical pinkish-grey nepheline syenite. Weathered surfaces are pinkish grey, fresh surfaces are mottled buff and bright red. Map-unit 7a.

Petrographic Description. Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Anhedral grains of carbonate are disseminated throughout the thin section. Antiperthite forms anhedral to subhedral, tabular grains. Areas of albite (An_{8-10}) twinning are separated by areas of untwinned potassium feldspar. Hydronephelinite (?) forms fine-grained, anhedral, interstitial patches; testing for potassium has produced an intense stain.

Map No. 462A
Sample No. NR32-7
Biotite - nepheline - aegirine-augite syenite.

Field Description. Coarse to medium grained, equigranular, massive, homogeneous. Weathered and fresh surfaces are red. Map-unit 7a.

Petrographic Description. Fine to medium grained, massive, inequigranular-seriate, allotriomorphic to hypidiomorphic, with curved to straight grain boundaries. Aegirine-augite forms dark green, anhedral grains. Minor cancrinite forms large anhedral grains. Albite (An_8) forms subhedral to anhedral grains with patchy potassium feldspar replacement. Stringy perthite forms anhedral to subhedral grains. Biotite forms anhedral, irregular grains; larger grains have subrounded inclusions of nepheline and pyroxene. Carbonate is interstitial. Nepheline forms subhedral to euhedral blocky grains. Minor apatite is present.

Map No. 463
Sample No. NR32-8
Biotite - aegirine-augite - nepheline syenite.

Field Description. Fine to medium grained, inequigranular-porphyritic-seriate. Feldspar phenocrysts are up to 2 mm in size, comprising about 5 percent of the rock. The sample was taken from a dike 1.5 m wide. Map-unit 10c.

Petrographic Description. Fine grained, massive, inequigranular-seriate, hypidiomorphic. Aegirine-augite forms anhedral, irregular grains, which are subophitic with albite. Nepheline is completely altered to sericite, cancrinite, and some carbonate. Albite forms subhedral, tabular crystals with albite twinning. Biotite forms anhedral, irregular grains and also occurs as very fine-grained, felty masses replacing pyroxene. Several orthoclase grains are slightly larger than albite. The crystals are Carlsbad-twinned, subhedral in outline. The rock is porphyritic in outcrop but not in thin section.

Map No. 464
Sample No. NR32-9
Biotite - aegirine-augite - nepheline syenite (malignite).

Field Description. Medium grained, equigranular, massive. Some carbonate occurs along joint surfaces in the outcrop. Colour index is 15 to 20. Weathered and fresh surfaces are pinkish buff. Map-unit 7a.

Petrographic Description. Fine grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Albite forms distinct, anhedral to subhedral grains roughly tabular in outline. Twinning is very fine. String perthite grains are anhedral in outline. Aegirine-augite is anhedral in outline and dark green in colour. Pyroxene grains may contain poikilitic apatite and traces of carbonate. Biotite forms brown to greenish-brown, anhedral grains. Nepheline is anhedral, interstitial to the feldspars and pyroxene, and altered to cancrinite, sericite, zeolite, and possibly carbonate. Testing for potassium has deeply stained this mineral.

Map No. 465
Sample No. NW34-3A
Leucocratic nepheline syenite.

Field Description. Coarse grained, massive, equigranular. Weathered surfaces are mottled black and pale pink; fresh surfaces are pink. Colour index is 5 to 10. Map-unit 8a.

Petrographic Description. Medium to coarse grained, massive, equigranular, hypidiomorphic. Nepheline forms anhedral to euhedral grains totally altered to sericite and zeolites (?). Nepheline alteration deeply stained (test for potassium). Orthoclase forms dark brown, anhedral grains, generally clear and fresh in appearance. Biotite forms dark brown, anhedral grains with traces of poikilitic radioactive zircon.

Map No. 466
Sample No. NW34-4A
Biotite - nepheline syenite.

Field Description. Coarse grained, massive, equigranular. Weathered surfaces are mottled black and pale pink; fresh surfaces are pink. Colour index is 5 to 10. Map-unit 8a.

Petrographic Description. Medium to coarse grained, massive, equigranular, hypidiomorphic. Nepheline forms anhedral to euhedral grains totally altered to sericite, zeolite, and possibly some cancrinite. Biotite forms brown to greenish-brown, anhedral grains. Rare tiny inclusions, probably zircon, have dark radioactive bombardment haloes. Orthoclase forms anhedral, relatively clear grains.

Map No. 467
Sample No. ND5
Alkalic olivine gabbro.

Field Description. Medium grained, equigranular. Fractures or joints are filled with biotite in crystals up to 3 cm in diameter. The sample is homogeneous. Weathered and fresh surfaces are greenish black. Map-unit 4a.

Petrographic Description. Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Olivine forms anhedral, rounded grains with broad turbid reaction rims. Unreacted olivine is poikilitically completely enclosed in pyroxene. There is a thin rim of talc between olivine and the turbid reaction rims. Biotite is anhedral, interstitial, brown to reddish-brown in colour and associated with reddish-brown amphibole mantles on pyroxene. Amphibole is a reddish-brown pleochroic mineral interstitial to plagioclase but more commonly mantling the pyroxene. The amphibole may or may not have a small reaction rim where in contact with the plagioclase. Pyroxene is anhedral augite, occurs interstitially, and often displays a turbid reaction rim where it is in contact with plagioclase. Some larger grains of pyroxene have a weak schiller texture in the cores of crystals. One orthoclase crystal is euhedral in outline, Carlsbad-twinned, and 1 cm in size. The crystal is weakly zoned and appears to be primary in origin. Plagioclase (An_{38-50}) is cloudy, forms tabular, anhedral crystals with traces of very fine-grained myrmekite along some grain boundaries.

Map No. 468
Sample No. ND-10
Olivine gabbro.

Field Description. Medium grained, massive, equigranular. Weathered surfaces are mottled black and white, fresh surfaces are black to greenish black. Map-unit 4a.

Petrographic Description. Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Biotite forms brown, irregular, anhedral grains. Apatite is euhedral to subhedral. Olivine forms irregular, rounded grains, some of which are poikilitic in pyroxene. Isolated grains have pronounced, turbid, kelyphitic rims. Augite forms anhedral, irregular grains; locally, portions of grain boundaries are pale green, implying that crystals are zoned or that incipient reaction rims have formed. There are traces of schiller-like intergrowths in several grains. Plagioclase ($An_{45?}$) is anhedral and somewhat altered. Albite twinning is not sharp and few grains are suitable for optical determination. The grains are tabular but not euhedral.

Map No. 469
Sample No. AL14-6D
Rheomorphic fenite.

Field Description. Fine to coarse grained, inequigranular-seriate. Weathered and fresh surfaces are greenish black. Map-unit 3a.

Petrographic Description. Fine grained, massive, equigranular, hypidiomorphic. Orthoclase and microcline are interstitial and clear; microcline only locally displays the quadrille twinning of microcline. Patches of twinned and untwinned potassium feldspar are gradational into each other. Albite forms turbid, euhedral to subhedral grains. Aegirine-augite is dark green and euhedral to subhedral.

Map No. 470
Sample No. BA13-2A
Nepheline syenite.

Field Description. Coarse grained, massive, equigranular. Weathered surfaces are mottled pink and pinkish-purple (nepheline). Abundant apatite is poikilitic in biotite, and interstitial to feldspar and nepheline. Map-unit 8a.

Petrographic Description. Fine to coarse grained, massive, inequigranular-porphyritic-hiatal, hypidiomorphic. Nepheline forms euhedral to subhedral crystals. Incipient saussuritization occurs along fractures and cleavages in nepheline. Staining indicates nepheline is zoned, with more potassium-rich rims. Apatite is poikilitic in magnetite and biotite. Magnetite and biotite form anhedral, irregular grains interstitial to nepheline. Orthoclase forms anhedral grains and is interstitial to nepheline.

Map No. 471
Sample No. BA13-6B
Mafic matrix of brecciated nepheline syenite.

Field Description. Fine to coarse grained, inequigranular-seriate. The rock possibly contains clastic rock fragments along with large books of biotite up to 4 cm in diameter. Pyroxene, nepheline, and pseudoleucite grains are also present. Rounded blebs of carbonate, up to 3 mm in diameter, are present. The sampled rock is the matrix of a megabreccia. The matrix contains clasts of nepheline syenite up to 5 cm in diameter. Map-unit 8b.

Petrographic Description. Fine to coarse grained, massive, inequigranular-seriate, hypidiomorphic. Cancrinite is turbid and likely replaces nepheline. Augite crystals are euhedral and well zoned. Where pyroxene is in contact with carbonate, a dark reaction rim has formed. Biotite forms anhedral to euhedral, dark brown grains. The matrix of the sample is a turbid, brown, fine-grained material, in part, after pyroxene.

Map No. 472
Sample No. BA13-8A1
Nepheline-bearing, amphibole syenite.

Field Description. Fine grained, equigranular. Weathered and fresh surfaces are pinkish black. Map-unit 7a.

Petrographic Description. Fine grained, equigranular, massive, hypidiomorphic. Biotite forms anhedral, irregular grains. Amphibole is yellowish green to dark green, pleochroic, euhedral to subhedral in outline. Amphibole is sodic. Plagioclase of albite composition is the dominant feldspar and has locally been replaced by potassium feldspar. Nepheline is interstitial or occurs in rounded blebs. Nepheline has been altered to sericite.

Map No. 473
Sample No. BA13-9M
Nepheline syenite.

Field Description. Fine to coarse grained, massive, inequigranular-seriate. Large oikocrysts of potassium feldspar, up to 2 cm in diameter, poikilitically enclose pyroxene. Weathered and fresh surfaces are pinkish green. The sample was taken from outcrop at the entrance to the adit on the northeast shore of Nemegosenda Lake. Map-unit 6a.

Petrographic Description. Fine to coarse grained, massive, hypidiomorphic. Fine-grained, euhedral to subhedral aegirine-augite and nepheline poikilocrysts sit randomly in large (1 cm or more) amoeboid oikocrysts of orthoclase. Minor zircon occurs in reddish-brown biotite. Zircons have radioactive bombardment haloes. Aegirine-augite forms euhedral to subhedral crystals.

Map No. 474
Sample No. BA13-10B
Nepheline-bearing, aegirine-augite syenite.

Field Description. Medium grained, equigranular, massive. Weathered surfaces are mottled pinkish-grey and buff. Carbonatite weathers out leaving small 2-3 mm cavities lined with euhedral feldspar. Nepheline weathers to a subdued relief. Map-unit 7a.

Petrographic Description. Fine to medium grained, equigranular, massive, hypidiomorphic. Nepheline is minor and forms euhedral to subhedral grains, locally altered to cancrinite where in contact with carbonate. Perthite forms large, anhedral grains with stringy perthite texture; locally albite is present along the peripheries of grains. Aegirine-augite forms anhedral, irregular grains and in places poikilitically encloses rounded blebs of nepheline. Minor reddish-brown biotite is associated with pyroxene.

Map No. 475
Sample No. H9 22.4-22.8
Malignite.

Fine grained, equigranular, massive, hypidiomorphic. Dark reddish-brown, anhedral, irregular biotite is associated with aegirine. Nepheline is turbid and forms blocky, euhedral crystals partially enclosed in orthoclase. Orthoclase is anhedral in outline, Carlsbad-twinned, and contains abundant poikilitic inclusions of nepheline and aegirine-augite. Aegirine-augite is anhedral and irregular in outline. Pyroxene typically is dark green.

Map No. 476
Sample No. H9 644.5-645.0
Malignite.

Fine grained, massive, equigranular, allotriomorphic, with curved grain boundaries. Orthoclase forms anhedral grains interlocking with nepheline and pyroxene. Nepheline is fresh with slight alteration or cloudiness in grains along cleavages parallel to "C" crystallographic axis. Pyroxene is a dark green aegirine-augite in rounded, irregular almost amoeboid-like grains. Rarely, the ends of grains have altered to a clear colourless amphibole, possibly actinolite.

Map No. 477
Sample No. H9 74.2-74.7
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, irregular grains of brown to reddish-brown colour. Some altered nepheline is poikilitic in biotite. Nepheline is altered to a very fine-grained, felty mass, likely sericite. Aegirine-augite forms anhedral grains; locally some grains have a pale almost colourless core. Orthoclase forms anhedral, irregular grains with irregular, rounded poikilitic grains of altered nepheline and subhedral grains of aegirine-augite.

Map No. 478
Sample No. H10 33.1-33.6
Malignite.

Fine grained, inequigranular-seriate, hypidiomorphic. Dark red to brownish-red biotite rarely contains tiny poikilitic inclusions with dark rings, implying the presence of radioactive zircon. Pyroxene is a dark green aegirine-augite forming irregular, rounded to amoeboid-like grains. Nepheline forms moderately to strongly altered, blocky, subhedral crystals poikilitic in orthoclase and closely associated with pyroxene. Orthoclase forms large, anhedral oikocrysts with poikilitic inclusions of nepheline and pyroxene.

Map No. 479
Sample No. H10 77.6-78.0
Malignite.

Fine to medium grained, massive, inequigranular-seriate, hypidiomorphic. Dark red to brownish-red biotite contains small inclusions with dark haloes, possibly radioactive zircons. Pyroxene is green, anhedral aegirine-augite. Pyroxene forms anhedral, rounded, somewhat amoeboid aggregates. Nepheline is anhedral to subhedral, moderately to highly altered, poikilitic in orthoclase and commonly associated with pyroxene. Orthoclase forms small to large grains; large grains are oikocrysts with inclusions of nepheline and pyroxene.

Map No. 480
Sample No. H10 427.1-427.6
Melanocratic aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Calcite is clear and interstitial. Biotite forms large red to brownish-red, irregular, anhedral grains. One large grain contains poikilitic orthoclase. Pyroxene is dark green aegirine-augite, locally altered to a green to colourless, acicular amphibole, possibly actinolite. Orthoclase is interstitial to pyroxene. Microcline is similar to and associated with orthoclase.

Map No. 481
Sample No. H11 266.0-266.5
Biotite - nepheline syenite dike (lamprophyre?).

Fine to very fine grained, massive, allotriomorphic, with curved to straight grain boundaries. Sericite occurs with carbonate in irregular elliptical clots giving the sample a pseudoporphyritic appearance. Sericite and carbonate are also common in the groundmass. Biotite forms brown, irregular, ragged grains. Nepheline and orthoclase (?) form very fine-grained, intergrown grains. The minerals are too fine-grained to determine optically, but staining suggests extensive intergrowth of the two minerals. A trace of sphene is present.

Map No. 482
Sample No. H11 411.25-411.5
Melanocratic aegirine-augite syenite.

Fine to very fine grained, inequigranular-seriate, hypidiomorphic. Nepheline and orthoclase (?) are very fine grained; staining suggests the possibility of complex intergrowths. Orthoclase also occurs as anhedral grains associated with pyroxene and as large, anhedral, irregular grains with poikilitic, subhedral to euhedral pyroxene. Pyroxene is pale green aegirine-augite. The nepheline and orthoclase (?) mixtures are too fine-grained for optical study.

Map No. 483
Sample No. H11 742.75-743.2
Melanocratic aegirine-augite syenite.

Fine to medium grained, inequigranular-seriate. Red to brownish biotite is interstitial to pyroxene. Biotite also forms narrow reaction rims on magnetite. Acicular aegirine-augite is subhedral to, rarely, almost euhedral. Minor interstitial carbonate is present. Orthoclase forms grains interstitial to augite and large, anhedral, amoeboid, optically continuous grains poikilitically enclosing the pyroxene. Minor pyrochlore is common along grain boundaries and interstitial to pyroxene grains.

Map No. 484
Sample No. H12 56.75-57.25
Malignite.

Fine grained, massive, inequigranular-seriate, hypidiomorphic. Olivine forms several grains which are clear, irregular, and have high relief. Large 2V angles suggest a high magnesium content. Olivine is associated with biotite and magnetite. Biotite is red to brownish-red and contains rounded blebs of nepheline and possibly zircon. Nepheline forms moderately to extensive altered, subhedral to euhedral, blocky crystals. Aegirine-augite forms subhedral, irregular grains with occasional poikilitic inclusions of altered nepheline. Orthoclase forms large, irregular, anhedral grains poikilitically enclosing pyroxene and nepheline.

Map No. 485
Sample No. H12 289.5-290.0
Malignite.

Fine-grained, massive, inequigranular-seriate, hypidiomorphic. Biotite forms anhedral, red to brownish-red grains with rounded nepheline inclusions. Aegirine-augite forms irregular, anhedral grains. Biotite and aegirine-augite are closely associated. Nepheline forms turbid, irregular, subhedral to euhedral grains. Irregular, amoeboid grains of orthoclase, with lobate grain boundaries, form an interlocking mosaic. Orthoclase contains poikilitic inclusions of nepheline and aegirine-augite.

Map No. 486
Sample No. H13 917.0-917.45
Aegirine-augite - biotite silicocarbonatite.

Fine grained, massive, inequigranular-seriate, hypidiomorphic, with clotty mafic minerals. Apatite forms anhedral to subhedral grains with abundant poikilitic inclusions of aegirine-augite. Biotite contains inclusions of zircon, which have very well-developed, dark, radioactive decay bombardment haloes. Aegirine-augite forms euhedral to anhedral, dark green grains closely associated with biotite. Anhedral grains of carbonate form an interlocking mosaic.

Map No. 487
Sample No. H13 921.3-921.8
Biotite sovite.

Fine to medium grained, equigranular, hypidiomorphic. Biotite is red to brownish-red, and forms anhedral to subhedral crystals. Dark radioactive bombardment haloes surround very small zircons (?). Aegirine-augite forms anhedral to euhedral, green crystals. Apatite is euhedral to subhedral. Biotite may contain small anhedral inclusions of aegirine-augite. Anhedral carbonate grains form an interlocking mosaic.

Map No. 488
Sample No. H13 978.0-978.55
Melanocratic carbonate-rich, aegirine-augite syenite.

Fine to medium grained, equigranular, massive, hypidiomorphic, with clots of mafic minerals. Biotite is dark red to brownish-red; it forms crystal aggregates and may contain traces of poikilitic radioactive zircon. Biotite is present along the margins of some pyroxene crystals and partially encloses some pyroxene. Carbonate is anhedral and interstitial. Orthoclase is subhedral to euhedral and occasionally tabular in outline. Magnetite is disseminated and anhedral. Aegirine-augite forms euhedral to subhedral crystals, somewhat elongated. Pyrochlore occurs as small poikilitic grains in aegirine-augite and as larger grains along pyroxene grain boundaries.

Map No. 489
Sample No. H15 84.6-84.85
Biotite melteigite (?).

Fine to medium grained, massive, inequigranular-seriate, hypidiomorphic. Wollastonite forms colourless, stubby, subhedral crystals, which have well-developed cleavage and high relief. Fluorite is deep purple, very fine-grained and associated with altered biotite; it occurs along cleavage planes and grain boundaries of biotite. Aegirine-augite is minor, turbid, and not the usual clear dark green. Aegirine-augite encloses some smaller wollastonite grains. Biotite is dark red and contains abundant dark circular spots from entrapped radioactive zircon (?). Tiny anhedral, poikilitic inclusions of wollastonite occur in some biotite grains. Zeolites (?) occur as turbid radiating masses between wollastonite grains; possibly the zeolite is after nepheline.

Map No. 490
Sample No. H16 149.1-149.55
Sericite - carbonate - biotite syenite.

Very fine to fine grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Carbonate and sericite form rounded or eliptical clots up to 2 mm in maximum dimension. Some sericite and abundant carbonate are present in the groundmass. Biotite forms brown, turbid, ragged, anhedral grains. Orthoclase is very fine grained, interstitial and was identified on the basis of positive stain for potassium. Some orthoclase is roughly tabular.

Map No. 491
Sample No. H16 591.25-591.6
Porphyritic alkalic dike.

Fine to medium grained, massive, inequigranular-porphyritic-seriate, hypidiomorphic. The core sample contains one euhedral phenocryst of albite ($An_{10?}$). Orthoclase is euhedral to subhedral in outline with ragged edges. Some saussuritization has occurred along the edges of crystals. Cancrinite is present as crystal aggregates in the groundmass. Mafic phenocrysts are altered to a felty mass of dark brown biotite. Groundmass biotite is fine grained, dark brown, and anhedral. Some very fine-grained albite (?) occurs in the groundmass, also some very fine-grained cancrinite. Acicular zeolite, possibly thomsonite, is a major component of the groundmass.

Map No. 492
Sample No. H17 242.9-243.3
Magnetite sovite.

Fine grained, massive, inequigranular-seriate, hypidiomorphic. Magnetite forms subhedral to euhedral grains. Biotite forms brown to reddish-brown, subhedral grains, commonly along crystal faces of magnetite. One clot of very fine-grained biotite may be an alteration of an unknown mineral. Aegirine-augite forms tiny, pale green, euhedral to subhedral crystals. Calcite forms an interlocking mosaic of anhedral crystals.

Map No. 493
Sample No. H17 442.4-442.8
Cancrinite - biotite syenite.

Fine grained, inequigranular, porphyritic-seriate, hypidiomorphic. Phenocrysts consist of Carlsbad-twinned orthoclase and microcline. The crystals are subhedral to euhedral and potassium staining suggests that some are zoned. Apatite is euhedral and associated with fine-grained clots of biotite. These fine-grained clots contain abundant purple fluorite. Biotite in anhedral crystals is common in the matrix along with aegirine-augite. Platey fine-grained albite (?) feldspar, with pronounced trachytic texture, forms the groundmass. Cancrinite occurs as relatively large grains associated with and partially enclosing orthoclase, as interstitial grains, and as optically continuous grains containing poikilitic inclusions of albite.

Map No. 494
Sample No. H21 308.5-309.0
Biotite - nepheline syenite.

Medium to coarse grained, massive, equigranular, allotriomorphic, with straight to curved grain boundaries. Nepheline is anhedral and has been completely altered to fine-grained sericite. Sericite flakes are subparallel. Biotite forms anhedral grains, partially enveloping some altered nepheline. Orthoclase forms anhedral irregular grains, partially engulfing former nepheline.

Map No. 495
Sample No. H21 1100.6-1101.1
Malignite.

Fine to medium grained, massive, inequigranular-seriate, hypidiomorphic. Nepheline forms blocky, subhedral crystals, which are moderately to strongly altered. Rounded, irregular blebs of calcite are interstitial to nepheline and pyroxene. Aegirine-augite forms anhedral, irregular grains which are partially interlocking with nepheline. Orthoclase forms anhedral, optically continuous grains with poikilitic inclusions of pyroxene and nepheline along margins.

Map No. 496
Sample No. H21 1300.0-1300.5
Biotite - nepheline syenite.

Medium to coarse grained, massive, equigranular, allotriomorphic, with straight to curved grain boundaries. Biotite forms brown, anhedral grains interstitial to and locally, partially engulfing orthoclase. Nepheline, which is anhedral and irregular, is extensively altered to sericite; locally, fresh nepheline occurs in the cores of larger grains. Sericite flakes are oriented subparallel. Trace amounts of cancrinite, zeolite, and possibly natrolite are present. Orthoclase forms anhedral grains with local rounded blebs of altered nepheline.There are local areas of turbid incipient alteration on the orthoclase.

Map No. 497
Sample No. H24 98.1-98.6
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral to subhedral, brown crystals. Nepheline forms blocky, subhedral to anhedral grains with turbid areas of incipient alteration. Orthoclase forms large, clear, optically continuous grains with abundant, randomly oriented inclusions of pyroxene and nepheline. Aegirine-augite forms anhedral to subhedral grains of dark green colour. Pyroxene locally encloses nepheline and one grain contains poikilitic reddish-brown biotite. Larger grains have pale green cores, which imply that the grains are zoned.

Map No. 498
Sample No. H26 86.8-87.3
Malignite.

Fine grained, massive, inequigranular-seriate, hypidiomorphic. Biotite is brown, anhedral, and has poikilitic inclusions of nepheline and aegirine-augite. Aegirine-augite forms anhedral grains. Rarely, paler cores imply that the grains are zoned. Aegirine-augite contains inclusions of altered nepheline. Nepheline has been extensively altered to sericite and possibly a clay mineral. Nepheline is subhedral to anhedral in outline. Orthoclase forms large, optically continuous grains containing randomly oriented aegirine-augite and nepheline.

Map No. 499
Sample No. H26 517.8-518.4
Melanocratic aegirine-augite syenite.

Fine to medium grained, equigranular, hypidiomorphic. Carbonate forms irregular, interstitial grains; locally it occurs as subangular blebs in orthoclase. Aegirine-augite forms dark green, elongated grains with subhedral to euhedral outline. Orthoclase forms anhedral, irregular, amoeboid-like grains with randomly oriented aegirine-augite inclusions. Pyrochlore occurs as tiny, euhedral, poikilitic inclusions within the aegirine-augite and as larger euhedral crystals along the crystal faces of the pyroxene.

Map No. 500
Sample No. H26 622.3-622.9
Malignite.

Fine to medium grained, inequigranular-porphyritic-seriate, hypidiomorphic. Garnet, possibly melanite, forms large, irregular, anhedral grains which are pale brown in colour. Some small grains of pyroxene are poikilitically enclosed by the garnet. Small grains of garnet, which are colourless and have anomalous birefringence, are locally associated with aegirine-augite. Aegirine-augite forms anhedral to subhedral, dark green grains. Nepheline forms subhedral, blocky grains in close association with pyroxene; nepheline is generally fresh. Orthoclase forms larger irregular grains with random poikilitic inclusions of aegirine-augite and rarely nepheline. One orthoclase grain consists of a mosaic of polycrystalline grains and displays a metamorphic texture. Actinolite needles are associated with brown garnet.

Map No. 501
Sample No. H27 785.8-786.25
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, brown, irregular grains. Several grains have dark spots possibly radioactive bombardment haloes around zircon (?). Aegirine-augite forms anhedral to subhedral, dark green grains commonly associated with nepheline. Nepheline forms anhedral to subhedral, blocky, relatively fresh grains. Orthoclase forms anhedral, irregular, oikocrystic grains, optically clear, with random poikilitic inclusions of pyroxene and nepheline.

Map No. 502
Sample No. H27 591.0-591.5
Pyroxene - biotite syenite (altered).

Very fine to fine grained, massive, equigranular, hypidiomorphic. Pyroxene is euhedral, colourless to pale green, fine grained and strongly zoned. Extinction angle varies from 10 to 15 degrees from core to rim of some grains. Pyroxene is augite. Minor euhedral apatite is present. Anhedral cancrinite is present in a small area of the thin section. Biotite forms ragged booklets, in part possibly replacing margins of pyroxene grains. Orthoclase and albite form fine-grained, anhedral grains in the groundmass. Several grains contain vestiges of albite twinning.

Map No. 503
Sample No. H28 31.6-31.84
Altered malignite.

Fine to very fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, irregular grains; the colour is locally mottled brown to yellow-brown. Calcite is anhedral and interstitial. Nepheline is completely altered to sericite and possibly analcite (?). Cancrinite is also a local alteration product. Former nepheline is anhedral to subhedral in outline. Potassium feldspar, possibly orthoclase, forms fine-grained, dark polycrystalline aggregates with wavy extinction. Several grains show the quadrille twinning of microcline.

Map No. 504
Sample No. H29 291.9-292.4
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Aegirine-augite forms subhedral crystals of dark green colour. The odd crystal has a colourless core. Biotite forms anhedral, irregular books. Poikilitic inclusions of anhedral aegirine-augite are common, nepheline rare. Orthoclase forms anhedral grains which may locally contain poikilitic inclusions of pyroxene, nepheline, or biotite. Nepheline is fresh, forms blocky, subhedral crystals, and is found in close association with pyroxene.

Map No. 505
Sample No. H30 135.0-135.6
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms reddish-brown to brownish-red, anhedral, ragged grains with poikilitic inclusions of altered and unaltered nepheline. Nepheline forms blocky anhedral to euhedral crystals, almost totally altered to very fine-grained sericite, cancrinite, etc. (?). Aegirine-augite forms elongated, dark green, anhedral crystals and is closely associated with nepheline. Orthoclase forms large, clear, anhedral, amoeboid grains with poikilitic aegirine-augite and nepheline. Orthoclase forms oikocrysts.

Map No. 506
Sample No. H30 313.0-313.5
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, irregular, grains with irregular poikilitic inclusions of aegirine and nepheline. Aegirine-augite forms anhedral, irregular dark green grains. Nepheline is altered to a turbid, very fine-grained, highly birefringent mineral. There are local relicts of fresh nepheline. Orthoclase forms anhedral, clear grains with poikilitic inclusions of aegirine-augite and less commonly of nepheline.

Map No. 507
Sample No. H33 166.5-167.0
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, irregular, brown grains; some are ragged in outline, and one grain has bent (001) cleavage. Nepheline and pyroxene are poikilitic in biotite. Aegirine-augite forms green, anhedral to euhedral grains; larger grains have colourless cores. Nepheline forms anhedral to euhedral grains altered to a very fine-grained, unidentifiable, turbid mass. Nepheline is closely associated with pyroxene. Orthoclase forms clear colourless grains with poikilitic inclusions of biotite, nepheline, and pyroxene.

Map No. 508
Sample No. H33 251.5-252.25
Apatite - carbonate - biotite - wollastonite rock.

Fine to medium grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Biotite forms large, anhedral grains of red to brownish-red colour; locally it has abundant poikilitic inclusions of tiny zircons with pronounced dark radioactive bombardment haloes. Fluorite forms purple disseminated grains. Carbonate is interstitial and locally intergrown with wollastonite. Wollastonite forms colourless anhedral, stubby grains. Apatite is anhedral and closely associated with wollastonite.

Map No. 509
Sample No. H34 272.3-273.6
Melanocratic aegirine-augite syenite.

Fine grained, equigranular, hypidiomorphic. Pyrochlore forms euhedral reddish-brown grains with pronounced zonation. Pyrochlore is poikilitic in pyroxene. Pyroxene is aegirine-augite, and forms elongated, dark green crystals. Biotite forms euhedral to subhedral, red to brownish-red crystals. Large crystals of biotite enclose pyroxene. Carbonate is anhedral and irregular in outline; locally it contains irregular blebs of carbonate and partially encloses pyroxene grains.

Map No. 510
Sample No. H34 590.0-590.6
Malignite.

Fine to medium grained, massive, inequigranular-seriate, hypidiomorphic. Aegirine-augite forms subhedral to anhedral, irregular grains. Larger grains have very pale green to colourless cores; rims are deep green. Biotite forms anhedral, irregular grains with poikilitic inclusions of nepheline and aegirine-augite. Nepheline is totally altered to sericite and possibly some cancrinite; euhedral to anhedral grains of former nepheline are closely associated with pyroxene. Cancrinite is minor and appears to be primary. Anhedral cancrinite encloses pyroxene and altered nepheline. Orthoclase forms large clear oikocrysts of amoeboid outline. The grains are poikilitic with altered nepheline and aegirine-augite.

Map No. 511
Sample No. H35 97.8-98.2
Biotite - pyroxene syenite.

Fine grained, inequigranular, porphyritic-seriate, hypidiomorphic. Carbonate is anhedral and interstitial. Pyroxene consists of euhedral augite. Augite is rimmed with bright green aegirine. Biotite has ragged outlines and is brown. Orthoclase forms anhedral, interlocking grains. Carlsbad twinning is present; several grains have vestiges of albite twinning.

Map No. 512
Sample No. H36 227.0-227.2
Melanocratic carbonate - aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Scattered, very tiny, reddish-brown grains of pyrochlore are associated with pyroxene. Carbonate is anhedral and interstitial. Dark red biotite forms anhedral grains between pyroxene grains. The aegirine-augite forms elongated dark green crystals; locally, grains are altered along edges and ends, possibly to tremolite. Pyroxene is generally subhedral in outline. Apatite is euhedral to subhedral. Orthoclase forms clear grains, anhedral to euhedral in outline. Euhedral crystals project into carbonate.

Map No. 513
Sample No. H36 337.25-337.5
Melanocratic, carbonate - aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Pyrochlore forms tiny, reddish-brown, euhedral crystals poikilitic within and along grain boundaries of aegirine-augite. Aegirine-augite forms elongated, dark green, subhedral to anhedral grains. Locally the pyroxene is altered to a clear colourless amphibole, probably actinolite. Several patches of fine-grained sericite may be after nepheline. Orthoclase forms subhedral to euhedral grains; one grain has the quadrille twinning of microcline and another grain displays well-developed concentric zoning. Carbonate is anhedral and interstitial.

Map No. 514
Sample No. H36 464.4-464.6
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Aegirine-augite forms anhedral to subhedral, dark green grains. Pyroxene is locally turbid and paler in colour, possibly because of alteration to tremolite. The alteration is most intense next to carbonate. Biotite forms red to brownish-red grains and occurs along pyroxene grain boundaries. Orthoclase forms anhedral, irregular grains, which are amoeboid in outline, partially enclose pyroxene, and enclose altered nepheline. Nepheline is altered to a fine-grained, turbid mass, which may be, in part, sericite.

Map No. 515
Sample No. H36 533.6-533.9
Malignite.

Fine to medium grained, massive, allotriomorphic to hypidiomorphic. Aegirine-augite forms subhedral to euhedral, dark green crystals. Minor, dark red-brown, euhedral grains of pyrochlore are poikilitic in, and marginal to, pyroxene crystals. Nepheline is altered to fine-grained, felty masses of sericite. Former grains are anhedral in outline. Orthoclase forms subhedral to euhedral crystals, some with vestiges of quadrille twinning.

Map No. 516
Sample No. H36 658.4-658.6
Melanocratic, aegirine-augite syenite (altered).

Fine grained, massive, equigranular, hypidiomorphic. Orthoclase forms anhedral to subhedral grains. Some display Carlsbad twinning. Pyroxene is altered to an isotropic mass of chlorite and limonite; former grains have anhedral to euhedral outlines. Carbonate is anhedral and interstitial to feldspars; possibly it is in part alteration of pyroxene.

Map No. 517
Sample No. H36 717.3-717.5
Melanocratic, aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Magnetite forms anhedral, irregular grains interstitial to pyroxene. Aegirine-augite forms dark green crystals with anhedral to euhedral outline. Orthoclase forms anhedral, amoeboid, optically continuous grains which enclose pyroxene. Carbonate is very fine-grained and interstitial to pyroxene. Carbonate may replace orthoclase.

Map No. 518
Sample No. H36 801.5-801.8
Albite-carbonate rock.

Fine to medium grained, equigranular, hypidiomorphic. Carbonate forms euhedral to anhedral grains; the well-developed euhedral crystals project into albite. Albite is interstitial to carbonate. It forms clear grains with rare wavy extinction and biaxial positive optic figure. It looks similar to cherty quartz.

Map No. 519
Sample No. H37 187.2-187.6
Leucocratic, carbonate - cancrinite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Carbonate is anhedral and interstitial. Cancrinite is clearly interstitial, locally engulfing and enclosing feldspar. Albite (An_{4-10}) forms part of an interlocking mosaic of feldspar and is anhedral in outline. Orthoclase is Carlsbad-twinned, tabular, and anhedral to euhedral. The rock is likely a cumulate phase.

Map No. 520
Sample No. H37 381.2-381.6
Malignite.

Fine grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Zeolite (?) is present as radiating, acicular crystals, and sericite occurs as very fine-grained aggregates. The zeolite and sericite may be after former nepheline. Biotite forms anhedral, brown crystals. Orthoclase forms anhedral, irregular crystals with curved to lobate grain boundaries. The crystals contain poikilitic inclusions of biotite. Orthoclase is turbid due to inclusions, possibly of a clay mineral. Some spotty saussuritization of feldspars is evident. Vestiges of albite twinning are present.

Map No. 521
Sample No. H37 410.0-410.4
Cancrinite - biotite syenite.

Very fine to fine grained, massive, equigranular, allotriomorphic, with curved to straight grain boundaries. Cancrinite is interstitial, forming irregular grains between feldspars. Biotite forms brown, anhedral, irregular crystals. Perthite has well-developed string texture; the potassium feldspar may be microcline. Minor plagioclase is interstitial to perthite.

Map No. 522
Sample No. H39 212.6-212.95
Syenite porphyry.

Very fine to coarse grained, massive, inequigranular-porphyritic-hiatial, hypidiomorphic. Phenocrysts of orthoclase with Carlsbad twinning are sharply euhedral in outline. Carbonate occurs along fractures. Orthoclase in the groundmass forms anhedral to subhedral grains between larger phenocrysts. Some grains are tabular in outline. The matrix is a fine-grained aggregate of limonite, carbonate, and sericite. Some of the matrix may formerly have been nepheline on the basis of crude crystal outlines of some of the patches of alteration.

Map No. 523
Sample No. H39 340.0-340.45
Nepheline syenite.

Medium to coarse grained, massive, hypidiomorphic. Biotite forms anhedral, irregular grains of pale green and dark brown colour. Biotite contains inclusions of altered nepheline. Nepheline is anhedral to euhedral in outline and altered to a very fine-grained mixture of sericite and carbonate. Orthoclase forms anhedral, irregular grains with spotty saussuritization. Vestiges of albite twinning occur along fractures and in areas marginal to alteration.

Map No. 524
Sample No. H40 669.05-669.25
Leucocratic, carbonate syenite.

Fine grained, massive, equigranular, allotriomorphic, with curved grain boundaries. Calcite is interstitial and anhedral. Orthoclase has vestiges of albite twinning; it is turbid and forms interlocking grains with curved to lobate grain boundaries. Plagioclase (An_{10}) forms vestiges associated with the orthoclase. Feldspars take intense stain for potassium.

Map No. 525
Sample No. H41 207.5-208.0
Malignite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, irregular, brown grains in association with pyroxene. Pyroxene is an aegirine-augite with anhedral to subhedral outline. Cores of some grains are much paler than rims.

Nepheline is anhedral to subhedral in outline, and completely altered to carbonate, sericite, and possibly some cancrinite. Nepheline is closely associated with biotite and pyroxene. Orthoclase forms anhedral grains which are generally clear and contain poikilitic inclusions of aegirine-augite and altered nepheline. Orthoclase is oikocrystic.

Map No. 526
Sample No. H41 245.0-245.6
Malignite.

Medium grained, massive, equigranular, hypidiomorphic. Aegirine-augite forms anhedral to euhedral crystals of irregular outline. Some irregular blebs of altered nepheline are enclosed by the aegerine-augite. Nepheline is anhedral to euhedral in outline and extensively altered to very fine-grained sericite and possibly zeolites. Some cancrinite may be present. Orthoclase forms anhedral to euhedral Carlsbad-twinned crystals of tabular outline. Some irregular blebs of altered nepheline may be enclosed within feldspars.

Map No. 527
Sample No. H41 253.2-253.7
Malignite.

Fine to medium grained, massive, inequigranular-porphyritic-seriate, hypidiomorphic. Carbonate is interstitial and fine-grained. Aegirine-augite forms subhedral to anhedral crystals, undergoing alteration to a fine-grained, turbid mass in several areas. Alteration products are possibly in part limonite and chlorite, and locally include considerable carbonate. Nepheline formed anhedral to euhedral crystals which are completely altered to sericite, carbonate and possibly cancrinite. Nepheline is closely associated with pyroxene. Orthoclase forms Carlsbad-twinned crystals which are subhedral in outline and weakly saussuritized along grain boundaries.

Map No. 528
Sample No. H41 325.65-326.25
Nepheline syenite porphyry.

Fine to medium grained, massive, inequigranular-porphyritic-seriate-hiatial, hypidiomorphic. Orthoclase forms subhedral to euhedral crystals, which display well-developed Carlsbad twinning and Baveno twins. Orthoclase contains altered inclusions of nepheline. Nepheline forms anhedral to euhedral crystals, extensively altered to sericite and carbonate. Pyroxene is totally altered but former crystal outlines are evident. Pyroxene is extensively altered to chlorite, carbonate and limonite. The original pyroxene composition was likely aegirine-augite.

Map No. 529
Sample No. H41 419.25-419.75
Lamprophyre (altered monchiquite?).

Fine grained, inequigranular, porphyritic-seriate, hypidiomorphic. Euhedral analcite or leucite crystals are undergoing reaction with the matrix to form a very fine-grained, undefined mineral. Albite (?) grains are very minor and extensively saussuritized. Traces of apatite are present. The rock consists dominantly of chlorite. Euhedral olivine crystals, pseudomorphically replaced by chlorite, carbonate, and serpentine, comprise approximately 15 volume percent. Carbonate and sericite are present in the matrix.

Map No. 530
Sample No. H41 423.1-423.4
Sovite.

Fine to medium grained, inequigranular-seriate, allotriomorphic. Chlorite is very fine grained and forms radiating ball-like or spherical clots. Magnetite is a minor component, subhedral in outline, with some limonitic alteration. Calcite forms an interlocking mosaic of anhedral grains.

Map No. 531
Sample No. H41 423.1-423.4
Sovite.

Fine to medium grained, equigranular, allotriomorphic with straight grain boundaries. Minor chlorite forms rounded, spherical inclusions with radiating structures. Limonite is present in minor amounts. Anhedral grains of carbonate form an interlocking mosaic.

Map No. 532
Sample No. H42 147.7-148.0
Sovite.

Fine to medium grained, massive, equigranular, allotriomorphic, with straight grain boundaries. Apatite forms clear, colourless, subhedral crystals. Quartz is anhedral, dusted with magnetite, and displays an undulatory radiating extinction. Opaques are in part needle-like crystals of hematite (?), partially altered to limonite. Opaques are very minor.

Map No. 533
Sample No. H48 131.6-131.8
Magnetite sovite.

Fine to coarse grained, massive, inequigranular-seriate, hypidiomorphic. Magnetite forms anhedral, irregular grains. Biotite forms dark red grains peripheral to the magnetite grains. Apatite forms anhedral to subhedral grains. Pyroxene forms tiny anhedral to subhedral grains in association with magnetite and biotite. Pyroxene grains are too small to determine optically. Pyroxene cleavage is present. Pyroxene, apatite and biotite content is minor.

Map No. 534
Sample No. H46 388.5-399.0
Porphyritic sericite syenite.

Very fine to medium grained, massive, inequigranular-porphyritic-hiatal, allotriomorphic, with curved to straight grain boundaries. Plagioclase phenocrysts are subhedral with ragged edges. The crystals are turbid and enclosed in a fine-grained, anhedral matrix of anhedral orthoclase and very fine-grained sericite. Some local areas of tabular, Carlsbad-twinned crystals have a less turbid appearance. Sericite forms very fine-grained, felty, interstitial mats. The primary mineral altering to sericite could not be identified.

Map No. 535
Sample No. H4 1116.8-1117.4
Biotite - cancrinite syenite.

Very fine to fine grained, massive, equigranular, hypidiomorphic. Biotite forms anhedral, brown crystals. Biotite also forms very fine-grained crystal aggregates, probably replacing a former primary mafic mineral. Aegirine-augite forms tiny, subhedral to euhedral, pale green crystals poikilitic in orthoclase and partially engulfing orthoclase. Orthoclase forms anhedral grains with poikilitic inclusions of aegirine-augite. Minor, anhedral grains of fluorite are disseminated through the sample.

Map No. 536
Sample No. H46 1220.8-1221.3
Magnetite - apatite sovite.

Fine to medium grained, equigranular, massive, hypidiomorphic. Apatite is present in small bead-like grains which are subhedral in outline. Aegirine-augite forms tiny, subhedral to euhedral, green grains. Magnetite forms rounded, anhedral grains. Carbonate forms an interlocking mosaic of anhedral grains.

Map No. 537
Sample No. H47 592.2-592.45
Malignite.

Fine grained, massive, inequigranular-seriate, hypidiomorphic. Nepheline forms anhedral to euhedral grains extensively altered to sericite, carbonate, cancrinite and possibly a clay mineral. Biotite forms reddish-brown crystals with poikilitic inclusions of aegirine-augite and nepheline. Aegirine-augite forms anhedral to subhedral grains. Larger grains are strongly zoned from dark green rims to pale green cores. Orthoclase forms anhedral, amoeboid, irregular oikocrysts with poikilitic inclusions of euhedral aegirine-augite and partially altered, euhedral nepheline.

Map No. 538
Sample No. H48 294.0-294.4
Melanocratic aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite forms irregular, anhedral, red to brownish-red grains interlocking with green pyroxene. One or two tiny inclusions of zircon have dark radioactive bombardment haloes. Pyroxene is a dark green, anhedral to euhedral aegirine-augite. Carbonate is interstitial to pyroxene and closely associated with feldspar. Orthoclase forms subhedral to anhedral grains interstitial to aegirine-augite.

Map No. 539
Sample No. H49 153.35-153.75
Malignite (mafic).

Fine grained, massive, equigranular, hypidiomorphic. Pyrochlore forms euhedral crystals poikilitic in aegirine-augite and along crystal margins. Magnetite is amoeboid and partially enclosed in aegirine-augite. Aegirine-augite forms dark geen, anhedral to subhedral crystals. Carbonate is anhedral, interstitial to pyroxene, and closely associated with feldspars. Nepheline forms anhedral, irregular grains in close association with orthoclase. Nepheline is totally altered to sericite, cancrinite, and calcite. Orthoclase forms anhedral, amoeboid grains with poikilitic inclusions of subhedral to euhedral aegirine-augite and irregular nepheline.

Map No. 540
Sample No. H49 414.6-415.1
Melanocratic, aegirine-augite syenite.

Medium grained, equigranular, massive, hypidiomorphic. Carbonate is anhedral and interstitial. There are traces of perovskite and pyrochlore. Aegirine-augite forms elongate, dark green crystals, anhedral to euhedral in outline. Biotite forms scattered, anhedral grains along margins of augite grains. Orthoclase forms anhedral, irregular grains, poikilitically enclosing aegirine-augite.

Map No. 541
Sample No. H62 224.45-224.9
Biotite syenite (altered).

Fine grained, massive, equigranular, hypidiomorphic. Biotite is irregular and ragged in outline, possibly in part altering to limonite. Some very fine-grained, radiating spheres of biotite are present. Potassium feldspar (orthoclase) forms anhedral, ragged grains sprinkled with saussuritization. Saussuritization is locally so extensive as to make grains cloudy. Crystals are anhedral to euhedral in outline. Albite is clear and colourless; it rims some potassium feldspar crystals. Carbonate is interstitial and anhedral.

Map No. 542
Sample No. H62 235.4-235.9
Malignite (heavily altered).

Fine grained, massive, equigranular, hypidiomorphic. Magnetite is anhedral and interstitial in part, an alteration product of a former mafic mineral that altered to a turbid mass containing some tremolite (?). Nepheline formed anhedral crystals, which have been extensively altered to a felty, fine-grained, matted mass of sericite. Orthoclase forms anhedral to subhedral crystals, very fresh in appearance relative to the other two dominant minerals. Carbonate is interstitial. Vestiges of quadrille twinning of microcline are apparent in some orthoclase grains.

Map No. 543
Sample No. H62 444.4-444.7
Melanocratic, aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Biotite is brown to reddish-brown, anhedral, and marginal to the pyroxene. Aegirine-augite forms elongated, dark green, anhedral to euhedral crystals. Orthoclase and microcline form anhedral grains interstitial to pyroxene. Microcline shows moderaltely developed quadrille twinning. The interior and margins of some grains are weakly saussuritized. Carbonate forms anhedral, irregular grains, interstitial to pyroxene and orthoclase.

Map No. 544
Sample No. H64 264.5-264.85
Melanocratic, aegirine-augite syenite.

Fine grained, massive, equigranular, hypidiomorphic. Aegirine-augite forms dark green elongated crystals which are anhedral to euhedral in outline. Orthoclase forms anhedral to subhedral crystals, interstitial to pyroxene. Carbonate forms irregular, anhedral grains interstitial to pyroxene and orthoclase.

Map No. 545
Sample No. H64 322.0-322.33
Carbonate - biotite dike (lamprophyre).

Very fine to fine grained, equigranular, massive, allotriomorphic, with straight to curved grain boundaries. Biotite forms small, ragged, anhedral crystals. One area of felty biotite with carbonate is pseudomorphic after a former pyroxene phenocryst. Carbonate is interstitial and anhedral in outline.

Map No. 546
Sample No. H64 362.0-362.45
Biotite - cancrinite - garnet rock.

Fine grained, massive, equigranular, allotriomorphic. Biotite forms brown, anhedral crystals which have ragged outlines and poikilitically enclose cancrinite. Cancrinite forms rounded, polycrystalline grains enveloped in a mesh of brown garnet. Cancrinite is probably after nepheline. Garnet forms brown, polycrystalline, anhedral grains, which have ragged outlines and enclose rounded polycrystalline grains of cancrinite. Very minor pyroxene has augite cores and aegirine-augite rims; extinction angle varies by 23 degrees from core to rim on one grain. Pyroxene is associated with biotite.

Map No. 547
Sample No. H64 413.15-413.55
Melteigite.

Fine grained, massive, equigranular, allotriomorphic, with curved grain boundaries. Pale brown garnet forms anhedral, rounded grains. Biotite forms brown, irregular grains; some are pronouncedly intercalated with apatite. Pyroxene is pale green, anhedral, aegirine-augite; the cores of larger grains are very pale green to colourless. Apatite forms anhedral to subhedral grains, sometimes interleaved with biotite. Nepheline (?) is very fine-grained, and totally altered. The alteration minerals are very fine grained and birefringent.

Map No. A
Sample No. H37 75.0
Nepheline-apatite-plagioclase-biotite sovite.

Fine grained, inequigranular, seriate, allotriomorphic with curved grain boundaries. Carbonate forms an anhedral interlocking mosaic of carbonate grains. Apatite forms rounded bead-like grains which may enclose rounded carbonate grains. The plagioclase (An_{3-7}) occurs as rounded subhedral grains with sericite plus carbonate alteration. Biotite is present as tabular irregular grains with some being altered to green chlorite. The biotite may enclose round carbonate, epidote and plagioclase(?) grains. Nepheline occurs as anhedral rounded grains with cancrinite alteration along cleavages. Small epidote grains are associated with biotite and opaques. Traces to minor amounts of pyroxene, perovskite, microcline and opaques are present.

Rounding of apatite, nepheline and to some extent plagioclase grains suggests some resorption of these minerals. Some of the minerals, particularly nepheline and feldspar, may be xenocrystic. Sample may be from a carbonatite dike cutting nepheline syenite. Note: this sample was added just prior to publication of this report.

TABLE A-2. MAJOR ELEMENT ANALYSES OF WHOLE-ROCK SAMPLES FROM THE NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX

	Unit 4A			Unit 5A		Unit 6	
Map No.	**467**	**468**	**450**	**448**	**449**	**476**	**495**
SiO_2	45.6	45.4	46.7	43.3	46.8	45.8	47.5
Al_2O_3	17.2	17.1	18.6	17.4	15.9	19.9	16.4
Fe_2O_3	2.90	4.26	3.21	3.82	3.69	4.07	5.95
FeO	10.3	8.86	7.73	4.43	5.23	5.88	4.91
MgO	4.21	4.28	5.89	3.91	4.37	1.21	2.04
CaO	8.17	8.34	10.7	10.0	10.1	6.06	6.80
Na_2O	6.34	5.35	4.55	10.2	9.04	8.54	2.99
K_2O	2.01	1.88	0.79	2.78	2.83	5.85	6.30
TiO_2	1.37	1.37	0.91	0.20	0.17	0.22	0.08
P_2O_5	0.55	0.46	0.21	0.09	0.03	0.64	0.56
S	0.05	0.03	<0.01	<0.01	0.01	0.02	0.01
MnO	0.19	0.19	0.16	0.35	0.37	0.31	0.38
CO_2	0.56	0.26	0.28	2.06	0.46	0.40	1.30
H_2O^+	0.39	2.35	0.47	0.31	0.19	0.25	2.25
H_2O^-	0.24	0.16	0.24	0.38	0.23	0.21	0.65
H_2O^-	0.24	0.16	0.24	0.38	0.23	0.21	0.65

	Unit 6						
Map No.	**500**	**514**	**515**	**526**	**527**	**539**	**542**
SiO_2	50.1	46.0	49.5	51.9	49.4	44.3	45.6
Al_2O_3	14.0	10.2	11.3	15.6	16.1	5.47	18.2
Fe_2O_3	6.62	11.1	9.31	6.85	8.97	13.3	5.22
FeO	4.75	6.76	6.92	4.19	2.82	11.2	5.47
MgO	0.92	1.68	0.63	0.86	1.10	0.72	0.93
CaO	8.29	7.54	7.46	5.47	5.36	12.8	6.50
Na_2O	6.31	3.22	3.27	3.95	2.00	4.66	1.89
K_2O	6.03	6.73	5.91	6.44	8.53	1.65	8.25
TiO_2	0.24	0.63	0.25	0.10	0.10	0.56	0.14
P_2O_5	0.03	0.21	0.08	0.12	0.10	0.10	0.11
S	0.01	0.21	0.15	0.01	0.01	0.35	0.01
MnO	1.01	0.48	0.71	0.46	0.35	1.44	0.49
CO_2	0.34	3.58	1.66	1.06	2.06	2.36	4.12
H_2O^+	0.36	0.60	0.49	1.68	0.94	0.05	1.89
H_2O^-	0.16	0.37	0.51	0.34	0.36	0.28	0.47

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
467	ND-5	500	H26 622.3-622.9
468	ND-10	514	H36 464.4-464.6
450	NR14-3	515	H36 533.6-533.9
448	NR14-1	526	H41 245.0-245.6
449	NR14-2	527	H41 253.2-253.7
476	H9 644.5-645.0	539	H49 153.35-153.75
495	H21 1100.6-1101.1	542	H62 235.4-235.9

TABLE A-2. Continued.

	Unit 6	Unit 6A					
Map No.	547	459	458	473	475	477	478
SiO_2	40.3	44.7	45.3	48.2	48.4	47.2	47.0
Al_2O_3	14.0	19.9	17.2	18.0	19.0	19.1	19.4
Fe_2O_3	9.55	3.79	6.35	5.94	5.32	4.79	4.56
FeO	7.16	6.04	5.72	5.50	4.75	6.04	5.80
MgO	5.98	2.21	1.37	1.50	1.07	1.63	1.39
CaO	10.1	5.96	5.68	5.86	4.33	5.18	5.29
Na_2O	1.05	7.53	4.99	4.04	5.53	2.19	6.09
K_2O	4.72	6.71	6.54	6.15	7.10	7.36	6.88
TiO_2	1.14	0.35	0.55	0.51	0.49	0.56	0.43
P_2O_5	0.40	0.87	0.54	0.53	0.30	0.47	0.48
S	0.02	0.03	0.04	0.04	0.05	0.04	0.04
MnO	0.95	0.31	0.42	0.41	0.36	0.30	0.29
CO_2	0.46	0.38	1.66	2.52	0.25	0.44	0.32
H_2O^+	2.23	0.65	1.92	2.43	1.22	2.34	0.81
H_2O^-	0.60	0.36	0.23	0.28	0.33	0.52	0.40

	Unit 6A						
Map No.	479	484	485	497	498	501	503
SiO_2	46.9	49.3	49.5	47.3	48.0	46.3	44.8
Al_2O_3	18.9	19.6	19.1	19.0	19.4	18.1	17.2
Fe_2O_3	5.30	4.65	5.21	3.86	5.23	3.46	5.35
FeO	5.31	4.91	5.39	6.52	5.64	8.05	4.91
MgO	1.27	1.20	1.08	1.41	1.52	1.78	1.38
CaO	4.32	2.37	3.29	4.92	5.03	4.35	6.44
Na_2O	5.89	4.19	4.76	6.20	3.45	5.48	4.02
K_2O	6.95	8.69	7.94	7.22	7.09	7.56	6.21
TiO_2	0.51	0.49	0.48	0.48	0.48	0.55	0.30
P_2O_5	0.45	0.18	0.26	0.54	0.57	0.68	0.61
S	0.05	0.07	0.05	0.06	0.05	0.11	0.02
MnO	0.30	0.22	0.27	0.28	0.30	0.30	0.32
CO_2	0.56	0.34	0.26	0.34	0.24	0.46	3.66
H_2O^+	1.39	1.23	1.31	0.99	2.41	0.86	2.61
H_2O^-	0.46	0.52	0.29	0.15	0.29	0.15	0.54

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
547	H64 413.15-413.55	479	H10 77.6-78.0
459	NR22-12	484	H12 56.75-57.25
458	NR22-10	485	H12 289.5-290.0
473	BA13-9M	497	H24 98.1-98.6
475	H9 22.4-22.8	498	H26 86.8-87.3
477	H9 74.2-74.7	501	H27 785.8-786.25
478	H10 33.1-33.6	503	H28 31.6-31.84

TABLE A-2. Continued.

	Unit 6A						Unit 8A
Map No.	**504**	**505**	**510**	**520**	**537**	**482**	**460**
SiO_2	45.4	47.6	46.9	50.0	47.8	45.3	52.6
Al_2O_3	18.6	17.7	18.3	16.7	19.3	18.5	20.9
Fe_2O_3	3.48	4.93	5.69	2.30	4.29	6.95	0.46
FeO	7.49	5.64	6.76	9.09	6.04	4.19	1.13
MgO	1.95	1.30	1.81	1.59	1.59	2.11	0.19
CaO	5.27	4.18	5.04	2.32	4.65	4.99	3.48
Na_2O	6.22	4.85	2.52	1.81	4.30	0.82	3.92
K_2O	7.16	7.89	7.68	10.0	7.71	8.53	10.9
TiO_2	0.58	0.47	0.67	0.34	0.60	0.62	0.05
P_2O_5	0.71	0.37	0.53	0.45	0.52	0.61	0.45
S	0.07	0.07	0.08	0.07	0.04	0.01	0.02
MnO	0.35	0.32	0.36	0.16	0.27	0.32	0.07
CO_2	0.34	1.66	0.36	0.98	0.34	2.52	2.02
H_2O^+	0.71	1.24	2.14	1.62	1.09	2.15	1.93
H_2O^-	0.26	0.26	0.37	0.36	0.36	0.64	0.37

	Unit 8A						Unit 7A
Map No.	**465**	**466**	**494**	**496**	**523**	**541**	**456**
SiO_2	47.0	46.5	50.3	47.5	51.8	53.2	49.6
Al_2O_3	26.0	27.9	23.9	16.4	20.5	17.2	17.8
Fe_2O_3	1.18	1.57	1.32	5.95	2.78	2.16	2.80
FeO	0.89	1.29	2.17	4.91	2.09	2.66	8.37
MgO	0.17	2.41	1.22	2.04	0.71	0.36	2.01
CaO	1.86	1.76	1.57	6.80	3.55	5.57	4.17
Na_2O	9.56	2.25	3.42	2.99	0.27	0.00	5.12
K_2O	8.75	8.35	10.0	6.30	11.2	11.9	5.07
TiO_2	0.06	0.06	0.18	0.08	0.24	0.14	0.95
P_2O_5	0.94	0.09	0.34	0.56	0.28	0.23	1.00
S	0.02	0.02	0.02	0.01	0.02	0.04	0.05
MnO	0.07	0.13	0.08	0.38	0.14	0.28	0.24
CO_2	0.62	0.60	0.56	1.30	2.46	3.32	0.30
H_2O^+	1.57	5.21	3.26	2.25	1.26	0.65	1.60
H_2O^-	0.33	0.62	0.47	0.65	0.31	0.52	0.20

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
504	H29 291.9-292.4	465	NW34-3A
505	H30 135.0-135.6	466	NW34-4A
510	H34 590.0-590.6	494	H21 308.5-309.0
520	H37 381.2-381.6	496	H21 1300.0-1300.5
537	H47 592.2-592.45	523	H39 340.0-340.45
482	H11 411.25-411.5	541	H62 224.45-224.9
460	NR32-4A	456	NR22-8B

TABLE A-2. Continued.

	Unit 7A						
Map No.	**461**	**451**	**454**	**457**	**464**	**462**	**472**
SiO_2	54.5	49.2	50.2	49.6	51.8	51.7	52.0
Al_2O_3	21.3	17.7	18.2	18.0	18.9	19.5	18.5
Fe_2O_3	3.56	3.35	2.91	3.05	4.46	0.55	3.05
FeO	2.25	7.16	7.73	7.97	2.90	1.85	7.51
MgO	0.29	1.74	1.80	1.95	0.42	0.11	2.56
CaO	2.23	4.81	3.99	4.38	3.91	5.97	4.10
Na_2O	5.71	5.08	5.50	5.12	8.06	5.99	4.32
K_2O	5.86	5.91	5.02	4.88	5.92	6.91	4.97
TiO_2	0.10	0.97	0.86	0.91	0.22	0.06	0.92
P_2O_5	0.10	0.99	0.01	1.00	0.33	0.41	0.70
S	0.01	0.04	0.03	0.05	0.04	0.01	0.02
MnO	0.19	0.19	0.24	0.25	0.13	0.22	0.23
CO_2	0.38	1.12	0.26	0.44	1.50	3.42	0.36
H_2O^+	1.80	1.39	1.33	1.40	0.55	2.95	1.46
H_2O^-	0.45	0.39	0.36	0.44	0.22	0.30	0.32

	Unit 7A			Unit 7B		
Map No.	**474**	**462A**	**452**	**480**	**483**	**488**
SiO_2	52.3	50.4	51.5	48.2	50.3	46.8
Al_2O_3	19.4	17.9	18.7	8.05	6.83	7.09
Fe_2O_3	3.77	3.09	2.19	10.0	12.1	7.26
FeO	2.46	2.66	6.60	7.73	6.68	6.52
MgO	0.17	0.39	1.78	1.84	1.02	2.47
CaO	5.17	6.28	3.21	10.8	8.55	13.5
Na_2O	5.02	7.31	4.43	4.33	5.02	3.45
K_2O	6.50	6.47	5.26	4.06	4.58	4.82
TiO_2	0.16	0.14	0.71	0.31	0.46	0.19
P_2O_5	0.40	0.64	0.69	0.15	0.14	0.08
S	0.01	0.01	0.01	0.30	0.23	0.25
MnO	0.15	0.14	0.21	0.59	0.65	0.44
CO_2	3.10	2.94	0.56	1.90	1.56	5.12
H_2O^+	0.57	0.30	2.78	0.05	0.48	0.19
H_2O^-	0.15	0.35	0.24	0.32	0.42	0.18

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
461	NR32-6A	474	BA13-10B
451	NR22-1C	462A	NR32-7
454	NR22-5	452	NR22-2A
457	NR22-9A	480	H10 427.1-427.6
464	NR32-9	483	H11 742.75-743.2
462	NR32-10A	488	H13 978.0-978.55
472	BA13-8A1		

TABLE A-2. Continued.

	Unit 7B						
Map No.	499	509	512	513	516	517	538
SiO_2	45.9	50.5	47.0	52.2	48.1	47.8	49.8
Al_2O_3	6.35	5.95	6.45	11.2	12.0	7.41	6.06
Fe_2O_3	14.9	10.1	11.3	7.35	8.10	13.6	13.3
FeO	7.89	6.76	5.55	3.38	3.78	8.61	6.28
MgO	2.00	2.49	2.58	1.45	0.64	1.20	1.66
CaO	10.8	10.5	12.1	7.51	8.12	9.99	9.58
Na_2O	3.38	4.53	4.86	3.60	2.11	4.59	5.08
K_2O	3.56	3.94	4.08	7.54	8.20	3.49	3.51
TiO_2	0.92	0.28	0.23	0.20	0.11	0.39	0.25
P_2O_5	0.06	0.17	0.23	0.19	0.18	0.06	0.13
S	0.27	0.30	0.29	0.06	0.41	0.24	0.06
MnO	0.66	0.57	0.51	0.37	0.47	0.81	0.60
CO_2	1.08	1.52	3.56	3.36	4.20	1.10	2.54
H_2O^+	0.28	0.26	0.41	0.36	0.61	0.29	0.15
H_2O^-	0.22	0.33	0.47	0.49	0.63	0.39	0.42

	Unit 7B			Unit 9			
Map No.	540	543	544	487	492	532	533
SiO_2	50.7	50.8	51.6	23.9	51.0	8.43	8.58
Al_2O_3	9.19	8.32	7.71	5.27	19.8	3.02	2.71
Fe_2O_3	11.2	10.7	11.9	4.90	1.74	1.60	3.29
FeO	7.00	5.39	5.15	11.3	4.59	0.89	16.6
MgO	1.15	1.58	1.31	3.62	0.81	0.00	0.94
CaO	8.55	8.93	7.91	25.6	2.59	40.27	19.2
Na_2O	4.33	4.76	5.21	1.26	8.53	0.28	0.78
K_2O	4.35	5.01	4.57	4.61	6.00	0.23	1.52
TiO_2	0.34	0.26	0.30	0.38	0.29	0.00	0.12
P_2O_5	0.12	0.11	0.09	3.47	0.31	1.13	7.60
S	0.80	0.25	0.35	0.12	0.03	0.01	0.03
MnO	0.71	0.53	0.63	0.47	0.20	0.81	0.70
CO_2	1.64	2.26	1.82	13.7	2.40	36.8	5.85
H_2O^+	0.18	0.11	0.18	1.07	1.54	0.07	0.40
H_2O^-	0.29	0.18	0.25	0.39	0.53	0.44	0.36

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
499	H26 517.8-518.4	540	H49 414.6-415.1
509	H34 272.3-273.6	543	H62 444.4-444.7
512	H36 227.0-227.2	544	H64 264.5-264.8
513	H36 337.25-337.5	487	H13 921.3-921.8
516	H36 658.4-658.6	492	H17 242.9-243.3
517	H36 717.3-717.5	532	H42 147.7-148.0
538	H48 294.0-294.4	533	H48 131.6-131.8

TABLE A-2. Continued.

Map No.	Unit 9 536	Unit 9 A	Unit 10C 463	Unit 10C 455	Unit 10C 453	Porph. Alkalic Dike 522
SiO_2	2.59	22.6	51.6	50.2	52.2	38.4
Al_2O_3	0.11	8.04	20.6	18.2	18.9	16.7
Fe_2O_3	2.66	0.08	1.93	2.39	3.02	7.32
FeO	1.69	1.23	3.78	8.29	6.12	7.00
MgO	0.10	0.23	0.49	2.12	2.14	1.61
CaO	49.8	30.8	3.65	4.19	2.74	9.08
Na_2O	0.58	3.86	3.05	4.84	3.90	0.00
K_2O	0.02	2.26	7.97	5.06	6.12	7.57
TiO_2	0.00	0.00	0.21	0.96	0.62	0.11
P_2O_5	1.17	1.20	0.28	1.20	0.67	0.55
S	<0.01	0.02	0.01	0.04	0.01	0.01
MnO	0.20	0.19	0.18	0.21	0.20	0.44
CO_2	38.5	27.9	2.56	0.30	0.62	6.35
H_2O^+	0.05	0.18	2.41	1.32	2.05	2.73
H_2O^-	0.34	0.54	0.38	0.36	0.25	0.47

Map No.	Porphyritic Alkalic Dike 528	Porphyritic Alkalic Dike 534	Alkalic Dike 481	Alkalic Dike 490	Alkalic Dike 491	Alkalic Dike 493
SiO_2	50.0	50.3	37.2	41.8	51.0	51.9
Al_2O_3	1.54	21.1	14.2	15.7	19.8	20.1
Fe_2O_3	9.37	1.77	8.36	2.92	1.74	1.86
FeO	2.82	4.51	2.74	7.81	4.59	4.91
MgO	1.77	0.36	5.73	4.13	0.81	0.92
CaO	5.12	4.10	11.0	8.59	2.59	2.68
Na_2O	0.42	0.44	0.49	2.52	8.53	7.95
K_2O	7.09	10.1	7.19	4.62	6.00	6.31
TiO_2	0.16	0.10	1.83	1.26	0.29	0.31
P_2O_5	0.23	0.44	1.57	1.50	0.31	0.39
S	0.01	0.02	0.02	0.03	0.03	0.01
MnO	0.39	0.17	0.26	0.24	0.20	0.18
CO_2	3.72	2.70	5.76	3.96	2.40	0.80
H_2O^+	2.00	1.85	1.68	2.84	1.54	1.03
H_2O^-	0.55	0.47	0.71	0.59	0.53	0.33

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
536	H46 1220.8-1221.3	528	H41 325.65-326.25
A	H37 75.0	534	H46 388.5-399.0
463	NR32-8	481	H11 266.0-266.5
455	NR22-7B	490	H16 149.1-149.5
453	NR22-4	491	H16 591.25-591.6
522	H39 212.6-212.95	493	H17 442.4-442.8

TABLE A-2. Continued.

	Alkalic Dike				Basic Dike	
Map No.	502	506	511	521	525	535
SiO_2	43.7	45.7	39.5	54.3	47.5	45.9
Al_2O_3	16.2	18.4	15.1	20.6	18.2	16.5
Fe_2O_3	2.93	4.42	3.29	1.35	3.88	5.21
FeO	7.89	7.00	5.57	4.03	8.21	3.94
MgO	3.87	1.97	3.28	0.22	1.87	3.23
CaO	9.08	4.84	9.81	1.35	4.91	6.45
Na_2O	3.33	5.17	4.64	8.81	2.55	6.24
K_2O	5.27	7.15	5.95	5.97	6.26	6.47
TiO_2	1.20	0.75	0.81	0.08	0.63	0.64
P_2O_5	1.44	0.66	1.00	0.13	0.47	0.64
S	0.08	0.06	0.07	0.02	0.04	0.05
MnO	0.24	0.30	0.31	0.12	0.36	0.26
CO_2	0.90	0.70	4.52	0.82	0.44	1.62
H_2O^+	3.20	1.07	2.68	0.92	3.00	1.28
H_2O^-	0.39	0.25	0.33	0.30	0.48	0.37

	Basic Dike	Miscellaneous				Pulaskite Dike
Map No.	545	469	471	546	524	507
SiO_2	29.3	48.7	44.0	38.2	58.6	46.3
Al_2O_3	10.0	16.0	12.5	14.9	17.8	19.4
Fe_2O_3	2.22	10.4	4.03	10.3	2.03	3.47
FeO	8.53	3.04	6.72	5.39	0.81	7.41
MgO	11.5	1.25	4.15	7.68	0.28	2.35
CaO	15.4	6.42	12.6	11.1	2.79	5.88
Na_2O	0.87	5.64	2.75	0.59	0.0	3.00
K_2O	4.30	3.71	5.14	5.59	13.3	6.51
TiO_2	2.10	0.24	0.73	1.19	0.04	0.60
P_2O_5	1.38	0.18	1.55	0.70	0.17	0.75
S	0.04	0.01	0.13	0.01	0.13	0.09
MnO	0.35	0.44	0.35	0.62	0.11	0.32
CO_2	10.8	1.12	5.38	0.26	2.56	0.24
H_2O^+	2.85	3.25	0.49	1.78	0.07	2.67
H_2O^-	0.60	0.32	0.04	0.41	0.36	0.66

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
502	H27 591.0-591.5	545	H64 322.0-322.33
506	H30 313.0-313.5	469	AL14-6D
511	H35 97.8-98.2	471	BA13-6B
521	H37 410.0-410.4	546	H64 362.0-362.45
525	H41 207.5-208	524	H40 669.05-669.25
535	H4 1116.8-1117.4	507	H33 166.5-167.0

TABLE A-3. TRACE ELEMENT ANALYSES OF WHOLE-ROCK SAMPLES FROM THE NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX

	Unit 4A			Unit 5A		Unit 6	
Map No.	**467**	**468**	**450**	**448**	**449**	**476**	**495**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	990	960	560	380	260	960	960
Be	4	5	6	15	15	<1	15
Bi							
Co	45	45	45	15	15	10	6
Cr	40	40	110	25	60	<5	10
Ca	40	35	20	5	<5	8	5
Ga	10	15	15	15	15	10	15
Hg							
Li	<3	3	4	8	4	<3	10
Ma							
Mo	<1	<1	<1	<1	<1	<1	<1
Nb	90	80	200	45	150	100	250
Ni	49	50	80	24	20	<5	<5
Pb	10	15	10	35	20	<10	15
Rb	40	40	20	50	60	60	130
Sb							
Sc	20	25	<5	35	35	<5	8
Sn	<3	<3	<3	4	7	<3	9
Sr	600	700	2500	800	500	900	1500
Ti							
V	150	150	20	60	80	<10	15
Y	45	45	30	45	30	<10	20
Zn	145	145	100	125	175	55	95
Zr	250	250	700	300	800	300	1500
La	<100	100	100	250	<100	<100	<100
Nd	<100	<100	<100	<100	<100	<100	<100
Ce	240	260	150	350	130	530	130
Eu	<100	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
467	ND-5	449	NR14-2
468	ND-10	476	H9 644.5-645.0
450	NR14-3	495	H21 1100.6-1101.1
448	NR14-1		

TABLE A-3. Continued.

	Unit 6						
Map No.	**500**	**514**	**515**	**526**	**527**	**539**	**542**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	300	1100	660	700	1800	370	1900
Be	40	15	30	15	15	35	20
Bi							
Co	6	10	8	9	9	9	5
Cr	6	<5	<5	8	9	6	<5
Ca	<5	20	20	<5	<5	30	7
Ga	20	20	25	15	15	20	20
Hg							
Li	<3	9	15	25	30	3	40
Ma							
Mo	<1	<1	<1	<1	<1	<1	<1
Nb	1500	800	2000	250	350	3000	700
Ni	<5	5	<5	<5	<5	<5	<5
Pb	35	25	45	20	30	50	75
Rb	440	210	200	170	220	60	200
Sb							
Sc	15	<5	15	8	9	<5	<5
Sn	10	15	25	7	10	15	10
Sr	1000	1000	1000	3000	1.8%	1500	3500
Ti							
V	10	30	<10	15	10	<10	<10
Y	250	20	80	20	20	40	60
Zn	300	320	380	125	150	610	180
Zr	3000	1500	3000	2000	2000	300	1500
La	700	<100	200	<100	<100	<100	100
Nd	800	<100	250	<100	<100	<100	<100
Ce	1240	170	320	90	60	170	190
Eu	700	<100	<100	<100	<100	100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
500	H26 622.3-622.9	527	H41 253.2-253.7
514	H36 464.4-464.6	539	H49 153.35-153.75
515	H36 533.6-533.9	542	H62 235.4-235.9
526	H41 245.0-245.6		

TABLE A-3. Continued.

	Unit 6	Unit 6A					
Map No.	**547**	**459**	**458**	**473**	**475**	**477**	**478**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As				<1			
Ba	640	720	2000	500	3200	2900	2000
Be	25	6	9	<3	10	<1	<1
Bi							
Co	30	15	15	10	10	15	15
Cr	285	<5	<5	<10	<5	<5	8
Ca	6	15	15	15	15	20	20
Ga	15	6	10	5	10	8	8
Hg							
Li	15	<3	10	<20	<3	15	3
Ma							
Mo	<1	<1	<1	<10	<1	<1	<1
Nb	400	1500	150	300	500	80	80
Ni	115	<5	<5	<5	<5	<5	<5
Pb	45	10	10	<10	20	15	<10
Rb	220	110	110	70	140	110	100
Sb				<4			
Sc	10	<5	<5	<20	<5	<5	<5
Sn	5	<3	4	<10	5	<3	<3
Sr	4000	700	1500	1000	800	3500	1000
Ti							
V	45	20	<10	10	<10	<10	<10
Y	250	<10	<10	<20	35	<10	<10
Zn	700	100	175	152	300	60	70
Zr	200	200	250	300	500	200	200
La	800	<100	<100	<10	<100	<100	100
Nd	700	<100	<100	<300	<100	<100	<100
Ce	1360	150	170	<500	120	110	130
Eu	<100	<100	<100		<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
547	H64 413.15-413.55	475	H9 22.4-22.8
459	NR22-12	477	H9 74.2-74.7
458	NR22-10	478	H10 33.1-33.6
473	BA13-9M		

TABLE A-3. Continued.

	Unit 6A						
Map No.	**479**	**484**	**485**	**497**	**498**	**501**	**503**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	2500	720	2400	2100	2100	1700	2700
Be	<1	<1	7	<1	9	4	8
Bi							
Co	10	15	10	15	15	15	10
Cr	7	7	<5	5	<5	<5	<5
Ca	15	25	20	15	15	20	10
Ga	7	15	8	7	10	8	8
Hg							
Li	4	4	6	3	6	7	10
Ma							
Mo	<1	3	<1	<1	<1	≲1	<1
Nb	100	3500	300	70	500	250	450
Ni	<5	<5	<5	<5	<5	<5	<5
Pb	<10	50	<10	<10	20	10	<10
Rb	110	130	120	100	110	120	130
Sb							
Sc	<5	<5	<5	<5	<5	<5	<5
Sn	<3	20	<3	<3	5	<3	<3
Sr	900	1000	800	1000	3500	1000	3000
Ti							
V	<10	35	<10	<10	<10	20	<10
Y	<10	20	<10		15	15	25
Zn	85	220	100	60	155	85	125
Zr	200	900	400	200	700	250	600
La	<100	<100	<100	<100	<100	<100	<100
Nd	<100	<100	<100	<100	<100	<100	<100
Ce	140	120	160	180	110	300	180
Eu	<100	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
479	H10 77.6-78.0	498	H26 86.8-87.3
484	H12 56.75-57.25	501	H27 785.8-786.25
485	H12 289.5-290.0	503	H28 31.6-31.84
497	H24 98.1-98.6		

TABLE A-3. Continued.

	Unit 6A						Unit 8A
Map No.	**504**	**505**	**510**	**520**	**537**	**482**	**460**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	1200	3000	2000	2000	2900	3000	3000
Be	7	8	7	7	<1	10	4
Bi							
Co	15	15	20	15	15	15	<5
Cr	<5	<5	<5	<5	<5	<5	<5
Ca	15	15	10	8	20	15	6
Ga	8	8	10	10	7	6	8
Hg							
Li	<3	4	5	8	<3	10	<3
Ma							
Mo	<1	<1	<1	<1	<1	<1	<1
Nb	300	300	800	900	900	200	100
Ni	<5	<5	<5	<5	<5	<5	<5
Pb	<10	20	<10	30	9	<10	30
Rb	120	110	150	350	110	190	320
Sb							
Sc	<5	<5	<5	<5	<5	<5	<5
Sn	<3	<3	3	7	<3	<3	
Sr	1000	1000	5000	1000	1000	4000	1500
Ti							
V	20	<10	15	25	<10	20	<10
Y	20	15	15	10	<10	10	<10
Zn	160	150	135	160	55	120	20
Zr	250	250	300	450	150	250	80
La	100	<100	<100	<100	<100	<100	<100
Nd	<100	<100	<100	<100	<100	<100	<100
Ce	250	160	140	50	213	60	<50
Eu	<100	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
504	H29 291.9-292.4	537	H47 592.2-592.45
505	H30 135.0-135.6	482	H11 411.25-411.5
510	H34 590.0-590.6	460	NR32-4A
520	H37 381.2-381.6		

TABLE A-3. Continued.

	Unit 8A						Unit 7A
Map No.	**465**	**466**	**494**	**496**	**523**	**541**	**456**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	1900	1100	2800	960	7400	1100	1000
Be	6	8	5	15	7	7	6
Bi							
Co	<5	<5	<5	6	7	<5	20
Cr	6	<5	<5	10	<5	<5	8
Ca	5	<5	8	5	8	20	20
Ga	10	15	9	15	7	20	15
Hg							
Li	4	15	5	10	20	<3	10
Ma							
Mo	<1	<1	<1	<1	<1	<1	<1
Nb	70	350	200	250	200	1500	200
Ni	<5	<5	<5	<5	<5	<5	<5
Pb	40	30	45	15	<10	95	40
Rb	230	150	190	130	240	360	100
Sb							
Sc	<5	<5	<5	8	<5	<5	<5
Sn	<3	<3	<3	9	<3	5	<3
Sr	900	3000	800	1500	4000	800	1500
Ti							
V	<10	<10	<10	15	<10	<10	20
Y	<10	<10	<10	20	<10	15	40
Zn	35	60	55	95	55	30	150
Zr	80	250	<10	1500	200	1000	600
La	<100	<100	<100	<100	<100	<100	200
Nd	<100	<100	<100	<100	<100	<100	<100
Ce	60	<50	<50	130	50	140	300
Eu	<100	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
465	NW34-3A	523	H39 340.0-340.45
466	NW34-4A	541	H62 224.45-224.9
494	H21 308.5-309.0	456	NR22-8B
496	H21 1300.0-1300.5		

TABLE A-3. Continued.

	Unit 7A						
Map No.	**461**	**451**	**454**	**457**	**464**	**462**	**472**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							<1
Ba	150	840	940	1200	770	290	2000
Be	10	<1	6	6	6	3	3
Bi							
Co	<5	15	20	20	<5	<5	15
Cr	<5	5	<5	<5	<5	<5	10
Ca	10	20	25	25	8	5	40
Ga	15	10	15	15	10	15	10
Hg							
Li	11	10	6	8	4	25	<20
Ma							
Mo		<1	<1	<1	<1	<1	<10
Nb	250	<30	150	200	150	250	300
Ni	<5	<5	<5	<5	<5	<5	10
Pb	55	15	15	20	10	15	10
Rb	140	160	100	130	180	150	70
Sb							<4
Sc	<5	30	<5	<5	<5	<5	20
Sn	4			<3	5	<3	<10
Sr	7000	700	2500	1500	900	500	1000
Ti							
V	<10	200	15	15	<10	<10	30
Y	30	25	40	40	<10	25	40
Zn	150	150	150	155	70	15	150
Zr	1500	150	500	700	800	600	400
La	<100	<100	150	150	<100	250	70
Nd	<100	<100	<100	<100	<100	<100	<300
Ce	160	270	300	330	130	320	<500
Eu	<100	<100	<100	<100	<100	<100	

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
461	NR32-6A	464	NR32-9
451	NR22-1C	462	NR32-10A
454	NR22-5	472	BA13-8A1
457	NR22-9A		

TABLE A-3. Continued.

	Unit 7A			Unit 7B		
Map No.	**474**	**462A**	**452**	**480**	**483**	**488**
Ag	<1	<1	<1		<1	<1
Au						
As	2					
Ba	1500	690	1000	720	740	460
Be	5	6	7	<1	20	15
Bi						
Co	<10	<5	10	15	10	9
Cr	8	<5	6	7	<5	9
Ca	10	9	15	25	30	20
Ga	10	15	15	15	10	15
Hg						
Li	<20	3	25	4	4	3
Ma						
Mo	<10	<1	<1	3		<1
Nb	100	200	200	3500	1000	2000
Ni	<5	<5	<5	<5	<5	<5
Pb	<10	10	15	50	45	125
Rb	100	200	130	130	170	150
Sb	<4					
Sc	<20	<5	5		<5	10
Sn	<10	4	<3	20	15	20
Sr	1000	1000	2500	1000	1000	4000
Ti						
V	<10	<10	15	35	<10	15
Y	20	25	40	20	10	40
Zn	65	70	145	220	320	140
Zr	400	1000	1500	900	500	1500
La	10	<100	300	<100	<100	<100
Nd	<300	<100	<100	<100	<100	<100
Ce	<500	110	320	120	150	160
Eu		<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
474	BA13-10B	480	H10 427.1-427.6
462A	NR32-7	483	H11 742.75-743.2
452	NR22-2A	488	H13 978.0-978.55

TABLE A-3. Continued.

	Unit 7B						
Map No.	**499**	**509**	**512**	**513**	**516**	**517**	**538**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	620	710	580	1100	980	610	530
Be	15	15	15	20	20	20	15
Bi							
Co	15	10	15	8	10	10	8
Cr	<5	6	55	5	<5	5	<5
Ca	20	26	30	10	30	25	15
Ga	20	15	15	20	15	15	15
Hg							
Li	<3	4	4	8	6	6	4
Ma							
Mo	<1	3		<1	<1	<1	7
Nb	6000	3000	3500	2000	1000	2000	1000
Ni	5	<5	<5	<5	<5	<5	<5
Pb	80	60	65	45	40	205	50
Rb	120	140	130	230	210	110	120
Sb							
Sc	<5	10	15	<5	20	<5	
Sn	20	30	25	10	15	30	15
Sr	1000	1000	1500	1000	2600	1000	1000
Ti							
V	40	40	50	20	<10	<10	<10
Y	15	30	25	25	60	25	20
Zn	350	230	400	165	220	450	280
Zr	450	1500	2000	1500	3000	500	700
La	<100	100	<100	<100	150	<100	<100
Nd	<100	<100	<100	<100	<100	<100	<100
Ce	210	190	140	190	210	100	90
Eu	<100	<100	<100	<10	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
499	H26 517.8-518.4	516	H36 658.4-658.6
509	H34 272.3-273.6	517	H36 717.3-717.5
512	H36 227.0-227.2	538	H48 294.0-294.4
513	H36 337.25-337.5		

TABLE A-3. Continued.

	Unit 7B			Unit 9			
Map No.	**540**	**543**	**544**	**487**	**492**	**532**	**533**
Ag	<1	<1	<1	<1	<1	<1	<1
Au							
As							
Ba	540	710	640	300	500	160	820
Be	20	20	15	9	<1	3	7
Bi							
Co	7	10	10	15	6	<5	25
Cr	<5	<5	6	30	35	<5	<5
Ca	15	20	30	15	9	7	10
Ga	15	20	15	15	2	<1	6
Hg							
Li	<3	<3	<3	5	6	<3	10
Ma							
Mo	<1	<1	4	<1	<1	<1	10
Nb	2000	1500	3500	2599	700	200	5000
Ni	<5	<5	7	<5	<5	<5	<5
Pb	30	35	100	30	255	40	45
Rb	180	190	170	230	40	<10	70
Sb							
Sc	<5		<5	<5	<5	<5	15
Sn	10	20	10	8	15	<3	45
Sr	900	1000	900	9000	1.7%	5000	1.7%
Ti							
V	<10	20	20	<10	25	<10	25
Y	25	20	30	70	150	150	150
Zn	330	270	280	250	175	250	680
Zr	500	800	400	700	400	150	2500
La	<100	<100	<100	350	1500	1000	1500
Nd	<100	<100	<100	350	1000	1500	2000
Ce	100	100	170	520	1590	1481	1690
Eu	<100	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
540	H49 414.6-415.1	492	H17 242.9-243.3
543	H62 444.4-444.7	532	H42 147.7-148.0
544	H64 264.5-264.8	533	H48 131.6-131.8
487	H13 921.3-921.8		

TABLE A-3. Continued.

	Unit 9		Unit 10C			Porph. Alkalic Dike
Map No.	**536**	**A**	**463**	**455**	**453**	**522**
Ag	<1		<1	<1	<1	<1
Au						
As						
Ba	1300	260	890	1000	740	3600
Be	<1		7	6	8	15
Bi						
Co	<5	~5	5	20	15	10
Cr	5	~5	<5	<5	<5	10
Ca	6	8	10	25	10	6
Ga	<1		15	15	15	15
Hg						
Li	4	8	40	6	4	145
Ma						
Mo	<1	~5	<1	<1	<1	<1
Nb	250	9	250	150	150	150
Ni	<5	~5	<5	<5	<5	<5
Pb	35	35	15	10	<10	155
Rb	<10		300	120	110	240
Sb						
Sc	<5	2	<5	<5	<5	<5
Sn	<3		<3	<3	<3	15
Sr	>3%	7180	1500	1000	1000	3500
Ti						
V	<10	7	<10	25	<10	20
Y	45	55	25	40	45	30
Zn	130	55	95	135	165	120
Zr	25		900	500	800	1500
La	250	155	150	150	200	<100
Nd	<100	140	<100	<100	<100	<100
Ce	441	360	120	330	310	<50
Eu	<100		<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
536	H46 1220.8-1221.3	455	NR22-7B
A	H37 75.0	453	NR22-4
463	NR32-8	522	H39 212.6-212.95

TABLE A-3. Continued.

	Porphyritic Alkalic Dike		Alkalic Dike			
Map No.	**528**	**534**	**481**	**490**	**491**	**493**
Ag	<1	<1	<1	<1	<1	<1
Au						
As						
Ba	1800	3900	3800	2600	720	1000
Be	20	15	8	10	8	8
Bi						
Co	8	5	30	25	9	9
Cr	10	<5	45	80	8	7
Ca	6	<5	40	25	10	15
Ga	15	7	15	15	15	10
Hg						
Li	95	50	10	8	8	8
Ma						
Mo	<1	<1	<1	<1	15	1
Nb	400	200	100	150	100	150
Ni	<5	<5	25	25	<5	<5
Pb	20	15	75	30	20	65
Rb	260	260	250	90	190	130
Sb						
Sc	9	<5	10	10	<5	<5
Sn	9	4	6	<3	3	3
Sr	3500	2000	5000	7000	700	1000
Ti						
V	15	<10	100	100	15	<10
Y	40	<10	60	50	30	25
Zn	270	90	105	130	115	130
Zr	2000	70	200	500	700	600
La	<100	<100	250	200	150	100
Nd	<100	<100	<100	<100	<100	<100
Ce	750	70	370	340	270	210
Eu	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
528	H41 325.65-326.25	490	H16 149.1-149.5
534	H46 388.5-399.0	491	H16 591.25-591.6
481	H11 266.0-266.5	493	H17 442.4-442.8

TABLE A-3. Continued.

	Alkalic Dike				Basic Dike	
Map No.	**502**	**506**	**511**	**521**	**525**	**535**
Ag	<1	<1	<1	<1	<1	<1
Au						
As						
Ba	1000	2000	1600	110	2000	1100
Be	8	5	9	7	6	8
Bi						
Co	30	20	20	5	20	20
Cr	65	<5	120	<5	<5	105
Ca	35	25	35	8	20	35
Ga	15	7	15	15	8	15
Hg						
Li	10	4	15	4	80	15
Ma						
Mo	5	<1	<1	<1	<1	<1
Nb	150	150	250	50	350	300
Ni	20	<5	<5	<5	<5	35
Pb	20	<10	15	10	15	20
Rb	140	110	180	170	100	130
Sb						
Sc	10	<5	<5	<5	<5	10
Sn	<3	<3	3	<3	<3	3
Sr	5000	900	4000	500	4500	1500
Ti						
V	100	20	60	<10	15	80
Y	45	20	45	<10	20	45
Zn	135	70	145	130	80	145
Zr	500	200	300	500	500	800
La	200	100	200	<100	<100	250
Nd	<100	<100	<100	<100	<100	<100
Ce	430	230	350	<50	210	370
Eu	<100	<100	<100	<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
502	H27 591.0-591.5	521	H37 410.0-410.4
506	H30 313.0-313.5	525	H41 207.5-208
511	H35 97.8-98.2	535	H4 1116.8-1117.4

TABLE A-3. Continued.

	Basic Dike	Miscellaneous				Pulaskite Dike
Map No.	**545**	**469**	**471**	**546**	**524**	**507**
Ag	<1	<1	<1	<1	<1	<1
Au						
As		<1	<1			
Ba	2600	500	1500	870	1400	1100
Be	10	15	3	15	5	4
Bi						
Co	45	10	30	35	5	15
Cr	440	10	500	520	<5	<5
Ca	60	40	70	10	30	15
Ga	10	5	5	15	15	8
Hg						
Li	9	<20	<20	20	<3	8
Ma						
Mo	<1	<10	<10	<1	<1	<1
Nb	100	500	300	30	1000	200
Ni	180	10	150	175	<5	<5
Pb	35	<10	<10	65	30	<10
Rb	140	90	50	270	410	120
Sb		<4	<4			
Sc	25	<20	20	15	<5	<5
Sn	8	<10	<10	5	<3	<3
Sr	1000	2000	1500	1500	600	2500
Ti						
V	200	15	150	80	<10	20
Y	45	50	40	250	<10	20
Zn	95	130	92	620	15	65
Zr	500	300	300	150	1000	250
La	100	200	100	600	<100	<100
Nd	<100	<300	<300	800	<100	<100
Ce	380	1000	800	1070	140	250
Eu	<100			<100	<100	<100

Notes: For sample descriptions, see Table A-1. Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

Map No.	Sample No.	Map No.	Sample No.
545	H64 322.0-322.33	546	H64 362.0-362.45
469	AL14-6D	524	H40 669.05-669.25
471	BA13-6B	507	H33 166.5-167.0

TABLE A-4. NORMATIVE MINERALS (CIPW NORM) FOR WHOLE-ROCK SAMPLES FROM THE NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX

	Unit 4A			Unit 5A		Unit 6	
Map No.	**467**	**468**	**450**	**448**	**449**	**476**	**495**
S.G.	3.02	3.00	2.98	2.92	2.98	2.88	2.86
AP	1.29	1.09	0.49	0.22	0.07	1.51	1.38
PO	0.14	0.08	0.03	0.03	0.03	0.06	0.03
IL	2.63	2.67	1.74	0.39	0.33	0.42	0.16
OR	12.03	11.40	4.70	0.0	0.0	12.25	39.68
AB	12.96	17.72	18.30	0.0	0.0	0.0	9.01
AN	12.68	17.53	28.15	0.0	0.0	0.0	13.53
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC	0.0	0.0	0.0	11.22	9.36	2.23	0.0
MT	4.25	6.33	4.68	0.12	0.74	4.87	9.19
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	1.92	0.0	0.11	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DI	9.39	9.62	12.10	6.83	19.35	6.60	8.50
FO	4.38	4.53	6.41	4.85	1.45	0.0	1.03
FA	6.63	5.03	4.96	4.59	1.41	0.0	1.04
NE	22.37	15.55	11.05	41.55	36.29	38.37	9.71
LC	0.0	0.0	0.0	13.36	13.32	17.94	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	11.25	8.44	7.40	5.11	14.81	15.65	6.76
CC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	9.82	2.84	0.0	0.0

S.G. - Specific Gravity; AP - Apatite; PO - Pyrrhotite; IL - Ilmenite; OR - Orthoclase; AB - Albite; AN - Anorthite; C - Corundum; AC - Acmite; MT - Magnetite; HM - Hematite; WO - Wollastonite; EN - Enstatite; FS - Ferrosilite; Q - Quartz; DI - Diopside; FO - Forsterite; FA - Fayalite; NE - Nepheline; LC - Leucite; KP - Kaliophilite; HE - Hedenbergite; CC - Calcite; RU - Rutile; NS - Na_2SiO_3; KS - Kalsilite; CR - Chromite; LN - Larnite.

Note: For sample descriptions, See Table A-1.

Map No.	Sample No.	Map No.	Sample No.
467	ND-5	449	NR14-2
468	ND-10	476	H9 644.5-645.0
450	NR14-3	495	H21 1100.6-1101.1
448	NR14-1		

TABLE A-4. Continued.

	Unit 6						
Map No.	**500**	**514**	**515**	**526**	**527**	**539**	**542**
S.G.	2.96	3.02	3.05	2.83	2.88	3.39	2.71
AP	0.07	0.50	0.19	0.29	0.25	0.24	0.26
PO	0.03	0.67	0.43	0.03	0.03	0.97	0.03
IL	0.46	1.22	0.50	0.20	0.20	1.08	0.27
OR	23.39	40.52	36.63	39.70	53.20	9.88	50.35
AB	0.0	9.73	19.27	23.01	8.04	13.20	13.09
AN	0.0	0.0	0.0	6.04	10.27	0.0	5.66
C	0.0	0.0	0.0	0.0	0.0	0.0	4.28
AC	13.42	11.02	2.29	0.0	0.0	18.28	0.0
MT	3.04	10.86	13.00	10.35	10.41	10.37	7.81
HM	0.0	0.0	0.0	0.0	2.28	0.0	0.0
WO	7.11	0.0	8.59	3.90	3.79	4.75	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DI	5.03	5.46	3.55	4.81	6.23	3.92	0.0
FO	0.0	1.21	0.0	0.0	0.0	0.0	1.67
FA	0.0	1.66	0.0	0.0	0.0	0.0	5.08
NE	21.16	2.98	3.86	6.40	5.31	3.24	1.85
LC	10.10	0.0	0.0	0.0	0.0	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	16.19	5.91	11.69	5.26	0.0	28.65	0.0
CC	0.0	8.28	0.0	0.0	0.0	5.43	9.66
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
500	H26 622.3-622.9	527	H41 253.2-253.7
514	H36 464.4-464.6	539	H49 153.35-153.75
515	H36 533.6-533.9	542	H62 235.4-235.9
526	H41 245.0-245.6		

TABLE A-4. Continued.

	Unit 6	Unit 6A					
Map No.	547	459	458	473	475	477	478
S.G.	3.13	2.87	2.85	2.84	2.84	2.84	2.86
AP	0.97	2.05	1.32	1.24	0.72	1.15	1.14
PO	0.06	0.08	0.12	0.11	0.14	0.12	0.11
IL	2.27	0.68	1.10	0.98	0.96	1.00	0.84
OR	15.08	8.12	40.22	36.68	43.44	45.93	33.40
AB	0.0	0.0	0.0	22.84	4.06	5.68	0.0
AN	20.48	0.68	5.49	9.75	6.24	21.66	5.39
C	0.0	0.0	0.0	1.16	0.0	0.0	0.0
AC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT	14.52	5.59	9.72	8.68	7.98	7.33	6.77
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DI	5.05	8.81	7.58	2.64	5.08	0.76	5.83
FO	1.89	1.06	0.06	3.85	0.28	2.75	0.59
FA	5.05	1.66	0.10	6.30	0.46	5.01	1.23
NE	11.13	35.08	24.15	0.0	24.02	7.51	28.59
LC	0.0	25.26	0.50	0.0	0.0	0.0	6.50
KP	5.37	0.0	0.0	0.0	0.0	0.0	0.0
HE	0.0	10.94	9.63	0.0	6.62	1.10	9.62
CC	0.0	0.0	0.0	5.78	0.0	0.0	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	Sample No.	Map No.	Sample No.
547	H64 413.15-413.55	475	H9 22.4-22.8
459	NR22-12	477	H9 74.2-74.7
458	NR22-10	478	H10 33.1-33.6
473	BA13-9M		

TABLE A-4. Continued.

	Unit 6A						
Map No.	**479**	**484**	**485**	**497**	**498**	**501**	**503**
S.G.	2.82	2.76	2.81	2.86	2.83	2.86	2.70
AP	1.09	0.44	0.62	1.28	1.37	1.63	1.49
PO	0.14	0.20	0.14	0.17	0.14	0.31	0.06
IL	1.01	0.97	0.94	0.93	0.94	1.08	0.60
OR	42.77	53.63	48.26	32.47	43.35	32.07	38.58
AB	0.70	3.57	5.30	0.0	6.96	0.0	20.75
AN	4.77	9.38	7.48	2.73	17.05	2.53	5.06
C	0.0	0.0	0.0	0.0	0.0	0.0	2.20
AC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT	7.99	7.04	7.76	5.73	7.84	5.19	8.15
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DI	5.18	0.61	2.41	5.19	1.79	4.07	0.0
FO	0.62	1.99	1.16	0.83	2.16	1.89	2.53
FA	1.06	3.29	2.41	2.15	3.52	5.23	3.74
NE	27.70	18.10	19.55	29.07	12.58	25.98	8.11
LC	0.0	0.0	0.0	8.79	0.0	11.13	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	6.97	0.79	3.97	10.66	2.31	8.89	0.0
CC	0.0	0.0	0.0	0.0	0.0	0.0	8.74
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
479	H10 77.6-78.0	498	H26 86.8-87.3
484	H12 56.75-57.25	501	H27 785.8-786.25
485	H12 289.5-290.0	503	H28 31.6-31.84
497	H24 98.1-98.6		

TABLE A-4. Continued.

	Unit 6A						Unit 8A
Map No.	504	505	510	520	537	482	460
S.G.	2.88	2.79	2.86	2.72	2.84	2.82	2.59
AP	1.69	0.90	1.28	1.10	1.25	1.48	1.11
PO	0.20	0.20	0.23	0.20	0.11	0.03	0.06
IL	1.13	0.94	1.32	0.68	0.12	1.23	0.10
OR	19.59	46.04	47.17	62.40	44.61	52.85	56.41
AB	0.0	0.0	2.18	0.28	0.0	7.27	0.0
AN	1.72	3.36	16.53	8.31	10.95	5.06	7.68
C	0.0	0.0	0.0	0.0	0.0	6.43	0.0
AC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT	5.19	7.50	8.57	3.52	6.44	10.56	0.71
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	0.0	0.0	1.02
EN	0.0	0.0	0.0	0.0	0.0	5.50	0.0
FS	0.0	0.0	0.0	0.0	0.0	1.55	0.0
Q	0.0	0.0	0.0	0.0	0.0	2.03	0.0
DI	6.08	5.22	2.09	0.15	2.94	0.0	1.08
FO	1.53	0.69	2.60	2.88	1.92	0.0	0.0
FA	3.56	1.36	4.42	11.41	4.16	0.0	0.0
NE	29.31	23.33	10.81	8.60	20.41	0.0	19.08
LC	18.79	2.31	0.0	0.0	2.06	0.0	9.45
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	11.22	8.17	2.81	0.47	5.04	0.0	3.32
CC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	Sample No.	Map No.	Sample No.
504	H29 291.9-292.4	537	H47 592.2-592.45
505	H30 135.0-135.6	482	H11 411.25-411.5
510	H34 590.0-590.6	460	NR32-4A
520	H37 381.2-381.6		

TABLE A-4. Continued.

	Unit 8A						Unit 7A
Map No.	**465**	**466**	**494**	**496**	**523**	**541**	**456**
S.G.	2.64	2.62	2.58	2.86	2.68	2.59	2.82
AP	2.26	0.23	0.84	1.38	0.68	0.55	2.39
PO	0.06	0.06	0.06	0.03	0.06	0.11	0.14
IL	0.12	0.12	0.36	0.16	0.48	0.27	1.86
OR	22.18	53.50	62.59	39.68	68.99	72.53	30.87
AB	0.0	10.81	3.32	9.01	2.38	0.0	23.25
AN	2.25	8.82	5.89	13.53	0.24	5.30	10.91
C	0.0	13.18	5.72	0.0	8.16	2.50	0.0
AC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT	1.77	2.47	2.03	9.19	4.20	3.23	4.18
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EN	0.0	0.0	0.0	0.0	1.84	0.92	0.0
FS	0.0	0.0	0.0	0.0	1.38	3.32	0.0
Q	0.0	0.0	0.0	0.0	5.79	3.48	0.0
DI	0.35	0.0	0.0	8.50	0.0	0.0	1.02
FO	0.19	4.56	2.25	1.03	0.0	0.0	3.28
FA	0.31	0.95	2.18	1.04	0.0	0.0	8.47
NE	45.41	5.31	14.79	9.71	0.0	0.0	11.56
LC	24.67	0.0	0.0	0.0	0.0	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	0.44	0.0	0.0	6.76	0.0	0.0	2.08
CC	0.0	0.0	0.0	0.0	5.82	7.78	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	Sample No.	Map No.	Sample No.
465	NW34-3A	523	H39 340.0-340.45
466	NW34-4A	541	H62 224.45-224.9
494	H21 308.5-309.0	456	NR22-8B
496	H21 1300.0-1300.5		

TABLE A-4. Continued.

	Unit 7A						
Map No.	**461**	**451**	**454**	**457**	**464**	**462**	**472**
S.G.	2.67	2.79	2.82	2.80	2.73	2.49	2.78
AP	0.24	2.37	0.02	2.39	0.79	0.98	1.64
PO	0.03	0.11	0.09	0.14	0.11	0.03	0.06
IL	0.20	1.90	1.69	1.78	0.43	0.12	1.77
OR	36.07	35.99	30.78	29.72	36.07	42.27	29.73
AB	36.24	15.44	20.45	24.41	16.10	23.70	29.95
AN	10.83	8.26	10.51	12.05	0.0	5.50	15.94
C	1.82	0.0	0.0	0.0	0.0	0.22	0.24
AC	0.0	0.0	0.0	0.0	3.60	0.0	0.0
MT	5.37	5.00	4.37	4.55	4.86	0.83	4.47
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	4.03	0.0	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DI	0.0	2.91	2.75	1.03	2.32	0.0	0.0
FO	0.53	2.18	2.36	3.17	0.0	0.20	4.52
FA	1.08	4.97	6.21	7.82	0.0	2.57	7.89
NE	7.60	15.61	15.05	10.94	27.12	15.55	3.80
LC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	0.0	5.26	5.72	2.01	4.56	0.0	0.0
CC	0.0	0.0	0.0	0.0	0.0	8.04	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
461	NR32-6A	464	NR32-9
451	NR22-1C	462	NR32-10A
454	NR22-5	472	BA13-8A1
457	NR22-9A		

TABLE A-4. Continued.

	Unit 7A			Unit 7B		
Map No.	**474**	**462A**	**452**	**480**	**483**	**488**
S.G.	2.68	2.70	2.73	3.18	3.16	3.06
AP	0.94	1.51	1.68	0.36	0.34	0.19
PO	0.03	0.03	0.03	0.86	0.65	0.70
IL	0.31	0.27	1.42	0.61	0.91	0.37
OR	38.99	38.91	32.65	24.96	28.09	29.13
AB	34.83	13.83	32.85	3.64	0.98	4.26
AN	3.48	0.0	11.97	0.0	0.0	0.0
C	2.88	0.0	1.61	0.0	0.0	0.0
AC	0.0	5.22	0.0	16.35	30.02	17.63
MT	5.54	1.94	3.33	6.88	3.15	1.92
HM	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	8.37	5.75	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0
DI	0.0	1.67	0.0	10.27	5.68	11.87
FO	0.30	0.15	3.26	0.0	0.0	0.55
FA	1.08	0.64	7.68	0.0	0.0	1.02
NE	4.47	23.36	3.52	8.60	4.87	3.01
LC	0.0	0.0	0.0	0.0	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0
HE	0.0	5.68	0.0	19.11	19.58	17.46
CC	7.15	6.80	0.0	0.0	0.0	11.89
RU	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
474	BA13-10B	480	H10 427.1-427.6
462A	NR32-7	483	H11 742.75-743.2
452	NR22-2A	488	H13 978.0-978.55

TABLE A-4. Continued.

Map No.	499	509	512	513	516	517	538
	Unit 7B						
S.G.	3.29	3.18	3.13	2.88	2.85	3.27	3.21
AP	0.14	0.41	0.54	0.45	0.43	0.14	0.31
PO	0.76	0.86	0.81	0.17	1.17	0.67	0.17
IL	1.80	0.55	0.44	0.39	0.22	0.76	0.48
OR	23.57	24.29	22.93	45.32	50.41	21.05	21.01
AB	8.42	0.31	0.0	13.62	16.65	9.26	11.75
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC	15.87	27.25	27.41	13.31	1.67	18.12	27.97
MT	14.35	1.61	2.88	4.16	10.85	11.03	5.50
HM	0.0	0.0	0.0	0.0	0.36	0.0	0.0
WO	12.28	4.71	0.62	0.0	3.53	8.86	0.18
EN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	1.21	0.0	0.87
DI	11.09	13.94	14.06	6.32	3.57	6.57	9.02
FO	0.0	0.0	0.0	0.52	0.0	0.0	0.0
FA	0.0	0.0	0.0	0.64	0.0	0.0	0.0
NE	1.67	4.72	5.74	1.20	0.0	5.29	0.0
LC	0.0	0.0	1.21	0.0	0.0	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HE	10.03	21.36	15.16	6.14	0.0	18.26	16.92
CC	0.0	0.0	8.21	7.76	9.92	0.0	5.84
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	Sample No.	Map No.	Sample No.
499	H26 517.8-518.4	516	H36 658.4-658.6
509	H34 272.3-273.6	517	H36 717.3-717.5
512	H36 227.0-227.2	538	H48 294.0-294.4
513	H36 337.25-337.5		

TABLE A-4. Continued.

	Unit 7B			Unit 9			
Map No.	**540**	**543**	**544**	**487**	**492**	**532**	**533**
S.G.	3.15	3.07	3.12	3.05	2.97	2.76	3.72
AP	0.28	0.26	0.22	8.17	4.55	2.23	15.00
PO	0.22	0.69	0.99	0.33	0.02	0.02	0.07
IL	0.65	0.50	0.59	0.73	0.02	0.02	0.19
OR	25.90	30.00	27.99	0.0	2.67	1.16	7.65
AB	23.18	10.38	8.89	0.0	2.79	2.02	4.65
AN	0.0	0.0	0.0	0.0	0.0	17.37	0.0
C	0.0	0.0	0.0	0.0	0.0	8.33	0.0
AC	12.07	22.65	27.27	8.27	3.07	0.0	0.85
MT	10.30	4.35	4.20	3.07	6.34	1.98	40.17
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WO	3.20	1.56	6.99	0.0	0.0	0.0	0.0
EN	0.0	0.0	0.0	0.0	1.46	0.02	0.94
FS	0.0	0.0	0.0	0.0	6.41	1.50	1.83
Q	0.11	0.0	0.0	0.0	11.68	28.87	11.20
DI	6.22	8.59	7.29	0.0	0.20	0.0	2.27
FO	0.0	0.0	0.0	6.41	0.0	0.0	0.0
FA	0.0	0.0	0.0	14.72	0.0	0.0	0.0
NE	0.0	2.54	3.15	0.78	0.0	0.0	0.0
LC	0.0	0.0	0.0	16.83	0.0	0.0	0.0
KP	0.0	0.0	0.0	3.53	0.0	0.0	0.0
HE	14.11	13.28	12.43	0.0	0.76	0.0	3.86
CC	3.75	5.20	0.0	31.61	60.04	71.22	11.32
RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	5.56	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
540	H49 414.6-415.1	492	H17 242.9-243.3
543	H62 444.4-444.7	532	H42 147.7-148.0
544	H64 264.5-264.8	533	H48 131.6-131.8
487	H13 921.3-921.8		

TABLE A-4. Continued.

Map No.	Unit 9		Unit 10C			Porph. Alkalic Dike
	536	A	463	455	453	522
S.G.	2.85	2.70	2.65	2.84	2.73	2.81
AP	2.31	3.948	0.67	2.85	1.61	1.34
PO	0.02	0.078	0.03	0.11	0.03	0.03
IL	0.02	0.027	0.41	1.87	1.22	0.22
OR	0.10	0.0	48.95	30.64	37.46	47.06
AB	0.39	0.0	26.80	25.82	31.13	0.09
AN	0.0	0.0	0.10	13.24	9.53	1.37
C	0.0	0.0	7.18	0.02	2.57	8.41
AC	3.34	0.328	0.0	0.0	0.0	0.0
MT	1.61	0.0	2.91	3.55	4.53	11.16
HM	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	81.755	0.0	0.0	0.0	0.0
EN	0.36	0.0	1.27	0.0	0.0	4.21
FS	3.40	0.0	5.50	0.0	0.0	7.78
Q	16.87	-26.548	0.15	0.0	0.0	3.16
DI	~0.32	0.0	0.0	0.0	0.0	0.0
FO	0.0	0.569	0.0	3.79	3.87	0.0
FA	0.0	2.753	0.0	9.40	6.43	0.0
NE	0.0	22.096	0.0	8.73	1.64	0.0
LC	0.0	0.0	0.0	0.0	0.0	0.0
KP	0.0	10.772	0.0	0.0	0.0	0.0
HE	~2.65	0.0	0.0	0.0	0.0	0.0
CC	74.55	0.0	6.04	0.0	0.0	15.17
RU	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	1.199	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	3.023	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	Sample No.	Map No.	Sample No.
536	H46 1220.8-1221.3	455	NR22-7B
A	H37 75.0	453	NR22-4
463	NR32-8	522	H39 212.6-212.95

TABLE A-4. Continued.

	Porphyritic Alkalic Dike		Alkalic Dike			
Map No.	**528**	**534**	**481**	**490**	**491**	**493**
S.G.	2.81	2.69	2.86	2.83	2.63	2.67
AP	0.55	1.06	3.78	3.66	0.73	0.93
PO	0.03	0.06	0.06	0.09	0.08	0.03
IL	0.32	0.20	3.61	2.52	0.56	0.60
OR	43.46	62.17	44.15	28.75	36.11	38.27
AB	3.68	3.87	2.33	22.43	21.46	14.40
AN	0.39	0.41	8.18	8.17	0.0	0.52
C	7.14	9.67	2.82	3.90	0.0	0.0
AC	0.0	0.0	0.0	0.0	3.37	0.0
MT	10.18	2.67	4.39	4.45	0.88	2.77
HM	2.69	0.0	5.65	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	0.0	0.0
EN	4.57	0.93	0.0	1.40	0.0	0.0
FS	0.0	7.17	0.0	1.38	0.0	0.0
Q	18.23	5.41	0.0	0.0	0.0	0.0
DI	0.0	0.0	0.0	0.0	~0.88	2.39
FO	0.0	0.0	10.38	6.60	1.73	0.87
FA	0.0	0.0	0.0	7.20	7.26	3.03
NE	0.0	0.0	1.07	0.0	26.09	29.56
LC	0.0	0.0	0.0	0.0	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0
HE	0.0	0.0	0.0	0.0	~2.94	6.62
CC	8.77	6.39	13.59	9.47	5.55	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
528	H41 325.65-326.25	490	H16 149.1-149.5
534	H46 388.5-399.0	491	H16 591.25-591.6
481	H11 266.0-266.5	493	H17 442.4-442.8

TABLE A-4. Continued.

	Alkalic Dike				Basic Dike	
Map No.	502	506	511	521	525	535
S.G.	2.86	2.85	2.80	2.62	2.85	2.78
AP	3.51	1.59	2.42	0.31	1.15	1.55
PO	0.23	0.17	0.20	0.06	0.12	0.14
IL	2.39	1.48	1.61	0.16	1.26	1.27
OR	27.04	33.87	28.35	36.42	39.03	20.51
AB	0.0	0.0	0.0	23.24	12.82	0.0
AN	14.37	6.08	2.91	0.0	20.78	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0
AC	0.0	0.0	0.0	1.68	0.0	3.67
MT	4.46	6.65	4.98	1.18	5.93	6.07
HM	0.0	0.0	0.0	0.0	0.0	0.0
WO	0.0	0.0	0.0	0.0	0.0	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0
DI	9.94	4.89	4.50	0.45	0.45	17.46
FO	3.87	1.98	4.51	0.25	3.29	0.23
FA	4.51	3.68	6.17	3.39	8.83	0.10
NE	16.03	24.58	22.20	28.02	5.38	27.69
LC	4.47	7.85	6.57	0.0	0.0	15.34
KP	0.0	0.0	0.0	0.0	0.0	0.0
HE	9.17	7.19	4.87	4.86	0.96	5.97
CC	0.0	0.0	10.73	0.0	0.0	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	0.0	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	Sample No.	Map No.	Sample No.
502	H27 591.0-591.5	521	H37 410.0-410.4
506	H30 313.0-313.5	525	H41 207.5-208
511	H35 97.8-98.2	535	H4 1116.8-1117.4

TABLE A-4. Continued.

	Basic Dike	Miscellaneous				Pulaskite Dike
Map No.	**545**	**469**	**471**	**546**	**524**	**507**
S.G.	2.86	2.81	2.93	3.14	2.53	2.86
AP	3.31	0.44	3.60	1.69	0.40	1.81
PO	0.11	0.03	0.36	0.03	0.36	0.26
IL	4.12	0.48	1.39	2.35	0.08	1.19
OR	26.28	22.85	30.41	0.0	79.82	40.10
AB	1.11	30.61	16.20	0.0	0.09	3.35
AN	−0.94	7.68	6.57	22.31	−3.51	21.06
C	4.38	0.0	0.0	0.0	4.71	0.0
AC	0.0	0.0	0.0	0.0	0.0	0.0
MT	3.33	10.90	5.85	15.51	14.52	5.24
HM	0.0	3.31	0.0	0.0	0.0	0.0
WO	0.0	6.38	0.0	0.0	0.0	0.0
EN	0.0	0.0	0.0	0.0	0.0	0.0
FS	0.0	0.0	0.0	0.0	0.0	0.0
Q	0.0	0.0	0.0	0.0	0.0	0.0
DI	0.0	6.99	5.80	16.57	0.0	1.42
FO	20.74	0.0	5.36	8.54	0.0	3.81
FA	8.66	0.0	4.53	0.26	0.0	7.15
NE	3.52	10.34	3.83	2.81	0.0	12.50
LC	0.0	0.0	0.0	26.93	0.0	0.0
KP	0.0	0.0	0.0	0.0	0.0	0.0
HE	0.0	0.0	3.87	0.40	0.0	2.12
CC	25.38	0.0	12.24	0.0	5.91	0.0
RU	0.0	0.0	0.0	0.0	0.0	0.0
NS	0.0	0.0	0.0	0.0	0.0	0.0
KS	0.0	0.0	0.0	0.0	0.0	0.0
CR	0.0	0.0	0.0	0.0	0.0	0.0
LN	0.0	0.0	0.0	2.60	0.0	0.0

Note: For sample descriptions, see Table A-1.

Map No.	**Sample No.**	**Map No.**	**Sample No.**
545	H64 322.0-322.33	546	H64 362.0-362.45
469	AL14-6D	524	H40 669.05-669.25
471	BA13-6B	507	H33 166.5-167.0

TABLE A-5. NORMATIVE MINERALS (ALKALIC ROCKS) FOR WHOLE-ROCK SAMPLES FROM THE NEMEGOSENDA LAKE CARBONATITE COMPLEX

	Unit 4A			Unit 5A		Unit 6	
Map No.	**467**	**468**	**450**	**448**	**449**	**476**	**495**
Quartz	0.0	0.0	4.95	0.0	0.0	0.0	1.02
Corundum	0.0	0.0	1.17	0.0	0.0	0.0	0.66
Orthoclase	6.63	9.70	4.66	0.0	0.0	13.62	37.18
Albite	36.85	40.14	33.14	1.76	5.77	10.62	25.28
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	10.99	2.93	0.0	34.47	35.09	43.92	0.0
Carnegieite	0.0	0.0	0.0	13.99	7.03	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	10.53	8.93	1.46	0.0
Thenardite	0.53	0.31	0.09	0.09	0.09	0.22	0.0
Gehlenite	13.37	17.43	24.59	0.0	0.0	0.0	10.76
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.61	0.0	0.0	14.72	19.35	9.42	0.0
Enstatite	0.24	0.0	0.0	7.52	9.70	2.19	0.0
Ferrosilite	0.38	0.0	0.0	6.82	9.21	7.82	0.0
Forsterite	7.14	7.43	10.23	1.52	0.80	0.57	3.54
Fayalite	12.75	10.13	9.15	1.52	0.84	2.24	3.72
Andradite	0.0	0.0	0.0	0.0	0.0	0.18	0.0
Hematite	0.0	0.0	0.0	0.18	0.60	2.77	0.0
Magnetite	1.21	6.19	4.66	0.0	0.0	1.16	8.64
Sphene	3.36	0.93	0.0	0.49	0.42	0.54	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.99	0.28	0.0	0.0	0.0	0.08
Apatite	1.30	1.09	0.50	0.21	0.07	1.51	1.33
Calcite	1.27	0.59	0.64	4.68	1.05	0.91	2.95
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.63	2.51	0.65	0.69	0.42	0.46	2.90
Sum	100.28	100.38	99.71	99.20	99.37	99.43	98.06

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
467	ND-5	449	NR14-2
468	ND-10	476	H9 644.5-645.0
450	NR14-3	495	H21 1100.6-1101.1
448	NR14-1		

TABLE A-5. Continued.

	Unit 6						
Map No.	**500**	**514**	**515**	**526**	**527**	**539**	**542**
Quartz	0.0	2.23	1.75	0.0	3.12	6.35	0.46
Corundum	0.0	0.0	0.0	0.0	1.27	0.0	5.22
Orthoclase	23.63	39.96	34.88	37.62	50.35	9.74	48.69
Albite	4.59	15.28	21.60	31.97	16.58	18.93	15.65
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	25.13	0.0	0.0	0.82	0.0	0.0	0.0
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	12.88	1.95	0.0	0.0	0.0	13.00	0.0
Thenardite	0.09	2.52	1.64	0.09	0.09	1.55	0.09
Gehlenite	0.0	0.0	1.88	5.90	6.36	0.0	2.70
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	11.97	4.52	8.88	3.05	0.0	3.78	0.0
Enstatite	2.28	1.95	1.30	1.18	0.0	1.79	0.0
Ferrosilite	10.61	2.56	8.39	1.92	0.0	0.92	0.0
Forsterite	0.0	1.38	0.19	0.67	1.91	0.0	1.61
Fayalite	0.0	1.99	1.32	1.20	0.0	0.0	5.14
Andradite	5.63	0.0	0.0	0.0	0.0	22.47	0.0
Hematite	0.40	0.52	4.57	0.71	1.92	0.0	0.0
Magnetite	0.0	14.10	6.91	8.93	10.25	2.53	7.58
Sphene	0.59	1.52	0.61	0.25	0.0	1.37	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.0	0.0	0.0	0.10	0.0	0.14
Apatite	0.07	0.50	0.19	0.28	0.24	0.24	0.26
Calcite	0.77	8.23	3.77	2.41	4.68	5.36	9.36
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.52	0.94	1.00	2.02	1.30	0.33	2.36
Sum	99.15	100.15	98.87	99.01	98.17	88.36	99.27

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	Sample No.	Map No.	Sample No.
500	H26 622.3-622.9	527	H41 253.2-253.7
514	H36 464.4-464.6	539	H49 153.35-153.75
515	H36 533.6-533.9	542	H62 235.4-235.9
526	H41 245.0-245.6		

TABLE A-5. Continued.

Map No.	Unit 6 547	Unit 6A 459	458	473	475	477	478
Quartz	2.89	0.0	0.0	0.0	0.0	2.30	0.0
Corundum	0.0	0.0	0.0	3.05	0.0	4.21	0.0
Orthoclase	27.74	20.02	31.79	35.20	33.79	43.44	28.83
Albite	10.33	7.16	21.29	30.38	21.85	16.88	16.54
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	0.0	41.13	14.31	2.32	17.05	0.0	24.75
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thenardite	0.09	0.31	0.44	0.18	0.53	0.44	0.44
Gehlenite	18.28	1.27	5.99	4.77	6.99	9.77	6.05
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	1.28	7.37	0.03	0.0	0.77	0.0	3.04
Enstatite	0.81	2.92	0.01	0.0	0.28	0.0	1.00
Ferrosilite	0.39	4.54	0.02	0.0	0.52	0.0	2.15
Forsterite	9.87	1.80	2.37	2.60	1.67	2.83	1.72
Fayalite	5.32	3.09	4.65	4.60	3.46	5.95	4.08
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Magnetite	13.44	5.51	9.22	8.63	7.73	6.96	6.62
Sphene	2.82	0.86	1.35	0.0	1.20	0.0	1.05
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.0	0.0	0.51	0.0	0.50	0.0
Apatite	0.95	2.06	1.28	1.25	0.71	1.11	1.14
Calcite	1.00	0.86	3.77	5.73	0.64	1.00	0.73
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	3.03	1.01	2.15	2.71	1.55	2.86	1.21
Sum	98.24	99.91	98.69	101.93	98.73	98.26	99.35

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (I973).

Map No.	Sample No.	Map No.	Sample No.
547	H64 413.15-413.55	475	H9 22.4-22.8
459	NR22-12	477	H9 74.2-74.7
458	NR22-10	478	H10 33.1-33.6
473	BA13-9M		

TABLE A-5. Continued.

	Unit 6A						
Map No.	479	484	485	497	498	501	503
Quartz	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corundum	0.0	2.30	0.68	0.0	2.82	0.0	34.04
Orthoclase	31.12	45.80	40.01	29.87	40.33	34.16	25.78
Albite	19.84	17.12	20.58	13.92	22.92	12.33	0.0
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	5.49
Nepheline	20.80	11.54	13.15	26.78	3.18	21.98	0.0
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thenardite	0.53	0.75	0.53	0.66	0.53	1.20	0.22
Gehlenite	5.56	4.15	6.39	3.93	9.71	4.73	2.38
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.78	0.0	0.0	3.78	0.0	1.29	0.0
Enstatite	0.28	0.0	0.0	1.08	0.0	0.35	0.0
Ferrosilite	0.52	0.0	0.0	2.88	0.0	1.00	0.0
Forsterite	2.01	2.08	1.88	1.69	2.64	2.84	2.40
Fayalite	4.18	4.32	4.71	4.97	5.10	8.88	4.01
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Magnetite	7.70	6.76	7.57	5.61	7.60	5.03	7.77
Sphene	1.25	0.0	0.0	1.18	0.0	1.35	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.49	0.48	0.0	0.48	0.0	0.30
Apatite	1.07	0.43	0.62	1.28	1.35	1.61	1.44
Calcite	1.27	0.77	0.59	0.77	0.55	0.91	8.32
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	1.85	1.75	1.60	1.14	2.70	1.01	3.15
Sum	98.77	98.25	99.38	99.54	99.91	98.66	98.44

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	Sample No.	Map No.	Sample No.
479	H10 77.6-78.0	498	H26 86.8-87.3
484	H12 56.75-57.25	501	H27 785.8-786.25
485	H12 289.5-290.0	503	H28 31.6-31.84
497	H24 98.1-98.6		

TABLE A-5. Continued.

	Unit 6A						Unit 8A
Map No.	**504**	**505**	**510**	**520**	**537**	**482**	**460**
Quartz	0.0	0.0	0.0	0.0	0.0	5.42	0.0
Corundum	0.0	0.29	2.95	3.01	0.99	7.10	2.53
Orthoclase	27.78	39.47	45.19	58.00	39.43	50.35	57.35
Albite	8.86	18.15	17.64	9.63	17.54	6.61	12.57
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	30.42	14.92	0.29	2.15	12.77	0.0	14.68
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thenardite	0.75	0.75	0.89	0.75	0.44	0.09	0.22
Gehlenite	3.11	3.85	9.49	1.17	8.63	2.38	0.77
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	4.59	0.0	0.0	0.0	0.0	0.0	0.0
Enstatite	1.41	0.0	0.0	0.0	0.0	0.0	0.0
Ferrosilite	3.36	0.0	0.0	0.0	0.0	0.0	0.0
Forsterite	2.40	2.26	3.14	2.76	2.76	3.66	0.33
Fayalite	6.31	5.32	6.48	11.67	6.22	1.97	1.41
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Magnetite	5.06	7.16	8.27	3.34	6.23	10.10	0.67
Sphene	1.42	0.0	0.0	0.0	0.0	0.0	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.47	0.67	0.34	0.60	0.62	0.05
Apatite	1.68	0.88	1.25	1.07	1.23	1.44	1.07
Calcite	0.77	3.77	0.82	2.23	0.77	5.73	4.59
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.97	1.50	2.51	1.98	1.45	2.79	2.30
Sum	98.91	98.78	99.59	98.09	99.06	98.26	98.52

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (l973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
504	H29 291.9-292.4	537	H47 592.2-592.45
505	H30 135.0-135.6	482	H11 411.25-411.5
510	H34 590.0-590.6	460	NR32-4A
520	H37 381.2-381.6		

TABLE A-5. Continued.

Map No.	Unit 8A						Unit 7A
	465	466	494	496	523	541	456
Quartz	26.82	0.0	0.0	0.0	6.95	6.00	0.0
Corundum	0.0	14.53	7.24	7.45	8.05	3.38	2.44
Orthoclase	14.18	48.97	53.75	53.06	66.11	70.24	28.29
Albite	0.0	17.31	13.17	15.10	1.47	0.0	34.75
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	0.0	0.67	11.09	10.54	0.0	0.0	3.30
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	17.73	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	3.41	0.0	0.0	0.0	0.0	0.0	0.0
Thenardite	0.22	0.22	0.22	0.22	0.22	0.0	0.44
Gehlenite	0.0	2.14	1.00	0.0	0.11	2.53	6.06
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Enstatite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ferrosilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forsterite	0.09	4.22	2.12	0.65	1.23	0.63	3.47
Fayalite	1.36	1.19	2.35	1.65	1.39	2.80	10.40
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Magnetite	0.0	2.11	1.92	4.07	4.04	3.14	3.91
Sphene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.06	0.06	0.18	0.30	0.24	0.14	0.95
Apatite	2.23	0.19	0.80	0.76	0.66	0.54	2.37
Calcite	1.11	1.41	1.27	1.10	5.59	7.54	0.68
Magnesite	0.25	0.0	0.0	0.22	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	1.90	5.74	3.73	2.91	1.57	1.17	1.80
Sum	69.36	98.55	98.84	98.03	97.64	98.11	98.87

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	Sample No.	Map No.	Sample No.
465	NW34-3A	523	H39 340.0-340.45
466	NW34-4A	541	H62 224.45-224.9
494	H21 308.5-309.0	456	NR22-8B
496	H21 1300.0-1300.5		

TABLE A-5. Continued.

	Unit 7A						
Map No.	**461**	**451**	**454**	**457**	**464**	**462**	**472**
Quartz	0.0	0.0	0.0	0.0	0.0	0.0	2.04
Corundum	4.19	1.37	0.63	2.40	0.0	1.26	3.61
Orthoclase	33.29	31.01	25.99	26.97	23.61	34.55	29.33
Albite	44.12	30.36	35.05	36.14	32.17	32.68	36.20
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	2.72	8.14	7.66	3.85	23.80	13.10	0.0
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.0	2.03	0.0	0.0
Thenardite	0.13	0.44	0.31	0.53	0.44	0.09	0.09
Gehlenite	3.94	5.08	8.91	6.11	0.0	2.62	6.64
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	0.0	0.0	0.0	2.92	0.0	0.0
Enstatite	0.0	0.0	0.0	0.0	0.74	0.0	0.0
Ferrosilite	0.0	0.0	0.0	0.0	2.35	0.0	0.0
Forsterite	0.50	3.02	3.13	3.39	0.21	0.19	4.45
Fayalite	1.19	8.30	9.46	9.73	0.75	2.59	9.04
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	1.03	0.0	0.0
Magnetite	5.17	4.87	4.23	4.43	3.96	0.80	4.43
Sphene	0.0	0.0	0.0	0.0	0.54	0.0	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.10	0.97	0.86	0.91	0.0	0.06	0.92
Apatite	0.24	2.34	0.02	2.37	0.78	0.97	1.66
Calcite	0.86	2.54	0.59	1.00	3.41	7.77	0.82
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	2.25	1.78	1.69	1.84	0.77	3.25	1.78
Sum	98.72	100.23	98.51	99.67	99.51	99.93	101.01

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
461	NR32-6A	464	NR32-9
451	NR22-1C	462	NR32-10A
454	NR22-5	472	BA13-8A1
457	NR22-9A		

TABLE A-5. Continued.

	Unit 7A			Unit 7B		
Map No.	**474**	**462A**	**452**	**480**	**483**	**488**
Quartz	0.0	0.0	1.21	0.0	1.46	1.69
Corundum	3.51	0.0	4.34	0.0	0.0	0.0
Orthoclase	36.89	27.05	31.05	23.56	27.03	28.45
Albite	38.11	24.50	37.13	17.64	9.62	9.63
Leucite	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	3.10	23.40	0.0	0.85	0.0	0.0
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	4.82	0.0	4.90	20.72	8.30
Thenardite	0.04	0.09	0.09	3.32	2.52	2.75
Gehlenite	1.69	0.0	3.88	0.0	0.0	0.0
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	3.29	0.0	16.47	12.52	13.94
Enstatite	0.0	0.69	0.0	4.01	2.14	4.65
Ferrosilite	0.0	2.84	0.0	13.45	11.42	9.72
Forsterite	0.30	0.19	3.09	0.39	0.27	1.03
Fayalite	1.30	0.88	8.27	1.43	1.59	2.38
Andradite	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	8.32	4.95	4.40
Magnetite	5.48	2.07	3.18	0.0	0.0	0.0
Sphene	0.0	0.34	0.0	0.76	1.13	0.47
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.16	0.0	0.71	0.0	0.0	0.0
Apatite	0.95	1.51	1.63	0.36	0.33	0.19
Calcite	7.04	6.68	1.27	4.32	3.54	11.63
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.72	0.65	3.02	0.37	0.90	0.37
Sum	99.29	99.01	98.87	100.15	100.17	99.58

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
474	BA13-10B	480	H10 427.1-427.6
462A	NR32-7	483	H11 742.75-743.2
452	NR22-2A	488	H13 978.0-978.55

TABLE A-5. Continued.

	Unit 7B						
Map No.	**499**	**509**	**512**	**513**	**516**	**517**	**538**
Quartz	0.74	3.26	3.61	0.0	13.80	0.0	1.18
Corundum	0.0	0.0	0.0	0.0	0.60	0.0	0.0
Orthoclase	22.78	23.26	24.08	44.28	48.40	19.73	20.72
Albite	11.16	8.66	10.45	14.98	1.17	16.20	11.62
Leucite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	0.0	0.0	0.0	0.47	0.0	1.83	0.0
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	5.70	15.32	8.71	10.90	0.0	9.11	25.46
Thenardite	2.97	3.32	5.63	0.66	4.52	2.66	0.66
Gehlenite	0.0	0.0	0.0	0.0	6.18	0.0	0.0
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	17.99	16.84	14.68	5.87	0.0	17.04	12.40
Enstatite	4.56	5.47	5.46	2.10	0.0	2.72	3.21
Ferrosilite	14.45	11.94	9.51	3.90	0.0	15.80	9.87
Forsterite	0.28	0.49	0.66	1.05	1.11	0.18	0.63
Fayalite	0.98	1.19	1.27	2.14	0.87	1.18	2.15
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	12.95	4.81	8.31	3.28	0.0	10.47	4.51
Magnetite	0.0	0.0	0.0	0.45	11.77	0.0	0.0
Sphene	2.26	0.69	0.56	0.49	0.0	0.96	0.61
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.0	0.0	0.0	0.11	0.0	0.0
Apatite	0.14	0.40	0.54	0.45	0.43	0.14	0.31
Calcite	2.45	3.45	8.09	7.63	9.54	2.50	5.77
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.50	0.59	0.88	0.85	1.24	0.68	0.57
Sum	99.93	99.71	102.44	99.52	99.73	101.19	99.68

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
499	H26 517.8-518.4	516	H36 658.4-658.6
509	H34 272.3-273.6	517	H36 717.3-717.5
512	H36 227.0-227.2	538	H48 294.0-294.4
513	H36 337.25-337.5		

TABLE A-5. Continued.

	Unit 7B			Unit 9			
Map No.	**540**	**543**	**544**	**487**	**492**	**532**	**533**
Quartz	0.0	0.0	1.14	0.0	0.0	5.72	0.0
Corundum	0.0	0.0	0.0	0.0	0.0	2.37	0.0
Orthoclase	25.32	28.75	27.09	0.0	0.0	1.36	0.0
Albite	22.03	12.56	14.09	0.0	0.0	2.04	0.0
Leucite	0.0	0.0	0.0	11.48	0.0	0.0	3.26
Kalsilite	0.0	0.0	0.0	6.86	1.12	0.0	1.64
Nepheline	0.74	1.73	0.0	1.07	2.43	0.0	4.05
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	9.09	18.75	21.37	3.80	3.31	0.0	0.0
Thenardite	0.89	1.11	1.55	1.33	0.09	0.09	0.31
Gehlenite	0.0	0.0	0.0	0.0	0.0	0.0	0.01
Akermanite	0.0	0.0	0.0	0.0	0.73	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	2.73	0.0	0.0
Wollastonite	12.54	11.84	10.88	6.84	−2.17	0.0	3.41
Enstatite	2.27	3.29	2.70	2.29	−0.43	0.0	1.18
Ferrosilite	11.28	9.13	8.82	4.76	−1.90	0.0	2.33
Forsterite	0.41	0.44	0.38	4.68	1.38	0.0	0.81
Fayalite	2.24	1.36	1.40	10.75	6.72	1.41	1.76
Andradite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	8.07	4.23	4.52	0.0	0.0	0.0	0.0
Magnetite	0.0	0.0	0.0	5.21	7.60	2.32	47.79
Sphene	0.83	0.64	0.74	0.93	0.0	0.0	0.29
Perovskite	0.0	0.0	0.0	0.0	0.02	0.0	0.0
Rutile	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apatite	0.28	0.26	0.21	8.21	5.44	2.67	17.99
Calcite	3.73	5.14	4.14	31.13	70.44	76.34	13.29
Magnesite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.47	0.29	0.43	1.46	0.85	0.51	0.76
Sum	100.20	99.50	99.47	100.08	99.38	94.84	98.89

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
540	H49 414.6-415.1	492	H17 242.9-243.3
543	H62 444.4-444.7	532	H42 147.7-148.0
544	H64 264.5-264.8	533	H48 131.6-131.8
487	H13 921.3-921.8		

TABLE A-5. Continued.

	Unit 9		Unit 10C			Porph. Alkalic Dike
Map No.	**536**	**A**	**463**	**455**	**453**	**522**
Quartz	0.0	0.0	1.91	0.0	0.0	6.34
Corundum	0.0	0.0	7.00	3.06	0.0	8.27
Orthoclase	0.0	9.34	47.04	28.67	9.34	44.68
Albite	0.09	17.43	25.46	35.89	17.43	0.0
Leucite	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	0.25	8.41	0.0	2.52	8.41	0.0
Carnegieite	0.02	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.77	0.0	0.0	0.77	0.0
Acmite	3.63	0.23	0.0	0.0	0.23	0.0
Thenardite	0.09	0.09	0.09	0.44	0.09	0.0
Gehlenite	0.0	0.0	0.05	5.44	0.0	0.65
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	0.0	0.0	0.0	0.0	0.0
Enstatite	0.0	0.0	0.0	0.0	0.0	0.0
Ferrosilite	0.0	0.0	0.0	0.0	0.0	0.0
Forsterite	0.0	0.0	0.85	3.68	0.0	2.80
Fayalite	1.79	2.02	4.39	10.54	2.02	5.89
Andradite	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	0.0	0.0
Magnetite	2.04	0.0	2.80	3.47	0.0	10.63
Sphene	0.0	0.0	0.0	0.0	0.0	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.0	0.0	0.21	0.96	0.0	0.11
Apatite	2.77	2.84	0.66	2.84	2.84	1.30
Calcite	86.05	52.10	5.82	0.68	52.10	14.43
Magnesite	0.21	0.48	0.0	0.0	0.48	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	0.39	0.72	2.79	1.68	0.72	3.20
Sum	97.33	94.42	99.07	99.88	94.42	98.30

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
536	H46 1220.8-1221.3	455	NR22-7B
A	H37 75.0	453	NR22-4
463	NR32-8	522	H39 212.6-212.95

TABLE A-5. Continued.

	Porphyritic Alkalic Dike		Alkalic Dike			
Map No.	**528**	**534**	**481**	**490**	**491**	**493**
Quartz	19.26	7.70	2.27	3.50	0.0	0.0
Corundum	7.03	9.53	4.32	5.35	0.0	0.0
Orthoclase	41.85	59.61	42.44	27.27	22.60	24.43
Albite	3.22	2.90	3.33	20.16	32.15	30.65
Leucite	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	0.0	0.0	0.0	0.0	26.92	26.92
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.0	2.28	0.0
Thenardite	0.09	0.22	0.22	0.31	0.31	0.09
Gehlenite	0.19	0.20	3.89	3.83	0.0	0.69
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	0.0	0.0	0.0	0.0	1.34
Enstatite	0.0	0.0	0.0	0.0	0.0	0.32
Ferrosilite	0.0	0.0	0.0	0.0	0.0	1.10
Forsterite	3.07	0.63	9.95	7.17	0.31	1.37
Fayalite	0.0	5.52	0.0	9.57	6.20	5.19
Andradite	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	2.23	0.0	1.69	0.0	0.0	0.0
Magnetite	10.38	2.57	9.70	4.24	1.38	2.70
Sphene	0.0	0.0	0.0	0.0	0.0	0.76
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	0.16	0.10	1.83	1.26	0.29	0.0
Apatite	0.54	1.04	3.72	3.55	0.73	0.92
Calcite	8.45	6.13	13.09	9.00	3.89	1.82
Magnesite	0.0	0.0	0.0	0.0	1.31	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	2.55	2.32	7.33	3.43	0.85	1.36
Sum	99.03	98.48	103.77	98.65	99.23	99.67

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
528	H41 325.65-326.25	490	H16 149.1-149.5
534	H46 388.5-399.0	491	H16 591.25-591.6
481	H11 266.0-266.5	493	H17 442.4-442.8

TABLE A-5. Continued.

	Alkalic Dike				Basic Dike	
Map No.	502	506	511	521	525	535
Quartz	0.0	0.0	0.0	0.0	3.58	0.0
Corundum	0.17	0.0	0.0	0.0	4.16	0.0
Orthoclase	29.62	33.24	26.03	23.15	36.95	24.96
Albite	20.70	15.93	10.75	38.50	19.92	11.41
Leucite	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	3.11	18.82	19.09	25.38	0.0	27.79
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.89	0.0	1.75
Thenardite	0.89	0.66	0.75	0.22	0.44	0.53
Gehlenite	14.75	7.08	4.21	0.0	9.11	0.0
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	0.0	0.91	0.16	0.0	6.40
Enstatite	0.0	0.0	0.37	0.01	0.0	3.27
Ferrosilite	0.0	0.0	0.54	0.17	0.0	2.97
Forsterite	6.72	3.42	5.43	0.37	3.25	3.32
Fayalite	9.67	7.55	8.67	5.10	9.69	3.33
Andradite	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	0.0	0.0	0.0	0.0	4.08
Magnetite	4.26	6.42	4.78	1.52	5.64	0.77
Sphene	0.0	0.64	1.99	0.20	0.0	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	1.20	0.49	0.0	0.0	0.63	0.0
Apatite	3.41	1.56	2.37	0.31	1.11	2.77
Calcite	2.04	1.59	10.27	1.86	1.00	86.05
Magnesite	0.0	0.0	0.0	0.0	0.0	0.21
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	3.59	1.32	3.01	1.22	3.48	0.39
Sum	100.13	98.72	99.19	99.06	98.97	99.00

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	Sample No.	Map No.	Sample No.
502	H27 591.0-591.5	521	H37 410.0-410.4
506	H30 313.0-313.5	525	H41 207.5-208
511	H35 97.8-98.2	535	H4 1116.8-1117.4

TABLE A-5. Continued.

	Basic Dike	Miscellaneous				Pulaskite Dike
Map No.	**545**	**469**	**471**	**546**	**524**	**507**
Quartz	0.0	0.0	2.15	1.28	7.68	0.0
Corundum	4.23	0.0	0.0	0.0	3.41	3.95
Orthoclase	23.72	19.41	30.34	32.99	78.50	38.20
Albite	1.03	40.49	21.12	4.66	0.0	21.14
Leucite	0.0	0.0	0.0	0.0	0.0	0.0
Kalsilite	0.0	0.0	0.0	0.0	0.0	0.0
Nepheline	3.48	5.22	0.0	0.0	0.0	0.47
Carnegieite	0.0	0.0	0.0	0.0	0.0	0.0
Na_2SiO_3	0.0	0.0	0.0	0.0	0.0	0.0
Acmite	0.0	0.0	0.0	0.0	0.0	0.0
Thenardite	0.44	0.04	0.58	0.09	0.0	0.97
Gehlenite	0.0	7.36	7.59	21.34	0.0	11.20
Akermanite	0.0	0.0	0.0	0.0	0.0	0.0
Fe-Aker.	0.0	0.0	0.0	0.0	0.0	0.0
Wollastonite	0.0	3.26	0.17	0.57	0.0	0.0
Enstatite	0.0	1.47	0.09	0.44	0.0	0.0
Ferrosilite	0.0	1.76	0.08	0.06	0.0	0.0
Forsterite	19.75	1.14	7.15	13.03	0.0	4.08
Fayalite	11.19	1.50	7.41	1.92	0.01	8.76
Andradite	0.0	0.0	0.0	0.0	0.0	0.0
Hematite	0.0	7.15	0.0	0.0	0.0	0.0
Magnetite	3.23	4.74	5.85	14.96	2.95	5.04
Sphene	0.0	0.59	1.79	2.92	0.0	0.0
Perovskite	0.0	0.0	0.0	0.0	0.0	0.0
Rutile	2.10	0.0	0.0	0.0	0.04	0.30
Apatite	3.27	0.43	3.67	1.66	0.40	1.78
Calcite	24.22	2.54	12.22	0.59	4.58	0.55
Magnesite	0.27	0.0	0.0	0.0	0.58	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0	0.0
Zircon	0.0	0.0	0.0	0.0	0.0	0.0
Baddeleyite	0.0	0.0	0.0	0.0	0.0	0.0
H_2O	3.45	3.57	0.53	2.19	0.43	3.33
Sum	100.39	100.69	100.74	98.70	98.58	97.77

Notes: For sample descriptions, see Table A-1. Alkalic norms were calculated using the method of LeBas (1973).

Map No.	**Sample No.**	**Map No.**	**Sample No.**
545	H64 322.0-322.33	546	H64 362.0-362.45
469	AL14-6D	524	H40 669.05-669.25
471	BA13-6B	507	H33 166.5-167.0

TABLE A-6. AVERAGE CHEMICAL COMPOSITIONS OF LITHOLOGICAL UNITS FOR THE NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX

	Unit 4A (N = 3)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	38.0	23.9	12.3	46.8
Al_2O_3	12.9	5.27	6.61	17.4
Fe_2O_3	4.14	3.69	0.66	4.90
FeO	6.99	4.43	3.76	11.3
MgO	3.97	3.62	0.38	4.37
CaO	15.2	10.0	8.98	25.6
Na_2O	6.83	1.26	4.86	10.2
K_2O	3.41	2.78	1.04	4.61
H_2O^+	0.52	0.19	0.48	1.07
H_2O^-	0.33	0.23	0.09	0.39
CO_2	5.41	0.46	7.23	13.7
TiO_2	0.25	0.17	0.11	0.38
P_2O_5	1.20	0.03	1.97	3.47
S	0.05	0.01	0.06	0.12
MnO	0.40	0.35	0.06	0.47
Ag	1	1	0	1
Au				
As				
Ba	313	260	61	380
Be	40	15	43	90
Bi				
Co	15	15	0	15
Cr	38	25	19	60
Cu	8	5	6	15
Ga	15	15	0	15
Hg				
Li	6	4	2	8
Mn				
Mo	1	1	0	1
Nb	883	45	1388	2500
Ni	17	5	10	25
Pb	28	20	8	35
Rb	113	50	101	230
Sb				
Sc	25	5	17	35
Sn	6	4	2	8
Sr	3433	500	4823	9000
Ti				
V	50	10	36	80
Y	48	30	20	70
Zn	183	125	63	250
Zr	600	300	265	800
Ce	333	130	196	520
La	233	100	126	350
Nd	183	100	144	350

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6. Continued.

	Unit 5A (N = 2)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	26.7	24.9	2.51	28.4
Al_2O_3	2.12	1.21	1.28	3.02
Fe_2O_3	3.99	1.60	3.38	6.38
FeO	3.43	0.89	3.59	5.96
MgO	0.37	0.01	0.51	0.73
CaO	43.5	42.8	1.04	44.3
Na_2O	0.58	0.28	0.42	0.87
K_2O	0.38	0.23	0.21	0.53
H_2O^+	0.28	0.07	0.29	0.48
H_2O^-	0.41	0.37	0.05	0.44
CO_2	33.9	31.0	4.10	36.8
TiO_2	0.01	0.01	0.0	0.01
P_2O_5	1.72	1.13	0.83	2.30
S	0.01	0.01	0.0	0.01
MnO	0.77	0.73	0.57	0.81
Ag	1	1	0	1
Au				
As				
Ba	330	160	240	500
Be	2	1	1	3
Bi				
Co	6	5	1	6
Cr	20	5	21	37
Cu	7	7	0	7
Ga	11	1	13	20
Hg				
Li	5	3	2	6
Mn				
Mo	1	1	0	1
Nb	450	200	354	700
Ni	5	5	0	5
Pb	148	40	152	255
Rb	25	10	21	40
Sb				
Sc	5	5	0	5
Sn	9	3	8	15
Sr	2501	2	3534	5000
Ti				
V	18	10	11	25
Y	150	150	0	150
Zn	213	175	53	250
Zr	275	150	177	400
Ce	1535	1480	78	1590
La	1250	1000	354	1500
Nd	1250	1000	354	1500

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Unit 6 (N = 10)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	47.5	40.3	3.48	51.9
Al_2O_3	13.5	5.47	4.44	19.9
Fe_2O_3	8.44	4.07	2.94	13.3
FeO	5.93	2.82	2.17	11.2
MgO	1.58	0.63	1.52	5.98
CaO	7.66	5.36	2.18	12.8
Na_2O	3.92	1.05	2.17	8.54
K_2O	5.91	1.65	1.87	8.53
H_2O^+	0.99	0.05	0.85	2.25
H_2O^-	0.38	0.16	0.16	0.65
CO_2	1.74	0.34	1.25	4.12
TiO_2	0.34	0.08	0.32	1.14
P_2O_5	0.22	0.03	0.21	0.64
S	0.11	0.01	0.14	0.35
MnO	0.66	0.31	0.35	1.44
Ag	1	1	0	1
Au				
As				
Ba	912	300	522	1900
Be	21	1	11	40
Bi				
Co	10	5	7	30
Cr	32	5	84	285
Cu	13	5	10	30
Ga	17	10	4	25
Hg				
Li	14	3	13	40
Mn				
Mo	1	1	1	4
Nb	1168	100	1185	3500
Ni	15	5	33	115
Pb	41	10	27	100
Rb	189	60	102	440
Sb				
Sc	8	5	4	15
Sn	11	3	6	25
Sr	1664	2	1262	4000
Ti				
V	17	10	11	45
Y	73	10	90	250
Zn	290	55	208	700
Zr	1427	200	1035	3000
Ce	452	90	451	1360
La	227	100	261	800
Nd	232	100	261	800

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Unit 6A (N = 19)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	47.3	44.7	1.55	50.0
Al_2O_3	18.6	16.7	0.92	19.9
Fe_2O_3	4.69	2.30	1.02	6.35
FeO	6.09	4.75	1.14	9.09
MgO	1.50	1.07	0.30	2.21
CaO	4.69	2.32	1.13	6.44
Na_2O	4.67	1.81	1.53	7.53
K_2O	7.38	6.15	0.91	10.0
H_2O^+	1.50	0.65	0.65	2.61
H_2O^-	0.34	0.15	0.12	0.54
CO_2	0.84	0.24	0.95	3.66
TiO_2	0.46	0.06	0.13	0.67
P_2O_5	0.50	0.18	0.16	0.87
S	0.05	0.02	0.02	0.11
MnO	0.31	0.16	0.06	0.42
Ag	1	1	0	1
Au				
As	1	1	0	1
Ba	2090	500	749	3200
Be	5	1	3	10
Bi				
Co	14	10	3	20
Cr	5	5	1	10
Cu	16	8	4	20
Ga	8	5	2	10
Hg				
Li	7	3	5	20
Mn				
Mo	2	1	2	10
Nb	379	70	282	900
Ni	5	5	0	5
Pb	13	9	6	30
Rb	129	70	58	350
Sb	4	4	0	4
Sc	6	5	4	20
Sn	4	3	2	10
Sr	1578	700	1261	5000
Ti				
V	13	10	5	25
Y	14	10	7	35
Zn	125	55	59	300
Zr	383	150	318	1500
Ce	170	50	95	500
La	95	10	21	100
Nd	111	100	47	300

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Unit 8A (N = 7)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	49.7	46.5	2.48	52.6
Al_2O_3	23.8	20.5	2.86	27.9
Fe_2O_3	1.69	0.46	0.93	2.80
FeO	1.65	0.89	0.62	2.33
MgO	0.86	0.17	0.85	2.41
CaO	2.21	1.04	1.05	3.55
Na_2O	3.83	0.27	3.11	9.56
K_2O	9.84	8.35	1.13	11.2
H_2O^+	2.68	1.26	1.45	5.21
H_2O^-	0.40	0.29	0.13	0.62
CO_2	1.14	0.56	0.86	2.46
TiO_2	0.15	0.05	0.11	0.30
P_2O_5	0.40	0.09	0.29	0.94
S	0.02	0.02	0.00	0.02
MnO	0.10	0.07	0.03	0.14
Ag	1	1	0	1
Au				
As				
Ba	3083	1100	2221	7400
Be	6	4	1	8
Bi				
Co	5	5	1	7
Cr	5	5	0	6
Cu	6	5	1	8
Ga	10	7	3	15
Hg				
Li	9	3	7	20
Mn				
Mo	1	1	0	1
Nb	187	70	98	350
Ni	5	5	0	5
Pb	29	10	13	45
Rb	215	150	63	320
Sb				
Sc	5	5	0	5
Sn	3	3	0	3
Sr	1850	800	1340	400
Ti				
V	10	10	0	10
Y	10	10	0	10
Zn	49	20	18	70
Zr	106	10	98	250
Ce	58	50	16	90
La	100	100	0	100
Nd	100	100	0	100

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Unit 7A (N = 11)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	51.1	49.2	1.64	54.5
Al_2O_3	18.7	17.7	1.11	21.3
Fe_2O_3	3.06	0.55	1.01	4.46
FeO	5.09	1.85	2.84	8.37
MgO	1.14	0.11	0.95	2.56
CaO	4.50	2.23	1.15	6.28
Na_2O	5.72	4.32	1.14	8.06
K_2O	5.75	4.88	0.73	6.91
H_2O^+	1.34	0.30	0.76	2.95
H_2O^-	0.32	0.15	0.10	0.45
CO_2	1.38	0.26	1.29	3.42
TiO_2	0.53	0.06	0.42	0.97
P_2O_5	0.56	0.01	0.37	1.00
S	0.03	0.01	0.02	0.05
MnO	0.20	0.13	0.05	0.25
Ag	1	1	0	1
Au				
As	2	1	1	2
Ba	938	150	543	2000
Be	5	1	2	10
Bi				
Co	12	5	7	20
Cr	6	5	2	10
Cu	17	5	11	40
Ga	13	10	3	15
Hg				
Li	12	3	7	25
Mn				
Mo	3	1	4	10
Nb	183	30	79	300
Ni	6	5	2	10
Pb	20	10	15	55
Rb	133	70	41	200
Sb	4	4	0	4
Sc	11	5	9	30
Sn	5	3	3	10
Sr	1760	500	1924	7000
Ti				
V	33	10	59	200
Y	30	10	10	40
Zn	113	15	52	155
Zr	665	150	376	1500
Ce	292	110	136	500
La	123	10	68	250
Nd	140	100	84	300

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Unit 7B (N = 13)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	48.3	45.3	2.35	52.2
Al_2O_3	11.3	5.95	5.23	18.7
Fe_2O_3	8.76	2.19	4.17	14.9
FeO	6.76	3.38	1.93	10.3
MgO	2.29	0.64	1.45	5.89
CaO	8.79	3.21	2.33	12.1
Na_2O	4.22	0.82	1.34	6.34
K_2O	4.41	0.79	2.23	8.53
H_2O^+	0.74	0.05	0.89	2.78
H_2O^-	0.37	0.16	0.15	0.64
CO_2	1.78	0.26	1.23	4.20
TiO_2	0.57	0.11	0.41	1.37
P_2O_5	0.26	0.06	0.21	0.69
S	0.16	0.01	0.14	0.41
MnO	0.47	0.16	0.21	0.81
Ag	1	1	0	1
Au				
As				
Ba	909	530	610	3000
Be	13	1	7	20
Bi				
Co	18	7	14	45
Cr	20	5	30	110
Cu	23	10	9	40
Ga	14	6	4	20
Hg				
Li	6	3	6	25
Mn				
Mo	2	1	2	7
Nb	1718	80	1698	6000
Ni	16	5	24	80
Pb	49	10	49	205
Rb	131	20	62	230
Sb				
Sc	9	5	7	25
Sn	14	3	10	30
Sr	1487	600	964	4000
Ti				
V	39	10	47	150
Y	28	10	14	60
Zn	241	100	109	450
Zr	967	250	787	3000
Ce	169	60	72	320
La	117	100	52	300
Nd	100	100	0	100

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Unit 9 (N = 6)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	36.2	22.6	11.1	51.0
Al_2O_3	10.5	0.11	8.60	19.8
Fe_2O_3	9.72	1.74	13.2	32.9
FeO	6.69	1.69	6.01	16.6
MgO	2.34	0.10	2.45	5.73
CaO	18.2	2.59	18.6	49.8
Na_2O	2.58	0.49	3.43	8.53
K_2O	3.87	0.02	3.02	7.19
H_2O^+	1.30	0.05	1.11	2.84
H_2O^-	0.51	0.34	0.16	0.71
CO_2	11.3	2.40	15.3	38.5
TiO_2	0.70	0.01	0.80	1.83
P_2O_5	2.43	0.31	2.93	7.60
S	0.02	0.01	0.01	0.03
MnO	0.32	0.20	0.21	0.70
Ag	1	1	0	1
Au				
As				
Ba	1848	720	1323	3800
Be	7	1	3	10
Bi				
Co	19	5	11	30
Cr	29	5	33	80
Cu	18	6	14	40
Ga	10	1	7	15
Hg				
Li	8	4	2	10
Mn				
Mo	6	1	7	15
Nb	1120	100	2170	5000
Ni	13	5	11	25
Pb	41	20	21	75
Rb	122	10	97	250
Sb				
Sc	9	5	4	15
Sn	12	3	18	45
Sr	3175	2	3374	7000
Ti				
V	50	10	46	100
Y	67	30	48	150
Zn	232	105	251	680
Zr	785	25	994	2500
Ce	622	270	6700	1690
La	470	150	577	1500
Nd	480	100	850	2000

Notes: For complete listing of statistical parameters, see Open File Report 5410.

TABLE A-6.Continued.

	Alkalic Dikes (N = 8)			
	Mean	Minimum	Standard Deviation	Maximum
SiO_2	46.7	38.4	5.85	54.3
Al_2O_3	18.0	15.1	2.42	21.1
Fe_2O_3	4.04	1.35	2.89	9.37
FeO	5.72	2.82	1.88	7.89
MgO	1.75	0.22	1.30	3.87
CaO	5.76	1.35	3.19	9.81
Na_2O	3.85	0.01	3.43	8.81
K_2O	6.93	5.27	1.49	10.1
H_2O^+	1.94	0.92	0.88	3.20
H_2O^-	0.39	0.25	0.10	0.55
CO_2	2.56	0.70	2.14	6.35
TiO_2	0.44	0.08	0.42	1.20
P_2O_5	0.61	0.13	0.43	1.44
S	0.04	0.01	0.03	0.08
MnO	0.27	0.12	0.11	0.44
Ag	1	1	0	1
Au				
As				
Ba	1876	110	1299	3900
Be	11	5	5	20
Bi				
Co	13	5	9	30
Cr	28	5	42	120
Cu	17	5	13	35
Ga	12	7	4	15
Hg				
Li	41	4	52	145
Mn				
Mo	2	1	1	5
Nb	188	50	103	400
Ni	7	5	5	20
Pb	39	10	50	155
Rb	186	110	60	260
Sb				
Sc	6	5	2	10
Sn	5	3	4	15
Sr	2550	500	1671	5000
Ti				
V	31	10	33	100
Y	28	10	14	45
Zn	136	70	60	270
Zr	709	70	679	2000
Ce	268	50	240	750
La	125	100	46	200
Nd	100	100	0	100

Notes: For complete listing of statistical parameters, see Open File Report 5410

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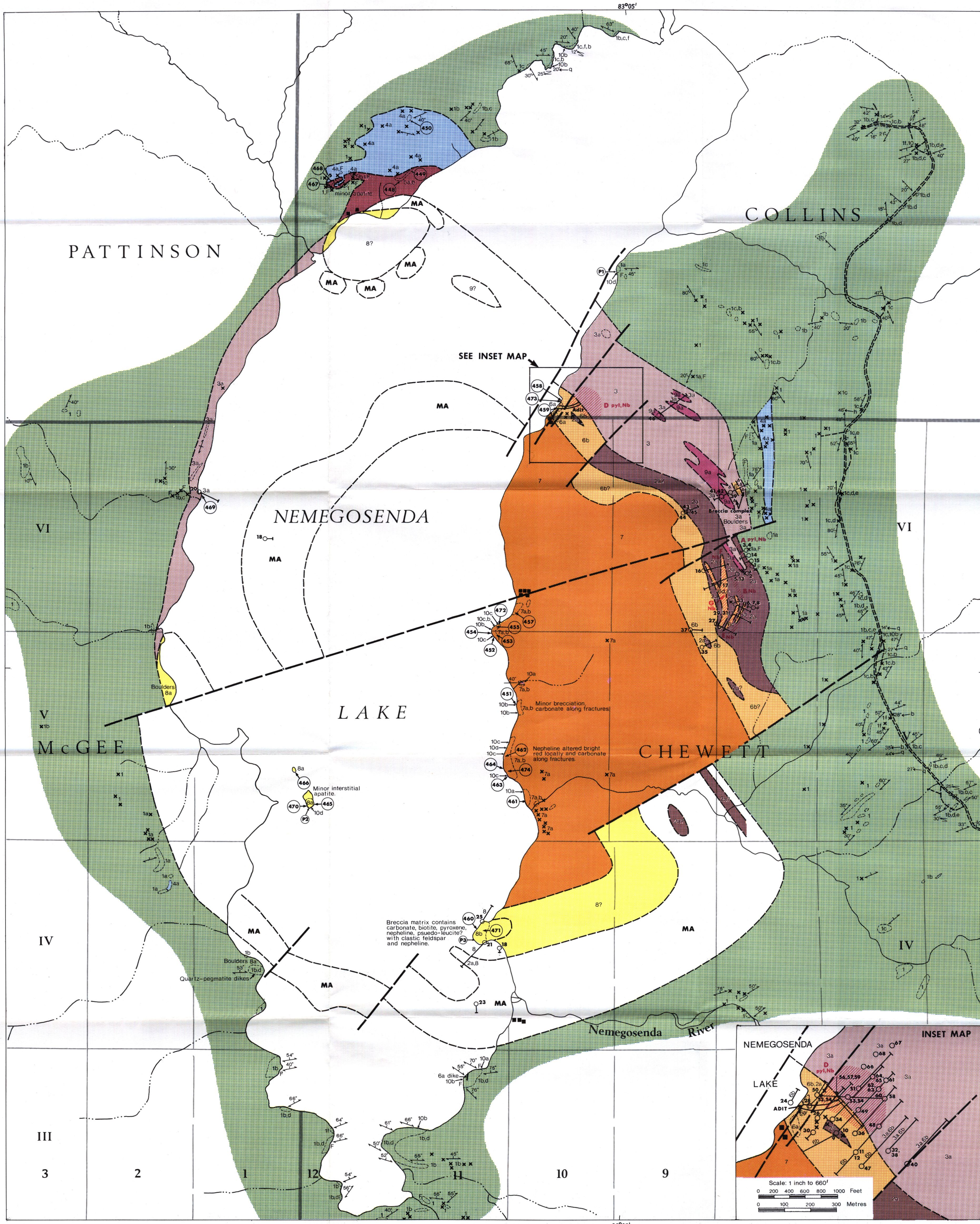


NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX LEGEND

CENOZOIC[a]

QUATERNARY

RECENT

Stream, lake, and swamp deposits.

PLEISTOCENE

Glacial deposits.

Unconformity

LATE PRECAMBRIAN[b]

NEMEGOSENDA LAKE ALKALIC ROCK COMPLEX[c]

DIKE ROCKS

- 10a Carbonate or carbonatite; fine- to coarse-grained sovite, generally ferruginous.
- 10b Biotite-carbonate lamprophyre; fine grained, massive.
- 10c Feldspar-porphyritic syenite; fine to medium grained, massive.
- 10d Aphanitic lamprophyre.

Intrusive Contact

CARBONATITE ROCKS[d]

- 9a Sovite; biotite-magnetite sovite; minor silicocarbonatite.

Intrusive Contact

INNER SYENITIC ROCKS

Nepheline Syenite

- 8 Undifferentiated.
- 8a Coarse-grained leucocratic nepheline syenite and biotite-nepheline syenite.
- 8b Same as 8a, but brecciated.

Intrusive Contact

Malignite and Mafic Syenite

- 7a Biotite malignite, biotite—aegirine-augite malignite (> 10% nepheline); fine to medium grained. Local leucocratic medium-grained rocks with abundant altered nepheline.
- 7b Nepheline-bearing mafic syenite (< 10% nepheline; mafic constituents are biotite, aegirine-augite, amphibole); fine to medium grained.

Intrusive Contact

OUTER SYENITIC ROCKS

Malignite and Aegirine-Augite Syenite

- 6 Undifferentiated.
- 6a Oikocrystic malignite, consisting of large orthoclase oikocrysts and poikilitic nepheline and aegirine-augite.
- 6b Aegirine-augite syenite (mafic), malignite, and malignite breccia.
- 6c Biotite-feldspar pegmatite.
- 6d Biotite-wollastonite rock; garnet-cancrinite-biotite rock; melteigite.

Intrusive Contact

IJOLITE[e]

- 5a Ijolite; medium grained, locally coarse grained to pegmatitic; locally contains xenoliths of other rock types.
- 5b Ijolite breccia.

GABBRO[e]

- 4a Gabbro; medium to coarse grained, massive, equigranular, locally trachytoidal.

Intrusive Contact (?)

FENITES[f]

Red Alkalic Fenite

- 3a Red alkalic fenite (aegirine-augite—orthoclase—albite rock).

Pyroxenitic Fenite

- 2a Pyroxenitic fenite (pyroxene—nepheline—feldspar rock); foliated with xenolithic phases.

Intrusive Contact

EARLY PRECAMBRIAN[b]

ORTHOGNEISS

- 1a Gneissic gabbroic anorthosite; possibly part of the Shawmere Anorthosite Complex.
- 1b Banded amphibolite (hornblende-feldspar gneiss); minor garnet; possibly mafic metavolcanics.
- 1c Quartz diorite to trondhjemite (biotite-quartz-hornblende gneiss).
- 1d Trondhjemite dikes; fine- to medium-grained; cuts units 1a through 1c.
- 1e Trondhjemite to granodiorite pegmatite; cuts units 1a through 1c.
- 1f Trondhjemite gneiss; biotite-quartz-feldspar gneiss; minor hornblende.
- 1g Garnet-hornblende-plagioclase gneiss; possibly part of the Shawmere Anorthosite Complex.

Higher grade niobium zones (Gulf Minerals Canada Limited)

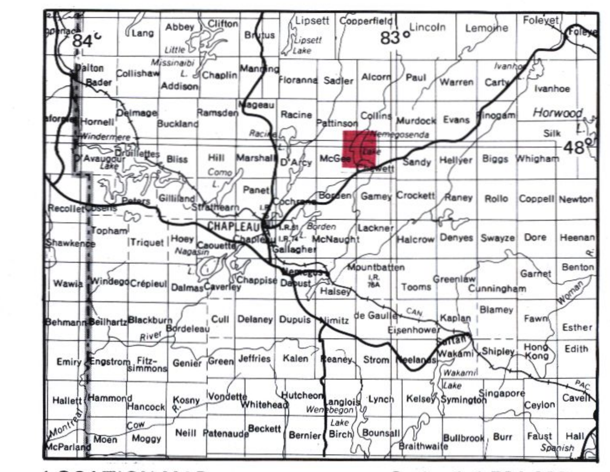
- F Partly fenitized, development of sodic pyroxene and/or amphibole, reddening of feldspar, etc.
- MA Magnetically anomalous areas interpreted as due to rock types 2, 3, 4, and 6.

NOTES

a. Unconsolidated deposits.
b. Bedrock geology.
c. The alkalic rocks are listed approximately in order of formation. However, certain types may have been introduced at more than one time-period. Order revised after Parsons (1961).
d. The carbonatite rocks are possibly late stage dike-like bodies.
e. These units are most likely part of the alkalic rock complex and not part of the wall rocks.
f. Fenite is used for *in situ* metasomatically altered country rocks, regardless of composition, adjacent to an alkalic or carbonatite complex.

ABBREVIATIONS

Nb	Niobium
pyl	Pyrochlore



LOCATION MAP

Scale: 1:1 584 000 or 1 inch to 25 miles

SYMBOLS

×	Small bedrock outcrop
	Area of bedrock outcrop
	Drill hole with number and rock types intersected; vertical, inclined
	Geological contact; known, inferred
	Foliation; inclined, vertical
	Schistosity; inclined, vertical
	Gneissosity; inclined, vertical
	Lineation with plunge; (h=hornblende elongation, q=quartz rodding, b=biotite clots elongated or streaked)
	Fault; inferred
	Small fold axis with plunge
	Township line, approximate location only
	Surveyed line, approximate location only
P3	Photograph location (see report)
454	Sample location (see report appendix)
Adit	Adit
	Logging road
D	Higher grade niobium±pyrochlore zones

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SCALE

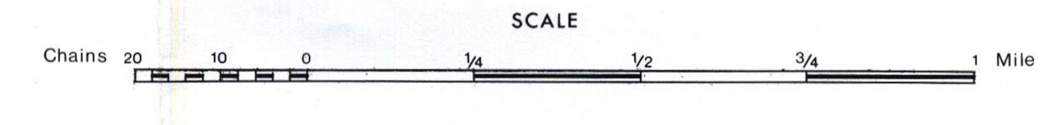

Figure 3. Geology of the Nemegosenda Lake Alkalic Rock Complex. Geology modified by R.P. Sage (see report) from Map 2007 (Parsons 1961). Surface exposures within the complex were remapped and drill core samples were examined in thin section by the author (R.P. Sage).