THE GEOLOGY OF THE SOUTHWEST QUARTER OF GUERCHEVILLE AND NORTH HALF LA RONDE, TOWNSHIPS

(with special emphasis on the Opawica River Complex)

by

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Field work 1973 and 1974 lab work 1974 and 1975

(this report is adapted from the M.S. theis of Arthur H. Maybin III submitted in 1975 to the Geology department of the University of Georgia, Athens, Georgia, USA)

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ARTHUR HARVIN MAYBIN III
The Geology of the Opawica River Complex Quebec, Canada
(Under the direction of GILLES O. ALLARD)

The Opawica River Complex is a layered mafic igneous intrusion which cuts Archean volcanic rocks of the Matagami-Chibougamau Greenstone Belt. The volcanic sequence was subsequently intruded by the Opawica River Pluton and then folded into an east-west trending anticline. The exposed portion of the complex is about 15,000 feet thick and over 15 miles long. The complex is divided into two zones: the Anorthosite Zone and the Gabbro-Ferropyroxenite Zone. The volcanics and intrusives were syntectonically affected by low grade (greenschist facies) regional metamorphism believed to be of Kenoran age (~2.7 b.y.).

Mineralogical studies using a petrographic microscope and electron probe microanalyzer indicate that the original cumulus phases were plagioclase and clinopyroxene. Intercumulus phases were clinopyroxene, plagioclase, magnetite, and ilmenite.

Major element chemistry and preserved textural relationships indicate that the regional metamorphism was essentially isochemical. Gabbroic rocks from the Opawica River Complex show an increase in FeO with a reciprocal decrease in MgO and suggest that the Opawica River Complex formed as a result of fractional crystallization of a basaltic magma having tholeiitic affinities.

ACKNOWLEDGMENTS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF FIGURES (continued)

CHAPTER I

INTRODUCTION

The study area is situated in the central part of Quebec, Canada. It is bounded by longitudes 75° 25' and 75° 46' west and latitudes 49° 30' and 49° 35' north in the Southwest Quarter of Guercheville Township (Plate 1), and the North Half of La Ronde Township (Plate 2). A thick section of Pleistocene glacial till masks the paleotopography and the contact relationships among certain rock units. Polished outcrop surfaces with glacial striae and grooves are common. Bedrock exposure is poor and generally represents less than 1% of the map-area. The area is heavily forested and covered by a carpet of moss. Access to Guercheville Township is limited to float plane and canoe. Logging roads in La Ronde Township enable access to the northern part by automobile.

The area is located in the eastern part of the Superior Province of the Canadian Shield (Figure 1). It is part of the east-trending Matagami-Chibougamau Greenstone Belt which is bordered by the Grenville Province on the east and the Kapuskasing Sub-province to the west. This Archean Greenstone Belt is typical of those which characterize the Superior Province and consists of volcanic and

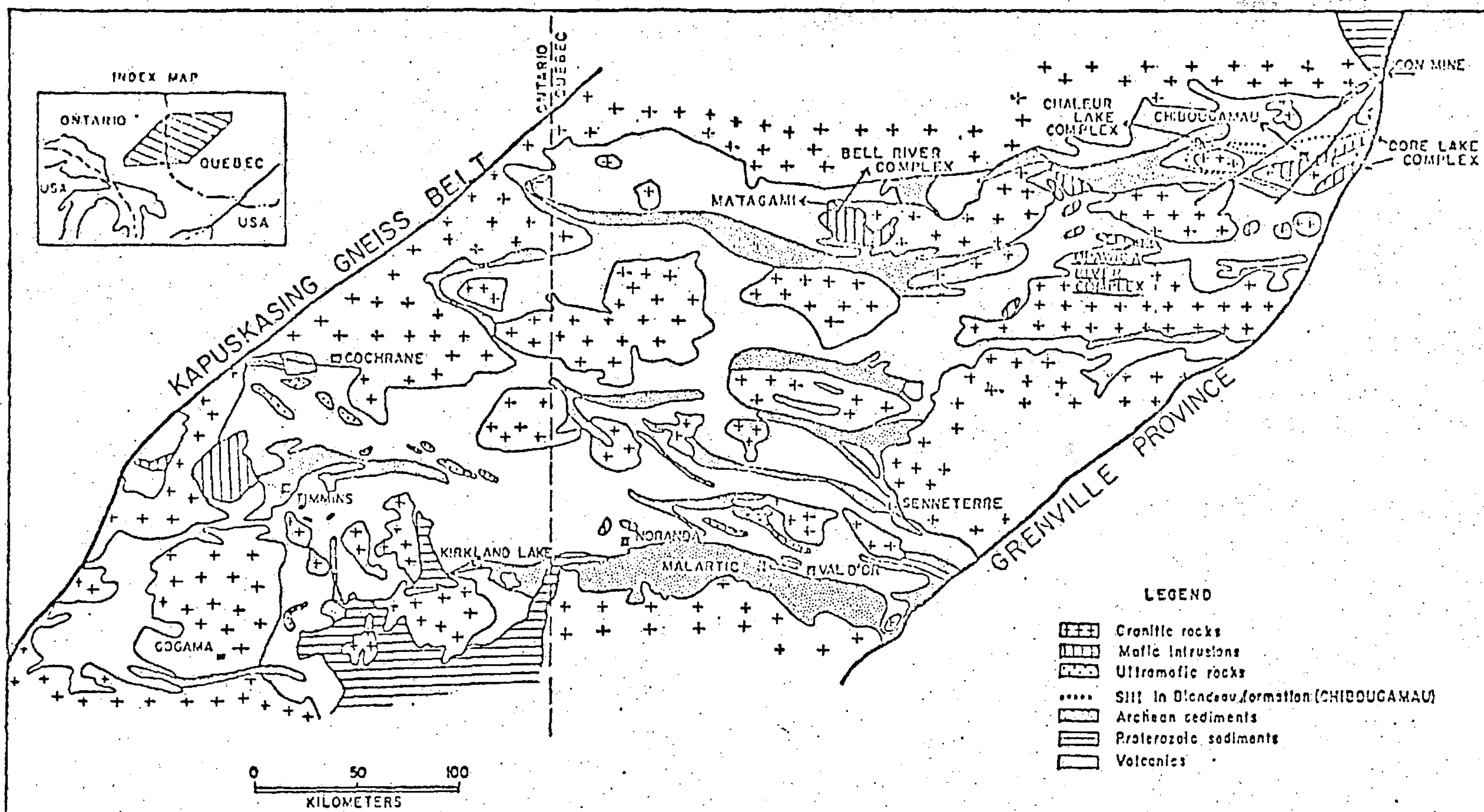

Figure 1. Index map of the Matagami-Chibougamau Greenstone Belt showing location of the Opawica River Complex (study area).

volcaniclastic rocks with intrusive layered mafic complexes and coeval granitic plutons. These rocks were affected by the Kenoran Orogeny dated at 2500 million years by Stockwell (1964) and more recently by Dallmeyer et al. (1975) at between 2650-2700 and 2780-2820 million years. After metamorphism, the north central portion of the study area was intruded by a concentrically zoned granitic pluton.

Previous work in the area was largely reconnaissance in nature and consisted of geologic mapping at a scale of 1:63,360 (Shaw, 1939; Remick, 1955). Present field work consisted of 1:12,000 geologic mapping and detailed petrographic and mineralogical studies.

The purpose of this study is to describe the petrography and chemistry of the rock units in the area. Special attention is given to the Opawica River Complex because of the economic potential of layered mafic intrusions.

CHAPTER II

GENERAL GEOLOGY

Introduction

In addition to the Opawica River Complex, six lithologic units have been mapped in the study area. The oldest is a greenstone unit, composed principally of intercalated volcanic and volcaniclastic rocks. These lithologies were intruded by the Opawica River Complex and the trondhjemitic Opawica River Pluton. This entire sequence was subsequently deformed and metamorphosed. The La Ronde Lake Pluton, a post-kinematic concentrically zoned granitic pluton, intruded the north-central part of the study area. Two other granitic bodies have been defined, however, chronological relationships to other rocks is obscured by glacial drift.

Metabasalts

The metabasalts are exposed in the northern portion of the study area (Plates 1 and 2). The basaltic rocks can be divided into two rock types: metabasalts and basaltic metatuffs. Metabasalt is the most abundant type. These rocks typically have a fine grained texture and a light green color. Primary bedding and graded bedding are common in the basaltic metatuffs. Primary volcanic structures preserved in the metabasalts include pillow structures, scoriaceous flow tops, vesicles, and amygdules. Pillow structures (Figure 2) indicate a submarine origin for these lavas. Scoriaceous flow tops and pillow structures provide excellent top determinations, although pillows are commonly flattened in the plane of tectonic foliation. Metabasalts which lack pillows are distinguished from tuffs by the absence of bedding.

Metabasalts typically exhibit a blastogranular texture whereas the tuffs have a fragmental texture. The dominant minerals are actinolite, plagioclase, epidote, and chlorite. Actinolite ($z \wedge c = 17$) occurs as prisms generally 1 mm in length with a pleochroic formula x = straw yellow, y = green, and z = blue. Plagioclase (An8*)[1] is generally saussuritized. Chlorite exhibits anomalous Berlin blue interference colors, light to dark green pleochroism and is length fast. Epidote is colorless to light green. Accessory minerals are sphene and magnetite. Analysis 1 Appendix II is the only available analysis for the metabasalts.

Metatuffs

Metatuffs are exposed along a thin belt on the south limb of the Opawica River Anticline in La Ronde Township (Plate 2). Glacial drift covers much of the area and

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[1]Plagioclase determinations marked by * were made on sections perpendicular to X, and those marked by + were made in oils using Tsuboi's method.

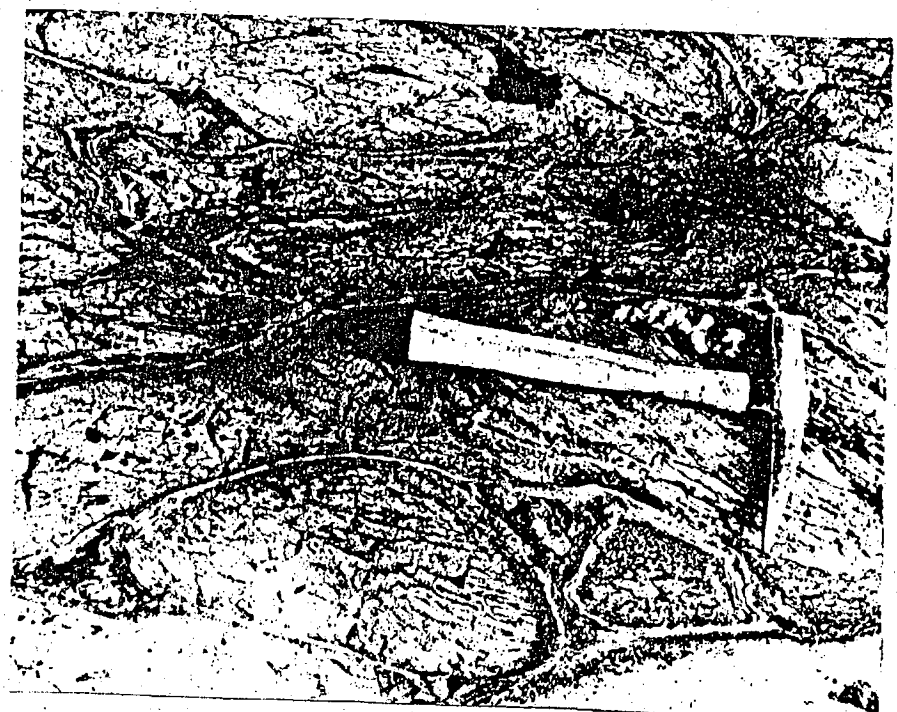

Figure 2. Outcrop of pillowed basalt just north of Tush Lake. Geologic hammer is shown for scale. Stratigraphic tops are to the top of the photograph.

exposures are scarce. The best exposures are along bull-dozed logging roads. The metatuffs can be subdivided into two principal rock units: basaltic metatuffs, and felsic metatuffs.

The metatuffs are generally well bedded and graded bedding in the felsic units provide excellent stratigraphic top determinations. Locally, the metatuffs are intensely deformed, exhibiting transposed primary layering (Figure 3) and crenulation cleavage (Figure 4). Because of their relative incompetency, it is likely that these units absorbed much of the regional orogenic strain.

The dominant rock type is a fine-grained, buff colored felsic tuff. Quartz and plagioclase (An9*) comprise more than 75% of the rock. Subangular to subrounded quartz gains (up to 4 mm in diameter) and sericitized plagioclase (up to 3 mm) are present as megacrysts. Sericite or paragonite is the only other major constituent of this rock type. Pyrite was the only accessory mineral identified. The basaltic metatuffs are similar to those previously discussed.

Opawica River Complex

The Opawica River Complex is a metastratiform igneous intrusion. It bears striking similarities to other stratiform complexes in the region especially the Dore Lake Complex (Chibougamau) and the Bell River Complex (Matagami). The Opawica River Complex consists of a sequence of gabbroic anorthosite, anorthositic gabbro, gabbro, ferropyroxenite,

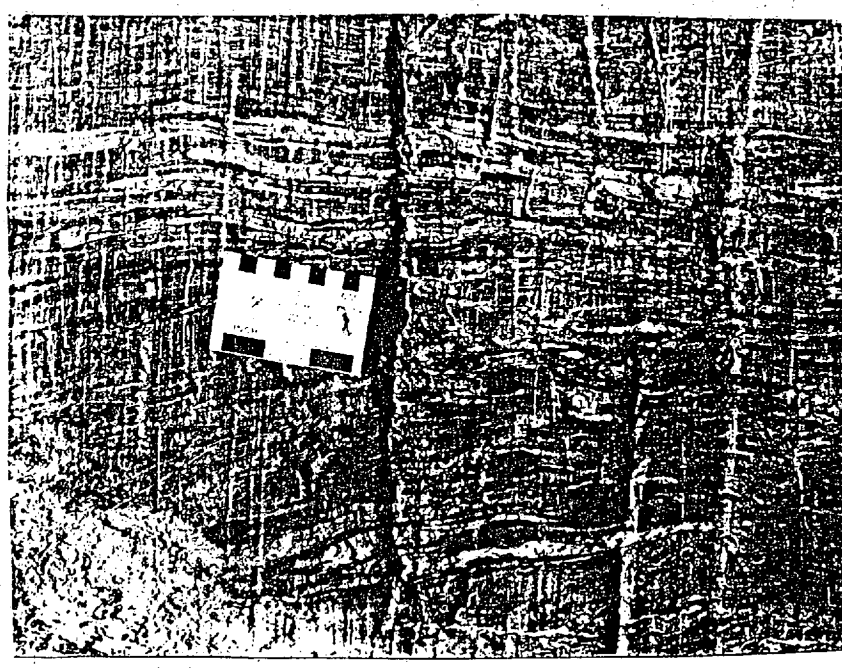

Figure 3. An outcrop of basaltic metatuff exhibiting transposed bedding. Vertical features are glacial grooves and striae. Photograph taken along logging road south of Tush Lake. Three inch rule is shown for scale.

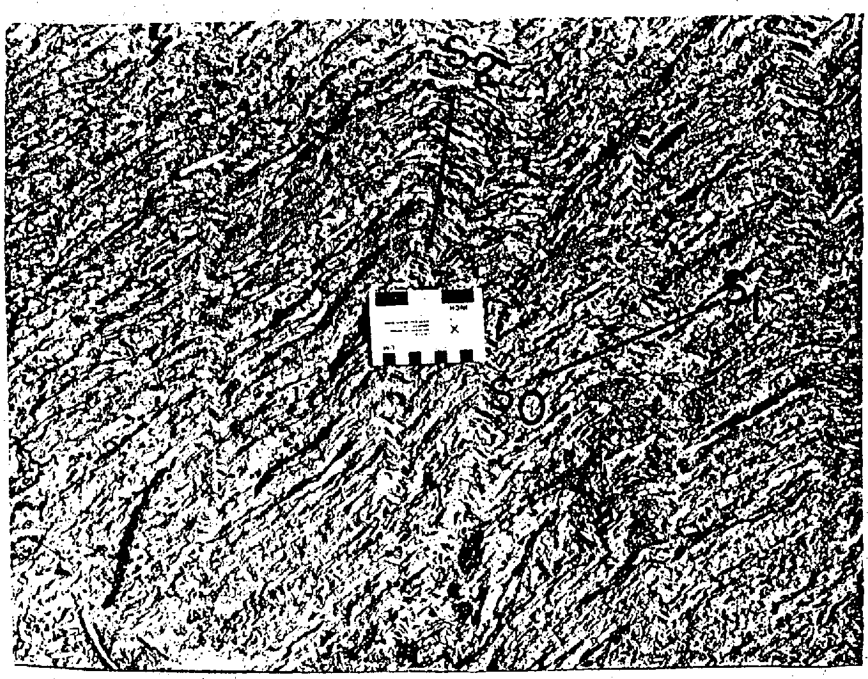

Figure 4. Well developed crenulation cleavage in felsic metatuff. Photograph taken along a logging road just south of Lake Tush. Three inch rule is shown for scale.

and diabase that have been variably metamorphosed. The complex appears to have an overall sill-like morphology, however, it is locally discordant to the host rock volcanics. The volcanic sequence has been affected by deformational and thermal affects associated with the Kenoran Orogeny. The rocks of the complex exhibit mineral assemblages characteristic of the greenschist facies.

Opawica River Pluton

The Opawica River Pluton intrudes metabasalts and the Opawica River Complex. It is exposed in the axial zone of the Opawica River Anticline and is well exposed along the shores of the Opawica River and Lake Lessard. The most conspicuous megascopic structural feature is a foliation reflecting the preferred planar alignment of biotite and muscovite. This penetrative tectonic surface is generally subparallel to the trend of the Opawica River Anticline (Plates 1 and 2).

The rock is a grey color and can be classified as a biotite trondhjemite according to Williams et al. (1954). The predominant minerals are plagioclase, quartz, biotite, epidote, and muscovite. Plagioclase is typically zoned from An 27* in the core to An 18* in the rims. Chlorite is a common alteration feature of biotite. Muscovite is interstitial. Epidote is colorless and exhibits characteristic optical properties. The accessory minerals are sphene and chlorite. Analyses 35 and 36 in Appendix II are chemical analyses.

La Ronde Lake Pluton

The La Ronde Lake Pluton is an undeformed post-kinematic granitic pluton that intrudes metabasalts and the Opawica River Complex in the north central portion of the study area. It is concentrically zoned from a hornblende monzonite border to a porphyritic quartz monzonite core. A zone of brecciation is locally developed along the contact with the Opawica River Complex in Guercheville Township (Plate 1). The pluton's contacts are discordant to structural trends of the other rock units. Locally, a foliation defined by planar preferred orientation of hornblende is developed subparallel to the contacts. Presumably this fabric element developed during emplacement of the pluton. No contact metamorphic aureole appears to be associated with the pluton. The above mentioned descriptions are characteristic of plutons of the transition zone between the epizone and the mesozone of Buddington (1955).

Rocks of the La Ronde Lake Pluton (Analyses 38-54, Appendix II) are various shades of pink. In general the pluton is homogeneous with the only major mineralogical variation being a decrease in quartz abundance from the core to rim. Perthite and plagioclase are the most abundant minerals throughout the pluton, with the ratio of the two feldspars being approximately 1:1. Plagioclase (An 23*) is zoned but the cores are too saussuritized and sericitized to determine their composition. Perthite is commonly interstitial, but locally forms phenocrysts (15 by 8 mm) in the core of the pluton. Quartz is always interstitial. Hornblende ($z \wedge c$ = 22°) typically comprises less than 20% by volume of the pluton. It has a pleochroic formula x = straw yellow, y = olive green, and z = blue green. Biotite occurs as reaction rims around hornblende. Chlorite is locally observed as an alteration product of biotite and hornblende. Accessory minerals are epidote, sphene, zircon, and apatite.

Experimental results on the system $NaAlSiO_8$-$KaLSiO_8$-SiO_2-H_2O (Bowen & Tuttle, 1950, Luth et al., 1964, and Stiener et al., 1975) have led to a better understanding of granitic rocks. By plotting normative quartz, albite, and orthoclase, it is possible to compare granitic rocks containing more than 80% of these normative components to experimental results. The plot of the normative components for the La Ronde Lake Pluton (Figure 5) reveals a cluster near the 10Kb minimum of Luth et al. (1964). Such liquid compositions could be generated by fractional melting of quartzo-feldspathic material at depths of 35 kilometers or so.

Other Granitic Rocks

Two other granitic bodies are exposed in the northwest quarter of La Ronde Township. The relative areas of these two distinct rock types cannot be determined because the contacts are masked by glacial drift. A biotite granodiorite is exposed in the central portion of the northwest quarter of La Ronde Township and consists of biotite, zoned

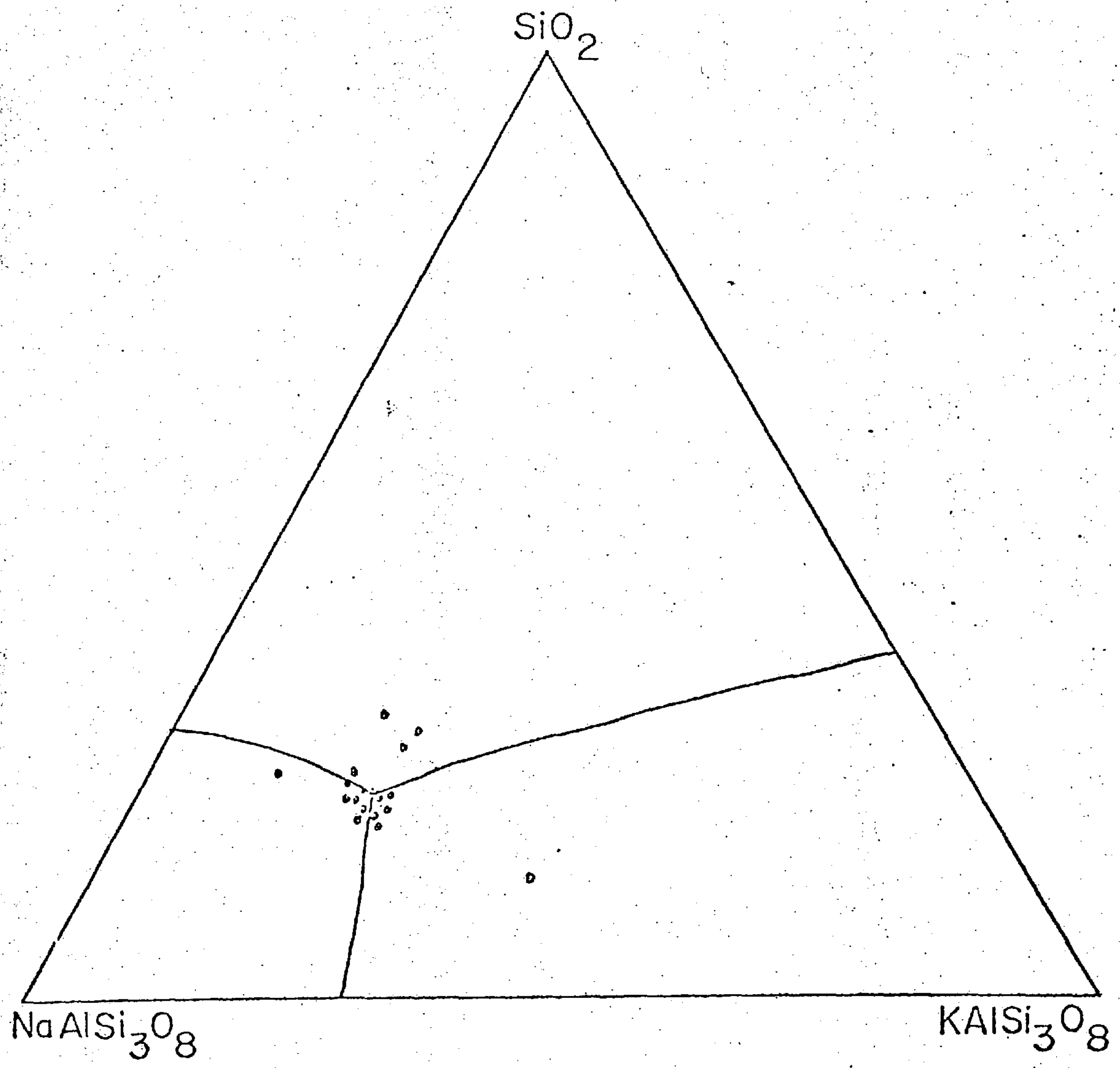

Figure 5. Plot of normative quartz, albite, and orthoclase (wt. %) in rocks of the La Ronde Lake Pluton. 10kb diagram of Luth and others (1964).

Table 1. Chemical Analyses of the La Ronde Lake Pluton

SiO_2	61.5	66.1	67.6
TiO_2	0.03	0.02	0.02
Al_2O_3	14.5	15.5	15.9
Fe_2O_3	1.07	0.22	0.17
FeO	0.90	0.34	0.24
MnO	0.05	0.04	0.03
MgO	1.40	0.43	0.58
CaO	3.55	2.69	2.28
Na_2O	4.60	5.59	5.44
K_2O	3.85	2.96	3.06
Total	91.45	93.85	95.32

1. Average of two analyses: hornblende monzonite
2. Average of three analyses: hornblende quartz monzonite
3. Average of 13 analyses: porphyritic hornblende quartz monzonite

plagioclase (An 28 core, An 20 rim *), quartz, perthite, muscovite, and epidote. Accessory minerals are apatite, sphene, and zircon. Hornblende granodiorite is the other rock type. In hand specimen this rock is medium grained and has a salt and pepper appearance. Mineralogically it consists of partially saussuritized plagioclase (An 30*), quartz, hornblende ($Z \wedge c = 24°$) with a pleochroic formula x = straw yellow, y = blue green, and z = olive green, biotite, epidote, and chlorite. The accessory minerals are apatite, magnetite, and muscovite.

Structure

Pillow structures, scoriaceous flow tops, graded bedding, and the stratigraphy of the Opawica River Complex are the top and bottom criteria used to resolve the structure. In the northern portion of the study area stratigraphic tops face north while in the metatuffs to the south stratigraphic tops face south. The resulting structure is an anticline (Opawica River Anticline) with the Opawica River Pluton exposed in the axial zone. Observed dips are nearly vertical with the shallowest dips being approximately 70°. These steep dips indicate that the anticline is isoclinal. S_2 crenulation cleavages were observed locally in the metatuffs, but with less than six readings it is impossible to resolve this fabric element.

Three faults having the same general trend (N2)E-N30E) were mapped.

CHAPTER III

OPAWICA RIVER COMPLEX

The Opawica River Complex has been divided into two zones (Plates 1 and 2); an Anorthosite Zone, stratigraphically the lowest exposed portion of the complex, and a Gabbro-Ferropyroxenite Zone which encompasses the upper portion of the complex. The Anorthosite Zone has a maximum outcrop width of 12,000 feet (3650 meters). Lithologies within the Anorthosite Zone (Analyses 2-29; Appendix II) are (in decreasing abundance): gabbroic anorthosite, anorthositic gabbro, and gabbro. The Gabbro-Ferropyroxenite Zone (Analyses 30-34; Appendix II) consisting of gabbro, ferropyroxenite, and diabase has a maximum outcrop width of 3000 feet (900 meters). Since the rocks are nearly vertical, outcrop width is nearly the same as the true thickness.

Textural Relations and Layering

Textural Relations

With the exception of the diabases within the Gabbro-Ferropyroxenite Zone, rocks of the Opawica River Complex are cumulates (usage of Wager & Brown, 1967). In other stratiform complexes (Bushveld Complex, Stillwater Complex, and Skaergaard Intrusion) the accumulated crystals are either plagioclase, orthopyroxene, olivine, Fe-Ti oxides, chromite, and apatite, but in the Opawica River Complex plagioclase and clinopyroxene are the only cumulate phases. Grain size varies from 1 mm (Figure 6) to over 15 cm (Figure 7). Another cumulus texture that is prevalent in the Anorthosite Zone is a hiatal texture characterized by two distinct sizes in the plagioclase crystals (Figure 8). This texture could result from having two generations of plagioclase crystals. Primary pyroxene replaced by metamorphic amphibole is generally intercumulus of the plagioclase and forms large blastopoikilitic[2] crystals. Fe-Ti oxides form intercumulus grains. Cameron (1969) suggests that post-cumulus changes in cumulus minerals could make minerals appear "intercumulus." It is possible that post-cumulus changes affected the oxides in the Opawica River Complex in this manner, but there is no textural evidence to support this theory. The diabases have an ophitic texture and occasionally contain megacrysts of plagioclase (Figure 9).

Layering

Three types of layering in plutonic igneous rocks defined by Wager and Deer (1939) were rhythmic, cryptic, and igneous lamination. Hess (1960) defined two other types of layering, phase layering and inch-scale layering, based on observations of the Stillwater Complex, Montana.

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[2]The suffix blasto- refers to igneous textures that have survived metamorphism, but the original igneous mineral has been replaced by a metamorphic mineral.

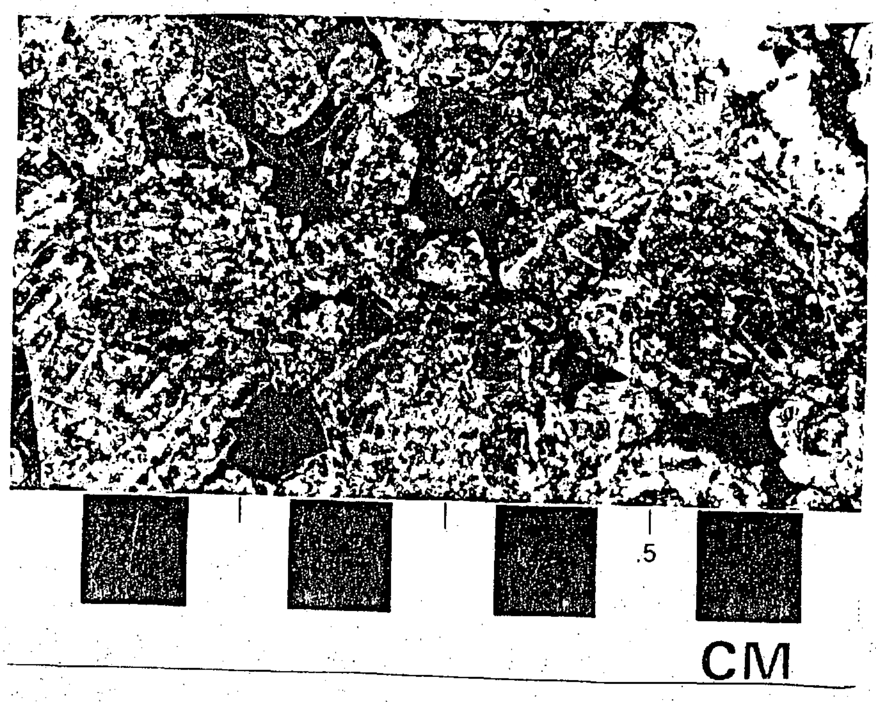

Figure 6. Photograph of a polished slab of a gabbroic anorthosite sample 73BM164 displaying cumulus texture. The light phase is plagioclase and the dark intercumulus phase is actinolite replacing primary pyroxene.

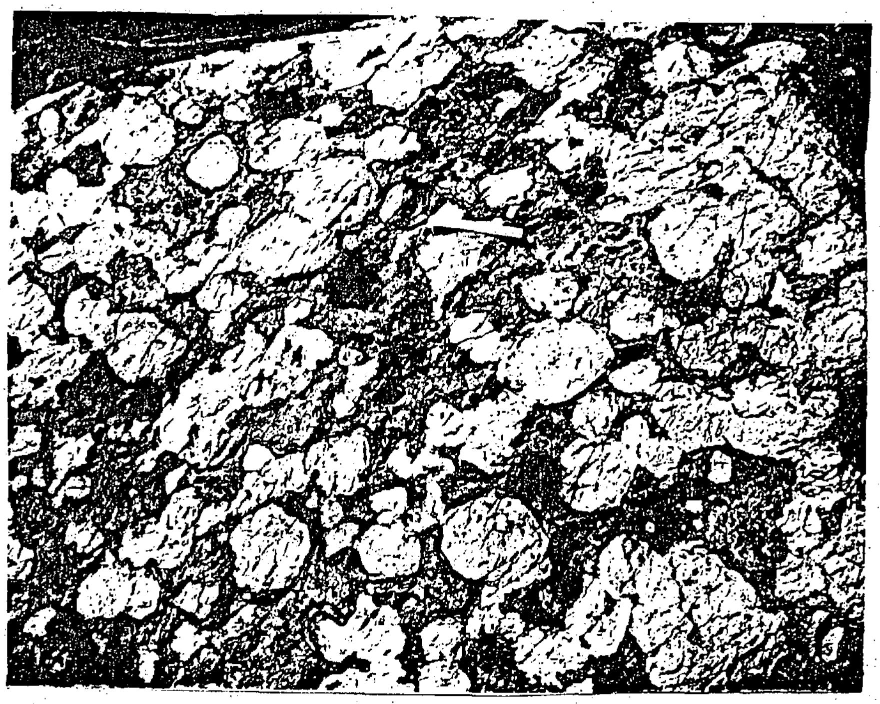

Figure 7. Photograph of an outcrop of coarse grained anorthositic gabbro exhibiting cumulus texture. The light phase is cumulus plagioclase and the dark phase is intercumulus actinolite replacing primary pyroxene. Photograph taken along a logging road in La Ronde Township. Six inch rule is shown for scale.

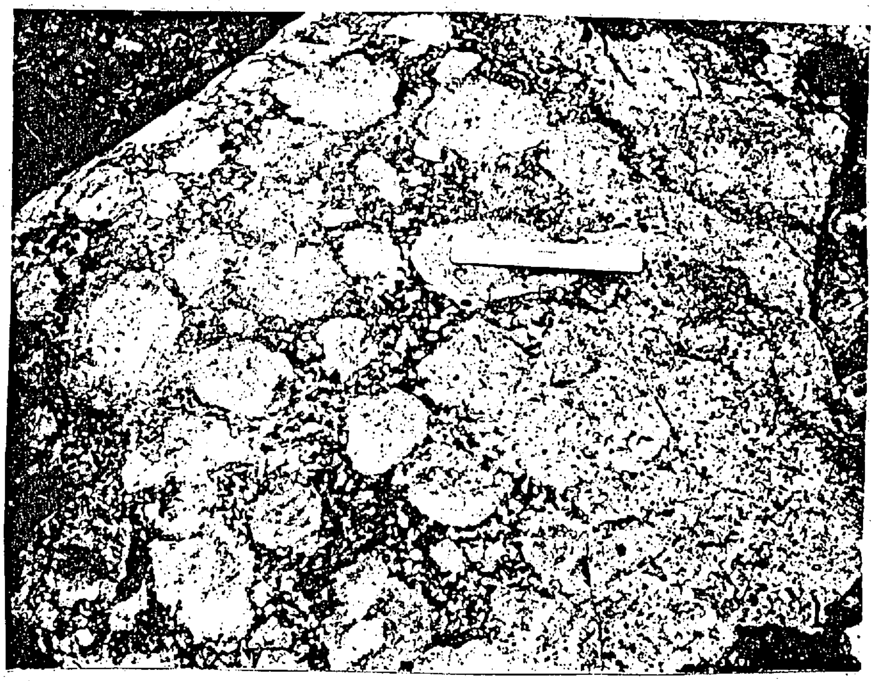

Figure 8. Photograph of an outcrop displaying hiatal texture in gabbroic anorthosite. Note the two distinct sizes of plagioclase (light). Photograph taken along a logging road in La Ronde Township. Six inch rule is shown for scale.

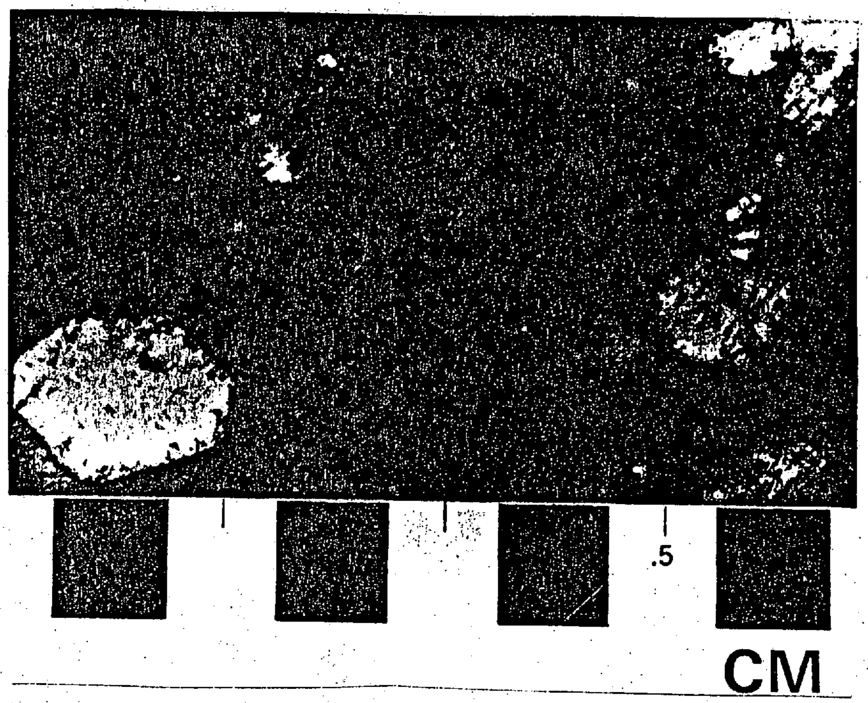

Figure 9. Photograph of a polished slab of sample 73BM174 displaying megacrysts of plagioclase in a diabase from the Gabbro-Ferropyroxenite Zone.

Within the Opawica River Complex rhythmic, cryptic, and inch-scale layering were observed. On the outcrop scale, layering results from either a difference in the mafic to felsic ratio (Figure 10), and/or a difference in grain size (Figures 11 and 12). Slightly irregular layering (Figure 13) and possible igneous cross-bedding (Figure 14) were also observed. Cryptic layering will be discussed in another section.

Anorthosite Zone

Rocks of the Anorthosite Zone consist of gabbroic anorthosite, gabbro and anorthositic gabbro. Gabbroic anorthosite is the most common lithology. The rocks are coarse gained with the grain size varying from 1 mm to 15 cm. Cumulus textures are common and layering is well developed.

Plagioclase (An 84-76+) is generally unaltered and is the dominant cumulus phase. Metamorphic amphiboles have replaced primary intercumulus pyroxene, but remnant pyroxenes are locally preserved.

Mineralogy

The essential minerals are plagioclase (50-90%), actinolite (5-45%), clinozoisite (0-10%), chlorite (0-5%), magnetite, and ilmenite (0-25%). Minor constituents are augite, sphene, and sericite (Table 2). The sericite in the rocks may be paragonite since the rocks are low in K_2O (Table 3).

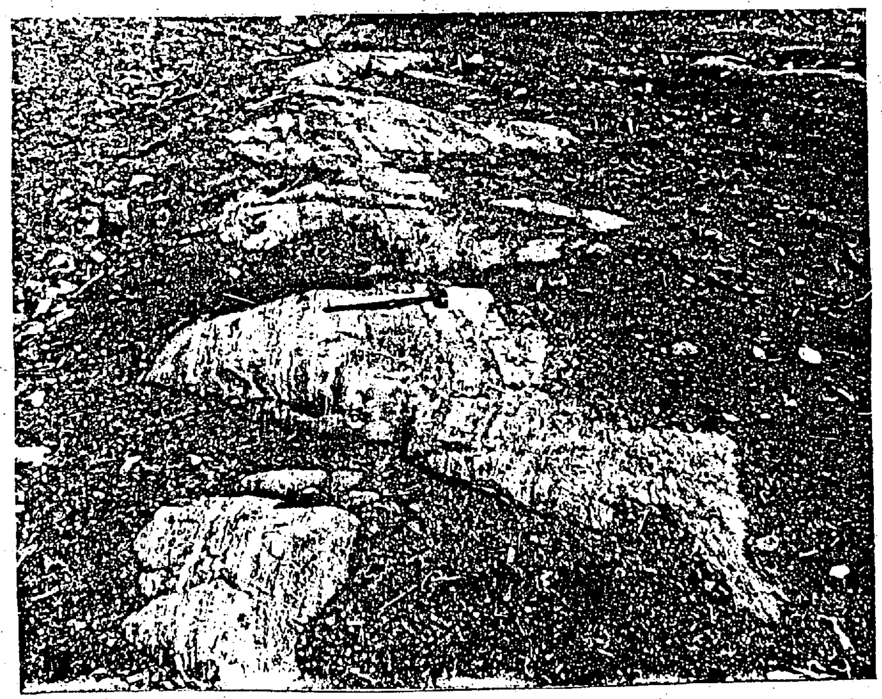

Figure 10. Inch-scale layering in gabbro of the Anorthosite Zone. Outcrop is along a logging road in La Ronde Township. The geologic hammer is shown for scale. Layering is the result of a difference in mafic to felsic ratio.

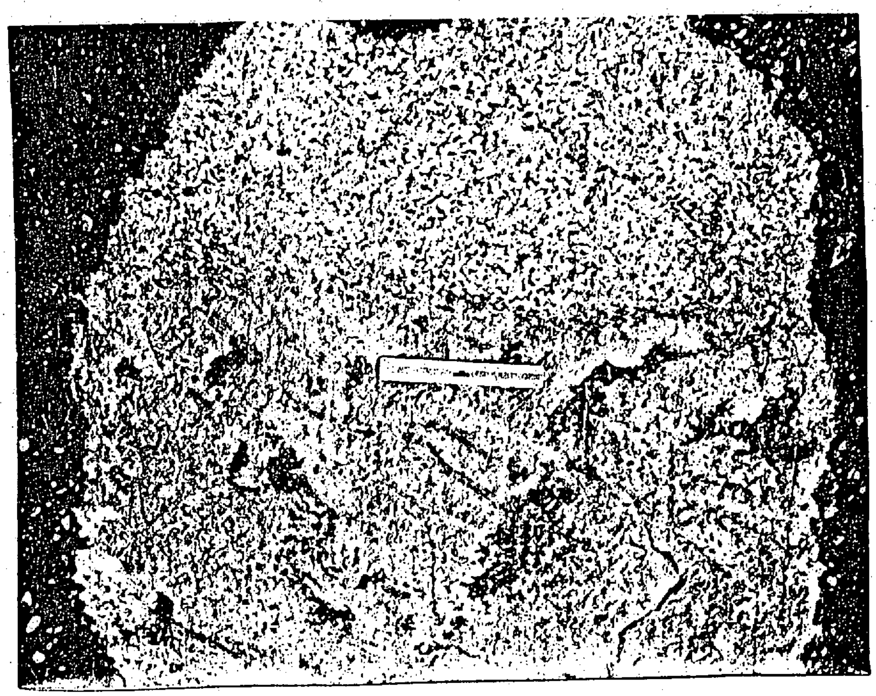

Figure 11. Layering in the Anorthosite Zone resulting from a difference in mafic to felsic ratio and grain size difference. Photograph taken along a logging road in La Ronde Township. Six inch rule is shown for scale. A well developed cumulus texture can be seen in the gabbroic anorthosite in the upper portion of the photograph. The lower portion of the photograph is an anorthosite. The light colored mineral is plagioclase which forms the cumulus grains. The dark mineral is actinolite which replaces primary intercumulus pyroxene.

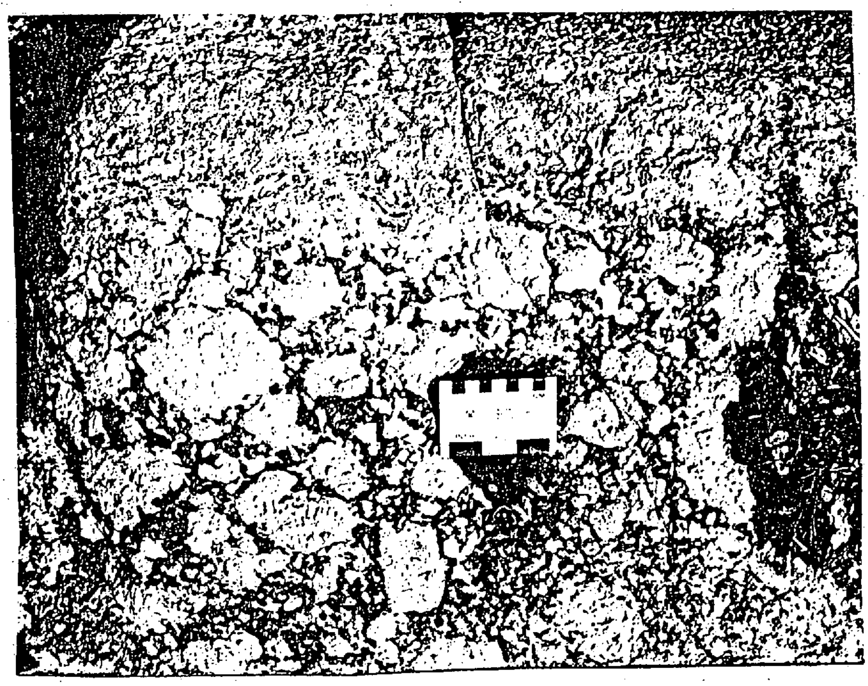

Figure 12. Layering in the Anorthosite Zone resulting from a difference in grain size and mafic to felsic ratio. Photograph taken along a logging road in La Ronde Township. Three-inch rule is shown for scale. A hiatal texture is developed in the lower portion of the picture. The dark mineral is actinolite that has replaced primary intercumulus pyroxene. The light mineral is cumulus plagioclase.

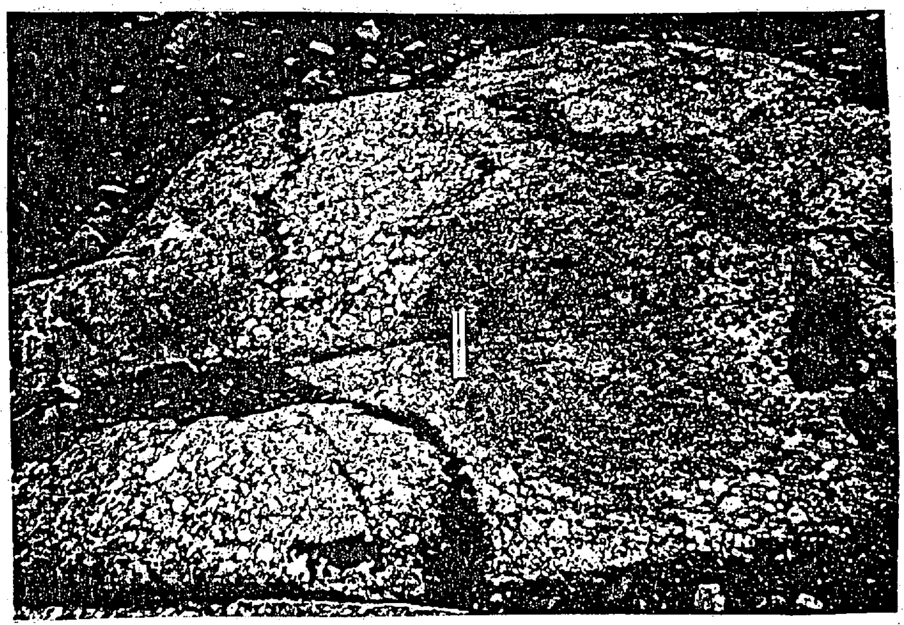

Figure 13. Irregular layering in the Anorthosite Zone resulting from a difference in mafic to felsic ratio. Photograph taken along a logging road in La Ronde Township. Six-inch rule is shown for scale. The large light colored mineral is plagioclase. The dark mineral is actinolite that replaced primary intercumulus pyroxene.

Figure 14. Possible igneous cross-bedding in the Anorthosite Zone. Photograph taken along a logging road in La Ronde Township. Geologic hammer in the upper part of the outcrop is shown for scale. The rocks in the upper portion dip from top to bottom while the rocks in the lower portion dip from left to right.

Table 2. Modal Analyses of Selected Rocks from the Anorthosite Zone

	1	2	3	4	5	6
Plagioclase	80	75	65	45	40	40
Actinolite	10	20	15	25	35	45
Chlorite	5	1	1	1	1	1
Clinozoisite-epidote	5	3	4	8	3	9
Magnetite-ilmenite	0	1	tr	0	15	0
Sphene	0	tr	0	0	1	2
Sericite	0	0	tr	1	0	3

1. 74AM5 gabbroic anorthosite
2. 74RA125 gabbroic anorthosite
3. 74AM147 gabbroic anorthosite
4. 74AM64 gabbroic anorthosite
5. 74AM83 gabbro
6. 74RA39 gabbro

Percentages based on visual estimates.

Table 3. Chemical analyses of rocks from the Anorthosite Zone of the Opawica River Complex and Anorthositic Rocks from the Skaergaard Intrusion and the Bushveld Complex

	1	2	3	4	5	6	7	8	9	10	11	12	13
SiO_2	45.7	46.5	48.1	47.1	43.4	42.6	47.2	47.1	47.6	45.7	45.1	44.0	45.3
TiO_2	0.18	0.21	0.83	1.61	2.63	1.10	0.49	0.24	0.39	0.19	0.14	0.23	0.19
Al_2O_3	27.7	10.1	9.5	11.2	14.2	12.6	9.8	22.7	22.0	25.9	25.3	17.8	29.7
Fe_2O_3	1.12	7.15	6.27	5.94	7.85	7.59	4.79	3.07	2.27	1.97	2.41	4.99	1.23
FeO	1.04	8.51	5.25	11.73	11.38	8.63	4.03	2.65	3.90	1.70	2.08	4.31	1.23
MnO	0.04	0.22	0.17	0.22	0.14	0.28	0.09	0.11	0.12	0.06	0.07	0.14	0.03
MgO	4.58	8.25	8.45	8.95	6.35	7.80	8.25	7.25	4.05	3.60	4.50	9.90	1.05
CaO	16.65	12.65	11.50	10.50	9.50	8.60	15.90	8.60	12.90	15.10	14.85	11.60	16.65
Na_2O	2.25	1.40	1.20	2.23	1.61	2.01	1.50	2.08	2.26	2.04	2.10	1.03	2.60
K_2O	0.43	0.13	0.21	0.38	0.47	1.10	0.18	0.63	0.25	0.42	0.13	0.00	0.04
Total	99.69	95.12	91.48	99.36	97.53	92.31	92.23	94.43	95.74	96.68	96.68	94.00	98.02

1. 74AM95, Anorthositic Gabbro
2. 74AM195, Gabbro
3. 74AM1B, Gabbro
4. 74AM63, Gabbro
5. 74AM92, Gabbro
6. 74RA55, Gabbro
7. 74AM181, Gabbro
8. 74RA39, Gabbro
9. 74AM5, Gabbroic Anorthosite
10. 74FA63, Gabbroic Anorthosite
11. 74AM104, Gabbroic Anorthosite
12. 73BM39A, Gabbroic Anorthosite
13. 74AM191, Gabbroic Anorthosite

FeO and Fe_2O_3 are calculated by using the method of Carman et al., 1975. Ratios are based on known FeO and Fe_2O_3 on rocks from the Opawica River Complex. See Appendix I for analytical procedures.

Table 3 (continued)

	14	15	16	17	18	19	20	21	22	23	24	25	26
SiO_2	50.1	45.7	46.4	47.7	46.8	46.2	45.5	44.1	46.2	46.5	45.3	36.9	44.0
TiO_2	0.43	0.18	0.19	0.20	0.20	0.58	0.24	0.21	0.19	0.21	0.20	0.19	0.21
Al_2O_3	19.0	25.7	24.2	26.0	30.8	29.4	25.8	26.9	26.4	33.5	28.7	29.9	27.6
Fe_2O_3	3.29	1.37	2.52	1.92	1.15	1.21	2.76	2.03	2.80	1.50	2.47	1.64	2.08
FeO	2.84	1.18	2.18	1.66	0.99	1.04	2.20	1.75	2.42	0.71	2.13	2.39	1.80
MnO	0.18	0.04	0.07	0.04	0.03	0.01	0.08	0.06	0.05	0.04	0.07	0.03	0.04
MgO	1.00	1.45	2.00	2.55	1.50	0.55	2.90	3.00	4.80	1.45	3.30	4.40	3.00
CaO	14.45	13.85	17.75	17.00	14.35	16.60	15.15	16.15	13.90	15.90	14.35	15.50	16.40
Na_2O	2.70	3.93	1.95	2.12	2.38	3.40	2.28	1.96	1.62	2.26	1.50	2.05	1.50
K_2O	0.28	0.09	0.00	0.00	0.00	0.00	0.23	0.00	0.03	0.03	0.03	0.13	0.00
Total	94.27	93.49	97.26	99.19	98.20	98.99	97.14	96.16	98.41	102.10	98.80	103.13	96.63

14. 74AM199, Anorthositic Gabbro
15. 74RA124, Gabbroic Anorthosite
16. 73BM118, Gabbroic Anorthosite
17. 73BM164A, Gabbroic Anorthosite
18. 73BM110B, Gabbroic Anorthosite
19. 73BM38, Gabbroic Anorthosite
20. 74AM17, Gabbroic Anorthosite
21. 73BM168, Gabbroic Anorthosite
22. 74AM172, Gabbroic Anorthosite
23. 74AM102, Gabbroic Anorthosite
24. 74AM64, Gabbroic Anorthosite
25. 74AM147, Gabbroic Anorthosite
26. 73BM167, Gabbroic Anorthosite

Table 3 (continued)

	27	28	29	30	31	32	33	34	35
SiO_2	46.0	44.6	48.9	47.5	53.3	50.5	49.5	48.9	50.7
TiO_2	0.21	0.23	0.00	0.00	0.10	0.10	0.05	0.10	0.50
Al_2O_3	27.8	17.2	30.0	32.3	23.3	27.4	21.8	26.5	25.5
Fe_2O_3	2.08	6.99	0.50	0.70	0.95	1.10	0.00	0.45	1.11
FeO	1.80	5.87	1.30	0.38	2.15	1.55	4.45	2.45	4.07
MnO	0.06	0.18	0.00	0.19	0.00	0.20	0.00	0.00	0.16
MgO	3.25	8.50	0.55	0.38	0.85	0.15	11.05	4.25	1.90
CaO	16.25	9.95	16.90	16.00	11.15	12.90	12.45	14.05	11.74
Na_2O	2.00	0.78	1.95	1.92	4.35	3.85	0.90	2.10	3.54
K_2O	0.00	0.26	0.15	0.43	1.95	0.50	0.05	0.00	0.36
Total	99.45	94.56	100.25	99.84	98.00	98.20	100.20	98.70	99.57

27. 74RA125, Gabbroic Anorthosite
28. 74AM4, Gabbroic Anorthosite
29. Anorthosite, Critical Zone, Bushveld Complex, Analysis I, p. 104, Analyses of Rocks, Minerals, Ores, Coal, Soil, and Waters from South Carica, Mem. Geol. Surv. S. Afr., 32, 876 pp.
30. Anorthosite, Critical Zone, Bushveld Complex, Analysis III, p. 104, same reference as 29.
31. Anorthosite, Main Zone, Bushveld Complex, Analysis IV, p. 104, same reference as 29.
32. Mottled Anorthosite, Main Zone, Bushveld Complex, Analysis V, p. 104, same reference as 29.
33. Anorthositic Norite, Bushveld Complex, Analysis VI, p. 104, same refernce as 29.
34. Spotted Anorthositic Hanging Wall Norite, Bushveld Complex, Analysis VII, same reference as 29.
35. Leucocratic Laer LZa, Skaergaard Intrusion, Analysis III, Table 5, p. 152, Layered Igneous Rocks, 588 pp.

Polysynthetically twined plagioclase occurs as euhedral cumulus grains varying in size from 1 mm -15 cm. The contacts between plagioclase and blasto-intercumulus actinolite commonly have a border of clinozoisite (Figure 15). Clinozoisite is also present along cracks and fractures in plagioclase and, locally, as pseudomorphs of primary plagioclase.

Metamorphic actinolite ($Z \wedge c \simeq 11°-20°$, Analyses 1, 2, 3, Table 4) has a pleochroic formula x = straw yellow, y = green, and z = blue green. Granoblastic and blasto-poikilitic varieties (Figure 16 A and B) are always intercumulus to plagioclase.

Remnant primary clinopyroxene (Analyses 4 and 5, Table 4) were identified. All observed clinopyroxenes have exsolution lamellae of orthopyroxene (Figure 17) and are altered to actinolite.

Pale green chlorite is present in most thin sections studied. It is pleochroic from colorless to pale green and is length fast. Chlorite is commonly found near or along grain boundaries with plagioclase (Figure 18). This is probably due to the availability of Al from plagioclase during metamorphism, however, chlorite can pseudomorph pyroxene and be intercumulus to plagioclase.

Fe-Ti oxides are found as "intercumulus" grains throughout the Anorthosite Zone. They do not, however, constitute more than 25% by volume (Table 2). Ilmenite is the only oxide observed in the lower half of the zone, while

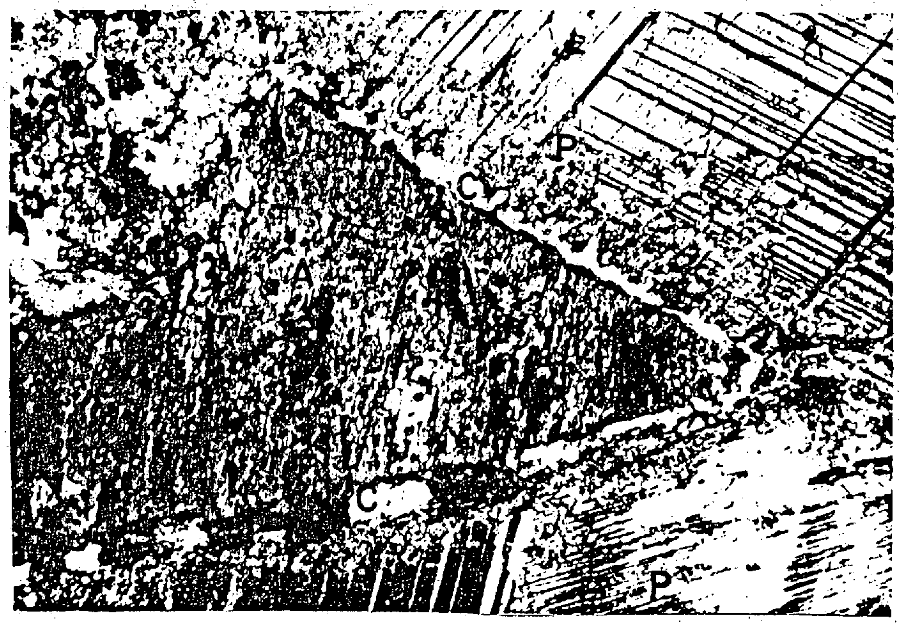

Figure 15. Photomicrograph of gabbroic anorthosite (74 AM95) displaying blasto-intercumulus actinolite (A) with clinozoisite (C) at the grain boundary with cumulus plagioclase (P). Crossed polars, width of field 6.5 mm.

Figure 16A. Photomicrograph of gabbroic anorthosite (74RA125) displaying granoblastic intercumulus actinolite (A) and cumulus plagioclase (P). Crossed polars, width of field 6.5 mm.

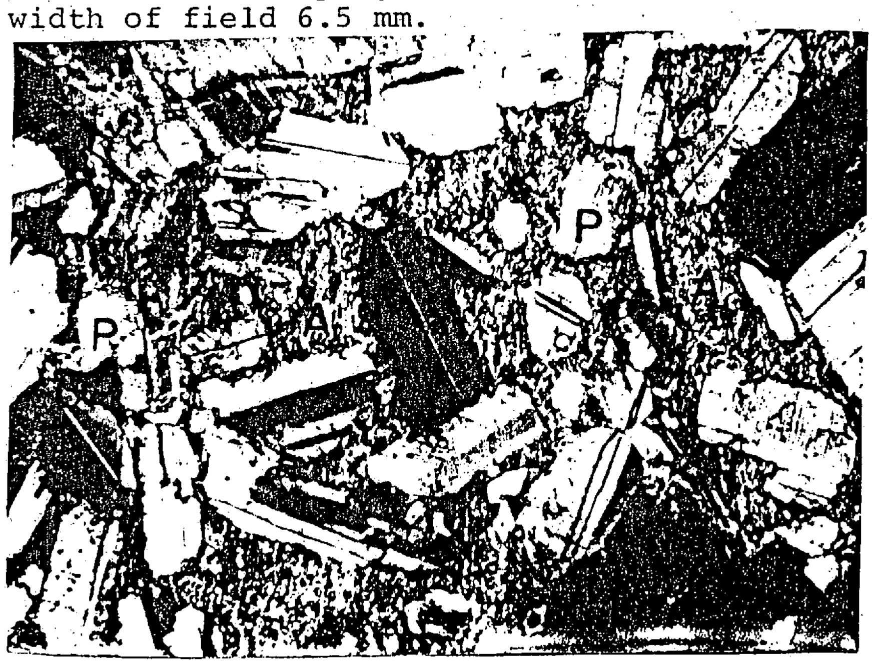

Figure 16B. Photomicrograph of gabbroic anorthosite (74AM147) displaying blastopoikilitic intercumulus actinolite (A) and cumulus plagioclase (P). Crossed polars, width of field 6.5 mm.

Table 4. Electroprobe Analyses of Amphiboles and Pyroxenes from the Anorthosite Zone of the Opawica River Complex

An. No.	1	2	3	4	5
SiO_2	42.2	53.4	50.0	54.9	47.3
Al_2O_3	16.5	4.0	10.0	3.4	2.8
TiO_2	1.0	0.0	0.0	0.0	0.8
FeO	13.5	11.4	13.8	8.2	11.1
MgO	10.8	15.2	12.5	16.8	14.8
CaO	11.8	12.9	11.3	14.5	19.3
Total	95.8	96.9	97.6	97.8	96.1

Analysis No.

1. Sample 74AM17, Actinolite ($z \wedge c=20$, x = pale yellow, y = green, z = bluish green)
2. Sample 74AM95, Actinolite
3. Sample 74AM64, Actinolite ($z \wedge c=17$, x = pale yellow, y = green, z = bluish green)
4. Sample 74AM95, Diopsidic augite
5. Sample 74RA 55, Diopsidic augite

See Appendix for analytical procedures.

Figure 17. Photomicrograph of a gabbro (74RA55). Clinopyroxene (CPX) that has been partially replaced by actinolite (A). Horizontal lines are exsolution lamellae of orthopyroxene. The diagonal lines are cleavage traces. Crossed polars, width of field 3 mm.

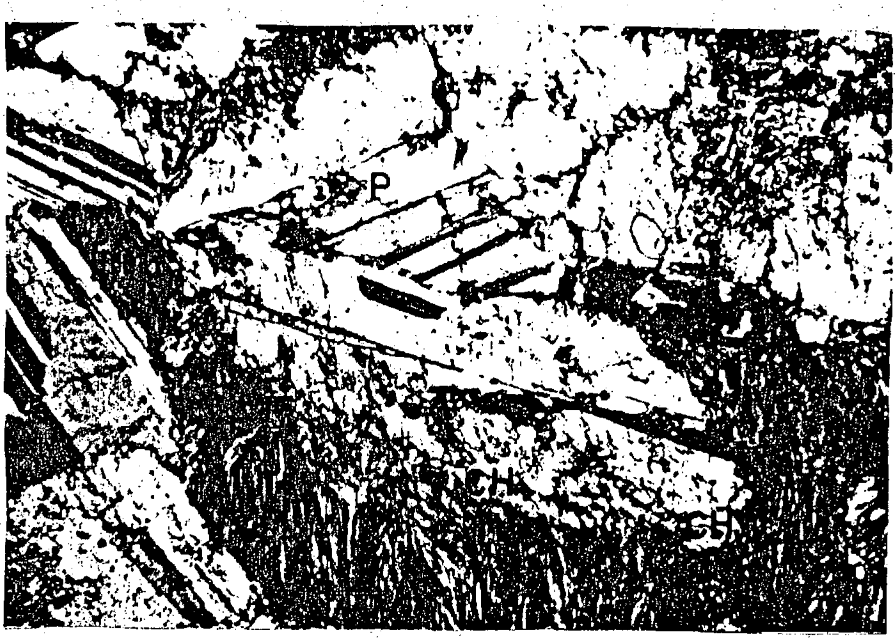

Figure 18. Photomicrograph of gabbroic anorthosite (74AM5). Blasto-intercumulus actinolite (A) with a border of chlorite (CH) at grain boundaries with cumulus plagioclase (P). Crossed polars, width of field 6.5 mm.

magnetite and ilmenite occur in the upper half. In reflected light, ilmenite is grey brown in color and strongly anisotropic while magnetite is grey in color and isotropic. Magnetite grains generally contain exsolution lamellae of ilmenite (Figure 19). Ilmenite also occurs as discrete grains. In some instances, magnetite is replaced by epidote and chlorite, but lamellae of ilmenite may still be identifiable (Figure 20).

Sphene and sericite are accessory minerals. Sericite is found associated with plagioclase. In some cases, the sericite may be paragonite since the rocks have very low concentrations of K_2O. Sphene commonly occurs as a fine dust in actinolite, and probably formed from the release of T_i in the reaction titanaugite + H_2O = actinolite + sphene. It is also found as a replacement product of ilmenite.

Gabbro-Ferropyroxenite Zone

The Gabbro-Ferropyroxenite Zone (Plate 2) is exposed only in La Ronde Township. Metagabbro, metaferropyroxenite, and metadiabase are the major rock types that constitute the zone. The rocks are generally finer grained than those of the Anorthosite Zone. The metaferropyroxenites resemble the enclosing metabasalts, however their lack of volcanic features and the abundance of finely disseminated magnetite distinguished them from the metabasalts. The gabbros are dark green and exhibit well developed cumulus textures (Figure 21). The metadiabases have a subophitic texture

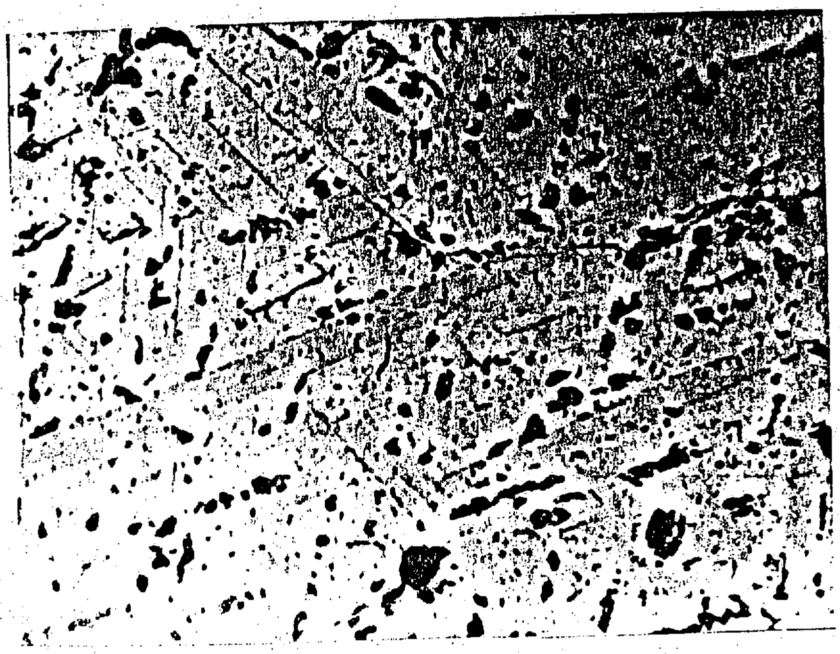

Figure 19. Reflected light photomicrograph of a gabbro (74RA55). Magnetite (M) grain with exsolved lamellae of ilmenite (I). The texture resulted from the oxidation of magnetite.

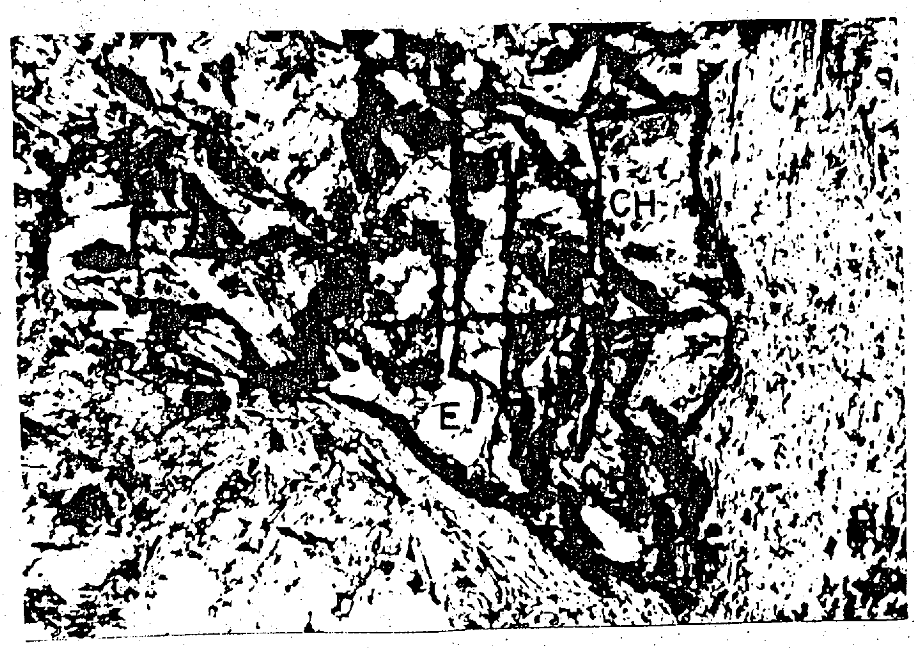

Figure 20. Photomicrograph of anorthositic gabbro (74AM195). Shown is an original grain of titaniferous magnetite that has been replaced by epidote (E), and chlorite (CH) leaving only the ilmenite (I) lamellae. Plain light, width of field 6.5 mm.

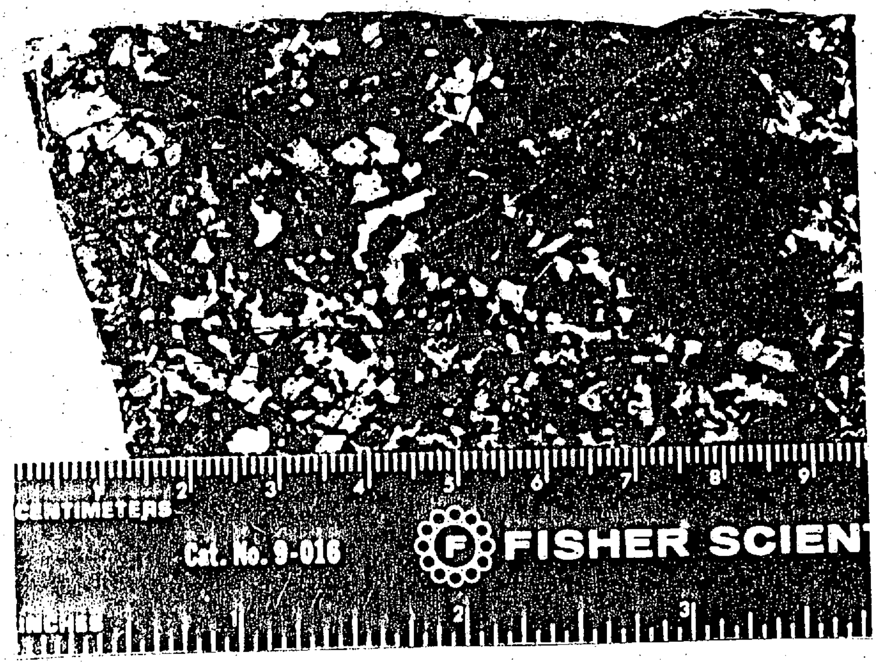

Figure 21. Polished slab of gabbro (74RA144) displaying cumulus texture. Note the intercumulus nature of the plagioclase (light) and the cumulus actinolite and pyroxene (dark).

and megacrysts of plagioclase (Figure 9) are common. Metamoprhism appears to have produced more extensive recrystallization in rocks within the Gabbro-Ferropyroxenite Zone than in those of the Anorthosite Zone.

Mineralogy

The principal minerals of the Gabbro-Ferropyroxenite Zone are plagioclase, actinolite, clinozoisite-epidote, chlorite, and Fe-Ti oxides. Minor constituents are ferrohastingsite, clinopyroxene, and quartz.

Polysynthetically twinned plagioclase (An 69+) occurs in the gabbros both as cumulus and intercumulus grains. The plagioclase in the metaferropyroxenites and diabases is generally saussuritized.

Metamorphic actinolite and ferroactinolite are present as pseudomorphs of primary clinopyroxene. These amphiboles vary in color from green to pale green to yellow (Analyses 1, 2, 3, Table 5).

Ferrohastingsite occurs associated with lamellae of ilmenite (Figure 22). This amphibole has a 2V of 10-40° and is strongly pleochroic: x = straw yellow, y = dark green, z = dark bluish green. It is thought that ferrohastingite formed from the reaction: plagioclase + magnetite + augite + water = ferrohastingsite. Baskin (1975) reports ferrohastingsite from the Dore Lake Complex and writes a similar reaction: plagioclase + magnetite + ferroaugite = ferrohastingsite. Electron microprobe analysis of

Table 5. Electron Microprobe Analyses of Amphiboles and Pyroxenes from the Gabbro-Ferropyroxenite Zone of the Opawica River Complex

An. No.	1	2	3	4	5	6
SiO_2	44.8	47.2	56.6	40.6	51.9	51.2
TiO_2					0.9	0.9
Al_2O_3	12.8	10.2	1.4	10.8	2.7	2.5
FeO	21.0	21.0	13.2	23.8	10.4	10.0
MgO	6.6	9.0	15.2	7.5	13.8	13.0
CaO	11.6	11.6	13.9	9.4	21.6	21.6
K_2O				0.3		
Na_2O				1.3		
V_2O_3				1.1		
Total	96.8	99.0	100.3	94.8	101.3	99.2

Analysis No.

1. Sample 74RA30, Ferroactinolite ($z \wedge c$=19, x = yellow, y = green, z = blue green)
2. Sample 74RA30, Ferroactinolite
3. Sample 74RA144, Actinolite ($z \wedge c$=17, x = pale green, y = yellow, z = bluish green)
4. Sample 74RA143, Ferrohastingsite ($z \wedge c$=13, x = yellow, y = dark green, z = dark bluish green)
5. Sample 74RA144, Diopsidic augite ($z \wedge c$=42)
6. Sample 74RA144, Diopsidic augite

See Appendix for analytical procedures.

Figure 22. Photomicrograph of gabbro (74RA143) showing ferrohastingsite (FH) replacing magnetite, but the lamellae of ilmenite still remains. Plain light, width of field 6.5 mm.

ferrohastingsite (Analysis 4, Table 5) reveals an appreciable amount of V_2O_3. Magnetites from the Opawica River Complex contain considerable amounts of vanadium (Table 8) while pyroxenes contain no vanadium (Table 5). The vanadium content of the ferrohastingsite and its association with lamellae of ilmenite suggests that magnetite supplied much of the needed iron to form ferrohastingsite.

Chlorite is more strongly colored than chlorite from the Anorthosite Zone and varies from pale green to green. It has anomalous Berlin blue interference colors and is length fast.

Fe-Ti oxides occur as "intercumulus" grains with similar textural relations as described in the Anorthosite Zone. Ilmenite is grey brown and strongly anisotropic while magnetite is isotropic. Sphene occurs as an alteration of ilmenite (Figure 23).

Remnant primary clinopyroxene identified as augite was observed in one thin section. It occurs as cumulus grains that exhibit various stages of alteration to actinolite (Figure 24).

Cryptic Variations

Hess (1960) describes cryptic layering as ". . . the inconspicuous, and for the most part gradual change in composition of mineral phases upward in the intrusive." Plagioclase, clinopyroxene, magnetite, and ilmenite will be used to illustrate cryptic variations within the Opawica River Complex.

Table 6. Chemical Analyses of Rocks from the Gabbro-Ferropyroxenite Zone

An. No.	1	2	3	4	5	6	7	8
SiO_2	44.0	48.7	48.6	47.6	48.4	48.8	47.4	45.4
TiO_2	1.52	1.04	2.25	1.49	0.23	2.10	0.88	1.10
Al_2O_3	10.2	8.0	11.1	13.5	11.9	10.8	15.3	10.4
Fe_2O_3	2.86	2.8	2.0	7.10	4.50	6.10	3.06	3.01
FeO	7.19	9.70	14.64	5.97	3.79	9.27	8.94	7.57
MnO	0.20	0.24	0.25	0.05	0.17	0.21	0.21	0.20
MgO	12.80	10.50	5.05	6.60	6.65	4.45	6.90	11.45
CaO	7.00	14.50	8.30	11.75	11.35	9.60	9.55	4.10
Na_2O	0.25	0.50	2.90	2.38	2.84	0.95	2.58	0.58
K_2O	0.04	0.42	0.20	0.31	0.07	0.01	0.49	0.15
Total	86.06	96.40	95.29	96.75	89.90	92.29	95.31	83.96

1. 74AM74, Metaferropyroxenite
2. 74RA144, Gabbro
3. 74RA30, Metaferropyroxenite
4. 74RA97, Metadiabase
5. 74RA134, Metadiabase
6. 74AM135, Metaferropyroxenite
7. 74RA148, Metadiabase
8. 74RA50, Metaferropyroxenite

See Appendix for analytical procedures.

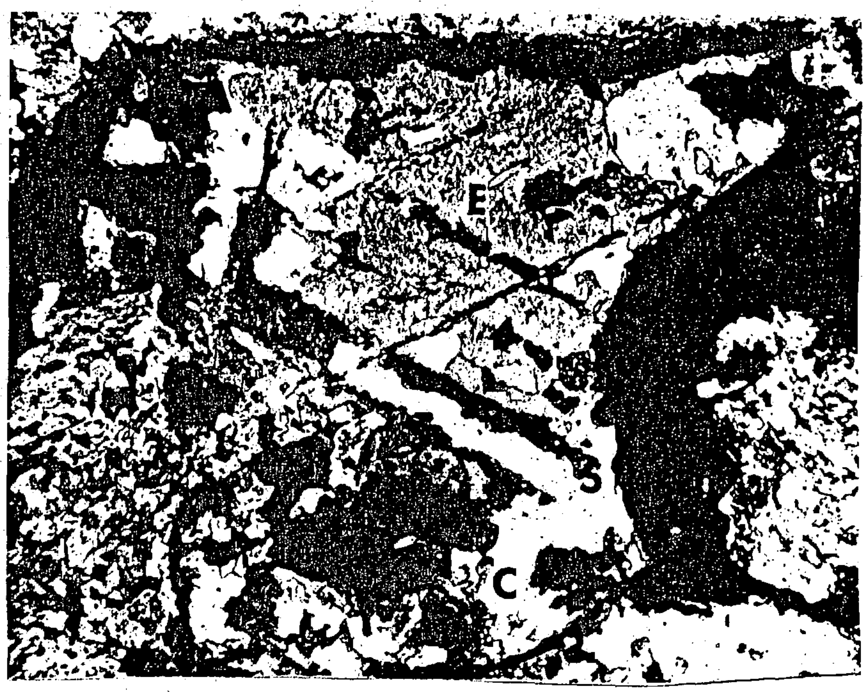

Figure 23. Photomicrograph of a gabbro (74RA144). Sphene (S) has partially replaced lamellae of ilmenite (I) white carbonate (C), epidote (E), and ferrohastingsite (FH) have replaced magnetite. Crossed polars, width of field 3 mm.

Figure 24. Negative representation of a thin section of 74RA144 a gabbro. Cumulus primary clinopyroxene (CPX) is partially replaced by actinolite (A). Plagioclase (P) is intercumulus.

Plagioclase

Plagioclase persists as a cumulus phase throughout the Anorthosite Zone and a portion of the Gabbro-Ferropyroxenite Zone. While plagioclase (An 84-69+) at the top is more sodic than at the bottom, there is no clear trend. There does, however, appear that fluctuations in An content occurs with an increase in structural height (Figure 25). Hess (1960) attributes similar fluctuations in An content of plagioclase in the Stillwater Complex, Montana, to varied rates of crystal accumulation. On the other hand, Wadsworth (1961) attributes fluctuations on anorthite content to the replenishment of the magma chamber by parental magma. It is proposed that Hess's hypothesis best explains this phenomenon in the Opawica River Complex.

Clinopyroxene

Remnant primary intercumulus and cumulus clinopyroxene containing exsolved lamellae of orthopyroxene was identified from the Opawica River Complex. Pyroxenes from the Opawica River Complex (Tables 4 and 5) exhibit a slight iron enrichment trend (Figure 26), however, their most striking compositional variation is in calcium content. The trend is somewhat misleading because the exsolved orthopyroxene was not analyzed.

Fe-Ti Oxides

Three samples containing coexisting magnetite and ilmenite were chosen for analysis in order to illustrate any

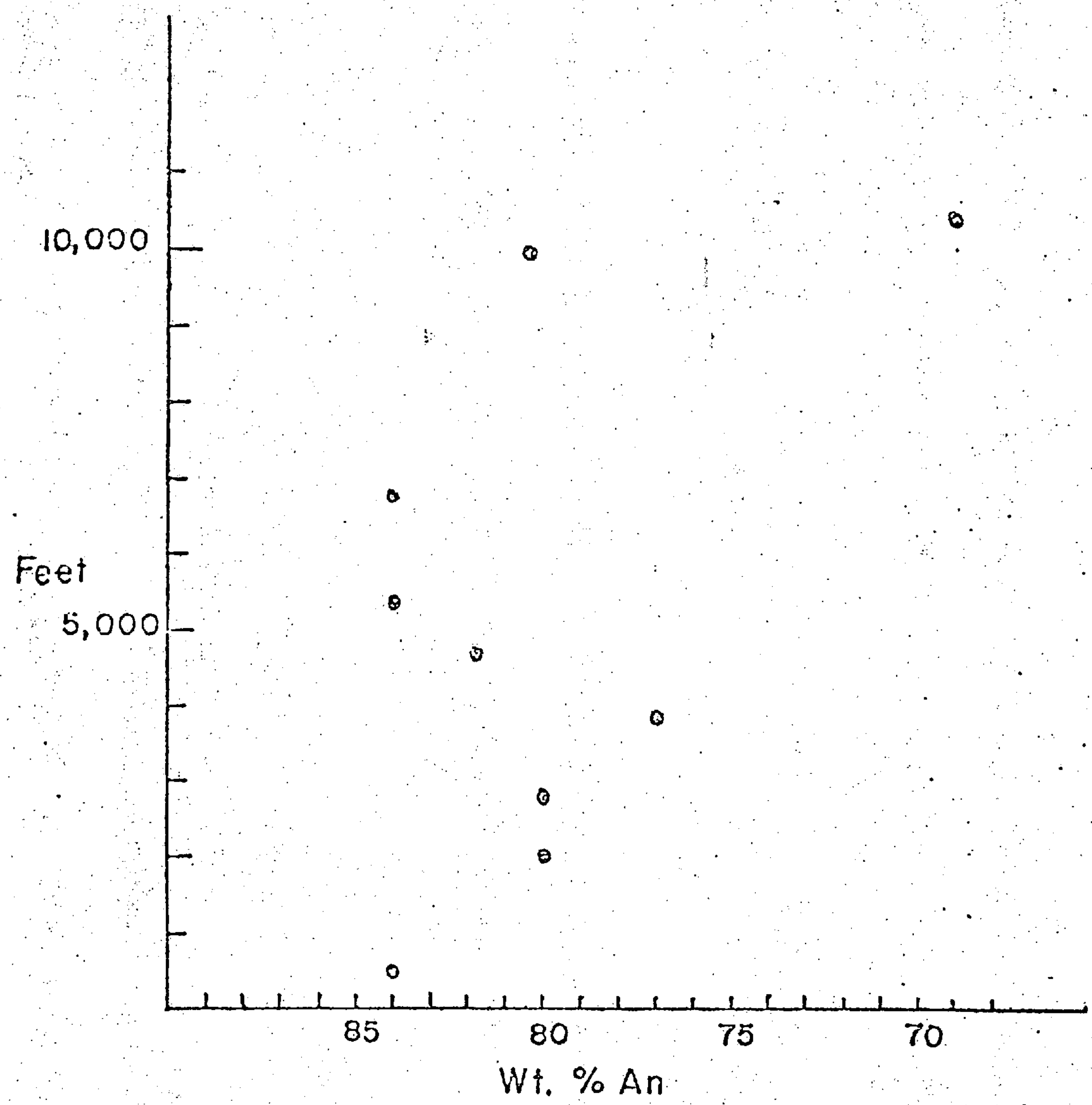

Figure 25. Anorthite content of plagioclase (determined optically) plotted against height above contact with the Opawica River Pluton.

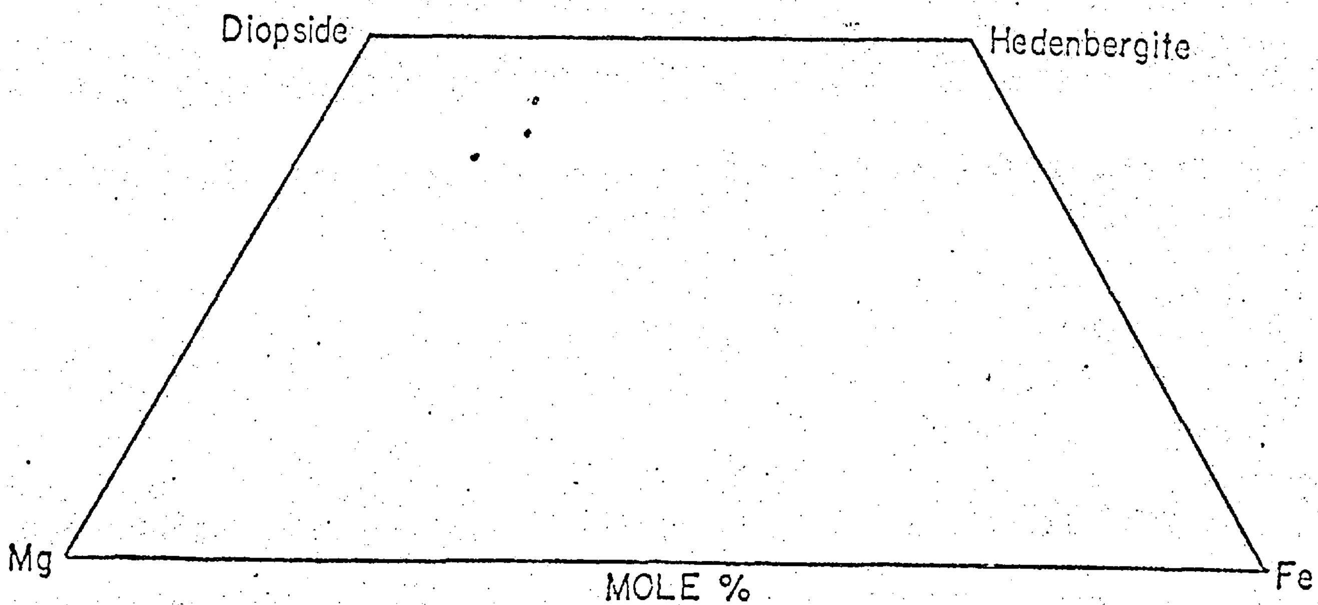

Figure 26. Plot of pyroxenes from the Opawica River Complex.

chemical variation exhibited by the minerals. The analyzed magnetite (Table 8) contained exolved ilmenite which were not included in the analysis.

In Figures 27 and 28 major and minor oxides are plotted against structural height above the level of intrusion of the Opawica River Pluton. Vanadium was discovered to have higher concentrations in the magnetites while the ilmenites had a higher concentration of manganese. A similar relationship exists between the magnetites and ilmenites of the Dore Lake Complex (Caty, 1970).

Geochemistry

One of the purposes of this study was to define the chemical characteristics of the Opawica River Complex. The preservation of original igneous structures and textures (Figures 6, 7, 8, 10, 11, 12, 13, and 14) and the similarity between original minerals and their metamorphic equivalents indicate that metamorphism was essentially isochemical; thus the bulk chemistry of the rocks was unaffected (Table 3). Since cumulate rocks do not represent liquid compositions, only gabbroic rocks were chosen to define the complex chemically.

Several chemical series are recognized in basaltic igneous rocks among these alkaline, calc-alkaline, and tholeiitic. The $(Na_2O + K_2O)/SiO_2$ variation diagram of MacDonald and Katsura (1964) and Kuno (1965) can be used to distinguish the alkaline series from the calc-alkaline and

Table 7. Analyses of Magnetites from the Opawica River Complex, Dore Lake Comples, and Bushveld Complex

Total Fe as FeO	94.6	93.6	91.7	83.92	86.06	81.88	70.78	70.49	63.95
TiO_2	nd	nd	nd	7.02	4.65	5.72	12.36	16.56	18.19
MnO	0.06	0.35	0.28	0.15	0.08	0.12	0.21	0.25	0.37
V_2O_3	2.26	2.05	2.18	1.27	1.33	1.36	0.99	0.41	0.16
Total	96.88	96.03	94.17	92.36	92.12	89.08	84.34	87.71	82.67

1. 74AM92, Opawica River Complex (electron microprobe analysis)
2. 74RA55, Opawice River Complex (electron microprobe analysis)
3. 74AM83, Opawica River Complex (electron microprobe analysis)
4. 3005, Dore Lake Complex (modified from Caty, 1970, p. 102)
5. 3006, Dore Lake Complex (modified from Caty, 1970, p. 102)
6. 3007, Dore Lake Complex (modified from Caty, 1970, p. 102)
7. LG, Bushveld Complex (modified from Wager and Brown, 1967, p. 398)
8. MG, Bushveld Complex (modified from Wager and Brown, 1967, p. 398)
9. UG, Bushveld Complex (modified from Wager and Brown, 1967, p. 398)

nd - not determined

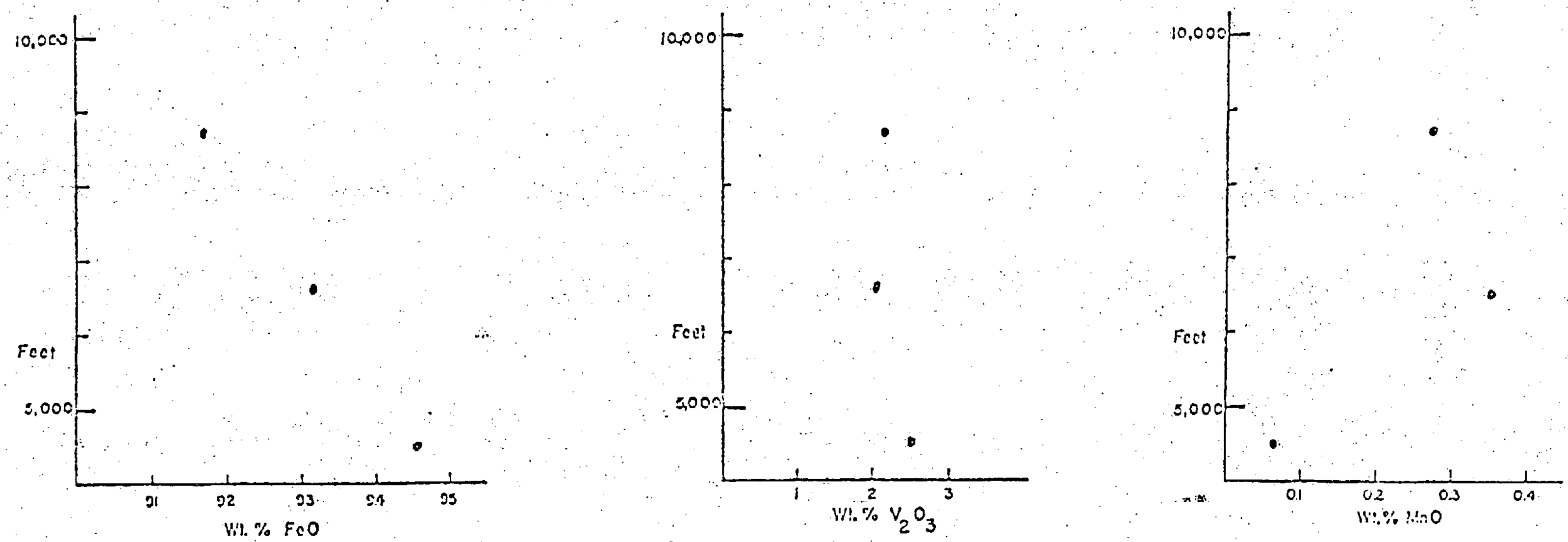

Figure 27. Oxide variation in magnetites from the Opawica River Complex plotted against structural height above the level of intrusion of the Opawica River Pluton.

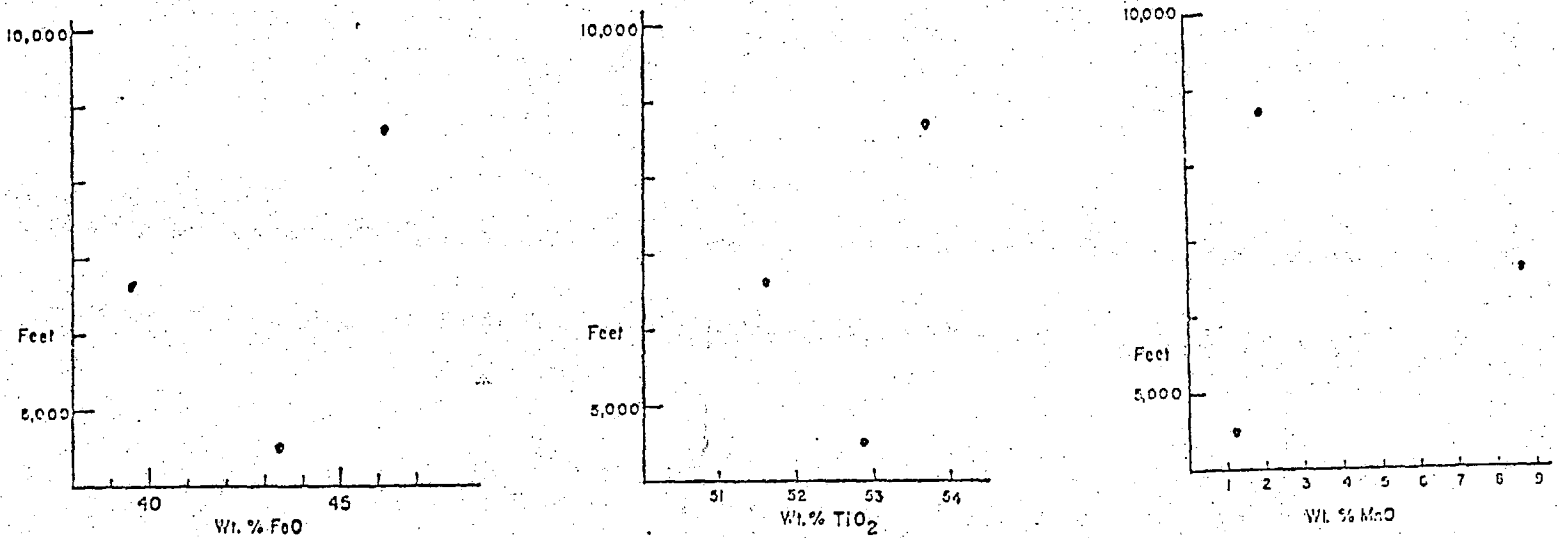

Figure 28. Oxide variation in ilmenites from the Opawica River Complex plotted against structural height above the level of intrusion of the Opawica River Pluton.

tholeiitic series. An AFM diagram can be used to distinguish the tholeiitic series from the calc-alkaline series. The calc-alkaline trend is marked by an alkali enrichment and lime impoverishment while the tholeiitic trend is marked by an iron enrichment as well as an alkali enrichment and lime impoverishment.

The gabbroic rocks of the Opawica River Complex have been plotted on the $(Na_2O + K_2O)/SiO_2$ variation diagram (Figure 29). Most of the analyzed rocks are tholeiitic according to MacDonald and Katsura (1964), but many plot in the high alumina basalt field of Kuno (1965). Oliveira (1963) has described similar chemical characteristics for basalts and gabbros from Chibougamau, and used the SiO_2-Al_2O_3-$(Na_2O + K_2O)$ diagram to resolve this discrepancy. Rocks from the Opawica River Complex are plotted on the SiO_2-Al_2O_3-$(Na_2O + K_2O)$ variation diagram (Figure 30) and all fall within the tholeiitic field.

An AFM diagram was used to distinguish the calc-alkaline series from the tholeiitic series (Figure 31). The chemical variations observed for the rocks of the Opawica River Complex exhibit an iron enrichment trend, but no alkali enrichment. The absence of an alkali enrichment trend like the one exhibited by the Skaergaard Intrusion (Figure 32) can be explained by the absence of granophyric differentiates in the Opawica River Complex. Even though there is no alkali enrichment, the differentiation trend exhibited by the rocks of the Opawica River Complex has tholeiitic affinities.

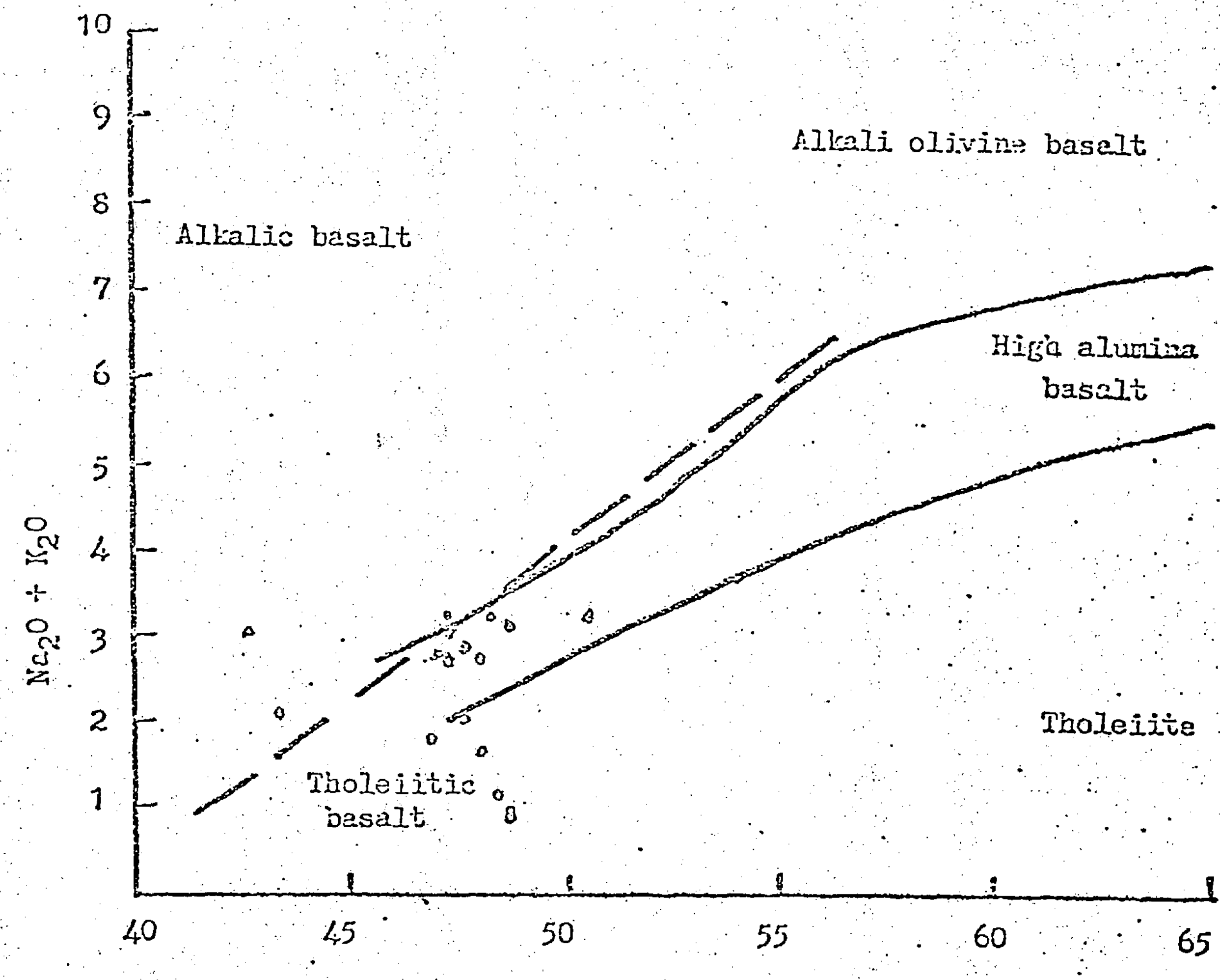

Figure 29. $(Na_2O + K_2O)/SiO_2$ plot for gabbroic rocks of the Opawica River Complex. (*________ after McDonald and Katsura, 1964), (________ after Kuno, 1965).

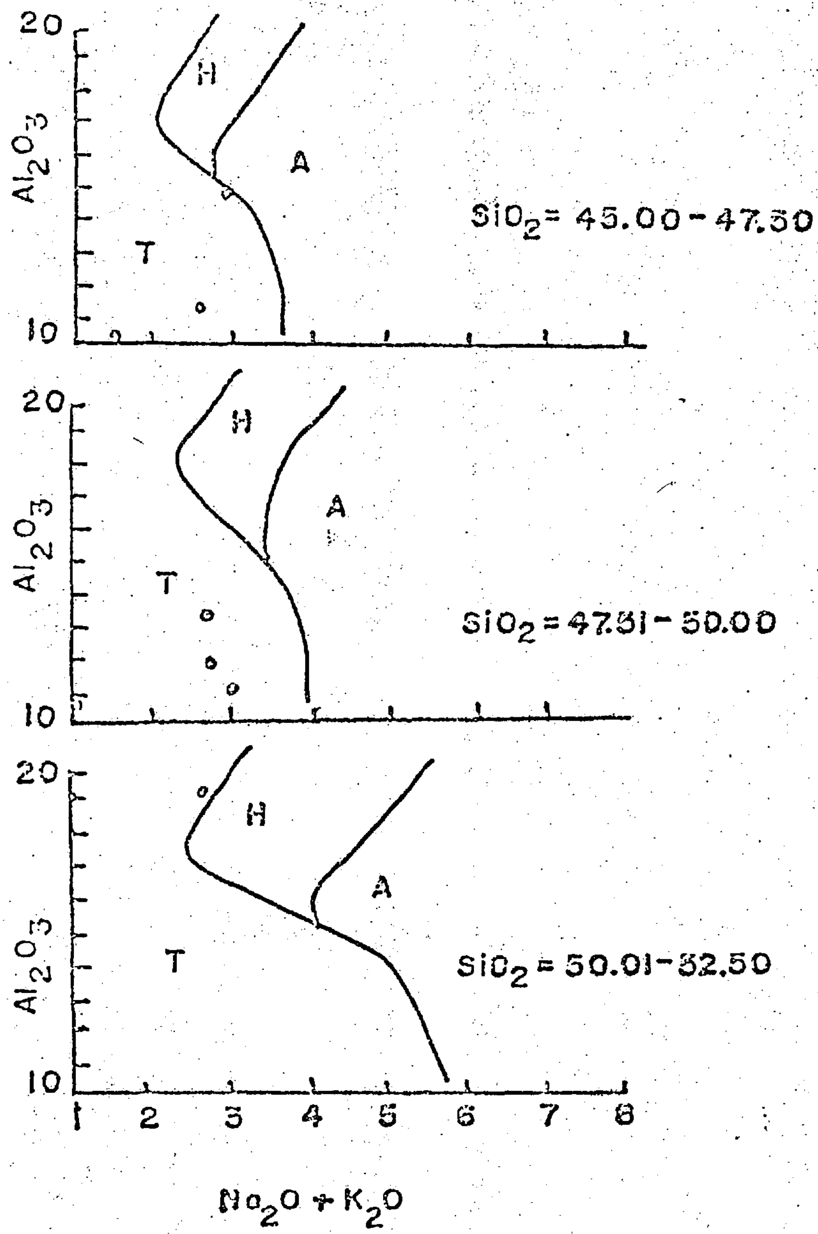

Figure 30. SiO_2-Al_2O_3-Na_2O + K_2O variation diagram (Kuno, 1960) for gabbroic rocks of the Opawica River Complex (wt. %). T = Tholeiite, H = High alumina basalt, A = Alkali olivine basalt.

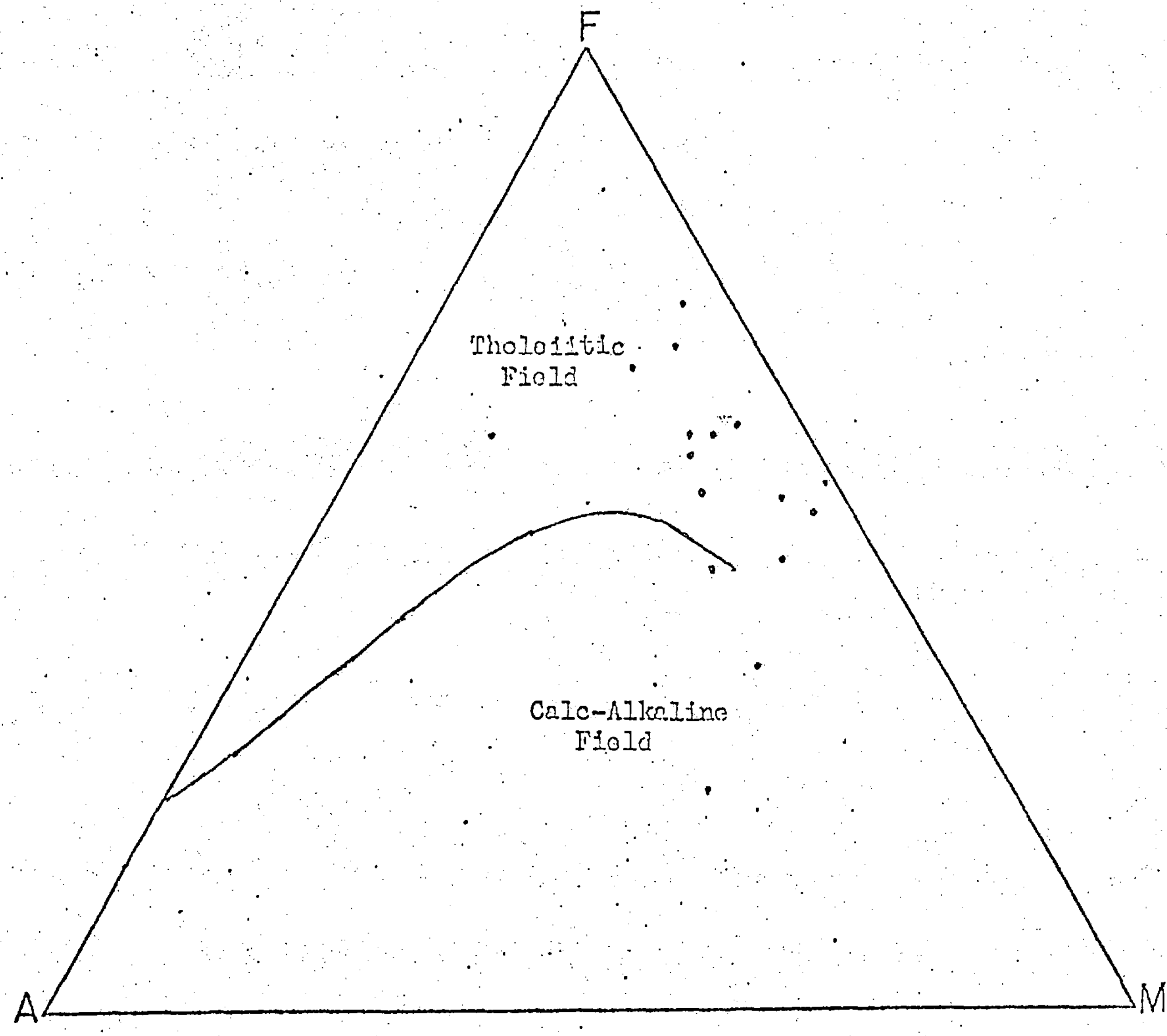

Figure 31. AFM diagram of the gabbroic rocks of the Opawica River Complex (wt. %). $A = Na_2O + K_2O$, $F = Fe_2O_3 + FeO$, $M = MgO$. Magma fields after Kuno, 1959.

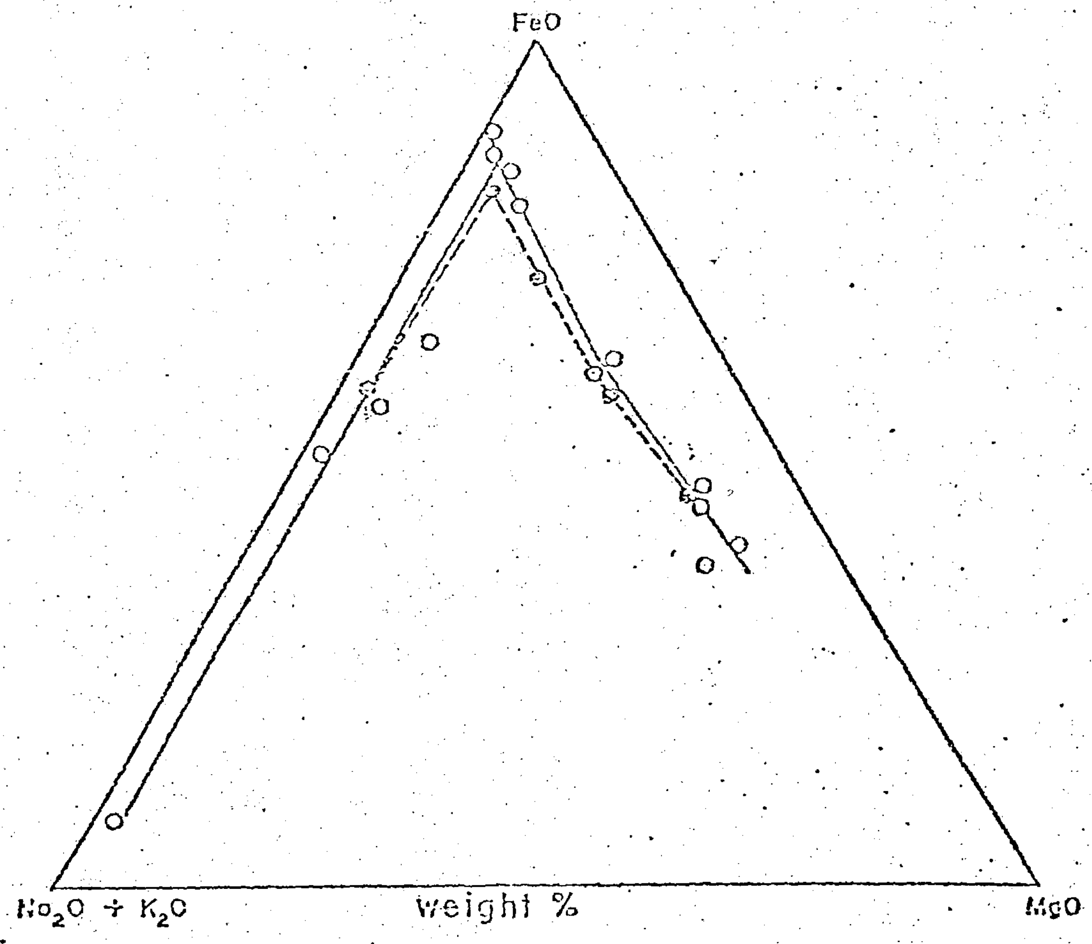

Figure 32. AFM diagram for the Skaergaard Complex after Wagner and Deer (1939).

Skaergaard Liquid
Skaergaard Rocks

Crystallization History and Evolution of the Opawica River Complex

In order to design a model for the crystallization history of the Opawica River Complex, it is necessary to list significant characteristics of well studied layered mafic intrusions. Most layered complexes have very similar stratigraphic sequences (Figure 33). The stratigraphy can be simplified into four major zones or their equivalents (Allard, 1973): (1) an ultramafic zone, (2) anorthosite zone, (3) layered zone or gabbro zone, and (4) granophyre zone. Although in the Opawica River Complex only two of the zones are exposed, it is postulated that a granophyre zone existed and possibly an ultramafic zone.

The original form of the Opawica River Complex is believed to be that of a tilted sheet-like body (Figure 34). It is necessary for the intrusion to be tilted in order to explain the present outcrop pattern (Plates 1 and 2). A single intrusive pulse filled the magma chamber, and crystallization proceeded in a closed system with the original magma having tholeiitic affinities. If the diabasic rocks of the complex represent a chilled border phase, then the megacrysts of plagioclase suggest that the original magma was charged with plagioclase crystals. Assuming a density of 2.7 for the magma (Hess, 1960; Wager & Brown, 1967), it is likely that the plagioclase crystals would have remained suspended until they reached a size that would enable them to sink according to Stokes' Law. The cumulate nature of

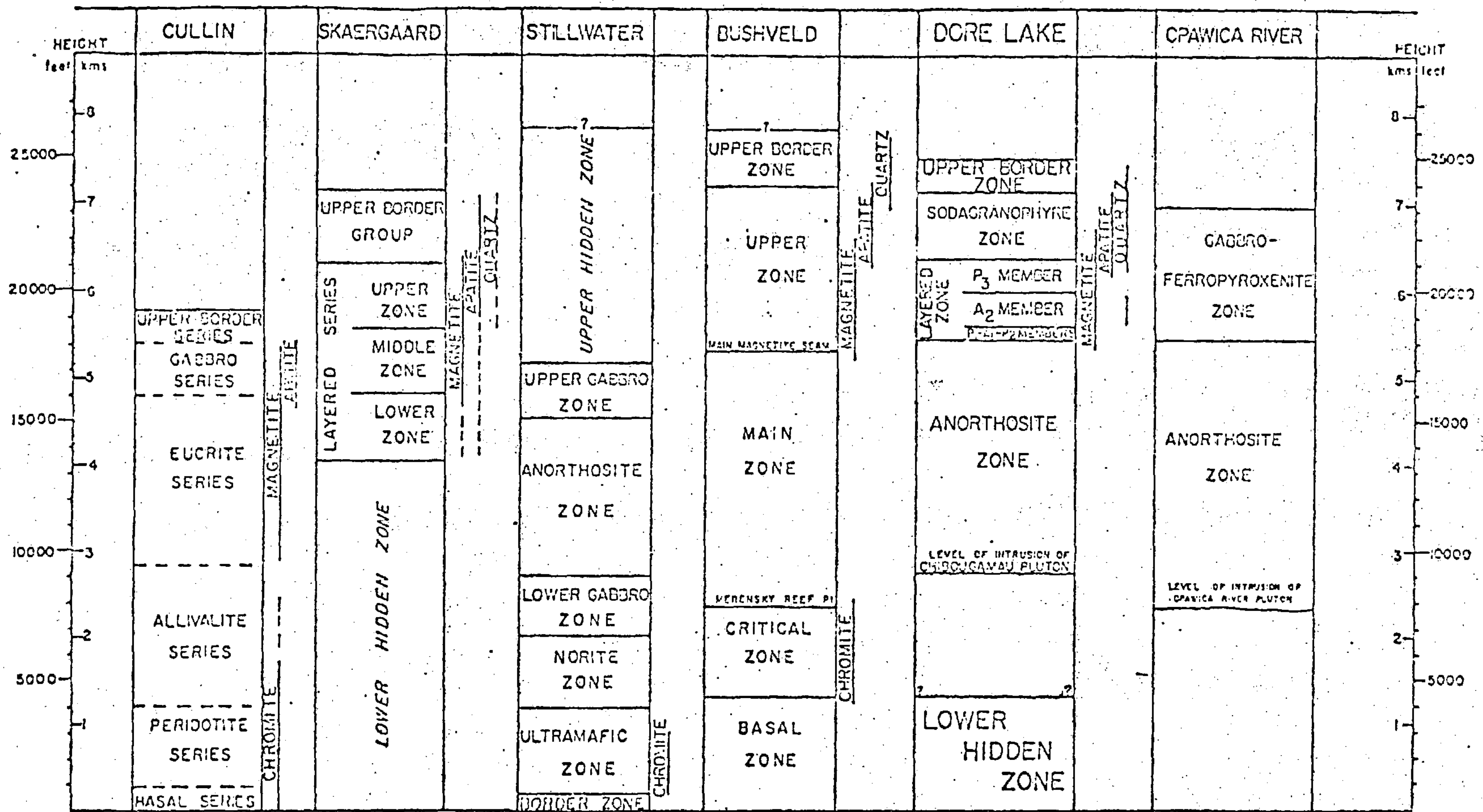

Figure 33. Comparison of the stratigraphy of the Opawica River Complex to other layered complexes. Modified from Allard, 1973.

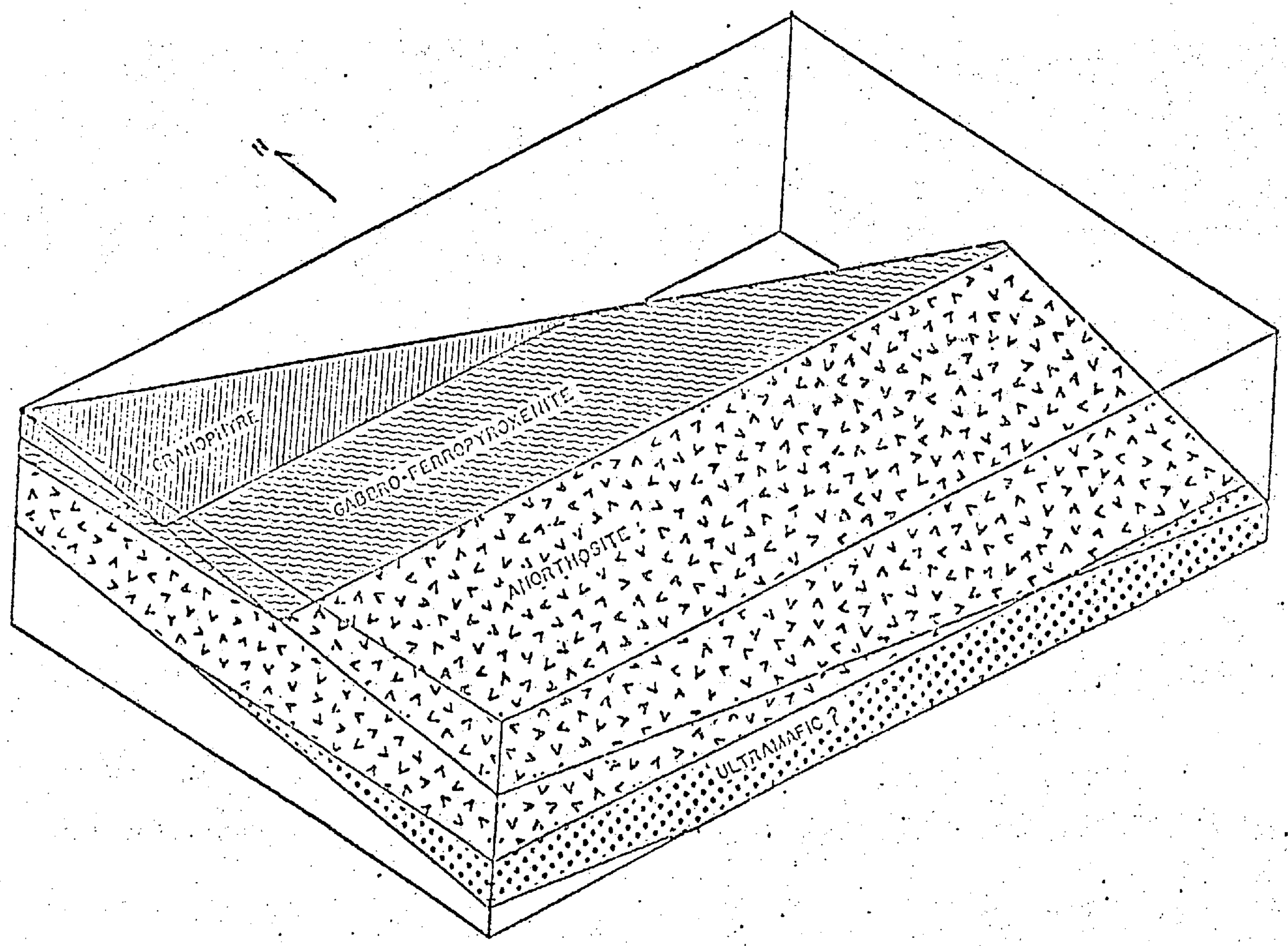

Figure 34. Sketch of the Opawica River Complex after crystallization. Sketch not drawn to scale.

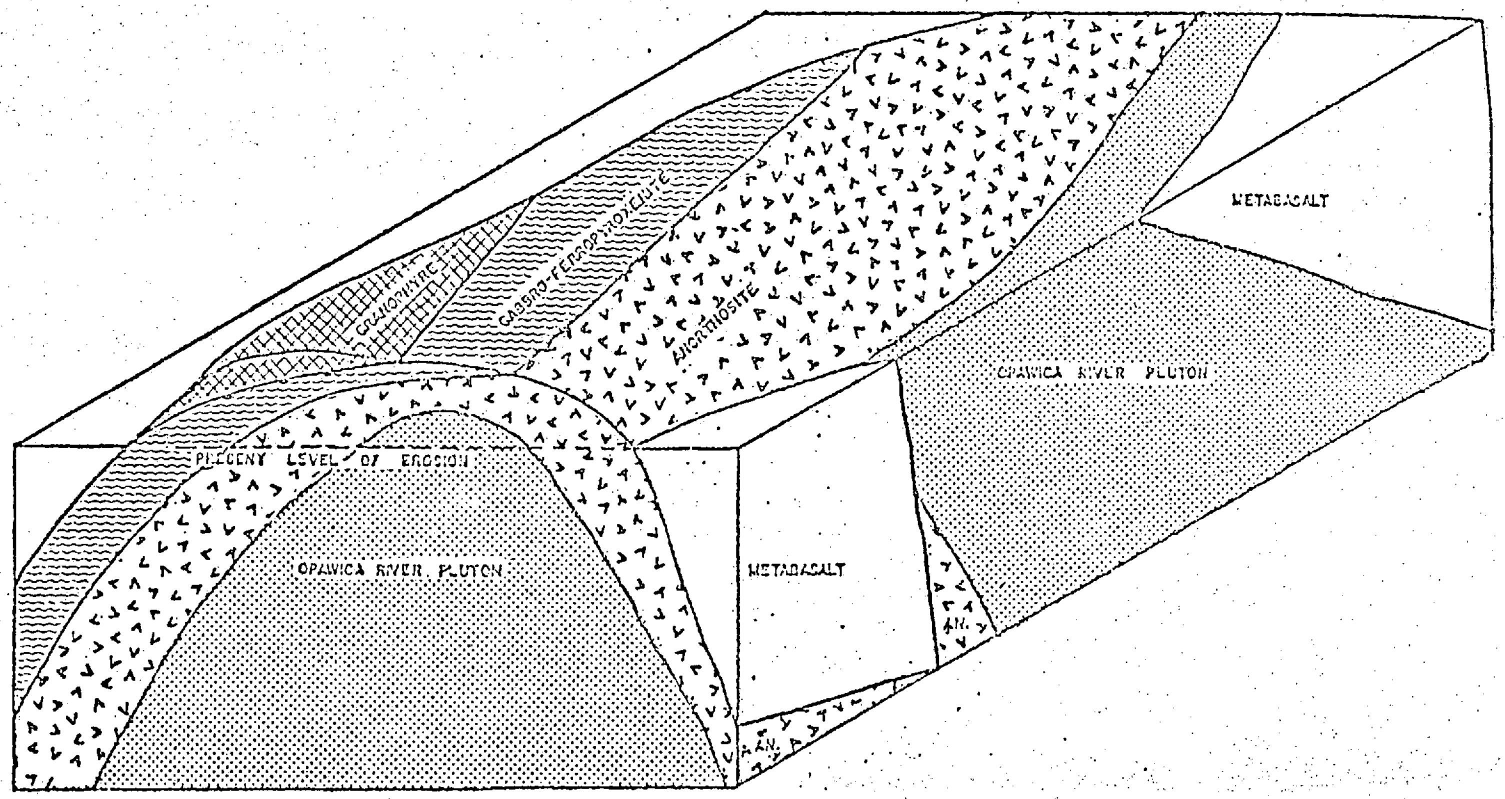

Figure 35. Sketch of the Opawica River Complex after folding but before erosion. Sketch not drawn to scale.

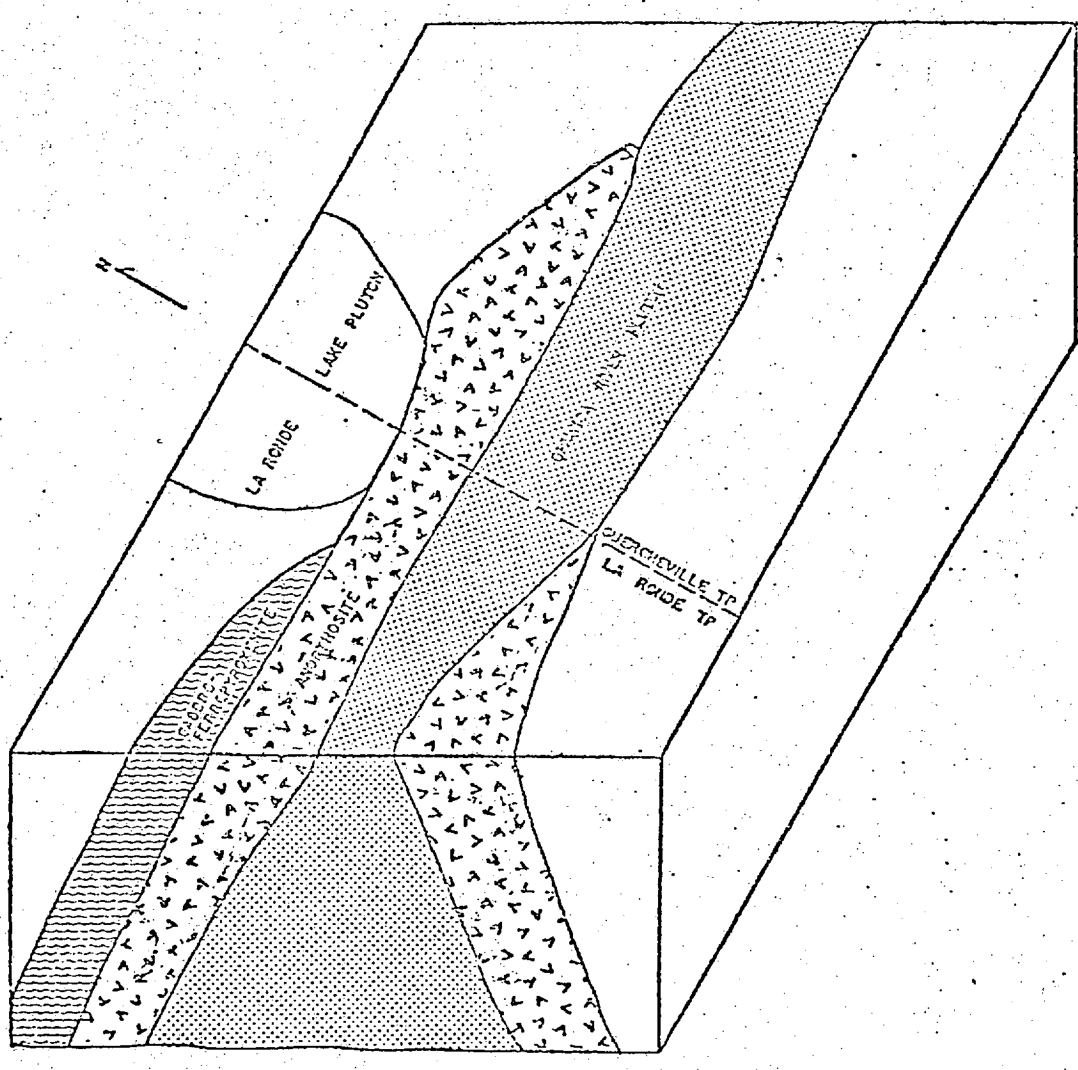

Figure 36. Sketch of the Opawica River Complex as it appears today. Sketch not drawn to scale.

CHAPTER IV

METAMORPHISM

A single metamorphic event believed to be associated with the Kenoran Orogeny altered the rocks of the Opawica River Complex. Except for relict primary igneous minerals, typical greenschist mineral assemblages characterize the complex and related rocks. The most important primary igneous minerals of the complex were plagioclase, clinopyroxene, magnetite, and ilmenite. The mineral assemblage albite + actinolite + clinozoisite + chlorite in the rocks of the study area indicate regional metamorphism of the quartz-albite-muscovite-chlorite subfacies of the greenschist facies.

Turner (1968) and Winkler (1967, 1974) stress the importance of the catalytic action of water during metamorphism, without which "the metamorphism of basalts to amphibolites or chlorite-epidote greenschists would have been impossible" (Winkler, 1974). Original intercumulus minerals evidently acted as a channel for water and other volatiles during metamorphism. As a result, original intercumulus pyroxene altered to amphibole; calcic plagioclase remained stable except along grain boundaries with amphibole where zoisite and albite became the stable assemblage, and cumulus pyroxene remained stable except along grain boundaries with plagioclase where actinolite became the stable assemblage.

Such conditions may indicate either insufficient quantities of water available for more complete alteration of cumulus phases or insufficient porosity-permeability to allow the passage of water to the entire rock.

Plagioclase

Plagioclase is the most abundant cumulus mineral in the complex. Calcic plagioclase (An 84-69+) has for the most part survived metamorphism. As described above, where water was available in sufficient quantities calcic plagioclase altered to an aggregate of clinozoisite and/or epidote and albite. The following reaction describes the transformation:

$$\text{5 calcic plagioclase (An 80)} + H_2O = \text{2 clinozoisite} + \text{albite} + 2SiO_2 + Al_2O_3 \qquad (1)$$

$$[NaAlSi_3O_8 + 4CaAl_2Si_2O_8] + H_2O = 2Ca_2Al_3Si_3O_{12}(OH) + NaAlSi_3O_8 + 2SiO_2 + Al_2O_3$$

502.9 cc   466.9 cc

Petrographic evidence indicates that the excess alumina reacts with augite to form chlorite, which when present is found at grain boundaries between plagioclase and actinolite (Figure 36).

Pyroxene

Augite is the only original mafic silicate mineral identified from the Opawica River Complex. Originally, it was present throughout the complex as an intercumulus phase and a cumulus phase in the Gabbro-Ferropyroxenite Zone. Subsequently, augite was altered to actinolite and chlorite:

$$5 \text{ augite} + H_2O = \text{actinolite} + 3\ CaO + 2SiO_2$$

$$5Ca(Mg,Fe)Si_2O_6 + H_2O = Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2 + 3CaO + 2SiO_2 \quad (2)$$

392.47 cc 406.13 cc

There is petrographic evidence that chlorite formed from the alteration of augite with the addition of alumina. The formation of chlorite can be described by the following reaction:

$$5 \text{ augite} + Al_2O_3 + 4H_2O = \text{chlorite} + 5CaO + 7SiO_2$$

$$5Ca(Mg,Fe)Si_2O_6 + Al_2O_3 + 4H_2O = (Mg,Fe)_5Al_2Si_3O_{22}(OH)_8 + 5CaO + 7SiO_2 \quad (3)$$

417.96 cc 542.14 cc

The excess silica and lime produced by the above reaction is available for the formation of sphene from ilmenite (reaction 6).

Magnetite

In the Opawica River Complex magnetite is present only as an "intercumulus" phase. Petrographic and chemical evidence indicate that magnetite was an important reactant in the formation of ferrohastingsite and epitode. Ferrohastingsite evidently replaced magnetite leaving lamellae oriented parallel to the magnetite (111) direction (Figure 22). Baskin (1975) reports ferrohastingsite from the Dore

Lake Complex, Chibougamau, and proposes the following reaction:

$$NaAlSi_3O_8 + 1/2CaAl_2Si_2O_8 + 3/2Ca(Mg,Fe)Si_2O_6 + 1/2Fe_2SiO_{26} + 1/2Fe_3O_4 = NaCa_2(Mg,Fe)_4Fe^{+3}Si_6Al_2O_{22}(OH)_2 + SiO_2 \quad (4)$$

An alternate reaction, perhaps better suited to the formation of ferrohastingsite in the Opawica River Complex follows:

Albite + 2anorthite +2magnetite +2augite + SiO_2 + $1/2Al_2O_3$ + $2H_2O$ + O_2 = ferrohastingsite + epidote + FeO + $1/4O_2$

$$NaAlSi_3O_8 + 2CaAl_2Si_2O_8 + 2Fe_3O_4 + 2Ca(Mg,Fe)Si_2O_6 + SiO_2 + 1/2Al_2O_3 + H_2O \quad (5)$$

572.78 cc

$$+O_2 = NaCa_2(Mg,Fe)_4Fe^{+3}Si_6Al_2O_{22}(OH)_2 + 2CaFe^{+}3Al_2Si_3O_{12}(OH) + FeO + 1/4O_2$$

567.45 cc

Ilmenite

Ilmenite occurs as an "intercumulus" phase and, as previously discussed, as lamellae parallel to the (111) direction in magnetite. Sphene is observed as an alteration of ilmenite (Figure 23). The following reaction is proposed to explain the formation of sphene in the complex:

ilmenite + CaO + SiO_2 = sphene + FeO (6)

$$FeTiO_3 + CaO + SiO_2 = CaTiSiO_5 + FeO$$

72.31 cc 68.02 cc

Discussion

Winkler (1974) states that metamorphism is essentially an isochemical process. The preservation of original igneous structures and textures (Figures 6, 8, 10, 11, 12) in the rocks of the Opawica River Complex support this hypothesis, but these observations alone are not sufficient criteria to support isochemical metamorphism. Turner (1948) states neither bulk composition nor specific gravity of the rock remains constant during metasomatic metamorphism. Table 8 compares specific gravity of rocks from the Bushveld Complex and Stillwater Complex to those of the Opawica River Complex. These comparisons indicate that the specific gravity of rocks from the Opawica River Complex are basically unaffected by metamorphism. Postulated metamorphic reactions can be used as a criteria for isochemical metamorphism. In the written reactions for observed mineral assemblages in the Opawica River Complex the addition of components from outside the system is not necessary (reactions 1, 2, 3, 5, and 6).

Preservation of original igneous textures and structures, minor changes in specific gravity of the rocks and postulated metamorphic reactions suggest that metamorphism was essentially isochemical and isovolumetric with any migration of elements limited to a few millimeters.

Table 8. Comparison of Specific Gravities of Rocks from the Opawica River Complex, Bushveld Complex, and Skaergaard Intrusion.

1	2	3	4	5	6	7	8	9	10	11	12	13
2.78	2.85	2.83	2.79	3.03	3.03	2.79	2.74	2.73	2.79	2.92	2.98	2.95

1. 74RA124 Gabbroic Anorthosite, Opawica River Complex
2. 74AM17 Gabbroic Anorthosite, Opawica River Complex
3. 73BM39A Gabbroic Anorthosite, Opawica River Complex
4. 73BM167 Gabbroic Anorthosite, Opawica River Complex
5. 74RA148 Metadiabase, Opawica River Complex
6. 74RA134 Metadiabase, Opawica River Complex
7. Anorthosite, Bushveld Complex Analysis I, p. 104, Analyses of Rocks, Minerals, Ores, Coal, Soil, and Waters from South Africa, Mem. Geol. Surv. S. Afr., 32, 876 pp.
8. Anorthosite, Bushveld Complex, Analysis II, p. 104, same reference as 7.
9. Anorthosite, Bushveld Complex, Analysis III, p. 104, same reference as 7.
10. Anorthosite, Bushveld Complex, Analysis IV, p. 104, same reference as 7.
11. Anorthositic norite, Bushveld Complex, Analysis VI, p. 104, same reference as 7.
12. Chilled Marginal Gabbro, Skaergaard Intrusion, Analysis XII, fold out after p. 335, Wager, L. R., and Deer, W. A. Geological Investigations in East Greenland, Pt. III. The Petrology of the Skaergaard Intrusion, Kangerdlugssuaq, East Greenland, Medd. om Gronland, 105, No. 4, 352 pp.
13. Chilled Marginal Gabbro, Skaergaard Intrusion, Analysis XIII, same reference as 12.

CHAPTER V

ECONOMIC GEOLOGY

Exploration for base metal sulfide deposits of Archean to Tertiary age has become more sophisticated since the volcanogenic nature of many of these base metal deposits was recognized. Volcanogenic massive sulfide deposits have many similiarities (Sangster, 1972). However, these are not the only important type deposits found in the Archean rocks of the Canadian Shield. Exploration in Archean rocks of the Canadian Shield should be directed toward mineral deposits having a magmatic origin with special attention given to ultramafic rocks and layered intrusions as well as toward the volcanogenic type deposits.

Magmatic Ore Deposits

Oxide and sulfide mineralization is known to occur as horizons in layered complexes. Chromite, vanadiferous magnetite, and sulfides of the platinum group minerals, copper and nickel, are found associated with layered complexes. Chromite and sulfide horizons are associated with mafic to ultramafic rocks (Cameron & Desborough, 1969, Bichan, 1969, Cousins, 1969, and Souch & Podalsky *et al.*, 1969). Because these minerals occur at the same stratigraphic horizons, exploration should be directed to ultramafic rocks associated with layered complexes. In the Opawica River Complex there is no exposed ultramafic zone. If an ultramafic zone exists, it would probably be located below the Opawica River Pluton. Vanadiferous magnetite is being mined from the Bushveld Complex. Magnetites from the Opawica River Complex have very similar chemistry to magnetites from the Bushveld Complex and Dore Lake Complex (Table 8). The magnetites occur in the Gabbro-Ferropyroxenite Zone and are defined by a magnetic high. In the lithologies studied, magnetite comprised less than 25% of the rock by volume. The large amounts of glacial drift could, however, mask concentrations of magnetite similar to those in the Bushveld Complex. Hence, more work is necessary in order to determine if economic concentrations of magnetite are present.

Volcanogenic Ore Deposits

Syngenetic deposits are generally associated with a volcanic sequence tens of thousands of feet thick (Goodwin, 1968). The volcanic complex can be divided into three main portions: the lowermost part consists of pillowed and vesiculated flows generally of basaltic composition, the second part consists of flows, flow breccias, and tuffs mostly of andesitic composition, and the upper most portion consists of flows and pyroclastics of dacitic to rhyolitic composition (Sangster, 1972). Another characteristic of these deposits is that the volcanic pile has been intruded by rocks of varying compositions. Acid intrusions are the most common rock types associated with the volcanic pile (Sangster, 1972). However, the Chibougamau and Matagami areas are two notable exceptions in that they have layered intrusions in the volcanic core, as does the Opawica River area. These layered intrusions could represent volcanic centers. If there is a link between mineralization and layered intrusions, the volcanic rocks in La Ronciere, Guercheville, Gand, and Lesperance Townships should be considered as exploration targets for volcanogenic ore deposits. Within the Opawica River Complex, as in the Dore Lake Complex, mineralized shear zones could be expected to occur in the Anorthosite Zone, but no areas of intense alteration have been observed. However, one must remember that approximately 99% of the area is drift covered.

CHAPTER VI

SUMMARY

The Opawica River Complex is an Archean layered intrusion. It intruded discordantly volcanic rocks of the Matagami-Chibougamau Greenstone Belt. The volcanics and Opawica River Complex were intruded by the Opawica River Pluton, consisting mostly of biotite trondhjemite, and folded into an east-west trending anticline during the Kenoran Orogeny. The La Ronde Lake Pluton, a post-kinematic zoned granitic pluton, has intruded the Opawica River Complex and volcanics. The complex and enclosing volcanics have for the most part been metamorphosed to the quartz-albite-muscovite-chlorite subfacies of the greenschist facies. Original igneous structures and textures have been well preserved.

The Opawica River Complex is divided into two zones: Anorthosite Zone and the gabbro-Ferropyroxenite Zone. Due to the tilted nature of the original magma chamber and folding the Gabbro-Ferropyroxenite Zone is not continous over the entire outcrop length of the complex.

The rocks are marked by an enrichment on FeO and depletion of MgO. The rocks are characterized by a high ratio of $Na_2O : K_2O$. The Opawica River Complex is the result of fractional crystallization of a basaltic magma having tholeiitic affinities.

Similarities in geology with the Chibougamau and Matagami areas make the Opawica River-La Ronde Lake region an excellent exploration target for volcanogenic sulfide deposits. Also, one might expect to find magmatic ore deposits within the Opawica River Complex since layered complexes are known to contain deposits of this type.

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APPENDIX I

Laboratory Procedures

APPENDIX I

LABORATORY PROCEDURES

Petrographic and Mineralogical Techniques

Several laboratory techniques were utilized to obtain petrographic and mineralogical data. Thin sections from approximately 100 rock samples were studied using a Zeiss petrographic microscope. Plagioclase compositions were determined with the microscope using F. C. Calkins' curves for sections perpendicular to X. Immersion oils and Tsuboi's curves for refractive indices of cleavage fragments (Kerr, 1959) were used on plagioclases from the Opawica River Complex.

Analyses of selected mineral specimens were obtained using a Materials Analysis Company 400S Electron Microanalyzer. Analyses were made on polished sections and polished thin sections which had been coated with a 250Å carbon film using a Varian vacuum evaporator. An operating voltage of 15KV and a sample current of 0.05 microamps were used. An average of five spots on each sample were analyzed using twenty second counts and a beam diameter of five microns. Only background and drift corrections were made since standards were selected to be very similar to the unknowns.

Semi-quantitative analyses of all major elements for actinolites were obtained using a Canberra energy dispersive detection system composed of a lithium-drifted silicon crystal, and a broad-spectrum, multichannel analyzer. X-ray emission spectrographs were made for unknown and natural mineral standards. Data were collected in 100 second counts. Peak heights of all major elements in the standards were graphically plotted and a line of calibration drawn between corresponding elements of standards. Observed peak heights of elements in the unknowns were compared with this calibration to obtain oxide percentages.

Whole Rock Chemical Techniques

Major elements except sodium and magnesium were analyzed by x-ray fluorescence. A cylindrical teflon mill (McCrone micronizing mill; McCrone Research Corporation) filled with corundum cylinders was loaded with 4.000 grams of rock powder and 1.000 gram of cellulose. Standards were prepared in an identical manner to compensate for possible aluminum contamination. Ethyl alcohol was added to the mill and agitated 10 minutes. The resulting slurry was rinsed and dried. The dry material was placed in a pellet die and pressed at 20 tons into a solid, stable pellet.

Pellets were analyzed on a Phillips-Norelco x-ray fluorescence instrument (Model Number PN 3260). Pellets of USGS standards were used to construct working curves. A pellet of SiO_2 was utilized as a blank for all elements except silicon. An internal standard was analyzed at every fourth count to provide for drift corrections. Count time was 100 seconds. Drift and background corrections were made on all samples.

Sodium and magnesium analyses were obtained with a Model 303 Perkins-Elmer Atomic Absorption Spectrophotometer. Instrument settings were essentially those recommended by the manufacturer's handbook. Samples were prepared for chemical analysis employing the method developed by Medlin, Surh, and Bodkin (1969).

Ferrous iron determinations were made by the "Wilson method" as described in Jeffery (1970). The method consists of a back titration using ferrous ammonium sulfate with barium dipheylamine as an indicator. USGS sample W-1 was used as a standare.

APPENDIX II

Analytical Results

IDENTIFICATION FIELD READS.. 739M44 METABASALT

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	47.29	47.85	0.00	QZ	.41	.40
TIO2	1.07	.62	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	[illegible]	11.95	0.10	OR	.25	.24
CR2O3	-0.00	0.00	0.00	PL	40.80	36.11
FE2O3	3.33	2.54	0.00	(AB)	22.11	19.04
FEO	9.69	8.22	0.00	(AN)	18.68	17.07
MNO	.24	[.21]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	8.05	12.16	0.00	KP	0.00	0.00
CAO	12.85	11.79	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.25	4.42	0.00	AC	0.00	0.00
K2O	.04	.05	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	32.19	30.04
SO3	-0.00	0.00	0.00	(WO)	16.10	15.35
S	-0.00	(0.00)	0.00	(EN)	10.58	8.72
CL	-0.00	(0.00)	0.00	(FS)	5.51	5.97
F	-0.00	(0.00)	0.00	HY	20.95	19.08
CO2	-0.00	0.00	0.00	(EN)	13.74	11.33
				(FS)	7.16	7.75
TOTAL	92.72	100.00		OL	0.00	0.00
-H2O	92.72			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	3.81	4.83
				CM	0.00	0.00
				IL	1.63	2.33
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	41.46	36.74
				FEMIC	58.54	55.98
				TOTAL	100.00	92.72

AN/PL WT PCT 47.27 MOL PCT 45.93

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 59.37 MOL PCT 65.75

DIFNOX WT PCT 19.63 CAT PCT 22.78

QZ-AB-OR DIAGRAM

WT PCT QZ 2.03 AB 95.76 OR 1.20

MOL PCT QZ 8.32 AB 90.62 OR 1.05

QZ-NE-KP DIAGRAM

WT PCT QZ 45.9_ NE 52.42 KP .63

MOL PCT QZ 67.65 NE 31.98 KP .37

AN-AB-OR DIAGRAM

WT PCT AN 46.96 AB 52.39 OR .55

MOL PCT AN 45.51 AB 53.96 OR .53

A-F-M DIAGRAM

WT PCT ALK 9.80 FE 55.74 MG 34.46

MOL PCT ALK 9.37 FE 39.71 MG 50.92

(NA+K)/AL ATM WT PCT 32.17 GRMATM PCT 37.45

(FE+MN)/(FE+MN+MG) ATM WT PCT 67.42 GRMATM PCT 47.40

NA2O/(NA2O+K2O) WT PCT 98.25 MOL PCT 98.84

FEO/(FEO+FE2O3) WT PCT 74.42 MOL PCT 86.61

COOMBS BASALT PLOT NE-OL-QZ-DI(=53.50)

QZ= .20 NE= 0.00 OL= .20 DI= .60

IDENTIFICATION FIELD READS.. 74AM104   GABBROIC ANORTHOSITE SP. G. 2.85

2

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	45.10	42.75	0.00
TIO2	.14	.10	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	25.30	28.27	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	2.41	1.72	0.00
FEO	2.08	1.65	0.00
MNO	.07	[.06]	
NIO	-0.00	[0.00]	
MGO	4.50	6.36	0.00
CAO	14.85	15.08	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	2.10	3.85	0.00
K2O	.13	.16	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	96.68	100.00	
-H2O	96.68		

MINERAL	CAT PRCNT	WT PRCNT
QZ	0.00	0.00
CO	0.00	0.00
Z	0.00	0.00
OR	.79	.77
PL	76.08	73.46
(AB)	15.46	14.23
(AN)	60.62	59.22
LC	0.00	0.00
NE	2.30	1.92
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	11.83	11.42
(WO)	5.92	6.03
(EN)	5.29	4.67
(FS)	.62	.72
HY	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
OL	6.22	5.36
(FO)	5.57	4.58
(FA)	.65	.78
CS	0.00	0.00
MT	2.58	3.49
CM	0.00	0.00
IL	.20	.27
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	79.17	76.14
FEMIC	20.83	20.54
TOTAL	100.00	96.68

AN/PL WT PCT 80.62 MOL PCT 79.68

FA/OL WT PCT 14.52 MOL PCT 10.50

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 16.92 CAT PCT 18.55

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 40.52 NE 56.90 KP 2.58

MOL PCT QZ 61.80 NE 36.71 KP 1.49

AN-AB-OR DIAGRAM

WT PCT AN 79.79 AB 19.18 OR 1.03

MOL PCT AN 78.87 AB 20.11 OR 1.02

A-F-M DIAGRAM

WT PCT ALK 19.88 FE 40.02 MG 40.11

MOL PCT ALK 18.47 FE 23.07 MG 58.47

(NA+K)/AL ATM WT PCT 12.44 GRMATM PCT 14.21

(FE+MN)/(FE+MN+MG) ATM WT PCT 55.29 GRMATM PCT 35.00

NA2O/(NA2O+K2O) WT PCT 94.17 MOL PCT 95.09

FEO/(FEO+FE2O3) WT PCT 46.33 MOL PCT 65.73

COOMBS BASALT PLOT NE-OL-QZ-DI(=20.35)

QZ= 0.00 NE= .11 OL= .31 DI= .58

IDENTIFICATION FIELD READS.. 74RA124   GABBROIC ANORTHOSITE SP. G. 2.78

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	45.70	44.41	0.00
TIO2	.18	.13	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	25.70	29.43	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	1.37	1.00	0.00
FEO	1.19	.96	0.00
MNO	.04	(.03)	
NIO	-0.00	(0.00)	
MGO	1.45	2.10	0.00
CAO	13.35	14.42	0.00
SRO	-0.00	(0.00)	
BAO	-0.00	(0.00)	
NA2O	3.93	7.40	0.00
K2O	.09	.11	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	93.49	100.00	
-H2O	93.49		

MINERAL	CAT PRCNT	WT PRCNT
QZ	0.00	0.00
CO	0.00	0.00
Z	0.00	0.00
OR	.56	.53
PL	76.87	72.05
(AB)	22.08	19.83
(AN)	54.79	52.22
LC	0.00	0.00
NE	8.97	7.27
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	2.00	1.99
DI	9.64	9.32
(WO)	4.92	4.89
(EN)	4.20	3.61
(FS)	.72	.81
HY	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	1.50	1.99
CM	0.00	0.00
IL	.26	.34
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	86.39	79.85
FEMIC	13.61	13.64
TOTAL	100.00	93.49

AN/PL WT PCT 72.48 MOL PCT 71.28

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 27.63 CAT PCT 31.60

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 33.72 NE 65.19 KP 1.09

MOL PCT QZ 54.64 NE 44.69 KP .67

AN-AB-OR DIAGRAM

WT PCT AN 71.94 AB 27.32 OR .73

MOL PCT AN 70.77 AB 28.51 OR .72

A-F-M DIAGRAM

WT PCT ALK 50.12 FE 31.80 MG 18.08

MOL PCT ALK 51.35 FE 19.95 MG 28.70

(NA+K)/AL ATM WT PCT 21.98 GRMATM PCT 25.54

(FE+MN)/(FE+MN+MG) ATM WT PCT 68.55 GRMATM PCT 48.70

NA2O/(NA2O+K2O) WT PCT 97.76 MOL PCT 98.52

FEO/(FEO+FE2O3) WT PCT 46.27 MOL PCT 65.69

COOMBS BASALT PLOT NE-OL-QZ-DI(=18.80)

QZ= 0.00 NE= .48 OL= 0.00 DI= .52

IDENTIFICATION FIELD READS.. 74AM17 GABBROIC ANORTHOSITE SP.G. 2.85

4

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	45.50	43.19	0.00
TIO2	.24	.17	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	25.80	28.87	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	2.75	1.97	0.00
FEO	2.20	1.75	0.00
MNO	.08	(.05)	
NIO	-0.00	(0.00)	
MGO	2.30	4.10	0.00
CAO	15.15	15.41	0.00
SRO	-0.00	(0.00)	
BAO	-0.00	(0.00)	
NA2O	2.28	4.20	0.00
K2O	.23	.29	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	97.14	100.00	
-H2O	97.14		

MINERAL	CAT PRCNT	WT PRCNT
QZ	0.00	0.00
CO	0.00	0.00
Z	0.00	0.00
OR	1.39	1.36
PL	77.40	74.59
(AB)	16.43	15.10
(AN)	60.93	59.48
LC	0.00	0.00
NE	2.73	2.27
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	12.85	12.45
(WO)	6.43	6.55
(EN)	5.54	4.88
(FS)	.88	1.02
HY	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
OL	2.32	2.02
(FO)	2.00	1.64
(FA)	.32	.38
CS	0.00	0.00
MT	2.96	4.00
CM	0.00	0.00
IL	.34	.46
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	81.53	78.22
FEMIC	18.47	18.92
TOTAL	100.00	97.14

AN/PL WT PCT 79.75 MOL PCT 79.78

FA/OL WT PCT 18.75 MOL PCT 13.74

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 18.73 CAT PCT 20.55

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 40.08 NE 55.79 KP 4.12

MOL PCT QZ 61.43 NE 36.17 KP 2.40

AN-AB-OR DIAGRAM

WT PCT AN 78.32 AB 19.89 OR 1.79

MOL PCT AN 77.38 AB 20.85 OR 1.77

A-F-M DIAGRAM

WT PCT ALK 24.20 FE 47.83 MG 27.97

MOL PCT ALK 24.66 FE 30.11 MG 45.22

(NA+K)/AL ATM WT PCT 13.79 GRMATM PCT 15.50

(FE+MN)/(FE+MN+MG) ATM WT PCT 67.92 GRMATM PCT 47.97

NA2O/(NA2O+K2O) WT PCT 90.84 MOL PCT 93.78

FEO/(FEO+FE2O3) WT PCT 44.35 MOL PCT 63.92

COOMBS BASALT PLOT NE-OL-QZ-DI(=17.90)

QZ= 0.00 NE= .15 OL= .13 DI= .72

IDENTIFICATION FIELD READS.. 74AM172 GABBROIC ANORTHOSITE SP. G. 2.88

5

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR OTPCT
SIO2	46.20	43.24	0.00
TIO2	.19	.13	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	26.40	29.12	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	2.80	1.97	0.00
FEO	2.42	1.89	0.00
MNO	.05	[.04]	
NIO	-0.00	[0.00]	
MGO	4.80	6.73	0.00
CAO	13.00	13.94	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	1.62	2.94	0.00
K2O	.03	.04	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	98.41	100.00	
-H2O	98.41		

MINERAL	CAT PRCNT	WT PRCNT
QZ	0.00	0.00
CO	0.00	0.00
Z	0.00	0.00
OR	.18	.18
PL	80.05	78.38
(AB)	14.70	13.71
(AN)	65.35	64.67
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	3.46	3.39
(WO)	1.73	1.79
(EN)	1.54	1.38
(FS)	.19	.22
HY	12.45	11.50
(EN)	11.10	9.91
(FS)	1.35	1.58
OL	.62	.55
(FO)	.56	.46
(FA)	.07	.08
CS	0.00	0.00
MT	2.95	4.06
CM	0.00	0.00
IL	.27	.36
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	80.23	78.56
FEMIC	19.77	19.85
TOTAL	100.00	98.41

AN/PL WT PCT 82.51 MOL PCT 81.54

FA/OL WT PCT 14.97 MOL PCT 10.84

EN/HY WT PCT 86.22 MOL PCT 89.15

DIFNOX WT PCT 13.89 CAT PCT 14.88

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 98.72 OR 1.23

MOL PCT QZ 0.00 AB 98.80 OR 1.20

QZ-NE-KP DIAGRAM

WT PCT QZ 45.79 NE 53.48 KP .73

MOL PCT QZ 66.67 NE 32.93 KP .40

AN-AB-OR DIAGRAM

WT PCT AN 82.33 AB 17.45 OR .23

MOL PCT AN 81.46 AB 18.32 OR .22

A-F-M DIAGRAM

WT PCT ALK 14.14 FE 44.73 MG 41.13

MOL PCT ALK 13.45 FE 26.03 MG 60.52

(NA+K)/AL ATM WT PCT 8.79 GRMATM PCT 10.22

(FE+MN)/(FE+MN+MG) ATM WT PCT 57.26 GRMATM PCT 36.84

NA2O/(NA2O+K2O) WT PCT 98.16 MOL PCT 98.80

FEO/(FEO+FE2O3) WT PCT 46.36 MOL PCT 65.77

COOMBS BASALT PLOT NE-OL-QZ-DI(=16.54)

QZ= .38 NE= 0.00 OL= .41 DI= .21

IDENTIFICATION FIELD READS.. 73SM164A GABBROIC ANORTHOSITE SP. G. 2.83

6

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	47.70	44.38	0.00	QZ	0.00	0.00
TIO2	.20	.14	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	26.00	28.51	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	79.76	78.36
FE2O3	1.92	1.34	0.00	(AB)	18.05	16.93
FEO	1.66	1.29	0.00	(AN)	61.71	61.43
MNO	.04	[.03]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	.64	.55
MGO	2.55	3.54	0.00	KP	0.00	0.00
CAO	17.00	16.95	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.12	3.82	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	1.11	1.16
H2O-	-0.00			DI	16.19	15.97
SO3	-0.00	0.00	0.00	(WO)	8.09	8.41
S	-0.00	(0.00)	0.00	(EN)	7.07	6.35
CL	-0.00	(0.00)	0.00	(FS)	1.02	1.21
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	99.19	100.00		OL	0.00	0.00
-H2O	99.19			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	2.02	2.79
				CM	0.00	0.00
				IL	.26	.38
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	80.40	78.90
				FEMIC	19.60	20.29
				TOTAL	100.00	99.19

AN/PL WT PCT 78.39 MOL PCT 77.37

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNDX WT PCT 17.46 CAT PCT 18.69

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 44.40 NE 55.60 KP 0.00

MOL PCT QZ 65.37 NE 34.63 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 78.39 AB 21.61 OR 0.00

MOL PCT AN 77.37 AB 22.63 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 25.70 FE 43.39 MG 30.91

MOL PCT ALK 25.80 FE 26.49 MG 47.71

(NA+K)/AL ATM WT PCT 11.43 GRMATM PCT 13.41

(FE+MN)/(FE+MN+MG) ATM WT PCT 63.40 GRMATM PCT 43.00

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.37 MOL PCT 65.77

COOMBS BASALT PLOT NE-OL-QZ-DI(=16.83)

QZ= 0.00 NE= .04 OL= 0.00 DI= .95

IDENTIFICATION FIELD READS.. 7334167   GABBROIC ANORTHOSITE SP. G. 2.79   7

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	44.00	42.01	0.00	QZ	0.00	0.00
TIO2	.21	.15	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	27.60	31.06	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	82.14	79.04
FE2O3	2.05	1.49	0.00	(AB)	11.44	10.46
FEO	1.80	1.44	0.00	(AN)	70.70	68.58
MNO	.04	(.03)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	1.46	1.21
MGO	3.00	4.27	0.00	KP	0.00	0.00
CAO	16.40	16.78	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	1.50	2.73	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	10.54	10.12
SO3	-0.00	0.00	0.00	(WO)	5.27	5.34
S	-0.00	(0.00)	0.00	(EN)	4.65	4.07
CL	-0.00	(0.00)	0.00	(FS)	.62	.72
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	96.63	100.00		OL	3.31	2.85
-H2O	96.63			(FO)	2.92	2.38
				(FA)	.39	.46
				CS	0.00	0.00
				MT	2.24	3.02
				CM	0.00	0.00
				IL	.30	.40
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	83.61	80.25
				FEMIC	16.39	16.38
				TOTAL	100.00	96.63

AN/PL WT PCT 86.76 MOL PCT 86.07

FA/OL WT PCT 16.24 MOL PCT 11.81

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 11.67 CAT PCT 12.91

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 41.08 NE 58.92 KP 0.00

MOL PCT QZ 62.24 NE 37.76 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 86.76 AB 13.24 OR 0.00

MOL PCT AN 86.07 AB 13.93 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 17.90 FE 46.30 MG 35.80

MOL PCT ALK 17.70 FE 27.86 MG 54.44

(NA+K)/AL ATM WT PCT 7.62 GRMATM PCT 8.94

(FE+MN)/(FE+MN+MG) ATM WT PCT 61.46 GRMATM PCT 40.98

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.39 MOL PCT 65.79

COOMBS BASALT PLOT NE-OL-QZ-DI(=15.32)

QZ= 0.00 NE= .10 OL= .22 DI= .69

IDENTIFICATION FIELD READS.. 733M118   GABBROIC ANORTHOSITE SP. G. 2.92   8

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	46.40	44.35	0.00	QZ	0.00	0.00
TIO2	.19	.14	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	24.20	27.26	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	76.94	73.55
FE2O3	2.52	1.81	0.00	(AB)	17.82	16.29
FEO	2.18	1.74	0.00	(AN)	59.12	57.28
MNO	.07	[.06]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	.15	.12
MGO	2.00	2.85	0.00	KP	0.00	0.00
CAO	17.75	18.18	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	1.95	3.61	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	5.51	5.56
H2O-	-0.00			DI	14.42	14.01
SO3	-0.00	0.00	0.00	(WO)	7.21	7.29
S	-0.00	(0.00)	0.00	(EN)	5.70	4.98
CL	-0.00	(0.00)	0.00	(FS)	1.51	1.74
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	97.26	100.00		OL	0.00	0.00
-H2O	97.26			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	2.72	3.65
				CM	0.00	0.00
				IL	.27	.36
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	77.09	73.68
				FEMIC	22.91	23.58
				TOTAL	100.00	97.26

AN/PL WT PCT 77.87 MOL PCT 76.84

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 16.40 CAT PCT 17.97

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 45.49 NE 54.51 KP 0.00

MOL PCT QZ 66.36 NE 33.64 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 77.87 AB 22.13 OR 0.00

MOL PCT AN 76.84 AB 23.16 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 22.54 FE 54.34 MG 23.12

MOL PCT ALK 24.73 FE 36.26 MG 39.00

(NA+K)/AL ATM WT PCT 11.29 GRMATM PCT 13.26

(FE+MN)/(FE+MN+MG) ATM WT PCT 74.43 GRMATM PCT 55.90

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.38 MOL PCT 65.79

COOMBS BASALT PLOT NE-OL-QZ-DI(=14.57)

QZ= 0.00 NE= .01 OL= 0.00 DI= .99

IDENTIFICATION FIELD READS.. 733M158   GABBROIC ANORTHOSITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	44.10	42.17	0.00	QZ	0.00	0.00
TIO2	.21	.15	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	26.90	30.32	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	78.27	75.15
FE2O3	2.03	1.46	0.00	(AB)	11.56	10.55
FEO	1.75	1.40	0.00	(AN)	66.71	64.60
MNO	.06	(.05)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	3.96	3.27
MGO	3.00	4.28	0.00	KP	0.00	0.00
CAO	16.15	16.55	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	1.96	3.63	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.05			DI	12.82	12.29
SO3	-0.00	0.00	0.00	(WO)	6.41	6.48
S	-0.00	(0.00)	0.00	(EN)	5.66	4.94
CL	-0.00	(0.00)	0.00	(FS)	.75	.86
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	96.15	100.00		OL	2.46	2.11
-H2O	96.16			(FO)	2.17	1.77
				(FA)	.29	.34
				CS	0.00	0.00
				MT	2.19	2.94
				CM	0.00	0.00
				IL	.30	.40
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	82.23	78.42
				FEMIC	17.77	17.74
				TOTAL	100.00	96.16

AN/PL WT PCT 85.95 MOL PCT 85.23

FA/OL WT PCT 16.10 MOL PCT 11.70

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 13.82 CAT PCT 15.53

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 34.99 NE 65.01 KP 0.00

MOL PCT QZ 56.00 NE 44.00 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 85.95 AB 14.04 OR 0.00

MOL PCT AN 85.23 AB 14.77 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 22.43 FE 43.25 MG 34.32

MOL PCT ALK 22.10 FE 25.90 MG 52.00

(NA+K)/AL ATM WT PCT 10.21 GRMATM PCT 11.99

(FE+MN)/(FE+MN+MG) ATM WT PCT 60.97 GRMATM PCT 40.49

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.30 MOL PCT 55.71

COOMBS BASALT PLOT NE-OL-QZ-DI(=19.24)

QZ= 0.00 NE= .21 OL= .13 DI= .67

IDENTIFICATION FIELD READS.. 74AM95   ANORTH GABBRO SP. G. 2.86

10

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	45.70	41.62	0.00	QZ	0.00	0.00
TIO2	.19	.12	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	27.70	29.73	0.00	OR	2.50	2.54
CR2O3	-0.00	0.00	0.00	PL	68.64	69.48
FE2O3	1.12	.77	0.00	(AB)	5.49	5.26
FEO	1.14	.79	0.00	(AN)	63.15	64.21
MNO	.04	(.03)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	8.62	7.46
MGO	4.58	6.22	0.00	KP	0.00	0.00
CAO	16.65	16.25	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	2.25	3.97	0.00	AC	0.00	0.00
K2O	.43	.50	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	14.47	14.41
SO3	-0.00	0.00	0.00	(WO)	7.23	7.68
S	-0.00	(0.00)	0.00	(EN)	6.88	6.31
CL	-0.00	(0.00)	0.00	(FS)	.35	.42
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	99.69	100.00		OL	4.37	3.83
-H2O	99.69			(FO)	4.16	3.57
				(FA)	.21	.26
				CS	0.00	0.00
				MT	1.15	1.62
				CM	0.00	0.00
				IL	.25	.34
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	79.76	79.48
				FEMIC	20.24	20.21
				TOTAL	100.00	99.69

AN/PL WT PCT 92.42 MOL PCT 92.30

FA/OL WT PCT 6.85 MOL PCT 4.84

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNDX WT PCT 15.27 CAT PCT 16.61

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 22.99 NE 67.56 KP 9.45

MOL PCT QZ 41.68 NE 51.81 KP 6.51

AN-AB-OR DIAGRAM

WT PCT AN 89.16 AB 7.31 OR 3.53

MOL PCT AN 88.77 AB 7.72 OR 3.51

A-F-M DIAGRAM

WT PCT ALK 28.45 FE 22.93 MG 48.52

MOL PCT ALK 23.22 FE 12.21 MG 64.56

(NA+K)/AL ATM WT PCT 13.82 GRMATM PCT 15.04

(FE+MN)/(FE+MN+MG) ATM WT PCT 37.01 GRMATM PCT 20.37

NA2O/(NA2O+K2O) WT PCT 83.96 MOL PCT 88.83

FEO/(FEO+FE2O3) WT PCT 46.15 MOL PCT 67.36

COOMBS BASALT PLOT NE-OL-QZ-DI(=27.45)

QZ= 0.00 NE= .31 OL= .16 DI= .53

IDENTIFICATION FIELD READS.. 74AM195 GABBRO SP. G. 3.09

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT.	MINERAL	CAT PRCNT	WT PRCNT
SIO2	46.50	46.51	0.00	QZ	3.04	3.04
TIO2	.21	.16	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	10.10	11.91	0.00	OR	.83	.77
CR2O3	-0.00	0.00	0.00	PL	36.14	32.74
FE2O3	7.15	5.33	0.00	(AB)	13.58	11.95
FEO	8.51	7.12	0.00	(AN)	22.56	20.79
MNO	.12	(.19)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	0.00	0.00
MGO	8.25	12.30	0.00	KP	0.00	0.00
CAO	12.65	13.56	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	1.40	2.72	0.00	AC	0.00	0.00
K2O	.13	.17	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	36.18	33.85
SO3	-0.00	0.00	0.00	(WO)	18.09	17.48
S	-0.00	(0.00)	0.00	(EN)	13.28	11.09
CL	-0.00	(0.00)	0.00	(FS)	4.81	5.28
F	-0.00	(0.00)	0.00	HY	15.42	13.96
CO2	-0.00	0.00	0.00	(EN)	11.32	9.46
				(FS)	4.10	4.50
TOTAL	95.12	100.00		OL	0.00	0.00
-H2O	95.12			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	8.07	10.37
				CM	0.00	0.00
				IL	.32	.40
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	40.01	36.55
				FEMIC	59.99	53.58
				TOTAL	100.00	95.12

AN/PL WT PCT 63.81 MOL PCT 62.44

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 67.75 MOL PCT 73.41

DIFNOX WT PCT 15.65 CAT PCT 17.45

QZ-AB-OR DIAGRAM

WT PCT QZ 19.43 AB 75.66 OR 4.91

MOL PCT QZ 51.37 AB 45.83 OR 2.80

QZ-NE-KP DIAGRAM

WT PCT QZ 56.22 NE 40.99 KP 2.79

MOL PCT QZ 75.35 NE 23.23 KP 1.42

AN-AB-OR DIAGRAM

WT PCT AN 62.35 AB 35.36 OR 2.29

MOL PCT AN 61.04 AB 36.72 OR 2.24

A-F-M DIAGRAM

WT PCT ALK 6.01 FE 61.56 MG 32.43

MOL PCT ALK 6.12 FE 41.65 MG 52.23

(NA+K)/AL ATM WT PCT 21.45 GRMATM PCT 24.20

(FE+MN)/(FE+MN+MG) ATM WT PCT 70.32 GRMATM PCT 50.77

NA2O/(NA2O+K2O) WT PCT 91.50 MOL PCT 94.24

FEO/(FEO+FE2O3) WT PCT 54.34 MOL PCT 72.57

COOMBS BASALT PLOT NE-OL-QZ-DI(=54.64)

QZ= .20 NE= 0.00 OL= .14 DI= .66

IDENTIFICATION FIELD READS.. 74AM1B GABBRO

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR (PCT.)
SIO2	48.10	49.75	0.00
TIO2	.83	.65	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	9.50	11.58	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	6.27	4.88	0.00
FEO	5.25	4.54	0.00
MNO	.17	(.15)	
NIO	-0.00	(0.00)	
MGO	8.45	13.93	0.00
CAO	11.50	12.74	0.00
SRO	-0.00	(0.00)	
BAO	-0.00	(0.00)	
NA2O	1.20	2.41	0.00
K2O	.21	.28	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	91.48	100.00	
-H2O	91.48		

MINERAL	CAT PRCNT	WT PRCNT
QZ	9.88	9.55
CO	0.00	0.00
Z	0.00	0.00
OR	1.39	1.24
PL	34.27	30.07
(AB)	12.03	10.15
(AN)	22.24	19.91
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	33.18	29.37
(WO)	16.59	15.51
(EN)	14.77	11.93
(FS)	1.82	1.93
HY	12.67	10.59
(EN)	11.28	9.11
(FS)	1.39	1.47
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	7.32	9.09
CM	0.00	0.00
IL	1.29	1.58
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	45.54	40.86
FEMIC	54.46	50.62
TOTAL	100.00	91.48

AN/PL WT PCT 66.23 MOL PCT 64.99

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 86.07 MOL PCT 89.03

DIFNDX WT PCT 20.94 CAT PCT 23.29

QZ-AB-OR DIAGRAM

WT PCT QZ 45.59 AB 48.46 OR 5.93

MOL PCT QZ 78.63 AB 19.16 OR 2.21

QZ-NE-KP DIAGRAM

WT PCT QZ 70.37 NE 26.27 KP 3.37

MOL PCT QZ 85.03 NE 13.42 KP 1.55

AN-AB-OR DIAGRAM

WT PCT AN 63.61 AB 32.43 OR 3.96

MOL PCT AN 62.37 AB 33.74 OR 3.88

A-F-M DIAGRAM

WT PCT ALK 6.59 FE 53.88 MG 39.52

MOL PCT ALK 6.28 FE 32.70 MG 61.02

(NA+K)/AL ATM WT PCT 21.17 GRMATM PCT 23.17

(FE+MN)/(FE+MN+MG) ATM WT PCT 62.79 GRMATM PCT 42.35

NA2O/(NA2O+K2O) WT PCT 85.11 MOL PCT 89.68

FEO/(FEO+FE2O3) WT PCT 45.57 MOL PCT 65.05

COOMBS BASALT PLOT NE-OL-QZ-DI(=55.73)

QZ= .29 NE= 0.00 OL= .11 DI= .60

IDENTIFICATION FIELD READS.. 74A183 GABBRO

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTRCI	MINERAL	CAT PRCNT	WT PRCNT
SIO2	47.13	44.93	0.00	QZ	0.00	0.00
TIO2	1.61	1.15	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	11.20	12.59	0.00	OR	2.31	2.25
CR2O3	-0.00	0.00	0.00	PL	40.63	38.30
FE2O3	5.94	4.26	0.00	(AB)	20.62	18.87
FEO	11.73	9.36	0.00	(AN)	20.01	19.43
MNO	.22	[.18]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	8.95	12.72	0.00	KP	0.00	0.00
CAO	1[illegible]	10.22	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.23	4.12	0.00	AC	0.00	0.00
K2O	.38	.46	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	24.87	24.62
SO3	-0.00	0.00	0.00	(WO)	12.43	12.60
S	-0.00	(0.00)	0.00	(EN)	8.34	7.33
CL	-0.00	(0.00)	0.00	(FS)	4.10	4.71
F	-0.00	(0.00)	0.00	HY	17.40	16.82
CO2	-0.00	0.00	0.00	(EN)	11.67	10.22
				(FS)	5.73	6.59
TOTAL	99.36	100.00		OL	6.08	5.71
-H2O	99.36			(FO)	4.08	3.34
				(FA)	2.00	2.37
				CS	0.00	0.00
				MT	6.40	8.61
				CM	0.00	0.00
				IL	2.31	3.06
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	42.94	40.54
				FEMIC	57.06	58.82
				TOTAL	100.00	99.36

AN/PL WT PCT 50.73 MOL PCT 49.25

FA/OL WT PCT 41.55 MOL PCT 32.93

EN/HY WT PCT 60.78 MOL PCT 67.07

DIFNOX WT PCT 21.12 CAT PCT 22.03

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 89.37 OR 10.63

MOL PCT QZ 0.00 AB 89.92 OR 10.08

QZ-NE-KP DIAGRAM

WT PCT QZ 45.54 NE 48.41 KP 6.04

MOL PCT QZ 66.67 NE 29.97 KP 3.35

AN-AB-OR DIAGRAM

WT PCT AN 47.92 AB 46.54 OR 5.54

MOL PCT AN 46.60 AB 48.02 OR 5.38

A-F-M DIAGRAM

WT PCT ALK 8.93 FE 60.45 MG 30.62

MOL PCT ALK 8.65 FE 43.34 MG 48.00

(NA+K)/AL ATM WT PCT 33.23 GRMATM PCT 36.43

(FE+MN)/(FE+MN+MG) ATM WT PCT 71.35 GRMATM PCT 52.02

NA2O/(NA2O+K2O) WT PCT 85.44 MOL PCT 89.92

FEO/(FEO+FE2O3) WT PCT 66.38 MOL PCT 81.44

COOMBS BASALT PLOT NE-OL-QZ-DI(=48.35)

QZ= .18 NE= 0.00 OL= .31 DI= .51

IDENTIFICATION FIELD READS.. 74AM92 GABBRO

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	43.40	42.96	0.00	QZ	1.37	1.38
TIO2	2.63	1.96	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	14.20	16.57	0.00	OR	2.97	2.78
CR2O3	-0.00	0.00	0.00	PL	47.66	43.75
FE2O3	7.85	5.85	0.00	(AB)	15.45	13.62
FEO	11.38	9.42	0.00	(AN)	32.21	30.13
MNO	.14	[.12]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	6.35	9.37	0.00	KP	0.00	0.00
CAO	9.50	10.08	0.00	HL	0.00	0.00
SRO	0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	1.61	3.09	0.00	AC	0.00	0.00
K2O	.47	.59	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	14.54	13.37
SO3	-0.00	0.00	0.00	(WO)	7.27	7.10
S	-0.00	(0.00)	0.00	(EN)	4.86	4.10
CL	-0.00	(0.00)	0.00	(FS)	2.41	2.68
F	-0.00	(0.00)	0.00	HY	20.78	19.37
CO2	-0.00	0.00	0.00	(EN)	13.88	11.72
				(FS)	6.90	7.65
TOTAL	97.53	100.00		OL	0.00	0.00
-H2O	97.53			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	8.77	11.39
				CM	0.00	0.00
				IL	3.92	4.99
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	51.99	47.91
				FEMIC	48.01	49.62
				TOTAL	100.00	97.53

AN/PL WT PCT 68.85 MOL PCT 67.58

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 60.49 MOL PCT 65.80

DIFNOX WT PCT 17.78 CAT PCT 19.79

QZ-AB-OR DIAGRAM

WT PCT QZ 7.77 AB 76.61 OR 15.62

MOL PCT QZ 27.08 AB 61.17 OR 11.75

QZ-NE-KP DIAGRAM

WT PCT QZ 49.62 NE 41.50 KP 8.98

MOL PCT QZ 70.34 NE 24.88 KP 4.78

AN-AB-OR DIAGRAM

WT PCT AN 64.75 AB 29.28 OR 5.97

MOL PCT AN 63.62 AB 30.52 OR 5.86

A-F-M DIAGRAM

WT PCT ALK 7.52 FE 69.52 MG 22.96

MOL PCT ALK 7.82 FE 52.41 MG 39.77

(NA+K)/AL ATM WT PCT 21.98 GRMATM PCT 22.23

(FE+MN)/(FE+MN+MG) ATM WT PCT 79.04 GRMATM PCT 62.15

NA2O/(NA2O+K2O) WT PCT 77.40 MOL PCT 83.89

FEO/(FEO+FE2O3) WT PCT 59.18 MOL PCT 76.32

COOMBS BASALT PLOT NE-OL-QZ-DI(=36.59)

QZ= .32 NE= 0.00 OL= .25 DI= .40

IDENTIFICATION FIELD READS.. 743455 GABBRO

15

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	42.60	43.65	0.00	OZ	0.00	0.00
TIO2	1.15	.65	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	12.60	15.22	0.00	OR	7.19	6.53
CR2O3	-0.00	0.00	0.00	PL	44.43	39.12
FE2O3	7.59	5.65	0.00	(AB)	19.97	17.01
FEO	8.63	7.40	0.00	(AN)	24.47	22.11
MNO	.28	[.24]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	7.80	11.91	0.00	KP	0.00	0.00
CAO	8.60	9.44	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.01	3.90	0.00	AC	0.00	0.00
K2O	1.10	1.44	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	18.20	16.57
SO3	-0.00	0.00	0.00	(WO)	9.10	5.58
S	-0.00	(0.00)	0.00	(EN)	6.87	5.60
CL	-0.00	(0.00)	0.00	(FS)	2.23	2.39
F	-0.00	(0.00)	0.00	HY	11.44	10.35
CO2	-0.00	0.00	0.00	(EN)	8.64	7.04
				(FS)	2.80	3.00
TOTAL	92.31	100.00		OL	8.26	6.98
-H2O	92.31			(FO)	6.24	4.75
				(FA)	2.02	2.23
				CS	0.00	0.00
				MT	8.78	11.00
				CM	0.00	0.00
				IL	1.70	2.09
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	51.62	45.62
				FEMIC	48.38	46.70
				TOTAL	100.00	92.31

AN/PL WT PCT 56.52 MOL PCT 55.36

FA/OL WT PCT 31.96 MOL PCT 24.49

EN/HY WT PCT 70.11 MOL PCT 75.51

DIENOX WT PCT 23.51 CAT PCT 27.16

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 72.35 OR 27.65

MOL PCT QZ 0.00 AB 73.53 OR 26.47

QZ-NE-KP DIAGRAM

WT PCT QZ 45.09 NE 39.19 KP 15.71

MOL PCT QZ 66.67 NE 24.51 KP 8.82

AN-AB-OR DIAGRAM

WT PCT AN 48.47 AB 37.28 OR 14.25

MOL PCT AN 47.39 AB 38.68 OR 13.93

A-F-M DIAGRAM

WT PCT ALK 11.46 FE 59.79 MG 28.75

MOL PCT ALK 10.88 FE 41.37 MG 47.75

(NA+K)/AL ATM WT PCT 36.05 GRMATM PCT 35.69

(FE+MN)/(FE+MN+MG) ATM WT PCT 72.23 GRMATM PCT 53.11

NA2O/(NA2O+K2O) WT PCT 64.63 MOL PCT 73.53

FEO/(FEO+FE2O3) WT PCT 53.21 MOL PCT 71.65

COOMBS BASALT PLOT NE-OL-QZ-DI(=37.93)

QZ= .15 NE= 0.06 OL= .37 DI= .48

IDENTIFICATION FIELD READS.. 74AM181 GABBRO SP. G. 3.15

16

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	47.20	47.85	0.00
TIO2	.49	.37	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	9.80	11.71	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	4.79	3.65	0.00
FEO	4.03	3.42	0.00
MNO	.09	[.08]	
NIO	-0.00	[0.00]	
MGO	8.25	12.47	0.00
CAO	15.90	17.27	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	1.50	2.95	0.00
K2O	.18	.23	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	92.23	100.00	
-H2O	92.23		

MINERAL	CAT PRCNT	WT PRCNT
QZ	3.01	2.97
CO	0.00	0.00
Z	0.00	0.00
OR	1.16	1.06
PL	36.06	32.17
(AB)	14.74	12.69
(AN)	21.32	19.48
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	52.03	46.87
(WO)	26.01	24.80
(EN)	23.57	19.42
(FS)	2.45	2.65
HY	1.51	1.28
(EN)	1.36	1.12
(FS)	.14	.15
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	5.48	6.95
CM	0.00	0.00
IL	.75	.93
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	40.24	36.20
FEMIC	59.76	56.03
TOTAL	100.00	92.23

AN/PL WT PCT 60.54 MOL PCT 59.12

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 88.00 MOL PCT 90.60

DIFNDX WT PCT 16.73 CAT PCT 18.92

QZ-AB-OR DIAGRAM

WT PCT QZ 17.77 AB 75.88 OR 6.35

MOL PCT QZ 48.64 AB 47.60 OR 3.76

QZ-NE-KP DIAGRAM

WT PCT QZ 55.28 NE 41.10 KP 3.61

MOL PCT QZ 74.67 NE 23.48 KP 1.85

AN-AB-OR DIAGRAM

WT PCT AN 58.60 AB 38.19 OR 3.20

MOL PCT AN 57.27 AB 39.60 OR 3.13

A-F-M DIAGRAM

WT PCT ALK 8.96 FE 47.04 MG 44.00

MOL PCT ALK 8.24 FE 27.17 MG 64.59

(NA+K)/AL ATM WT PCT 24.34 GRMATM PCT 27.17

(FE+MN)/(FE+MN+MG) ATM WT PCT 56.84 GRMATM PCT 36.44

NA2O/(NA2O+K2O) WT PCT 89.29 MOL PCT 92.68

FEO/(FEO+FE2O3) WT PCT 45.69 MOL PCT 65.16

COOMBS BASALT PLOT NE-OL-QZ-DI(=56.55)

QZ= .07 NE= 0.00 OL= .01 DI= .92

IDENTIFICATION FIELD READS.. 74RA39   GABBRO SP. G. 3.10

17

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	47.10	45.50	0.00
TIO2	.24	.17	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	22.70	25.85	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	3.07	2.23	0.00
FEO	2.65	2.14	0.00
MNO	.11	[.09]	
NIO	-0.00	[0.00]	
MGO	7.25	10.44	0.00
CAO	8.60	8.90	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	2.08	3.90	0.00
K2O	.63	.78	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.43	100.00	
-H2O	94.43		

MINERAL	CAT PRCNT	WT PRCNT
QZ	2.30	2.38
CO	3.37	2.96
Z	0.00	0.00
OR	3.88	3.72
PL	63.99	60.26
(AB)	19.48	17.60
(AN)	44.51	42.66
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	0.00	0.00
(WO)	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
HY	22.76	20.19
(EN)	20.88	18.06
(FS)	1.88	2.14
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	3.35	4.45
CM	0.00	0.00
IL	.35	.46
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	73.54	69.33
FEMIC	26.46	25.10
TOTAL	100.00	94.43

AN/PL WT PCT 70.80 MOL PCT 69.56

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 89.41 MOL PCT 91.73

DIFNDX WT PCT 23.71 CAT PCT 25.56

QZ-AB-OR DIAGRAM

WT PCT QZ 10.05 AB 74.25 OR 15.70

MOL PCT QZ 33.00 AB 55.87 OR 11.13

QZ-NE-KP DIAGRAM

WT PCT QZ 50.85 NE 40.22 KP 8.92

MOL PCT QZ 71.37 NE 23.88 KP 4.75

AN-AB-OR DIAGRAM

WT PCT AN 66.68 AB 27.51 OR 5.82

MOL PCT AN 65.58 AB 28.70 OR 5.72

A-F-M DIAGRAM

WT PCT ALK 17.28 FE 36.48 MG 46.24

MOL PCT ALK 14.57 FE 20.31 MG 65.11

(NA+K)/AL ATM WT PCT 17.20 GRMATM PCT 18.08

(FE+MN)/(FE+MN+MG) ATM WT PCT 49.54 GRMATM PCT 29.95

NA2O/(NA2O+K2O) WT PCT 76.75 MOL PCT 83.38

FEO/(FEO+FE2O3) WT PCT 46.33 MOL PCT 65.74

COOMBS BASALT PLOT NE-OL-QZ-DI(=25.06)

QZ= .55 NE= 0.00 OL= .45 DI= 0.00

IDENTIFICATION FIELD READS.. 74AM5 GABBROIC ANORTHOSITE SP. G. 2.86

18

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTRCT
SIO2	47.60	46.01	0.00
TIO2	.39	.28	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	22.00	25.06	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	2.27	1.65	0.00
FEO	3.90	3.15	0.00
MNO	.12	[.10]	
NIO	-0.00	[0.00]	
MGO	4.05	5.84	0.00
CAO	12.90	13.36	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	2.26	4.24	0.00
K2O	.25	.31	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	95.74	100.00	
-H2O	95.74		

MINERAL	CAT PRCNT	WT PRCNT
QZ	.78	.81
CO	0.00	0.00
Z	0.00	0.00
OR	1.54	1.48
PL	72.48	68.27
(AB)	21.18	19.12
(AN)	51.30	49.15
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	12.40	12.01
(WO)	6.20	6.20
(EN)	4.54	3.92
(FS)	1.66	1.89
HY	9.75	9.14
(EN)	7.13	6.17
(FS)	2.62	2.97
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	2.48	3.29
CM	0.00	0.00
IL	.57	.74
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	74.80	70.56
FEMIC	25.20	25.18
TOTAL	100.00	95.74

AN/PL WT PCT 71.99 MOL PCT 70.78

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 67.46 MOL PCT 73.15

DIFNDX WT PCT 21.41 CAT PCT 23.50

QZ-AB-OR DIAGRAM

WT PCT QZ 3.78 AB 89.32 OR 6.90

MOL PCT QZ 14.70 AB 79.52 OR 5.79

QZ-NE-KP DIAGRAM

WT PCT QZ 47.69 NE 48.39 KP 3.92

MOL PCT QZ 68.48 NE 29.38 KP 2.14

AN-AB-OR DIAGRAM

WT PCT AN 70.46 AB 27.42 OR 2.12

MOL PCT AN 69.31 AB 28.61 OR 2.08

A-F-M DIAGRAM

WT PCT ALK 19.72 FE 49.47 MG 31.81

MOL PCT ALK 18.80 FE 32.92 MG 48.28

(NA+K)/AL ATM WT PCT 16.13 GRMATM PCT 18.13

(FE+MN)/(FE+MN+MG) ATM WT PCT 65.85 GRMATM PCT 45.65

NA2O/(NA2O+K2O) WT PCT 90.04 MOL PCT 93.22

FEO/(FEO+FE2O3) WT PCT 63.21 MOL PCT 79.25

COOMBS BASALT PLOT NE-OL-QZ-DI(=22.94)

QZ= .25 NE= 0.00 OL= .21 DI= .54

IDENTIFICATION FIELD READS.. 74RA53 GABBROIC ANORTHOSITE SP. G. 2.89

19

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	45.70	43.38	0.00	QZ	0.00	0.00
TIO2	.19	.14	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	25.90	28.97	0.00	OR	2.54	2.48
CR2O3	-0.00	0.00	0.00	PL	76.92	74.20
FE2O3	1.97	1.41	0.00	(AB)	15.15	13.93
FEO	1.70	1.35	0.00	(AN)	61.78	60.27
MNO	.06	[.05]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	2.17	1.80
MGO	3.60	5.09	0.00	KP	0.00	0.00
CAO	15.10	15.36	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.04	3.75	0.00	AC	0.00	0.00
K2O	.42	.51	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	12.00	11.55
SO3	-0.00	0.00	0.00	(WO)	6.00	6.11
S	-0.00	(0.00)	0.00	(EN)	5.41	4.76
CL	-0.00	(0.00)	0.00	(FS)	.59	.69
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	96.68	100.00		OL	3.98	3.42
-H2O	96.68			(FO)	3.58	2.95
				(FA)	.39	.47
				CS	0.00	0.00
				MT	2.11	2.86
				CM	0.00	0.00
				IL	.27	.36
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	81.64	78.49
				FEMIC	18.36	18.19
				TOTAL	100.00	96.68

AN/PL WT PCT 81.23 MOL PCT 80.31

FA/OL WT PCT 13.70 MOL PCT 9.88

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 18.22 CAT PCT 19.85

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 40.93 NE 51.33 KP 7.74

MOL PCT QZ 62.41 NE 33.11 KP 4.48

AN-AB-OR DIAGRAM

WT PCT AN 78.60 AB 18.17 OR 3.24

MOL PCT AN 77.74 AB 19.06 OR 3.20

A-F-M DIAGRAM

WT PCT ALK 25.28 FE 37.72 MG 37.00

MOL PCT ALK 22.97 FE 22.13 MG 54.90

(NA+K)/AL ATM WT PCT 13.58 GRMATM PCT 14.71

(FE+MN)/(FE+MN+MG) ATM WT PCT 55.54 GRMATM PCT 35.51

NA2O/(NA2O+K2O) WT PCT 82.93 MOL PCT 88.07

FEO/(FEO+FE2O3) WT PCT 46.32 MOL PCT 65.73

COOMBS BASALT PLOT NE-OL-QZ-DI(=18.15)

QZ= 0.00 NE= .12 OL= .22 DI= .66

IDENTIFICATION FIELD REMPS.. 7134394   GABBROIC ANORTHOSITE SP. G. 2.93   20

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	44.00	43.22	0.00	QZ	0.00	0.00
TIO2	.23	.17	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	17.90	22.61	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	56.42	52.66
FE2O3	4.99	3.69	0.00	(AB)	9.81	8.72
FEO	4.31	3.54	0.00	(AN)	46.61	43.95
MNO	.14	[.12]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	9.00	14.49	0.00	KP	0.00	0.00
CAO	11.60	12.21	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	1.03	1.96	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	11.54	10.75
SO3	-0.00	0.00	0.00	(WO)	5.77	5.68
S	-0.00	(0.00)	0.00	(EN)	5.18	4.41
CL	-0.00	(0.00)	0.00	(FS)	.59	.66
F	-0.00	(0.00)	0.00	HY	25.17	22.09
CO2	-0.00	0.00	0.00	(EN)	22.61	19.23
				(FS)	2.56	2.86
TOTAL	94.00	100.00		OL	1.03	.83
-H2O	94.00			(FO)	.90	.71
				(FA)	.10	.12
				CS	0.00	0.00
				MT	5.53	7.24
				CM	0.00	0.00
				IL	.34	.44
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	56.42	52.65
				FEMIC	43.58	41.34
				TOTAL	100.00	94.00

AN/PL WT PCT 83.45 MOL PCT 82.62

FA/OL WT PCT 14.10 MOL PCT 10.18

EN/HY WT PCT 87.04 MOL PCT 89.82

DIFNOX WT PCT 8.72 CAT PCT 9.81

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB100.00 OR 0.00

MOL PCT QZ 0.00 AB100.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 45.83 NE 54.17 KP 0.00

MOL PCT QZ 66.67 NE 33.33 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 83.45 AB 16.55 OR 0.00

MOL PCT AN 82.62 AB 17.38 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 5.09 FE 45.97 MG 48.94

MOL PCT ALK 4.70 FE 25.81 MG 69.48

(NA+K)/AL ATM WT PCT 8.11 GRMATM PCT 9.52

(FE+MN)/(FE+MN+MG) ATM WT PCT 53.79 GRMATM PCT 33.63

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.34 MOL PCT 65.75

COOMBS BASALT PLOT NE-OL-QZ-DI(=37.71)

QZ= .33 NE= 0.00 OL= .36 DI= .31

IDENTIFICATION FIELD READS.. 74AM191 GABBROIC ANORTHOSITE SP. G. 2.80

21

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CJECT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	45.30	42.31	0.00	QZ	0.00	0.00
TIO2	.19	.13	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	29.73	32.69	0.00	OR	.24	.24
CR2O3	-0.00	0.00	0.00	PL	82.38	80.97
FE2O3	1.43	1.00	0.00	(AB)	12.54	11.72
FEO	1.23	.96	0.00	(AN)	69.84	69.25
MNO	.03	(.02)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	6.60	5.57
MGO	1.05	1.46	0.00	KP	0.00	0.00
CAO	16.55	16.66	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	2.60	4.71	0.00	AC	0.00	0.00
K2O	.04	.05	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	1.77	1.83
H2O-	-0.00			DI	7.24	7.18
SO3	-0.00	0.00	0.00	(WO)	3.62	3.75
S	-0.00	(0.00)	0.00	(EN)	2.92	2.62
CL	-0.00	(0.00)	0.00	(FS)	.70	.82
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	98.22	100.00		OL	0.00	0.00
-H2O	98.22			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	1.51	2.07
				CM	0.00	0.00
				IL	.27	.36
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	89.22	86.78
				FEMIC	10.78	11.44
				TOTAL	100.00	98.22

AN/PL WT PCT 85.52 MOL PCT 84.77

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 17.53 CAT PCT 19.38

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 31.23 NE 68.00 KP .77

MOL PCT QZ 51.81 NE 47.71 KP .48

AN-AB-OR DIAGRAM

WT PCT AN 85.27 AB 14.44 OR .29

MOL PCT AN 84.53 AB 15.18 OR .29

A-F-M DIAGRAM

WT PCT ALK 41.57 FE 41.89 MG 16.54

MOL PCT ALK 44.84 FE 27.59 MG 27.56

(NA+K)/AL ATM WT PCT 12.48 GRMATM PCT 14.55

(FE+MN)/(FE+MN+MG) ATM WT PCT 75.76 GRMATM PCT 57.65

NA2O/(NA2O+K2O) WT PCT 98.48 MOL PCT 99.00

FEO/(FEO+FE2O3) WT PCT 46.24 MOL PCT 65.66

COOMPS BASALT PLOT NE-OL-QZ-DI(=13.84)

QZ= 0.00 NE= .48 OL= 0.00 DI= .52

IDENTIFICATION FIELD READS.. 74M199   ANORTH GABBRO SP. G. 3.03

22

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	50.10	49.91	0.00
TIO2	.43	.32	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	19.50	22.31	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	3.29	2.47	0.10
FEO	2.84	2.37	0.10
MNO	.18	[.15]	
NIO	-0.00	[0.00]	
MGO	1.10	1.48	0.00
CAO	14.45	15.42	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	2.70	5.21	0.00
K2O	.28	.36	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.27	100.00	
-H2O	94.27		

MINERAL	CAT PRCNT	WT PRCNT
QZ	6.96	6.98
CO	0.00	0.00
Z	0.00	0.00
OR	1.78	1.65
PL	67.92	61.74
(AB)	26.07	22.85
(AN)	41.84	38.90
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	9.21	8.94
DI	9.79	9.36
(WO)	4.89	4.75
(EN)	2.97	2.49
(FS)	1.93	2.12
HY	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	3.70	4.77
CM	0.00	0.00
IL	.64	.82
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	76.65	70.38
FEMIC	23.35	23.89
TOTAL	100.00	94.27

AN/PL WT PCT 63.00 MOL PCT 61.51

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 31.49 CAT PCT 34.81

QZ-AB-OR DIAGRAM

WT PCT QZ 22.18 AB 72.56 OR 5.26

MOL PCT QZ 55.53 AB 41.53 OR 2.94

QZ-NE-KP DIAGRAM

WT PCT QZ 57.70 NE 39.31 KP 2.99

MOL PCT QZ 76.46 NE 22.03 KP 1.50

AN-AB-OR DIAGRAM

WT PCT AN 61.35 AB 36.04 OR 2.61

MOL PCT AN 60.03 AB 37.41 OR 2.55

A-F-M DIAGRAM

WT PCT ALK 29.48 FE 60.63 MG 9.89

MOL PCT ALK 35.40 FE 45.74 MG 18.87

(NA+K)/AL ATM WT PCT 22.23 GRMATM PCT 24.97

(FE+MN)/(FE+MN+MG) ATM WT PCT 88.51 GRMATM PCT 77.95

NA2O/(NA2O+K2O) WT PCT 90.60 MOL PCT 93.51

FEO/(FEO+FE2O3) WT PCT 46.33 MOL PCT 65.74

COOMBS BASALT PLOT NE-OL-QZ-DI(=16.75)

QZ= .42 NE= 0.00 OL= 0.00 DI= .58

IDENTIFICATION FIELD READS.. 73BM110B   GABBROIC ANORTHOSITE SP. G. 2.82

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	46.80	43.66	0.00	QZ	0.00	0.00
TIO2	.20	.14	0.00	CO	.87	.79
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	30.80	33.86	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	93.24	91.33
FE2O3	1.15	.81	0.00	(AB)	21.52	20.14
FEO	.99	.77	0.00	(AN)	71.71	71.19
MNO	.03	[.02]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	1.50	2.09	0.00	KP	0.00	0.00
CAO	14.35	14.34	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.38	4.30	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	0.00	0.00
SO3	-0.00	0.00	0.00	(WO)	0.00	0.00
S	-0.00	(0.00)	0.00	(EN)	0.00	0.00
CL	-0.00	(0.00)	0.00	(FS)	0.00	0.00
F	-0.00	(0.00)	0.00	HY	3.56	3.29
CO2	-0.00	0.00	0.00	(EN)	3.17	2.84
				(FS)	.38	.45
TOTAL	98.20	100.00		OL	.84	.74
-H2O	98.20			(FO)	.75	.63
				(FA)	.09	.11
				CS	0.00	0.00
				MT	1.21	1.67
				CM	0.00	0.00
				IL	.28	.38
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	94.11	92.12
				FEMIC	5.89	6.08
				TOTAL	100.00	98.20

AN/PL WT PCT 77.95 MOL PCT 76.92

FA/OL WT PCT 14.90 MOL PCT 10.78

EN/HY WT PCT 86.29 MOL PCT 89.22

DIFNDX WT PCT 20.14 CAT PCT 21.52

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB100.00 OR 0.00

MOL PCT QZ 0.00 AB100.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 45.83 NE 54.17 KP 0.00

MOL PCT QZ 66.67 NE 33.33 KP 0.00

AN-AB-OR DIAGRAM

WT PCT AN 77.95 AB 22.05 OR 0.00

MOL PCT AN 76.92 AB 23.08 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 39.53 FE 35.55 MG 24.92

MOL PCT ALK 39.76 FE 21.72 MG 38.52

(NA+K)/AL ATM WT PCT 10.83 GRMATM PCT 12.71

(FE+MN)/(FE+MN+MG) ATM WT PCT 63.94 GRMATM PCT 43.46

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.26 MOL PCT 65.68

COOMBS BASALT PLOT NE-OL-QZ-DI(= 4.40)

QZ= .40 NE= 0.00 OL= .60 DI= 0.00

IDENTIFICATION FIELD READS.. 733M38 GABBROIC ANORTHOSITE SP. G. 2.80 **24**

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	46.20	42.67	0.00
TIO2	.58	.40	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	29.40	32.00	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	1.21	.84	0.00
FEO	1.04	.80	0.00
MNO	.01	[.01]	
NIO	-0.00	[0.00]	
MGO	.55	.76	0.00
CAO	16.60	16.43	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	3.40	6.39	0.00
K2O	0.00	0.00	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	98.99	100.00	
-H2O	98.99		

MINERAL	CAT PRCNT	WT PRCNT
QZ	0.00	0.00
CO	0.00	0.00
Z	0.00	0.00
OR	0.00	0.00
PL	80.90	80.18
(AB)	16.10	15.22
(AN)	64.79	64.96
LC	0.00	0.00
NE	8.60	7.34
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	5.42	5.68
DI	3.03	2.95
(WO)	1.51	1.58
(EN)	1.51	1.37
(FS)	0.00	0.00
HY	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	1.22	1.70
CM	0.00	0.00
IL	.81	1.10
HM	.02	.04
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	89.49	87.52
FEMIC	10.51	11.47
TOTAL	100.00	98.99

AN/PL WT PCT 81.02 MOL PCT 80.09

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 22.55 CAT PCT 24.71

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 30.91 NE 69.09 KP 0.00

MOL PCT QZ 51.41 NE 48.60 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 81.02 AB 18.98 OR 0.00

MOL PCT AN 80.09 AB 19.91 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 54.84 FE 36.29 MG 8.87

MOL PCT ALK 60.58 FE 24.35 MG 15.07

(NA+K)/AL ATM WT PCT 16.21 GRMATM PCT 19.02

(FE+MN)/(FE+MN+MG) ATM WT PCT 83.37 GRMATM PCT 68.57

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.22 MOL PCT 65.64

COOMBS BASALT PLOT NE-OL-QZ-DI(=11.63)

QZ= 0.00 NE= .74 OL= 0.00 DI= .26

IDENTIFICATION FIELD REAPS.. 74AM102   GABBROIC ANORTHOSITE SP. G. 2.81

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT.	MINERAL	CAT PRCNT	WT PRCNT
SIO2	46.90	41.70	0.00	QZ	0.00	0.00
TIO2	.21	.14	0.00	CO	.99	.84
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	33.90	35.41	0.00	OR	.17	.18
CR2O3	-0.00	0.00	0.00	PL	91.74	93.93
FE2O3	1.90	1.01	0.00	(AB)	15.36	14.95
FEO	.71	.53	0.00	(AN)	76.38	78.89
MNO	.04	(.03)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	2.57	2.26
MGO	1.45	1.94	0.00	KP	0.00	0.00
CAO	15.90	15.28	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	2.26	3.93	0.00	AC	0.00	0.00
K2O	.03	.03	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	0.00	0.00
SO3	-0.00	0.00	0.00	(WO)	0.00	0.00
S	-0.00	(0.00)	0.00	(EN)	0.00	0.00
CL	-0.00	(0.00)	0.00	(FS)	0.00	0.00
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	102.10	100.00		OL	2.91	2.53
-H2O	102.10			(FO)	2.91	2.53
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	1.26	1.81
				CM	0.00	0.00
				IL	.28	.40
				HM	.17	.25
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.10	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	95.38	97.11
				FEMIC	4.62	4.99
				TOTAL	100.00	102.10

AN/PL WT PCT 84.07 MOL PCT 83.26

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 17.39 CAT PCT 18.10

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 39.84 NE 59.58 KP .58

MOL PCT QZ 61.05 NE 38.61 KP .34

AN-AB-OR DIAGRAM

WT PCT AN 83.91 AB 15.90 OR .19

MOL PCT AN 83.10 AB 16.71 OR .19

A-F-M DIAGRAM

WT PCT ALK 38.49 FE 37.14 MG 24.37

MOL PCT ALK 39.97 FE 20.95 MG 39.09

(NA+K)/AL ATM WT PCT 9.60 GRMATM PCT 11.20

(FE+MN)/(FE+MN+MG) ATM WT PCT 65.11 GRMATM PCT 44.83

NA2O/(NA2O+K2O) WT PCT 98.69 MOL PCT 99.13

FEO/(FEO+FE2O3) WT PCT 32.13 MOL PCT 51.27

COOMBS BASALT PLOT NE-OL-QZ-DI(= 5.48)

QZ= 0.00 NE= .47 OL= .53 DI= 0.00

IDENTIFICATION FIELD READS.. 74AH64   GABBROIC ANORTHOSITE SP. G. 2.89   26

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	45.30	42.27	0.00
TIO2	.20	.14	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	28.72	31.56	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	2.47	1.73	0.00
FEO	2.13	1.66	0.00
MNO	.07	[.06]	
NIO	-0.00	[0.00]	
MGO	3.30	4.59	0.00
CAO	14.35	14.35	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	1.50	2.71	0.00
K2O	.78	.93	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	98.80	100.00	
-H2O	98.80		

MINERAL	CAT PRCNT	WT PRCNT
QZ	0.00	0.00
CO	0.00	0.00
Z	0.00	0.00
OR	4.64	4.61
PL	83.37	81.97
(AB)	13.57	12.69
(AN)	69.80	69.27
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	1.54	1.52
(WO)	.77	.80
(EN)	.67	.60
(FS)	.10	.12
HY	.77	.72
(EN)	.67	.60
(FS)	.10	.12
OL	6.79	6.02
(FO)	5.88	4.92
(FA)	.91	1.10
CS	0.00	0.00
MT	2.60	3.58
CM	0.00	0.00
IL	.28	.38
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	88.01	86.58
FEMIC	11.99	12.23
TOTAL	100.00	98.80

AN/PL WT PCT 84.51 MOL PCT 83.72

FA/OL WT PCT 18.30 MOL PCT 13.40

EN/HY WT PCT 83.11 MOL PCT 86.50

DIFNOX WT PCT 17.30 CAT PCT 18.21

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 73.36 OR 26.64

MOL PCT QZ 0.00 AB 74.51 OR 25.49

QZ-NE-KP DIAGRAM

WT PCT QZ 45.12 NE 39.74 KP 15.14

MOL PCT QZ 66.67 NE 24.84 KP 8.50

AN-AB-OR DIAGRAM

WT PCT AN 80.02 AB 14.66 OR 5.32

MOL PCT AN 79.31 AB 15.42 OR 5.27

A-F-M DIAGRAM

WT PCT ALK 22.40 FE 45.19 MG 32.42

MOL PCT ALK 20.37 FE 28.29 MG 51.34

(NA+K)/AL	ATM WT PCT	11.59	GRMATM PCT	11.54
(FE+MN)/(FE+MN+MG)	ATM WT PCT	63.33	GRMATM PCT	42.93
NA2O/(NA2O+K2O)	WT PCT	65.79	MOL PCT	74.51
FEO/(FEO+FE2O3)	WT PCT	46.30	MOL PCT	65.72

COOMBS BASALT PLOT NE-OL-QZ-DI(= 9.11)

QZ= .04 NE= 0.00 OL= .79 DI= .17

IDENTIFICATION FIELD READS.. 74AM147 GABBROIC ANORTHOSITE SP. G. 2.86

SPECIES	INPUT WT PPCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	46.90	41.56	0.00	QZ	0.00	0.00
TIO2	.19	.13	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	29.90	31.23	0.00	OR	.73	.77
CR2O3	-0.00	0.00	0.00	PL	81.82	84.72
FE2O3	1.64	1.09	0.00	(AB)	12.92	12.72
FEO	2.39	1.77	0.00	(AN)	68.90	72.00
MNO	.03	[.02]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	2.62	2.50
MGO	4.40	5.81	0.00	KP	0.00	0.00
CAO	15.50	14.72	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.05	3.52	0.00	AC	0.00	0.00
K2O	.13	.15	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	3.75	3.90
SO3	-0.00	0.00	0.00	(WO)	1.87	2.04
S	-0.00	(0.00)	0.00	(EN)	1.57	1.48
CL	-0.00	(0.00)	0.00	(FS)	.30	.38
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	103.13	100.00		OL	8.99	9.49
-H2O	103.13			(FO)	7.54	6.64
				(FA)	1.45	1.85
				CS	0.00	0.00
				MT	1.64	2.38
				CM	0.00	0.00
				IL	.25	.36
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	85.37	88.00
				FEMIC	14.63	15.13
				TOTAL	100.00	103.13

AN/PL WT PCT 84.98 MOL PCT 84.21

FA/OL WT PCT 21.82 MOL PCT 16.16

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNDX WT PCT 16.00 CAT PCT 16.47

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 38.53 NE 58.74 KP 2.73

MOL PCT QZ 59.81 NE 38.58 KP 1.61

AN-AB-OR DIAGRAM

WT PCT AN 84.22 AB 14.83 OR .90

MOL PCT AN 83.46 AB 15.65 OR .89

A-F-M DIAGRAM

WT PCT ALK 20.55 FE 37.98 MG 41.47

MOL PCT ALK 18.41 FE 23.26 MG 58.33

(NA+K)/AL ATM WT PCT 10.29 GRMATM PCT 11.75

(FE+MN)/(FE+MN+MG) ATM WT PCT 53.29 GRMATM PCT 33.19

NA2O/(NA2O+K2O) WT PCT 94.04 MOL PCT 95.99

FEO/(FEO+FE2O3) WT PCT 59.31 MOL PCT 76.41

COOMBS BASALT PLOT NE-OL-QZ-DI (=15.56)

QZ= 0.00 NE= .18 OL= .58 DI= .24

IDENTIFICATION FIELD READS.. 74AM4   GABBROIC ANORTHOSITE SP. G. 2.94

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTRCT
SIO2	44.60	44.36	0.00
TIO2	.23	.17	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	17.20	20.16	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	6.99	5.23	0.00
FEO	5.97	4.88	0.00
MNO	.18	[.15]	
NIO	-0.00	[0.00]	
MGO	8.50	12.60	0.00
CAO	9.95	10.60	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	.78	1.50	0.00
K2O	.25	.33	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.56	100.00	
-H2O	94.56		

MINERAL	CAT PRCNT	WT PRCNT
QZ	4.24	4.27
CO	0.00	0.00
Z	0.00	0.00
OR	1.65	1.54
PL	53.34	49.25
(AB)	7.52	6.60
(AN)	45.82	42.65
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	5.76	5.33
(WO)	2.88	2.80
(EN)	2.44	2.05
(FS)	.44	.48
HY	26.82	23.60
(EN)	22.76	19.12
(FS)	4.06	4.48
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	7.85	10.13
CM	0.00	0.00
IL	.34	.44
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	59.23	55.06
FEMIC	40.77	39.50
TOTAL	100.00	94.56

AN/PL WT PCT 86.60 MOL PCT 85.90

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 81.02 MOL PCT 84.87

DIFNOX WT PCT 12.40 CAT PCT 13.41

QZ-AB-OR DIAGRAM

WT PCT QZ 34.39 AB 53.22 OR 12.39

MOL PCT QZ 69.82 AB 24.75 OR 5.43

QZ-NE-KP DIAGRAM

WT PCT QZ 64.13 NE 28.83 KP 7.04

MOL PCT QZ 81.18 NE 15.44 KP 3.38

AN-AB-OR DIAGRAM

WT PCT AN 83.98 AB 12.99 OR 3.02

MOL PCT AN 83.32 AB 13.69 OR 3.00

A-F-M DIAGRAM

WT PCT ALK 4.64 FE 57.41 MG 37.95

MOL PCT ALK 4.36 FE 35.68 MG 59.95

(NA+K)/AL	ATM WT PCT	8.73	GRMATM PCT	9.10
(FE+MN)/(FE+MN+MG)	ATM WT PCT	65.17	GRMATM PCT	44.89
NA2O/(NA2O+K2O)	WT PCT	75.00	MOL PCT	82.01
FEO/(FEO+FE2O3)	WT PCT	45.65	MOL PCT	65.11

COOMBS BASALT PLOT NE-OL-QZ-DI(=36.82)

QZ= .48 NE= 0.00 OL= .36 DI= .16

IDENTIFICATION FIELD READS.. 74RA125 GABBROIC ANORTHOSITE SP. G. 2.85

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTRCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	46.00	42.52	0.00	QZ	0.00	0.00
TIO2	.21	.15	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	27.80	30.29	0.00	OR	0.00	0.00
CR2O3	-0.00	0.00	0.00	PL	80.75	80.09
FE2O3	2.08	1.45	0.00	(AB)	13.99	13.21
FEO	1.80	1.39	0.00	(AN)	66.76	66.88
MNO	.06	[.05]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	2.36	2.01
MGO	3.25	4.48	0.00	KP	0.00	0.00
CAO	16.25	16.09	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	2.30	3.58	0.00	AC	0.00	0.00
K2O	0.00	0.00	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	10.97	10.87
SO3	-0.00	0.00	0.00	(WO)	5.49	5.74
S	-0.00	(0.00)	0.00	(EN)	4.87	4.40
CL	-0.00	(0.00)	0.00	(FS)	.62	.73
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	99.45	100.00		OL	3.46	3.07
-H2O	99.45			(FO)	3.07	2.59
				(FA)	.39	.48
				CS	0.00	0.00
				MT	2.17	3.02
				CM	0.00	0.00
				IL	.29	.40
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	83.11	82.10
				FEMIC	16.89	17.35
				TOTAL	100.00	99.45

AN/PL WT PCT 83.50 MOL PCT 82.67

FA/OL WT PCT 15.54 MOL PCT 11.28

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 15.22 CAT PCT 16.35

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 0.00 OR 0.00

MOL PCT QZ 0.00 AB 0.00 OR 0.00

QZ-NE-KP DIAGRAM

WT PCT QZ 39.77 NE 60.23 KP 0.00

MOL PCT QZ 60.96 NE 39.04 KP -.00

AN-AB-OR DIAGRAM

WT PCT AN 83.50 AB 16.50 OR 0.00

MOL PCT AN 82.67 AB 17.33 OR 0.00

A-F-M DIAGRAM

WT PCT ALK 21.91 FE 42.50 MG 35.60

MOL PCT ALK 21.37 FE 25.22 MG 53.40

(NA+K)/AL ATM WT PCT 10.08 GRMATM PCT 11.84

(FE+MN)/(FE+MN+MG) ATM WT PCT 59.67 GRMATM PCT 39.19

NA2O/(NA2O+K2O) WT PCT 100.00 MOL PCT 100.00

FEO/(FEO+FE2O3) WT PCT 46.39 MOL PCT 65.79

COOMBS BASALT PLOT NE-OL-QZ-DI (=16.79)

QZ= 0.00 NE= .14 OL= .21 DI= .65

IDENTIFICATION FIELD READS.. 74RA50 METAFERROPYROXENITE SP. G. 2.98

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	45.40	50.43	0.00
TIO2	1.10	.92	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	10.40	13.62	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	3.01	2.52	0.00
FEO	7.57	7.03	0.00
MNO	.20	[.19]	
NIO	-0.00	[0.00]	
MGO	11.45	18.96	0.00
CAO	4.10	4.88	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	.58	1.25	0.00
K2O	.15	.21	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	83.96	100.00	
-H2O	83.96		

MINERAL	CAT PRCNT	WT PRCNT
QZ	12.29	11.06
CO	2.39	1.83
Z	0.00	0.00
OR	1.06	.89
PL	30.64	25.25
(AB)	6.25	4.91
(AN)	24.40	20.34
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	0.00	0.00
(WO)	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
HY	48.03	38.49
(EN)	37.91	28.52
(FS)	10.09	9.97
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	3.77	4.36
CM	0.00	0.00
IL	1.94	2.09
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	46.39	39.02
FEMIC	53.61	44.94
TOTAL	100.00	83.96

AN/PL WT PCT 80.56 MOL PCT 79.62

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 74.10 MOL PCT 78.99

DIFNOX WT PCT 16.85 CAT PCT 19.59

QZ-AB-OR DIAGRAM

WT PCT QZ 65.62 AB 29.12 OR 5.26

MOL PCT QZ 89.37 AB 9.09 OR 1.55

QZ-NE-KP DIAGRAM

WT PCT QZ 81.24 NE 15.77 KP 2.99

MOL PCT QZ 91.23 NE 7.49 KP 1.27

AN-AB-OR DIAGRAM

WT PCT AN 77.83 AB 18.78 OR 3.39

MOL PCT AN 76.95 AB 19.70 OR 3.35

A-F-M DIAGRAM

WT PCT ALK 3.21 FE 46.49 MG 50.31

MOL PCT ALK 2.61 FE 29.63 MG 67.76

(NA+K)/AL ATM WT PCT 10.08 GRMATM PCT 10.74

(FE+MN)/(FE+MN+MG) ATM WT PCT 54.12 GRMATM PCT 33.93

NA2O/(NA2O+K2O) WT PCT 79.45 MOL PCT 85.46

FEO/(FEO+FE2O3) WT PCT 71.55 MOL PCT 84.83

COOMBS BASALT PLOT NE-OL-QZ-DI(=60.29)

QZ= .60 NE= 0.00 OL= .40 DI= 0.00

3!

IDENTIFICATION FIELD READS.. 74RA97 METADIABASE SP. G. 3.11

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	47.60	46.46	0.00
TIO2	1.49	1.09	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	13.50	15.53	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	7.10	5.22	0.00
FEO	5.97	4.87	0.00
MNO	.05	[.04]	
NIO	-0.00	[0.00]	
MGO	6.60	9.60	0.00
CAO	11.75	12.29	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	2.38	4.50	0.00
K2O	.31	.39	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	96.75	100.00	
-H2O	96.75		

MINERAL	CAT PRCNT	WT PRCNT
QZ	3.37	3.45
CO	0.00	0.00
Z	0.00	0.00
OR	1.93	1.83
PL	49.12	45.38
(AB)	22.52	20.14
(AN)	26.60	25.24
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	27.87	26.15
(WO)	13.94	13.90
(EN)	12.37	10.59
(FS)	1.56	1.76
HY	7.70	6.82
(EN)	6.83	5.85
(FS)	.86	.97
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	7.82	10.29
CM	0.00	0.00
IL	2.19	2.83
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	54.42	53.66
FEMIC	45.58	46.09
TOTAL	100.00	96.75

AN/PL WT PCT 55.62 MOL PCT 54.15

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 85.76 MOL PCT 88.78

DIFNOX WT PCT 25.42 CAT PCT 27.62

QZ-AB-OR DIAGRAM

WT PCT QZ 13.57 AB 79.22 OR 7.21

MOL PCT QZ 40.78 AB 54.55 OR 4.67

QZ-NE-KP DIAGRAM

WT PCT QZ 52.99 NE 42.92 KP 4.10

MOL PCT QZ 72.89 NE 24.97 KP 2.14

AN-AB-OR DIAGRAM

WT PCT AN 53.46 AB 42.66 OR 3.88

MOL PCT AN 52.11 AB 44.11 OR 3.78

A-F-M DIAGRAM

WT PCT ALK 12.03 FE 58.45 MG 29.52

MOL PCT ALK 12.52 FE 38.31 MG 49.17

(NA+K)/AL ATM WT PCT 28.31 GRMATM PCT 31.49

(FE+MN)/(FE+MN+MG) ATM WT PCT 70.79 GRMATM PCT 51.34

NA2O/(NA2O+K2O) WT PCT 58.48 MOL PCT 92.11

FEO/(FEO+FE2O3) WT PCT 45.68 MOL PCT 65.14

COOMBS BASALT PLOT NE-OL-QZ-DI(=38.94)

QZ= .19 NE= 0.00 OL= .10 DI= .72

IDENTIFICATION FIELD REAOS.. 74RA148 METADIABASE SP. G. 3.33

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR -CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	47.43	46.38	0.00	QZ	0.00	0.00
TIO2	.89	.65	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.30	17.64	0.00	OR	3.05	2.90
CR2O3	-0.00	0.00	0.00	PL	54.82	50.55
FE2O3	3.06	2.25	0.00	(AB)	24.47	21.83
FEO	8.94	7.32	0.00	(AN)	30.35	28.72
MNO	.21	(.17)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	0.00	0.00
MGO	6.90	10.06	0.00	KP	0.00	0.00
CAO	9.55	10.01	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	2.58	4.89	0.00	AC	0.00	0.00
K2O	.49	.61	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	15.77	15.29
SO3	-0.00	0.00	0.00	(WO)	7.89	7.79
S	-0.00	(0.00)	0.00	(EN)	5.03	4.29
CL	-0.00	(0.00)	0.00	(FS)	2.86	3.21
F	-0.00	(0.00)	0.00	HY	15.68	14.91
CO2	-0.05	0.00	0.00	(EN)	10.00	8.54
				(FS)	5.68	6.37
TOTAL	95.31	100.00		OL	6.00	5.56
-H2O	95.31			(FO)	3.62	3.05
				(FA)	2.17	2.51
				CS	0.00	0.00
				MT	3.38	4.44
				CM	0.00	0.00
				IL	1.30	1.67
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	57.88	53.45
				FEMIC	42.12	41.87
				TOTAL	100.00	95.31

AN/PL WT PCT 56.81 MOL PCT 55.35

FA/OL WT PCT 45.13 MOL PCT 36.22

EN/HY WT PCT 57.25 MOL PCT 63.79

DIFNDX WT PCT 24.73 CAT PCT 27.53

QZ-AB-OR DIAGRAM

WT PCT QZ 0.00 AB 88.29 OR 11.71

MOL PCT QZ 0.00 AB 88.89 OR 11.11

QZ-NE-KP DIAGRAM

WT PCT QZ 45.52 NE 47.83 KP 6.65

MOL PCT QZ 66.67 NE 29.63 KP 3.70

AN-AB-OR DIAGRAM

WT PCT AN 53.74 AB 40.85 OR 5.42

MOL PCT AN 52.43 AB 42.29 OR 5.28

A-F-M DIAGRAM

WT PCT ALK 13.97 FE 54.62 MG 31.41

MOL PCT ALK 12.95 FE 39.71 MG 47.34

(NA+K)/AL ATM WT PCT 28.66 GRMATM PCT 31.21

(FE+MN)/(FE+MN+MG) ATM WT PCT 56.98 GRMATM PCT 49.19

NA2O/(NA2O+K2O) WT PCT 84.04 MOL PCT 88.89

FEO/(FEO+FE2O3) WT PCT 74.50 MOL PCT 86.66

COOMBS BASALT PLOT NE-OL-QZ-DI (=37.45)

QZ= .21 NE= 0.00 OL= .37 DI= .42

IDENTIFICATION FIELD READS.. 74RA134   METADIABASE SP. G. 3.03

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	48.40	49.91	0.00
TIO2	.23	.18	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	11.90	14.46	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	4.50	3.49	0.10
FEO	3.79	3.27	0.00
MNO	.17	(.15)	
NIO	-0.00	(0.00)	
MGO	6.65	10.22	0.00
CAO	11.35	12.54	0.00
SRO	-0.00	(0.00)	
BAO	-0.00	(0.00)	
NA2O	2.34	5.68	0.00
K2O	.07	.09	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	89.90	100.00	
-H2O	89.90		

MINERAL	CAT PRCNT	WT PRCNT
QZ	4.00	3.88
CO	0.00	0.00
Z	0.00	0.00
OR	.46	.41
PL	50.13	43.55
(AB)	28.39	24.03
(AN)	21.73	19.52
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	32.78	29.17
(WO)	16.39	15.36
(EN)	14.30	11.59
(FS)	2.09	2.22
HY	7.04	5.93
(EN)	6.14	4.98
(FS)	.90	.96
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	5.24	6.52
CM	0.00	0.00
IL	.36	.44
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	54.59	47.84
FEMIC	45.41	42.06
TOTAL	100.00	89.90

AN/PL WT PCT 44.81 MOL PCT 43.35

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 83.90 MOL PCT 87.25

DIFNDX WT PCT 28.32 CAT PCT 32.85

QZ-AB-OR DIAGRAM

WT PCT QZ 13.69 AB 84.85 OR 1.46

MOL PCT QZ 40.94 AB 58.12 OR .94

QZ-NE-KP DIAGRAM

WT PCT QZ 53.21 NE 45.96 KP .83

MOL PCT QZ 72.92 NE 26.65 KP .43

AN-AB-OR DIAGRAM

WT PCT AN 44.39 AB 54.67 OR .94

MOL PCT AN 42.96 AB 56.13 OR .91

A-F-M DIAGRAM

WT PCT ALK 16.30 FE 46.44 MG 37.25

MOL PCT ALK 15.92 FE 27.67 MG 56.41

(NA+K)/AL ATM WT PCT 34.38 GRMATM PCT 39.90

(FE+MN)/(FE+MN+MG) ATM WT PCT 65.82 GRMATM PCT 40.33

NA2O/(NA2O+K2O) WT PCT 97.59 MOL PCT 98.40

FEO/(FEO+FE2O3) WT PCT 45.72 MOL PCT 65.18

COOMBS BASALT PLOT NE-OL-QZ-DI(=43.82)

QZ= .17 NE= 0.00 OL= .08 DI= .75

IDENTIFICATION FIELD READS.. 74AM135 META FERROPYROXENITE SP. G. 3.11

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP FERROP CTPCT
SIO2	48.93	51.69	0.00
TIO2	2.10	1.67	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	10.10	13.48	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	6.10	4.86	0.00
FEO	9.27	8.21	0.00
MNO	.21	[.19]	
NIO	-0.00	[0.00]	
MGO	4.45	7.03	0.00
CAO	9.60	10.90	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	.95	1.95	0.00
K2O	.01	.01	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	92.29	100.00	
-H2O	92.29		

MINERAL	CAT PRCNT	WT PRCNT
QZ	17.52	16.82
CO	0.00	0.00
Z	0.00	0.00
OR	.07	.06
PL	38.55	33.21
(AB)	9.76	8.04
(AN)	28.80	25.17
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	20.54	18.44
(WO)	10.27	9.37
(EN)	6.37	5.03
(FS)	3.90	4.04
HY	12.37	10.92
(EN)	7.68	6.06
(FS)	4.69	4.87
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	7.29	8.84
CM	0.00	0.00
IL	3.35	3.99
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	56.44	50.10
FEMIC	43.56	42.20
TOTAL	100.00	92.29

AN/PL WT PCT 75.80 MOL PCT 74.70

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 55.45 MOL PCT 62.05

DIFNOX WT PCT 24.92 CAT PCT 27.55

QZ-AB-OR DIAGRAM

WT PCT QZ 67.51 AB 32.25 OR .24

MOL PCT QZ 90.07 AB 9.86 OR .17

QZ-NE-KP DIAGRAM

WT PCT QZ 82.39 NE 17.47 KP .13

MOL PCT QZ 91.72 NE 8.23 KP .05

AN-AB-OR DIAGRAM

WT PCT AN 75.66 AB 24.16 OR .18

MOL PCT AN 74.56 AB 25.26 OR .17

A-F-M DIAGRAM

WT PCT ALK 4.62 FE 73.97 MG 21.41

MOL PCT ALK 5.27 FE 57.06 MG 37.67

(NA+K)/AL ATM WT PCT 12.48 GRMATM PCT 14.57

(FE+MN)/(FE+MN+MG) ATM WT PCT 81.26 GRMATM PCT 65.37

NA2O/(NA2O+K2O) WT PCT 98.96 MOL PCT 99.31

FEO/(FEO+FE2O3) WT PCT 60.31 MOL PCT 77.16

COOMBS BASALT PLOT NE-OL-QZ-DI(=50.74)

QZ= .47 NE= 0.00 OL= .12 DI= .40

IDENTIFICATION FIELD READS.. 73PS150   BIOTITE TRONDJHEMITE

35

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	62.90	60.75	0.00	QZ	17.09	17.69
TIO2	.03	.02	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.50	17.64	0.00	OR	9.24	8.36
CR2O3	-0.00	0.00	0.00	PL	58.82	54.27
FE2O3	1.00	.73	0.00	(AB)	38.67	34.95
FEO	1.36	1.10	0.00	(AN)	20.15	19.32
MNO	.05	[.04]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	1.90	2.74	0.00	KP	0.00	0.00
CAO	7.15	7.40	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	4.13	7.73	0.00	AC	0.00	0.00
K2O	1.50	1.85	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	13.47	12.95
SO3	-0.00	0.00	0.00	(WO)	6.74	6.74
S	-0.00	(0.00)	0.00	(EN)	5.28	4.57
CL	-0.00	(0.00)	0.00	(FS)	1.46	1.66
F	-0.00	(0.00)	0.00	HY	.24	.22
CO2	-0.00	0.00	0.00	(EN)	.19	.16
				(FS)	.05	.06
TOTAL	95.52	100.00		OL	0.00	0.00
-H2O	95.52			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	1.09	1.45
				CM	0.00	0.00
				IL	.04	.06
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	85.15	80.83
				FEMIC	14.85	14.70
				TOTAL	100.00	95.52

AN/PL WT PCT 35.61 MOL PCT 34.26

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 73.40 MOL PCT 78.33

DIFNDX WT PCT 61.50 CAT PCT 65.00

QZ-AB-OR DIAGRAM

WT PCT QZ 28.76 AB 56.82 OR 14.41

MOL PCT QZ 64.07 AB 29.00 OR 6.93

QZ-NE-KP DIAGRAM

WT PCT QZ 61.03 NE 30.78 KP 8.13

MOL PCT QZ 79.09 NE 16.87 KP 4.03

AN-AB-OR DIAGRAM

WT PCT AN 30.61 AB 55.35 OR 14.04

MOL PCT AN 29.61 AB 56.81 OR 13.58

A-F-M DIAGRAM

WT PCT ALK 56.93 FE 23.86 MG 19.21

MOL PCT ALK 53.30 FE 16.26 MG 30.43

(NA+K)/AL	ATM WT PCT	52.53	GRMATM PCT	54.31
(FE+MN)/(FE+MN+MG)	ATM WT PCT	61.04	GRMATM PCT	40.56
NA2O/(NA2O+K2O)	WT PCT	73.36	MOL PCT	80.71
FEO/(FEO+FE2O3)	WT PCT	57.63	MOL PCT	75.14

COOMBS BASALT PLOT NE-OL-QZ-DI(=30.80)

QZ= .56 NE= 0.00 OL= .00 DI= .44

IDENTIFICATION FIELD READS.. 73PS133   BIOTITE TRONDJHEMITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	71.93	68.78	0.00
TIO2	.01	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	14.83	16.72	0.10
CR2O3	-0.00	0.00	0.00
FE2O3	.21	.15	0.10
FEO	.29	.23	0.00
MNO	.04	[.03]	
NIO	-0.00	(0.00)	
MGO	.45	.64	0.10
CAO	3.00	3.07	0.01
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	4.60	8.53	0.00
K2O	1.50	1.83	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	96.63	100.00	
-H2O	96.83		

MINERAL	CAT PRCNT	WT PRCNT
QZ	30.72	32.11
CO	.21	.18
Z	0.00	0.00
OR	9.15	8.86
PL	58.03	53.81
(AB)	42.66	38.92
(AN)	15.37	14.88
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	0.00	0.00
(WO)	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
HY	1.65	1.54
(EN)	1.28	1.12
(FS)	.36	.42
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.23	.30
CM	0.00	0.00
IL	.01	.02
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	98.11	94.97
FEMIC	1.89	1.86
TOTAL	100.00	96.83

AN/PL WT PCT 27.66 MOL PCT 26.49

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 72.89 MOL PCT 77.94

DIFNDX WT PCT 79.90 CAT PCT 82.53

QZ-AB-OR DIAGRAM

WT PCT QZ 40.19 AB 48.71 OR 11.09

MOL PCT QZ 74.78 AB 20.77 OR 4.45

QZ-NE-KP DIAGRAM

WT PCT QZ 67.31 NE 26.39 KP 6.30

MOL PCT QZ 83.23 NE 13.80 KP 2.95

AN-AB-OR DIAGRAM

WT PCT AN 23.75 AB 62.11 OR 14.14

MOL PCT AN 22.88 AB 63.49 OR 13.62

A-F-M DIAGRAM

WT PCT ALK 86.52 FE 7.09 MG 6.38

MOL PCT ALK 84.52 FE 5.02 MG 10.47

(NA+K)/AL ATM WT PCT 59.34 GRMATM PCT 61.98

(FE+MN)/(FE+MN+MG) ATM WT PCT 59.77 GRMATM PCT 39.31

NA2O/(NA2O+K2O) WT PCT 75.41 MOL PCT 82.34

FEO/(FEO+FE2O3) WT PCT 58.00 MOL PCT 75.43

COOMBS BASALT PLOT NE-OL-QZ-DI(=32.37)

QZ= .97 NE= 0.00 OL= .03 DI= 0.00

IDENTIFICATION FIELD READS.. 73BM169   HR MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR DIPCT
SIO2	60.50	62.53	0.00
TIO2	.33	.02	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	15.15	18.45	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.48	.37	0.00
FEO	.75	.61	0.00
MNO	.05	[.04]	
NIO	-0.00	[0.00]	
MGO	.40	.62	0.00
CAO	3.80	4.21	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	4.95	9.92	0.00
K2O	2.45	3.23	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	88.51	100.00	
-H2O	88.51		

MINERAL	CAT PRCNT	WT PRCNT
QZ	15.16	14.67
CO	0.00	0.00
Z	0.00	0.00
OR	16.15	14.48
PL	62.86	53.77
(AB)	49.60	41.89
(AN)	13.26	11.88
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	1.09	.94
DI	4.22	3.93
(WO)	2.11	1.97
(EN)	1.23	1.03
(FS)	.88	.93
HY	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.55	.70
CM	0.00	0.00
IL	.05	.06
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	94.17	82.92
FEMIC	5.83	5.59
TOTAL	100.00	88.51

AN/PL WT PCT 22.10 MOL PCT 21.10

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 71.04 CAT PCT 80.91

QZ-AB-OR DIAGRAM

WT PCT QZ 20.65 AB 58.96 OR 20.38

MOL PCT QZ 53.56 AB 35.03 OR 11.41

QZ-NE-KP DIAGRAM

WT PCT QZ 56.48 NE 31.94 KP 11.58

MOL PCT QZ 75.92 NE 18.16 KP 5.91

AN-AB-OR DIAGRAM

WT PCT AN 17.41 AB 61.37 OR 21.21

MOL PCT AN 16.79 AB 62.77 OR 20.44

A-F-M DIAGRAM

WT PCT ALK 82.41 FE 13.14 MG 4.45

MOL PCT ALK 82.36 FE 9.92 MG 7.72

(NA+K)/AL ATM WT PCT 71.16 GRMATM PCT 71.25

(FE+MN)/(FE+MN+MG) ATM WT PCT 79.20 GRMATM PCT 62.39

NA2O/(NA2O+K2O) WT PCT 66.89 MOL PCT 75.44

FEO/(FEO+FE2O3) WT PCT 59.32 MOL PCT 76.42

COOMBS BASALT PLOT NE-OL-QZ-DI(=19.38)

QZ= .78 NE= 0.00 OL= 0.00 DI= .22

IDENTIFICATION FIELD READS.. 73849 HB MONZONITE

38

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	62.50	60.64	0.00
TIO2	.33	.62	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	13.90	15.79	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	1.65	1.20	0.00
FEO	1.10	.89	0.00
MNO	.06	[.05]	
NIO	-0.00	[0.00]	
MGO	2.40	3.47	0.00
CAO	3.30	3.43	0.00
SRO	-0.00	(0.00)	
BAO	-0.00	[0.00]	
NA2O	4.25	8.00	0.00
K2O	5.26	6.51	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.35	100.00	
-H2O	94.35		

MINERAL	CAT PRCNT	WT PRCNT
QZ	9.27	9.55
CO	0.00	0.00
Z	0.00	0.00
OR	32.55	31.08
PL	43.17	39.01
(AB)	39.98	35.96
(AN)	3.19	3.04
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	11.17	10.50
(WO)	5.59	5.57
(EN)	5.12	4.41
(FS)	.47	.53
HY	1.99	1.76
(EN)	1.82	1.57
(FS)	.17	.19
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	1.81	2.39
CM	0.00	0.00
IL	.04	.06
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	84.99	79.64
FEMIC	15.01	14.71
TOTAL	100.00	94.35

AN/PL WT PCT 7.80 MOL PCT 7.39

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 89.27 MOL PCT 91.62

DIFNDX WT PCT 76.60 CAT PCT 81.80

QZ-AB-OR DIAGRAM

WT PCT QZ 12.47 AB 46.95 OR 40.58

MOL PCT QZ 38.99 AB 33.63 OR 27.38

QZ-NE-KP DIAGRAM

WT PCT QZ 51.51 NE 25.43 KP 23.06

MOL PCT QZ 72.52 NE 15.15 KP 12.33

AN-AB-OR DIAGRAM

WT PCT AN 4.34 AB 51.31 OR 44.35

MOL PCT AN 4.21 AB 52.80 OR 42.99

A-F-M DIAGRAM

WT PCT ALK 64.87 FE 18.76 MG 16.37

MOL PCT ALK 59.36 FE 12.23 MG 28.41

(NA+K)/AL ATM WT PCT 102.96 GRMATM PCT 91.92

(FE+MN)/(FE+MN+MG) ATM WT PCT 58.68 GRMATM PCT 38.21

NA2O/(NA2O+K2O) WT PCT 44.69 MOL PCT 55.12

FEO/(FEO+FE2O3) WT PCT 40.00 MOL PCT 59.71

COOMBS BASALT PLOT NE-OL-QZ-DI(=22.43)

QZ= .46 NE= 0.00 OL= .04 DI= .50

IDENTIFICATION FIELD READS.. 739"115 HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIRCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	65.10	63.02	0.00	QZ	14.68	15.16
TIO2	.02	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	16.45	18.77	0.00	OR	18.21	17.43
CR2O3	-0.00	0.00	0.00	PL	63.81	58.18
FE2O3	.25	.19	0.00	(AB)	51.99	46.88
FEO	.38	.31	0.00	(AN)	11.82	11.31
MNO	.04	[.03]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	.40	.58	0.00	KP	0.00	0.00
CAO	2.34	3.05	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.54	10.40	0.00	AC	0.00	0.00
K2O	2.95	3.64	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	2.74	2.66
SO3	-0.00	0.00	0.00	(WO)	1.37	1.37
S	-0.00	(0.00)	0.00	(EN)	.98	.85
CL	-0.00	(0.00)	0.00	(FS)	.39	.44
F	-0.00	(0.00)	0.00	HY	.25	.23
CO2	-0.00	0.00	0.00	(EN)	.18	.15
				(FS)	.07	.08
TOTAL	94.18	100.00		OL	0.00	0.00
-H2O	94.08			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.28	.38
				CM	0.00	0.00
				IL	.03	.04
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	96.70	90.78
				FEMIC	3.30	3.31
				TOTAL	100.00	94.08

AN/PL WT PCT 19.43 MOL PCT 18.52

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 65.52 MOL PCT 71.40

DIFNDX WT PCT 79.47 CAT PCT 84.98

QZ-AB-OR DIAGRAM

WT PCT QZ 19.08 AB 58.99 OR 21.94

MOL PCT QZ 51.10 AB 36.21 OR 12.58

QZ-NE-KP DIAGRAM

WT PCT QZ 55.58 NE 31.96 KP 12.47

MOL PCT QZ 75.28 NE 18.31 KP 6.41

AN-AB-OR DIAGRAM

WT PCT AN 14.95 AB 62.00 OR 23.05

MOL PCT AN 14.41 AB 63.39 OR 22.21

A-F-M DIAGRAM

WT PCT ALK 89.09 FE 6.72 MG 4.20

MOL PCT ALK 87.76 FE 5.03 MG 7.21

(NA+K)/AL ATM WT PCT 75.34 GRMATM PCT 74.81

(FE+MN)/(FE+MN+MG) ATM WT PCT 67.81 GRMATM PCT 47.96

NA2O/(NA2O+K2O) WT PCT 65.25 MOL PCT 74.06

FEO/(FEO+FE2O3) WT PCT 59.37 MOL PCT 76.46

COOMBS BASALT PLOT NE-OL-QZ-DI(=17.66)

QZ= .84 NE= 0.00 OL= .01 DI= .16

IDENTIFICATION FIELD READS.. 73BM116   HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR OTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	66.40	65.11	0.00	QZ	17.06	17.40
TIO2	.02	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	14.14	16.34	0.00	OR	19.39	19.32
CR2O3	-0.00	0.00	0.00	PL	57.49	51.44
FE2O3	.23	.17	0.00	(AB)	52.66	46.88
FEO	.34	.28	0.00	(AN)	4.83	4.56
MNO	.04	[.03]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	.55	.80	0.00	KP	0.00	0.00
CAO	2.70	2.84	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.54	10.53	0.00	AC	0.00	0.00
K2O	3.10	3.89	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	1.71	1.59
H2O-	-0.00			DI	4.07	3.85
SO3	-0.00	0.00	0.00	(WO)	2.03	2.00
S	-0.00	(0.00)	0.00	(EN)	1.61	1.37
CL	-0.00	(0.00)	0.00	(FS)	.42	.48
F	-0.00	(0.00)	0.00	HY	0.00	0.00
CO2	-0.00	0.00	0.00	(EN)	0.00	0.00
				(FS)	0.00	0.00
TOTAL	93.06	100.00		OL	0.00	0.00
-H2O	93.06			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.25	.33
				CM	0.00	0.00
				IL	.03	.04
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	93.94	87.15
				FEMIC	6.06	5.91
				TOTAL	100.00	93.06

AN/PL WT PCT 8.65 MOL PCT 9.40

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 0.00 MOL PCT 0.00

DIFNOX WT PCT 82.60 CAT PCT 89.11

QZ-AB-OR DIAGRAM

WT PCT QZ 21.06 AB 56.76 OR 22.18

MOL PCT QZ 54.21 AB 33.47 OR 12.32

QZ-NE-KP DIAGRAM

WT PCT QZ 56.65 NE 30.75 KP 12.60

MOL PCT QZ 76.10 NE 17.47 KP 6.43

AN-AB-OR DIAGRAM

WT PCT AN 6.54 AB 67.20 OR 26.25

MOL PCT AN 6.28 AB 68.50 OR 25.22

A-F-M DIAGRAM

WT PCT ALK 88.52 FE 5.84 MG 5.64

MOL PCT ALK 86.06 FE 4.34 MG 9.60

(NA+K)/AL ATM WT PCT 89.31 GRMATM PCT 88.18

(FE+MN)/(FE+MN+MG) ATM WT PCT 57.90 GRMATM PCT 37.47

NA2O/(NA2O+K2O) WT PCT 64.12 MOL PCT 73.09

FEO/(FEO+FE2O3) WT PCT 59.65 MOL PCT 76.57

COOMBS BASALT PLOT NE-OL-QZ-DI(=21.13)

QZ= .81 NE= 0.00 OL= 0.00 DI= .19

IDENTIFICATION FIELD READS.. 73BM113 HB QTZ MONZONITE

41

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	66.72	64.36	0.00
TIO2	.01	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	15.03	18.08	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.16	.12	0.00
FEO	.31	.25	0.00
MNO	.03	[.02]	
NIO	-0.00	[0.00]	
MGO	.35	.50	0.00
CAO	2.42	2.50	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	5.70	10.66	0.00
K2O	2.84	3.59	0.00
P2O5	-0.00	0.00	0.00
H2O+	[illegible]		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.42	100.00	
-H2O	94.42		

MINERAL	CAT PRCNT	WT PRCNT
QZ	16.70	17.31
CO	0.00	0.00
Z	0.00	0.00
OR	17.48	16.78
PL	63.12	57.64
(AB)	53.32	48.23
(AN)	9.91	9.41
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	2.16	2.11
(WO)	1.08	1.08
(EN)	.76	.66
(FS)	.32	.36
HY	.34	.33
(EN)	.24	.21
(FS)	.10	.11
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.17	.23
CM	0.00	0.00
IL	.01	.02
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	97.30	91.74
FEMIC	2.70	2.68
TOTAL	100.00	94.42

AN/PL WT PCT 16.33 MOL PCT 15.53

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 64.66 MOL PCT 70.53

DIFNDX WT PCT 82.33 CAT PCT 87.50

QZ-AB-OR DIAGRAM

WT PCT QZ 21.03 AB 58.59 OR 20.38

MOL PCT QZ 54.12 AB 34.55 OR 11.33

QZ-NE-KP DIAGRAM

WT PCT QZ 56.68 NE 31.74 KP 11.58

MOL PCT QZ 76.08 NE 18.02 KP 5.91

AN-AB-OR DIAGRAM

WT PCT AN 12.65 AB 64.81 OR 22.55

MOL PCT AN 12.17 AB 66.15 OR 21.68

A-F-M DIAGRAM

WT PCT ALK 91.24 FE 5.02 MG 3.74

MOL PCT ALK 89.72 FE 3.91 MG 6.38

(NA+K)/AL ATM WT PCT 78.27 GRMATM PCT 78.31

(FE+MN)/(FE+MN+MG) ATM WT PCT 64.05 GRMATM PCT 43.71

NA2O/(NA2O+K2O) WT PCT 66.74 MOL PCT 75.31

FEO/(FEO+FE2O3) WT PCT 65.96 MOL PCT 81.16

COOMBS BASALT PLOT NE-OL-QZ-DI(=19.21)

QZ= .89 NE= 0.00 OL= .01 DI= .11

IDENTIFICATION FIELD READS.. 733M91 48 QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTRCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	67.93	63.82	0.10	QZ	15.08	16.05
TIO2	.22	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.50	17.17	0.10	OR	19.42	19.15
CR2O3	-0.00	0.00	0.00	PL	59.18	55.37
FE2O3	.23	.16	0.00	(AB)	51.93	48.23
FEO	.34	.27	0.00	(AN)	7.24	7.14
MNO	.04	[.03]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	1.25	1.75	0.00	KP	0.00	0.00
CAO	2.50	2.52	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.70	10.39	0.00	AC	0.00	0.00
K2O	3.24	3.58	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	4.27	4.16
SO3	-0.00	0.00	0.00	(WO)	2.14	2.20
S	-0.00	(0.00)	0.00	(EN)	1.91	1.70
CL	-0.00	(0.00)	0.00	(FS)	.22	.25
F	-0.00	(0.00)	0.00	HY	1.77	1.63
CO2	-0.00	0.00	0.00	(EN)	1.59	1.41
				(FS)	.18	.22
TOTAL	96.72	100.00		OL	0.00	0.00
-H2O	96.72			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.24	.33
				CM	0.00	0.00
				IL	.03	.04
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	93.69	90.56
				FEMIC	6.32	6.16
				TOTAL	100.00	96.72

AN/PL WT PCT 12.89 MOL PCT 12.24

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 86.75 MOL PCT 89.58

DIFNDX WT PCT 83.42 CAT PCT 86.44

QZ-AB-OR DIAGRAM

WT PCT QZ 19.23 AB 57.82 OR 22.95

MOL PCT QZ 51.38 AB 35.39 OR 13.23

QZ-NE-KP DIAGRAM

WT PCT QZ 55.64 NE 31.32 KP 13.04

MOL PCT QZ 75.35 NE 17.94 KP 6.71

AN-AB-OR DIAGRAM

WT PCT AN 9.58 AB 64.73 OR 25.69

MOL PCT AN 9.22 AB 66.07 OR 24.71

A-F-M DIAGRAM

WT PCT ALK 83.09 FE 5.30 MG 11.62

MOL PCT ALK 77.26 FE 3.77 MG 18.96

(NA+K)/AL	ATM WT PCT	84.33	GRMATM PCT	83.12
(FE+MN)/(FE+MN+MG)	ATM WT PCT	37.70	GRMATM PCT	20.97
NA2O/(NA2O+K2O)	WT PCT	63.75	MOL PCT	72.78
FEO/(FEO+FE2O3)	WT PCT	59.65	MOL PCT	76.57

COOMBS BASALT PLOT NE-OL-QZ-DI(=21.13)

QZ= .76 NE= 0.00 OL= .04 DI= .20

IDENTIFICATION FIELD READS.. 739M94 POR HB QTZ MONZONITE

43

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTECT
SIO2	65.10	63.82	0.00
TIO2	.02	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	15.03	18.41	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.19	.14	0.00
FEO	.28	.23	0.00
MNO	.05	[.04]	
NIO	-0.00	[0.00]	
MGO	.30	.44	0.00
CAO	2.44	2.56	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	5.54	10.53	0.00
K2O	3.05	3.81	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	92.90	100.00	
-H2O	92.90		

MINERAL	CAT PRCNT	WT PRCNT
QZ	15.57	15.88
CO	0.00	0.00
Z	0.00	0.00
OR	19.07	18.02
PL	62.81	56.47
(AB)	52.65	46.88
(AN)	10.15	9.59
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	2.13	2.04
(WO)	1.06	1.05
(EN)	.75	.64
(FS)	.32	.36
HY	.18	.17
(EN)	.13	.11
(FS)	.06	.06
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.21	.28
CM	0.00	0.00
IL	.03	.04
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	97.45	90.37
FEMIC	2.55	2.53
TOTAL	100.00	92.90

AN/PL WT PCT 16.98 MOL PCT 16.17

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 64.17 MOL PCT 73.18

DIFNDX WT PCT 80.78 CAT PCT 87.29

QZ-AB-OR DIAGRAM

WT PCT QZ 19.66 AB 58.03 OR 22.31

MOL PCT QZ 52.05 AB 35.20 OR 12.75

QZ-NE-KP DIAGRAM

WT PCT QZ 55.88 NE 31.44 KP 12.58

MOL PCT QZ 75.52 NE 17.97 KP 6.51

AN-AB-OR DIAGRAM

WT PCT AN 12.88 AB 62.93 OR 24.19

MOL PCT AN 12.40 AB 64.31 OR 23.29

A-F-M DIAGRAM

WT PCT ALK 91.77 FE 5.02 MG 3.21

MOL PCT ALK 90.67 FE 3.79 MG 5.54

(NA+K)/AL ATM WT PCT 78.78 GRMATM PCT 77.93

(FE+MN)/(FE+MN+MG) ATM WT PCT 68.27 GRMATM PCT 48.40

NA2O/(NA2O+K2O) WT PCT 64.49 MOL PCT 73.41

FEO/(FEO+FE2O3) WT PCT 59.57 MOL PCT 76.61

COOMBS BASALT PLOT NE-OL-QZ-DI(=17.85)

QZ= .89 NE= 0.09 OL= .01 DI= .12

IDENTIFICATION FIELD READS... 73BM9) POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	67.30	64.57	0.00
TIO2	.01	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	16.10	18.21	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.16	.12	0.00
FEO	.23	.18	0.00
MNO	.03	[.02]	
NIO	-0.00	[0.00]	
MGO	.65	.93	0.00
CAO	2.18	2.24	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	5.60	10.42	0.00
K2O	2.70	3.30	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.96	100.00	
-H2O	94.96		

MINERAL	CAT PRCNT	WT PRCNT
QZ	17.85	18.60
CO	.00	.00
Z	0.00	0.00
OR	16.52	15.96
PL	63.29	58.20
(AB)	52.09	47.39
(AN)	11.20	10.81
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	0.00	0.00
(WO)	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
HY	2.15	1.95
(EN)	1.85	1.62
(FS)	.29	.33
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.17	.23
CM	0.00	0.00
IL	.01	.02
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	97.57	92.76
FEMIC	2.33	2.20
TOTAL	100.00	94.96

AN/PL WT PCT 18.58 MOL PCT 17.70

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 83.09 MOL PCT 85.59

DIFNDX WT PCT 81.94 CAT PCT 86.45

QZ-AB-OR DIAGRAM

WT PCT QZ 22.70 AB 57.83 OR 19.47

MOL PCT QZ 56.54 AB 33.00 OR 10.47

QZ-NE-KP DIAGRAM

WT PCT QZ 57.61 NE 31.33 KP 11.06

MOL PCT QZ 76.75 NE 17.65 KP 5.60

AN-AB-OR DIAGRAM

WT PCT AN 14.58 AB 63.90 OR 21.52

MOL PCT AN 14.04 AB 65.26 OR 20.70

A-F-M DIAGRAM

WT PCT ALK 88.87 FE 4.18 MG 6.96

MOL PCT ALK 85.41 FE 3.02 MG 11.57

(NA+K)/AL ATM WT PCT 75.06 GRMATM PCT 75.37

(FE+MN)/(FE+MN+MG) ATM WT PCT 44.47 GRMATM PCT 25.87

NA2O/(NA2O+K2O) WT PCT 67.47 MOL PCT 75.92

FEO/(FEO+FE2O3) WT PCT 58.97 MOL PCT 76.16

COOMBS BASALT PLOT NE-OL-QZ-DI(=20.00)

QZ= .95 NE= 0.00 OL= .05 DI= 0.00

IDENTIFICATION FIELD READS.. 739481   POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	67.40	64.45	0.00	QZ	16.16	16.90
TIO2	.11	.08	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.58	17.56	0.00	OR	19.27	18.57
CR2O3	-0.00	0.00	0.00	PL	61.05	56.14
FE2O3	.16	.12	0.00	(AB)	53.58	48.91
FEO	.23	.18	0.00	(AN)	7.47	7.23
MNO	.03	[.02]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	.65	.93	0.00	KP	0.00	0.00
CAO	2.04	2.09	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.78	10.72	0.00	AC	0.00	0.00
K2O	3.16	3.85	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	2.38	2.27
SO3	-0.00	0.00	0.00	(WO)	1.19	1.21
S	-0.00	(0.00)	0.00	(EN)	1.11	.97
CL	-0.00	(0.00)	0.00	(FS)	.09	.10
F	-0.00	(0.00)	0.00	HY	.80	.72
CO2	-0.00	0.00	0.00	(EN)	.75	.65
				(FS)	.06	.07
TOTAL	95.14	100.00		OL	0.00	0.00
-H2O	95.14			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.17	.23
				CM	0.00	0.00
				IL	.16	.21
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	96.48	91.71
				FEMIC	3.52	3.43
				TOTAL	100.00	95.14

AN/PL WT PCT 12.38 MOL PCT 12.24

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 90.73 MOL PCT 92.83

DIFNDX WT PCT 84.48 CAT PCT 89.01

QZ-AB-OR DIAGRAM

WT PCT QZ 20.00 AB 57.90 OR 22.10

MOL PCT QZ 52.58 AB 34.88 OR 12.54

QZ-NE-KP DIAGRAM

WT PCT QZ 56.07 NE 31.36 KP 12.56

MOL PCT QZ 75.66 NE 17.90 KP 6.44

AN-AB-OR DIAGRAM

WT PCT AN 9.67 AB 65.37 OR 24.96

MOL PCT AN 9.30 AB 66.71 OR 23.99

A-F-M DIAGRAM

WT PCT ALK 89.58 FE 3.91 MG 6.51

MOL PCT ALK 86.18 FE 2.86 MG 10.96

(NA+K)/AL	ATM WT PCT	83.82	GRMATM PCT	82.98
(FE+MN)/(FE+MN+MG)	ATM WT PCT	44.47	GRMATM PCT	25.87
NA2O/(NA2O+K2O)	WT PCT	64.65	MOL PCT	73.55
FEO/(FEO+FE2O3)	WT PCT	58.97	MOL PCT	76.16

COOMBS BASALT PLOT NE-OL-QZ-DI(=19.34)

QZ= .86 NE= 0.00 OL= .02 DI= .12

IDENTIFICATION FIELD READS.. 7384104 POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	67.90	65.71	0.00	QZ	21.23	21.91
TIO2	.02	.01	0.00	CO	.62	.54
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.00	18.16	0.00	OR	19.41	19.56
CR2O3	-0.00	0.00	0.00	PL	57.41	52.30
FE2O3	.15	.11	0.00	(AB)	46.51	41.89
FEO	.22	.18	0.00	(AN)	10.90	10.42
MNO	.03	(.02)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	0.00	0.00
MGO	.30	.43	0.00	KP	0.00	0.00
CAO	2.10	2.18	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	4.95	9.30	0.00	AC	0.00	0.00
K2O	3.14	3.88	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	0.00	0.00
SO3	-0.00	0.00	0.00	(WO)	0.00	0.00
S	-0.00	(0.00)	0.00	(EN)	0.00	0.00
CL	-0.00	(0.00)	0.00	(FS)	0.00	0.00
F	-0.00	(0.00)	0.00	HY	1.13	1.05
CO2	-0.00	0.00	0.00	(EN)	.87	.75
				(FS)	.27	.30
TOTAL	94.61	100.00		OL	0.00	0.00
-H2O	94.61			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.16	.22
				CM	0.00	0.00
				IL	.03	.04
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	98.67	93.30
				FEMIC	1.33	1.31
				TOTAL	100.00	94.61

AN/PL WT PCT 19.92 MOL PCT 18.99

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 71.16 MOL PCT 76.43

DIFNOX WT PCT 82.35 CAT PCT 87.15

QZ-AB-OR DIAGRAM

WT PCT QZ 26.60 AB 50.85 OR 22.53

MOL PCT QZ 61.59 AB 27.03 OR 11.28

QZ-NE-KP DIAGRAM

WT PCT QZ 59.64 NE 27.56 KP 12.80

MOL PCT QZ 78.31 NE 15.30 KP 6.39

AN-AB-OR DIAGRAM

WT PCT AN 14.70 AB 59.11 OR 26.19

MOL PCT AN 14.19 AB 60.54 OR 25.27

A-F-M DIAGRAM

WT PCT ALK 92.35 FE 4.22 MG 3.42

MOL PCT ALK 90.82 FE 3.21 MG 5.97

(NA+K)/AL ATM WT PCT 74.51 GRMATM PCT 72.59

(FE+MN)/(FE+MN+MG) ATM WT PCT 62.31 GRMATM PCT 41.38

NA2O/(NA2O+K2O) WT PCT 61.19 MOL PCT 70.55

FEO/(FEO+FE2O3) WT PCT 59.46 MOL PCT 76.53

COOMBS BASALT PLOT NE-OL-QZ-DI(=22.37)

QZ= .97 NE= 0.00 OL= .03 DI= 0.00

IDENTIFICATION FIELD READS.. 733M93 POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	67.60	64.89	0.00	QZ	19.53	19.30
TIO2	.01	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.75	17.82	0.00	OR	16.29	15.72
CR2O3	-0.00	0.00	0.00	PL	62.19	57.13
FE2O3	.15	.12	0.00	(AB)	51.56	46.88
FEO	.23	.18	0.00	(AN)	10.63	10.25
MNO	.04	[.03]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	.65	.93	0.00	KP	0.00	0.00
CAO	2.38	2.45	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.54	10.31	0.00	AC	0.00	0.00
K2O	2.66	3.26	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	1.29	1.24
SO3	-0.00	0.00	0.00	(WO)	.64	.65
S	-0.00	(0.00)	0.00	(EN)	.55	.48
CL	-0.00	(0.00)	0.00	(FS)	.09	.10
F	-0.00	(0.00)	0.00	HY	1.52	1.38
CO2	-0.00	0.00	0.00	(EN)	1.31	1.14
				(FS)	.21	.24
TOTAL	95.02	100.00		OL	0.00	0.00
-H2O	95.02			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.17	.23
				CM	0.00	0.00
				IL	.01	.02
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	97.00	92.15
				FEMIC	3.00	2.87
				TOTAL	100.00	95.02

AN/PL WT PCT 17.94 MOL PCT 17.09

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 82.30 MOL PCT 85.94

DIFNOX WT PCT 81.90 CAT PCT 86.39

QZ-AB-OR DIAGRAM

WT PCT QZ 23.57 AB 57.24 OR 19.19

MOL PCT QZ 57.73 AB 32.12 OR 10.15

QZ-NE-KP DIAGRAM

WT PCT QZ 58.09 NE 31.01 KP 10.91

MOL PCT QZ 77.09 NE 17.41 KP 5.50

AN-AB-OR DIAGRAM

WT PCT AN 14.07 AB 64.35 OR 21.58

MOL PCT AN 13.54 AB 65.70 OR 20.75

A-F-M DIAGRAM

WT PCT ALK 88.74 FE 4.22 MG 7.03

MOL PCT ALK 85.26 FE 3.15 MG 11.59

(NA+K)/AL ATM WT PCT 75.89 GRMATM PCT 76.15

(FE+MN)/(FE+MN+MG) ATM WT PCT 45.37 GRMATM PCT 26.35

NA2O/(NA2O+K2O) WT PCT 67.56 MOL PCT 75.99

FEO/(FEO+FE2O3) WT PCT 58.97 MOL PCT 76.16

COOMBS BASALT PLOT NE-OL-QZ-DI(=21.34)

QZ= .90 NE= 0.00 OL= .04 DI= .06

IDENTIFICATION FIELD READS.. 733487 POR H9 QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT
SIO2	67.59	64.36	0.00
TIO2	.02	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	16.15	18.15	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.23	.17	0.00
FEO	.34	.27	0.00
MNO	.03	[.02]	
NIO	-0.00	[0.00]	
MGO	.40	.57	0.00
CAO	2.44	2.49	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	5.38	9.95	0.00
K2O	3.30	4.01	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	95.79	100.00	
-H2O	95.79		

MINERAL	CAT PRCNT	WT PRCNT
QZ	17.13	17.96
CO	0.00	0.00
Z	0.00	0.00
OR	20.07	19.50
PL	60.20	55.70
(AB)	49.73	45.52
(AN)	10.47	10.17
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	1.59	1.56
(WO)	.80	.81
(EN)	.59	.52
(FS)	.21	.24
HY	.74	.70
(EN)	.55	.48
(FS)	.19	.22
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.25	.33
CM	0.00	0.00
IL	.03	.04
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	97.39	93.16
FEMIC	2.61	2.63
TOTAL	100.00	95.79

AN/PL WT PCT 18.25 MOL PCT 17.40

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 68.55 MOL PCT 74.12

DIFNOX WT PCT 82.99 CAT PCT 86.92

QZ-AB-OR DIAGRAM

WT PCT QZ 21.64 AB 54.86 OR 23.50

MOL PCT QZ 55.09 AB 31.99 OR 12.91

QZ-NE-KP DIAGRAM

WT PCT QZ 56.93 NE 29.72 KP 13.35

MOL PCT QZ 76.34 NE 16.86 KP 5.80

AN-AB-OR DIAGRAM

WT PCT AN 13.53 AB 60.54 OR 25.93

MOL PCT AN 13.05 AB 61.95 OR 25.00

A-F-M DIAGRAM

WT PCT ALK 89.95 FE 5.91 MG 4.15

MOL PCT ALK 88.33 FE 4.48 MG 7.19

(NA+K)/AL ATM WT PCT 78.75 GRMATM PCT 76.92

(FE+MN)/(FE+MN+MG) ATM WT PCT 65.02 GRMATM PCT 44.75

NA2O/(NA2O+K2O) WT PCT 61.98 MOL PCT 71.25

FEO/(FEO+FE2O3) WT PCT 59.65 MOL PCT 76.57

COOMBS BASALT PLOT NE-OL-QZ-DI(=19.45)

QZ= .90 NE= 0.00 OL= .02 DI= .08

IDENTIFICATION FIELD READS.. 733M101   POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	65.00	63.31	0.00
TIO2	.01	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	16.59	18.94	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.10	.07	0.00
FEO	.15	.12	0.00
MNO	.04	[.03]	
NIO	-0.00	[0.00]	
MGO	.35	.51	0.00
CAO	2.41	2.52	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	5.58	10.54	0.00
K2O	3.18	3.95	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	93.32	100.00	
-H2O	93.32		

MINERAL	CAT PRCNT	WT PRCNT
QZ	14.48	14.87
CO	0.00	0.00
Z	0.00	0.00
OR	19.76	18.79
PL	63.82	57.80
(AB)	52.69	47.22
(AN)	11.13	10.58
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	1.16	1.10
(WO)	.58	.57
(EN)	.47	.41
(FS)	.10	.12
HY	.66	.60
(EN)	.54	.47
(FS)	.12	.13
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.11	.14
CM	0.00	0.00
IL	.01	.02
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	98.06	91.46
FEMIC	1.94	1.86
TOTAL	100.00	93.32

AN/PL WT PCT 18.31 MOL PCT 17.44

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 77.66 MOL PCT 82.04

DIFNDX WT PCT 80.98 CAT PCT 85.93

QZ-AB-OR DIAGRAM

WT PCT QZ 18.39 AB 58.38 OR 23.23

MOL PCT QZ 49.99 AB 36.37 OR 13.64

QZ-NE-KP DIAGRAM

WT PCT QZ 55.17 NE 31.63 KP 13.20

MOL PCT QZ 75.00 NE 18.18 KP 6.82

AN-AB-OR DIAGRAM

WT PCT AN 13.82 AB 51.65 OR 24.53

MOL PCT AN 13.32 AB 63.04 OR 23.64

A-F-M DIAGRAM

WT PCT ALK 93.59 FE 2.67 MG 3.74

MOL PCT ALK 91.57 FE 2.01 MG 6.42

(NA+K)/AL ATM WT PCT 77.63 GRMATM PCT 76.49

(FE+MN)/(FE+MN+MG) ATM WT PCT 50.75 GRMATM PCT 31.02

NA2O/(NA2O+K2O) WT PCT 63.70 MOL PCT 72.73

FEO/(FEO+FE2O3) WT PCT 60.00 MOL PCT 76.93

COOMBS BASALT PLOT NE-OL-QZ-DI(=16.30)

QZ= .91 NE= 0.00 OL= .02 DI= .07

IDENTIFICATION FIELD READS.. 73BM84 POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CIPCT
SIO2	71.10	67.38	0.00
TIO2	.02	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	15.70	17.54	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.08	.06	0.00
FEO	.12	.10	0.00
MNO	.03	(.02)	
NIO	-0.00	(0.00)	
MGO	.35	.49	0.00
CAO	1.35	1.32	0.00
SRO	-0.00	(0.00)	
BAO	-0.00	(0.00)	
NA2O	5.25	9.65	0.00
K2O	2.84	3.43	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	96.79	100.00	
-H2O	96.79		

MINERAL	CAT PRCNT	WT PRCNT
QZ	24.93	26.31
C0	1.82	1.63
Z	0.00	0.00
OR	17.17	16.78
PL	54.83	50.87
(AB)	48.23	44.42
(AN)	6.60	6.45
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	0.00	0.00
(WO)	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
HY	1.14	1.05
(EN)	.99	.87
(FS)	.15	.18
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.09	.12
CM	0.00	0.00
IL	.03	.04
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	98.74	95.59
FEMIC	1.26	1.20
TOTAL	100.00	96.79

AN/PL WT PCT 12.68 MOL PCT 12.04

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 83.12 MOL PCT 86.51

DIFNOX WT PCT 87.91 CAT PCT 90.33

QZ-AB-OR DIAGRAM

WT PCT QZ 30.06 AB 50.76 OR 19.18

MOL PCT QZ 65.59 AB 25.38 OR 9.03

QZ-NE-KP DIAGRAM

WT PCT QZ 61.60 NE 27.50 KP 10.90

MOL PCT QZ 79.62 NE 15.03 KP 5.35

AN-AB-OR DIAGRAM

WT PCT AN 9.53 AB 65.66 OR 24.81

MOL PCT AN 9.17 AB 66.99 OR 23.84

A-F-M DIAGRAM

WT PCT ALK 93.63 FE 2.31 MG 4.05

MOL PCT ALK 91.37 FE 1.73 MG 6.91

(NA+K)/AL ATM WT PCT 75.25 GRMATM PCT 74.59

(FE+MN)/(FE+MN+MG) ATM WT PCT 44.97 GRMATM PCT 26.28

NA2O/(NA2O+K2O) WT PCT 64.89 MOL PCT 73.75

FEO/(FEO+FE2O3) WT PCT 60.00 MOL PCT 76.93

COOMBS BASALT PLOT NE-OL-QZ-DI(=26.07)

QZ= .98 NE= 0.00 OL= .02 DI= 0.00

IDENTIFICATION FIELD READS., 739M86 POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR CTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	69.00	65.86	0.00	QZ	19.79	20.74
TIO2	.01	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.70	17.65	0.00	OR	18.39	17.85
CR2O3	-0.00	0.00	0.00	PL	60.60	55.93
FE2O3	.11	.08	0.00	(AB)	51.26	46.88
FEO	.16	.13	0.00	(AN)	9.33	9.05
MNO	.01	[.01]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	.31	.44	0.00	KP	0.00	0.00
CAO	1.84	1.88	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.54	10.25	0.00	AC	0.00	0.00
K2O	3.02	3.68	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	.06	.06
SO3	-0.00	0.00	0.00	(WO)	.03	.03
S	-0.00	(0.00)	0.00	(EN)	.03	.02
CL	-0.00	(0.00)	0.00	(FS)	.01	.01
F	-0.00	(0.00)	0.00	HY	1.03	.95
CO2	-0.00	0.00	0.00	(EN)	.86	.75
				(FS)	.17	.20
TOTAL	95.70	100.00		OL	0.00	0.00
-H2O	95.70			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.12	.16
				CM	0.00	0.00
				IL	.01	.02
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	98.78	94.51
				FEMIC	1.22	1.19
				TOTAL	100.00	95.70

AN/PL WT PCT 16.18 MOL PCT 15.40

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 79.02 MOL PCT 83.19

DIFNDX WT PCT 85.46 CAT PCT 89.45

QZ-AB-OR DIAGRAM

WT PCT QZ 24.26 AB 54.85 OR 20.88

MOL PCT QZ 58.69 AB 30.40 OR 10.93

QZ-NE-KP DIAGRAM

WT PCT QZ 58.42 NE 29.72 KP 11.87

MOL PCT QZ 77.38 NE 16.65 KP 5.97

AN-AB-OR DIAGRAM

WT PCT AN 12.27 AB 63.54 OR 24.19

MOL PCT AN 11.81 AB 64.91 OR 23.28

A-F-M DIAGRAM

WT PCT ALK 93.65 FE 2.95 MG 3.39

MOL PCT ALK 91.97 FE 2.21 MG 5.82

(NA+K)/AL ATM WT PCT 79.63 GRMATM PCT 78.87

(FE+MN)/(FE+MN+MG) ATM WT PCT 52.79 GRMATM PCT 32.75

NA2O/(NA2O+K2O) WT PCT 64.72 MOL PCT 73.60

FEO/(FEO+FE2O3) WT PCT 59.26 MOL PCT 76.38

COOMBS BASALT PLOT NE-OL-QZ-DI(=20.89)

QZ= .97 NE= 0.00 OL= .02 DI= .00

IDENTIFICATION FIELD READS., 73BM92 POR HB QTZ MONZONITE

52

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR DETECT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	74.10	64.80	0.00	QZ	17.77	19.22
TIO2	.01	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	16.30	17.76	0.00	OR	18.16	18.20
CR2O3	-0.00	0.00	0.00	PL	61.08	58.22
FE2O3	.18	.13	0.00	(AB)	51.52	48.65
FEO	.25	.20	0.00	(AN)	9.55	9.57
MNO	.03	[.02]		LC	0.00	0.00
NIO	-0.00	[0.00]		NE	0.00	0.00
MGO	.65	.90	0.00	KP	0.00	0.00
CAO	2.28	2.26	0.00	HL	0.00	0.00
SRO	-0.00	[0.00]		TH	0.00	0.00
BAO	-0.00	[0.00]				
NA2O	5.75	10.30	0.00	AC	0.00	0.00
K2O	3.08	3.63	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	1.39	1.38
SO3	-0.00	0.00	0.00	(WO)	.70	.73
S	-0.00	(0.00)	0.00	(EN)	.59	.54
CL	-0.00	(0.00)	0.00	(FS)	.10	.12
F	-0.00	(0.00)	0.00	HY	1.41	1.33
CO2	-0.00	0.00	0.00	(EN)	1.20	1.08
				(FS)	.21	.25
TOTAL	98.64	100.00		OL	0.00	0.00
-H2O	98.64			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				HT	.19	.26
				CM	0.00	0.00
				IL	.01	.02
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	97.00	95.65
				FEMIC	3.00	2.99
				TOTAL	100.00	98.64

AN/PL WT PCT 16.44 MOL PCT 15.64

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 81.48 MOL PCT 89.25

DIFNDX WT PCT 86.09 CAT PCT 87.45

QZ-AB-OR DIAGRAM

WT PCT QZ 22.33 AB 56.52 OR 21.14

MOL PCT QZ 56.04 AB 32.50 OR 11.46

QZ-NE-KP DIAGRAM

WT PCT QZ 57.36 NE 30.62 KP 12.02

MOL PCT QZ 76.61 NE 17.30 KP 6.10

AN-AB-OR DIAGRAM

WT PCT AN 12.52 AB 63.56 OR 23.91

MOL PCT AN 12.05 AB 65.03 OR 22.92

A-F-M DIAGRAM

WT PCT ALK 89.01 FE 4.44 MG 6.55

MOL PCT ALK 85.74 FE 3.24 MG 11.02

(NA+K)/AL ATM WT PCT 79.09 GRMATM PCT 78.48

(FE+MN)/(FE+MN+MG) ATM WT PCT 47.26 GRMATM PCT 28.08

NA2O/(NA2O+K2O) WT PCT 65.12 MOL PCT 73.94

FEO/(FEO+FE2O3) WT PCT 59.09 MOL PCT 76.25

COOMBS BASALT PLOT NE-OL-QZ-DI(=20.56)

QZ= .90 NE= 0.00 OL= .03 DI= .07

IDENTIFICATION FIELD READS.. 739M103 POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR OTPCT	MINERAL	CAT PRCNT	WT PRCNT
SIO2	65.72	64.22	0.00	QZ	16.17	16.54
TIO2	.02	.01	0.00	CO	0.00	0.00
ZRO2	-0.00	0.00	0.00	Z	0.00	0.00
AL2O3	15.63	18.01	0.00	OR	20.57	19.50
CR2O3	-0.00	0.00	0.00	PL	60.22	54.28
FE2O3	.15	.11	0.00	(AB)	50.98	45.52
FEO	.22	.18	0.00	(AN)	9.24	8.75
MNO	.03	(.02)		LC	0.00	0.00
NIO	-0.00	(0.00)		NE	0.00	0.00
MGO	.40	.58	0.00	KP	0.00	0.00
CAO	2.44	2.56	0.00	HL	0.00	0.00
SRO	-0.00	(0.00)		TH	0.00	0.00
BAO	-0.00	(0.00)				
NA2O	5.38	10.20	0.00	AC	0.00	0.00
K2O	3.30	4.11	0.00	NS	0.00	0.00
P2O5	-0.00	0.00	0.00	KS	0.00	0.00
H2O+	-0.00			WO	0.00	0.00
H2O-	-0.00			DI	2.83	2.68
SO3	-0.00	0.00	0.00	(WO)	1.42	1.40
S	-0.00	(0.00)	0.00	(EN)	1.15	.98
CL	-0.00	(0.00)	0.00	(FS)	.27	.30
F	-0.00	(0.00)	0.00	HY	.02	.02
CO2	-0.00	0.00	0.00	(EN)	.02	.01
				(FS)	.00	.00
TOTAL	93.27	100.00		OL	0.00	0.00
-H2O	93.27			(FO)	0.00	0.00
				(FA)	0.00	0.00
				CS	0.00	0.00
				MT	.17	.22
				CM	0.00	0.00
				IL	.03	.04
				HM	0.00	0.00
				SP	0.00	0.00
				PF	0.00	0.00
				RU	0.00	0.00
				AP	0.00	0.00
				FL	0.00	0.00
				PY	0.00	0.00
				CC	0.00	0.00
				SALIC	96.95	90.32
				FEMIC	3.05	2.95
				TOTAL	100.00	93.27

AN/PL WT PCT 16.13 MOL PCT 15.34

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 76.69 MOL PCT 81.21

DIFNDX WT PCT 81.56 CAT PCT 87.72

QZ-AB-OR DIAGRAM

WT PCT QZ 20.28 AB 55.81 OR 23.91

MOL PCT QZ 53.04 AB 33.45 OR 13.50

QZ-NE-KP DIAGRAM

WT PCT QZ 56.18 NE 30.24 KP 13.59

MOL PCT QZ 75.79 NE 17.25 KP 6.95

AN-AB-OR DIAGRAM

WT PCT AN 11.86 AB 61.70 OR 26.43

MOL PCT AN 11.43 AB 63.10 OR 25.45

A-F-M DIAGRAM

WT PCT ALK 91.85 FE 3.92 MG 4.23

MOL PCT ALK 89.74 FE 2.95 MG 7.31

(NA+K)/AL ATM WT PCT 81.37 GRMATM PCT 79.48

(FE+MN)/(FE+MN+MG) ATM WT PCT 55.36 GRMATM PCT 35.09

NA2O/(NA2O+K2O) WT PCT 61.93 MOL PCT 71.25

FEO/(FEO+FE2O3) WT PCT 59.46 MOL PCT 76.53

COOMBS BASALT PLOT NE-OL-QZ-DI(=19.02)

QZ= .85 NE= 0.00 OL= .00 DI= .15

IDENTIFICATION FIELD READS.. 7384100   POR HB QTZ MONZONITE

SPECIES	INPUT WT PRCNT	CALC CAT PRCNT	COMP ERROR [illegible]
SIO2	67.40	65.44	0.00
TIO2	.01	.01	0.00
ZRO2	-0.00	0.00	0.00
AL2O3	16.05	19.37	0.00
CR2O3	-0.00	0.00	0.00
FE2O3	.15	.11	0.00
FEO	.22	.18	0.00
MNO	.03	[.02]	
NIO	-0.00	[0.00]	
MGO	.65	.94	0.00
CAO	2.24	2.33	0.00
SRO	-0.00	[0.00]	
BAO	-0.00	[0.00]	
NA2O	4.65	8.75	0.00
K2O	3.11	3.85	0.00
P2O5	-0.00	0.00	0.00
H2O+	-0.00		
H2O-	-0.00		
SO3	-0.00	0.00	0.00
S	-0.00	(0.00)	0.00
CL	-0.00	(0.00)	0.00
F	-0.00	(0.00)	0.00
CO2	-0.00	0.00	0.00
TOTAL	94.51	100.00	
-H2O	94.51		

MINERAL	CAT PRCNT	WT PRCNT
QZ	21.89	22.54
CO	1.10	.95
Z	0.00	0.00
OR	19.26	18.38
PL	55.42	50.46
(AB)	43.77	39.35
(AN)	11.65	11.11
LC	0.00	0.00
NE	0.00	0.00
KP	0.00	0.00
HL	0.00	0.00
TH	0.00	0.00
AC	0.00	0.00
NS	0.00	0.00
KS	0.00	0.00
WO	0.00	0.00
DI	0.00	0.00
(WO)	0.00	0.00
(EN)	0.00	0.00
(FS)	0.00	0.00
HY	2.16	1.94
(EN)	1.88	1.62
(FS)	.28	.32
OL	0.00	0.00
(FO)	0.00	0.00
(FA)	0.00	0.00
CS	0.00	0.00
MT	.16	.22
CM	0.00	0.00
IL	.01	.02
HM	0.00	0.00
SP	0.00	0.00
PF	0.00	0.00
RU	0.00	0.00
AP	0.00	0.00
FL	0.00	0.00
PY	0.00	0.00
CC	0.00	0.00
SALIC	97.66	92.34
FEMIC	2.34	2.17
TOTAL	100.00	94.51

AN/PL WT PCT 22.02 MOL PCT 21.02

FA/OL WT PCT 0.00 MOL PCT 0.00

EN/HY WT PCT 83.52 MOL PCT 85.35

DIFNOX WT PCT 80.26 CAT PCT 84.91

QZ-AB-OR DIAGRAM

WT PCT QZ 28.08 AB 49.02 OR 22.90

MOL PCT QZ 63.45 AB 25.38 OR 11.17

QZ-NE-KP DIAGRAM

WT PCT QZ 60.43 NE 26.56 KP 13.01

MOL PCT QZ 78.88 NE 14.65 KP 6.45

AN-AB-OR DIAGRAM

WT PCT AN 16.14 AB 57.16 OR 26.70

MOL PCT AN 15.50 AB 58.51 OR 25.79

A-F-M DIAGRAM

WT PCT ALK 88.38 FE 4.21 MG 7.40

MOL PCT ALK 84.30 FE 3.12 MG 12.58

(NA+K)/AL ATM WT PCT 71.00 GRMATM PCT 66.63

(FE+MN)/(FE+MN+MG) ATM WT PCT 43.28 GRMATM PCT 24.96

NA2O/(NA2O+K2O) WT PCT 59.92 MOL PCT 69.44

FEO/(FEO+FE2O3) WT PCT 59.46 MOL PCT 76.53

COOMBS BASALT PLOT NE-OL-QZ-DI(=24.04)

QZ= .96 NE= 0.00 OL= .04 DI= 0.00