MAGNETITE ORE DEPOSITS AND RELATED ROCKS IN BLACK ROCK FOREST, CORNWALL, NEW YORK

by

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ABSTRACT

Throughout August 1990 to May 1991, research was conducted on a ridge striking NE in the NW portion of Black Rock Forest, Cornwall, N.Y. Two locations of Outcropping magnetite ore were geologically mapped, and samples were collected from both localities. During the investigation another locality was found in the NE part of the forest. The main rock types along the ridge are potassium feldspar-rich quartz-hornblende gneisses at the ridge crest and magnetite-plagioclase-pyroxene gneiss with varying amounts of hornblende and quartz SE of the ridge. This magnetite-rich zone is bordered by a biotite-plagioclase-hornblende gneiss on the SE of Locality 1. The next unit SE of the biotite-rich unit is a leucrocratic plagioclase-quartz gneiss. This unit may be the end product of an event that leached iron to form magnetite nearby. Locality 2 reveals similar lithologies with the addition of a plagioclase-hornblende-quartz pegmatoid near the ore zone. Large pegmatoid amphiboles are present throughout the ridge within or near the magnetite-rich zone. Ground magnetic studies reveal numerous, continuous ore bodies throughout the ridge. These bodies conform to the strike of the gneisses surrounding them.

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INTRODUCTION

The principle goal of the Black Rock Forest project was to gain a better understanding of magnetite ore deposits hosted by metamorphic rocks. Our study began in August 1990 with the help of Mr. Jack Karnig who located two previously mined or prospected ore pits, shown on Plate 1 as Localities 1 and 3. Throughout most of August, we studied the geology of Locality 1, collected hand samples from outcrops and drafted a base map of the area. During the following month we completing field work at Locality 1 and collecting rock samples from Locality 3. At the end of the month, we began preliminary studies of Locality 2, a trench found by Dr. James Webster, which had exposed magnetite-rich rocks. In September, representative samples from all three locations were prepared for thin section polishing and were sent out to be commercially polished. Field work at Locality 2 was completed and a base map of this area drawn. Traverses 1-13 and the baseline (Plate C) were flagged. Ground magnetics data were collected throughout most of November (Appendix D). The thin sections were studied throughout the Winter, 1990, and Spring, 1991. The rock types were identified and a list of them is found in Appendix A and C. Many of the rocks contain amphiboles, and throughout this report we use the terms amphibole and hornblende as generic references to iron-rich amphiboles. Geologic maps of Locality 1(Plate A), Locality 2(Plate B) and the ground magnetics map of the northwest portion of Black Rock Forest were completed by May, 1991.

ACKNOWLEDGEMENTS

Throughout the duration of the project Dr. Craig Johnson and Dr. James Webster provided invaluable guidance and assistance with the fieldwork and other studies. Special thanks to Curator Jack Karnig and Forest Manager John Brady for helping out during our rough periods while we stayed over at the forest. Thanks to Dr. Dennis Hayes of Lamont-Doherty Geological Observatory for letting us use

his magnetometer. Thanks to the staff of the American Museum of Natural History for allowing us to utilize their facilities for our research and their supportive input. And many thanks to the Black Rock Forest Consortium for making this project possible.

PREVIOUS WORK

Previous work on magnetite ore deposits has yielded theories on the origin of these ore zones:
1) magnetite that was originally present in sedimentary beds may be modified and transported by metamorphic processes,
2) leaching of iron from surrounding host rock may form iron ore deposits during regional metamorphism (via the temperature and pressure gradients),
3) magmatic emanations providing iron oxide-bearing solutions may transport iron to ore locations.

Gneisses and pegmatites vary in the amount of feldspar, pyroxene, amphibole and quartz that are present. These are the major metamorphic rock types in all the areas studied. Hornblende granites are the dominant igneous lithology with varying abundances of skarn also present.

Hagner, Collins and Clemancy(1) suggest that pyroxene amphibole host rock at the Scott magnetite mine in the Sterling Lake district of New York could have been the source of the iron in the magnetite deposits. They based their assumption on a decrease in iron content of mafic silicates such as amphibole and in host whole rocks with proximity to the ore body. They observed the amount of mafic silicates and magnetite in the amphibole host rock to be unchanging with proximity to the ore zone. They concluded that the replacement of the host rock constituents by gneisses and pegmatites during metamorphism to be the means by which the iron for the magnetite was leached out of the host rock; the iron was transported to structurally low pressure zones where magnetite was concentrated. Movement of fluid(s) to the ore zones occurred along foliation, lineations and grain boundaries.

Further work on deposits of the Ausable magnetite district of New

York by Hagner and Collins(2) reaffirm the suggestion that the host rock was the source for the iron ore formation. Their study concluded that during regional metamorphism iron from accessory magnetite and recrystallized pyroxene of the host granite gneiss migrated to areas of low pressure where magnetite formed. Smaller ore bodies in skarns north of their area of study formed by the recrystallization of clinopyroxene and hornblende gneisses to yield pyroxene- and magnetite-bearing rocks.

Buddington's (3) conclusions differs with the previous theories and states that the country rock contributed a minor abundance of iron to the ore zones. His work on pre-Cambrian rocks of the Adirondack area and the Hudson Highlands belt of New York and New Jersey concludes that the magnetite deposits give rise to two possible origins. Pre-metamorphic deposition of magnetite ore in sedimentary beds was modified by hypogene solutions. Buddington favors a magmatic origin where iron-rich solutions were transported and replaced host rock minerals to form iron oxide minerals in the magnetite deposits. These iron-rich solutions are assumed to result from differentiation of batholithic magma of a hornblende granite to an alaskite facies.

In a later work, Collins(4) does not support Buddington's theory on iron transportation from distant magma as a source for the magnetite deposits. He simplifies the scenario that recrystallization of high-index clinopyroxene gneiss may form alaskite and how clinopyroxene gneiss with iron being released to form magnetite in these end products. In this process microcline forms secondary plagioclase and quartz. Fluids released from biotite and hornblende gneiss act as catalysts for the recrystallization of clinopyroxene and supply a medium for the transportation of iron ions. This model assumes a minimal travel distance for the ore solutions.

By studying the Dover district of New Jersey, Collins (5) suggests that the recrystallization of ferromagnesian silicates from amphibole releases iron and other elements to form magnetite in low pressure shear zones in the country rock. In this process calcic plagioclase is converted to sodic plagioclase.

METHODS USED

Geologic Maps

Geologic maps (Plate A and B) were drawn at a scale of 1 inch = 50 feet. Both localities were limited in the number of exposed outcrops but contained large rubble piles of rocks already excavated during past digging. Samples were collected from the rubble piles and outcrops and the presence of magnetite was determined by eye and by using hand magnets. The base maps were drawn on oversized sheets of standard paper with a grid sectioned at every two inches. Trees located within the boundaries of the maps were used as control points to locate exposed outcrops and are marked as T and Tx on Plates A and B. Wooden stakes were planted wherever control points were needed and trees were scarce; stakes are marked C and P on the plates. All outcrops mapped were triangulated from two or more control points by bearings acquired with a brunton compass. Distances from outcrop to control point were measured with a 100 foot tape measure. Strike and dip of foliation of outcropping units was also measured using the brunton compass. The declination on our compass was set at 12.5 degrees west.

Accurate measurements were difficult to obtain near and within the magnetite localities when using the brunton compass due to the magnetic fields created by the ore bodies. To compensate for this effect it was necessary to sight and flag trees beyond the magnetic influence of the bodies. This method was used for plotting most information found on the base maps.

The limited exposure of outcrops due to topsoil and leaf cover at Localities 1 and 2 results in gaps in the mapped geology.

Ground Magnetics Map

Along a ridge in the northwest portion of the forest, a 3,900 foot base line striking N30°E was surveyed in and marked with orange and red flagging (Plate C), and traverses perpendicular to the base line were also surveyed in. Perpendicular traverses 1 through13 were marked with pink flagging at 300 foot intervals along the

baseline. These traverses were also marked at 300 foot intervals running east and west, starting at the baseline. The lengths of the perpendicular traverses range from 300-600 feet west of the baseline and 600-2100 feet east of the baseline. Distances were measured with a string machine distance counter and a 100 foot tape measure.

The surveying of both the baseline and the perpendicular traverses was accomplished by having two people sight on each other. One person would stand at a fixed position, and the other would go ahead along the correct bearing to a point within sight of the first, stationary person. Using brunton compasses both persons sighted on each other with the lead person shifting in position until the necessary bearing was attained and the person's position correct. This method was used with the maximum of 2 degrees variation in readings. Where underlying ore bodies disrupted the use of the brunton the traverses and baseline were flagged by backsighting along 2 or more previously flagged trees.

GROUND MAGNETIC DATA

A Geometrics 6-826 portable proton magnetometer was used to record the magnetic field of underlying or exposed ore bodies along the flagged lines. The magnetometer's sensitivity to metal objects near the instrument was determined, and the effects proved negligible. Different settings on the instrument were tested for reproducibility in readings and a setting of 53 kilogammas proved most consistent. As a preliminary test, readings were recorded at 50 foot intervals along a trail (Plate C) that runs between Old West Point Road and Continental Road. Four or more readings were taken at each station and an average of these readings were used in the final data recorded in Appendix D. Fifty foot intervals proved too large an increment between readings, and 25 foot intervals were implemented for the traverses and baseline with the exception of a 10 foot spacing used along the baseline between traverses 3 and 4.

At some locations with high magnetometer readings the measurements varied considerably. At these stations a greater

number of readings was recorded and averaged. When recording traverse 1, the magnetometer cable developed a loose wire which caused a high variation in readings taken at each station. The defective wire was replaced and traverse 1 was resurveyed. The initial readings determined with the defective wire were very similar to the second set of readings.

Ore Bodies

The iron ore bodies along the Northwest ridge are found striking North 41° East. This interpretation is based on analyses of Plates 2 and Plate C. The width of the ore zone is 10-15 feet wide and continues beyond our area of study. With the exception of a few slivers the magnetite within the ore body conforms to the foliation and lineation of the surrounding gneiss.

Both Localities 1 and 2 are positioned along ore body 2 in Plate 2. This is additional evidence that the ore bodies are in some way continuous.

Petrography

Representative hand samples of outcrops from Locations 1, 2 and 3 were cut into 1/4 inch slabs using a large diamond saw. These cuts were made perpendicular to foliation. The 1/4 inch slabs were further cut by a trim saw into slide size. These samples were then commercially polished and prepared into thin sections.

The thin sections were studied using a polarizing Nikon microscope. Minerals studied in thin section were viewed under reflected light, plane polarized light and cross nicols. Classifications of minerals studied were based upon their optic sign, whether or not the minerals were isotropic, uniaxial or biaxial and primarily upon appearance(Appendix C, Diagnostic features).

Thin Sections

The criteria by which individual minerals and their textures were identified are explained in detail in pages accompanying

Appendix C. The majority of this section describes observations regarding the mineral-mineral relationships.

Major minerals identified in hand samples and thin sections consist of magnetite, feldspar, quartz, pyroxene, hornblende, biotite, and pyrite. The most abundant mineral observed in thin section was feldspar. Microcline- and microperthite-rich samples typically contained less than 5 % magnetite. Samples that contain from 5-40% magnetite also contain both plagioclase and antiperthite. The plagioclase composition is andesine-oligoclase based on electron microprobe analysis of thin sections 13 and 20. These two minerals were often found to be highly sericitized and occurring with epidote and calcium carbonate. The magnetite was often seen embayed by feldspar, quartz, hornblende, pyroxene, and pyrite. It occurred rimmed by either hornblende or pyroxene. The amphibole hornblende was identified as hastingsite by microprobe in thin sections 13 and 20. Where the magnetite did not occur in a matrix, but as a porphyroblast, it rimmed pyroxene and hornblende. An oxide was often seen as altered hematite. Hornblende occurs in many states of alteration, and some exhibits many fine clasts radiating from larger crystal edges. The amphibole was often observed occurring with magnetite, pyroxene and pyrite. The amphiboles' color in plane polarized light varies from brown to light green; which possibly is a result of varying amounts of iron and titanium within the mineral. Pyroxene are found to rim many hornblende crystals.

Two types of pyroxene were found in thin sections. The first exhibits diallage parting (exsolution lamellae). The other has a large degree of fracturing and is often more iron-stained than the lamellae-bearing type. Both pyroxenes occur together in individual thin sections. The pyroxene was identified as ferro-augite by electron microprobe analysis. Where quartz is observed in larger amounts the pyroxene percentage is low. On the contrary, when pyroxene is found in greater amounts the quartz percentage is low. Quartz is always present where magnetite is concerned in all thin sections with the exception of Section 5 which contains biotite as a primary mineral.

ROCK UNITS

Black Rock Forest is situated in the NW region of the Reading Prong which consists of metamorphosed Grenvillian rocks (5,6,9). Rocks observed within the forest are of metamorphic origin and exhibit a high degree of foliation. Thin section analysis of the ridge in the North-west portion of the forest showed the units consist of potassium-rich feldspar-pyroxene-quartz-hornblende gneisses and pegmatoidal gneisses. These two varieties of gneiss were observed all along the ridge. Accessory minerals to this lithology are magnetite, zircon, epidote, pyroxene and biotite.

Locality 1

At outcrop Location 1 (Plate A), which is between the pit and the ridge crest, the mineralogy changes to antiperthite, pyroxene and microcline, with an increase in magnetite content seen in thin section 20.

Samples from the pit containing more than 35% magnetite show the feldspars to consist primarily of antiperthite and plagioclase with some microperthite (sections 1, 22, 23). This rock type was identified as a banded gneiss ore. Samples with lesser amounts of magnetite, plagioclase and antiperthite as their feldspar were labelled magnetite banded gneiss. These rocks varied in the amount of hornblende, pyroxene and quartz as major minerals. Accessory minerals include zircon, chlorite, pyrite, apatite, sericite, epidote, and hematite.

In the SE part of the pit the magnetite-plagioclase-pyroxene banded gneiss is bordered by a biotite-hornblende-rich plagioclase gneiss (Section 5). The biotite- and hornblende-rich plagioclase gneiss is in contact with a leucocratic layer to the SE that consists primarily of plagioclase and quartz with hornblende, magnetite and pyroxene as trace minerals(Section 2). The leucocratic rock also borders the magnetite-plagioclase-pyroxene banded gneiss unit in the NW portion of the pit.

Locality 2

Locality 2 lithologies were similar to those at Locality 1. The

ridge crest consists of potassium-rich feldspar-quartz-hornblende gneiss and pegmatoids. Banded magnetite gneisses(Section 17) were found within the main pit which strikes N38°W. South of the pit is a pegmatoid cross cutting a plagioclase-pyroxene-hornblende gneiss at N24°W. The pegmatoids contain varying amounts of magnetite which is found in percentages of higher concentration near the contact with the gneissic unit. The amount of hornblende and quartz in the gneissic unit increases nearer to the pegmatoid. The hornblende also appears "cleaner" (i.e., there are fewer inclusions present) in the pegmatoid. Abundances of pyroxene increase in the direction away from the pegmatoid. The pyroxenes also become less altered in this direction but display a higher degree of iron-staining.

The pegmatoid unit contains hornblende crystals of various sizes ranging from fine-grained to 6 inches or more in length. A large amount of these pegmatoid hornblende samples was observed in the rubble piles near magnetite bodies. The occurrence of large hornblende was also noted at Locality 1 rubble piles, but the amphibole was not found in outcropping units within the pit.

A leucocratic rock type was also found within the rubble pile of Locality 2. These loose samples appeared to have a slightly higher amount of mafics than the leucocratic rocks from Locality 1.

Other Interesting Outcrops

On route from Locality 1 to Locality 2 another outcrop containing 1 inch thick bands of magnetite was located N63°W of Station 6 along the baseline 93.8 feet away. The ore-rich bands of magnetite strike and dip in unison with the foliation planes of the feldspar-hornblende gneiss.

Pegmatoidal-sized hornblende crystals were also discovered at another locality at a distance of 79 feet from Station 8 along the direction S59°W. This area contained hornblende crystals over 1 foot in length. The rock type surrounding the hornblende is a plagioclase-pyroxene-quartz gneiss. Similar occurrences of oversized amphiboles were located near Station 6.

Representative rock samples from Locality 3 were collected from existing rubble piles. Thin section analysis proved the major minerals to be identical to those from Localities 1 and 2. The rock

types were also varieties of feldspar-quartz-pyroxene gneisses and pegmatoid gneisses.

Structure

The structure of the main ridge in the northwest portion of the forest has a uniform foliation pattern striking northeast to southwest, and the dip is steep to the southeast. The ridge itself appears to be a limb of an antiform striking in the same direction as the foliation of the gneisses and dipping SE. Folds are common throughout Black Rock Forest based, and this is similar to folded features within the Hudson Highlands. The localities with high magnetite concentrations are characterized by frequent jointing parallel to the plane of foliation of the gneissic rock units.

DISCUSSION/CONCLUSIONS

The geologic, petrologic, and geophysical evidence gathered during our study of the northwest portion of Black Rock Forest give variable support to the three currently accepted theories regarding magnetite enrichments in gneissic rocks. The magnetite bodies occuring along the main ridge in the northwest portion of the forest conform to the foliation of the surrounding gneisses. This is similar to that observed in all of the previously studied deposits listed under previous work. In general, these observations support the theory that the magnetite may have been deposited originally in sedimentary beds via hydrothermal venting and the notion that the gneisses surrounding it are altered sedimentary beds.

An alternative theory (Colins, 5) suggests that iron-rich solutions migrated to areas of lower pressure during metamorphism. These lower pressure areas formed by shearing and faulting during the initial deformation of the original lithologies. It is important to note that these types of structural features (i.e. strong shearing or faulting) were not directly observed along the ridge we studied. However, due to heavy topsoil cover these structural features may be present by unrecognized. Moreover, the presence of hornblende-

rich pegmatoids at the forest further suggests that space, i.e. shear zones or faults, may have been available in the gneisses for these minerals to form.

Previous studies have suggested that ores were found in metasomatized or veined paragneiss, amphibolites and metasomatized, contaminated or schlieren gneiss. The host rocks are high in potassium feldspar, are skarns or amphibolites(3). The transition of the original rock to gneiss was activated by elevated temperatures and pressures associated with metamorphism together with the injection of hypogene solutions from magmatic sources (3).

Buddington(3) postulates that the iron-rich solution(s) from magmatic sources were directly responsible for ore formation by moving to low pressure zones. He implies that to a relatively minor degree leaching of iron from mafic silicates in the host rocks contributed to the iron ore-rich zones. Hagner and others, Hagner and Collins, and Collins (1,2,4,5) supports most of Buddington's theories but he describes a simpler scenario. The decrease in abundance of iron in mafic silicates near ore zones was observed in all magnetite locations, except in the Clifton District. This theory cannot be proven or disproven to be the cause of the magnetite bodies in the Black Rock Forest.

Mineralogically, the magnetite bodies of Black Rock Forest are similar to the magnetite deposits previously studied (Hagner and others, Hagner and Collins, and Collins 1,2,4,5; Buddington 3). Garnet and fluorite have been reported to occur in other magnetite deposits, but they were not observed in the rocks of Locations 1, 2 & 3. Garnet and skarn were observed outside of the forest at a location a few miles east of the forest along Route 9W. Furthermore, alaskite containing 80% quartz was reported by Collins (4), but this rock type has not been observed at the Black Rock Forest localities studied so far. A leucrocratic feldspar-quartz gneiss lacking mafics was observed at several localities along the ridge.

In comparison to all previous work done on magnetite deposits, the LaVake, NY, and Rutgers, NJ, iron deposits are, mineralogically and petrographically, the most similar to the Black Rock Forest magnetite bodies. The magnetite ore consists of pyroxene-plagioclase gneiss as

in the rocks of Localities 1 and 2. Both garnet and fluorite are absent from both sites and zircon and apatite are equally common. As pyroxene recrystallized during metamorphism at Black Rock Forest (5) iron and silica may have been released to form magnetite and quartz, as suggested by Hagner and others, Hagner and Collins, and Collins (1,2,4,5) for the the LaVake, NY, and Rutgers, NJ, magnetite deposits. This suggestion is supported by thin section analysis; the quartz content decreases as the pyroxene content increases. At Localities 1 and 2 and in the gneisses that Collins (5) describes the abundance of quartz is 20-35%. Even the plagioclase composition at Black Rock Forest magnetite bodies is similar to that observed at the LaVake, NY, and Rutgers, NJ, iron deposits; oligoclase is the principle plagioclase. The amphibole of the LaVake and Rutgers deposits is hastingsite and the pyroxene is augite(5). Our preliminary microprobe analyses verify that these are the dominant amphibole and pyroxene at several rock outcrops along the ridge. Lastly, Collins consents that biotite and hornblende at Andover released iron, calcium, potassium, aluminum, and silica to form pegmatites of amphiboles near ore zones (5). Samples of pegmatoidal amphiboles were collected near or within Localities 1 and 2 at Black Rock Forest.

A metamorphic reaction sequence for the mafic minerals has been suggested by Collins and Buddington (2,3). With an increase in temperature during metamorphism biotite and hornblende release iron. This results in the formation of pyroxene at the expense of hornblende. In thin sections containing both minerals we observed this type of mineral-mineral relationship (App.C). Eventually, much hornblende and pyroxene (2,3) may break down to form significant pyroxene and magnetite. According to Buddington(3) the magnetite is the youngest mineralogically within these zones, which gives some support to this suggested sequence of events. Ilmenite was identified by the electron microprobe in several samples from Black Rock Forest, and this oxide was also found in the Palmer Hill Mine (2).

REFERENCES

(1) Hagner, Collins and Clemency (1963) Host Rock as a Source of Magnetite Ore, Scott Mine, Sterling Lake, N.Y. Economic Geology 38, 730-768

(2) Hagner and Collins (1967) Magnetite Ore Formed During Regional Metamorphism, Ausable Magnetite District, New York. Economic Geology 62, 1034-1071

(3) Buddington (1966) The PreCambrian Magnetite Deposits of New York and New Jersey. Economic Geology 61, 484-510

(4) Collins (1969) Host Rock Origin of Magnetite in Pyroxene Skarn and Gneiss and its Relation to Alaskite and Hornblende Granite. Economic Geology 64, 191-201

(5) Collins (1969) Regional Recrystallization and the Formation of Magnetite Concentrations, Dover Magnetite District, New Jersey. Economic Geology 64, 17-33

(6) Johnson (1990) Petrologic and Stable Isotropic Studies of the Metamorphosed Zinc-Iron-Manganese Deposit at Sterling Hill, New Jersey. Unpub. PhD dissertation, 108p

(7) Atlas of Igneous Rock Identification

(8) Atlas of Metamorphic Rock Identification

(9) Helenek and Mose (1984) Geology and Geochronology fo Canada Hill Granite and its Bearing on the Timing of Grenvillian Events in the Hudson Highlands, New York. Geological Society of America Special Paper 194 57-73

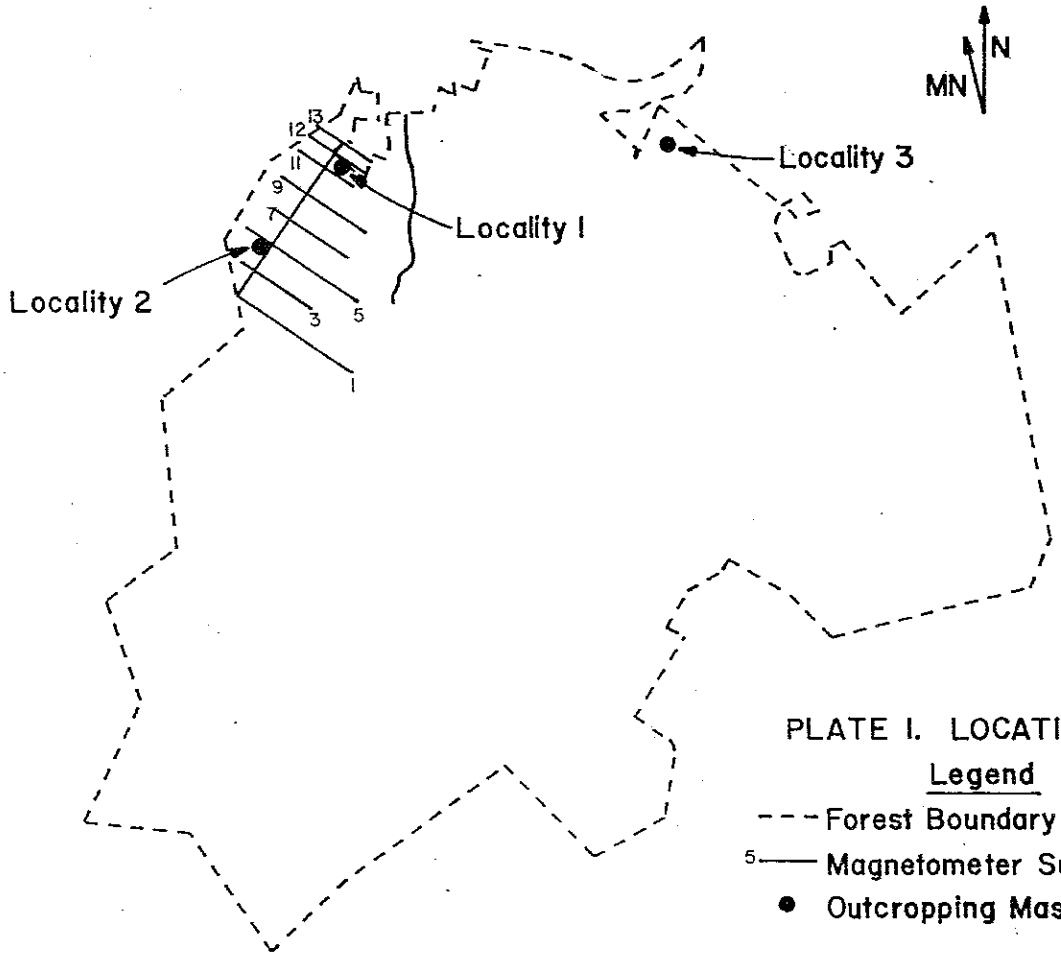


PLATE I. LOCATION MAP

Legend

- - - Forest Boundary

5—— Magnetometer Survey Lines

● Outcropping Massive Magnetite

0 2000 4000 6000 ft.

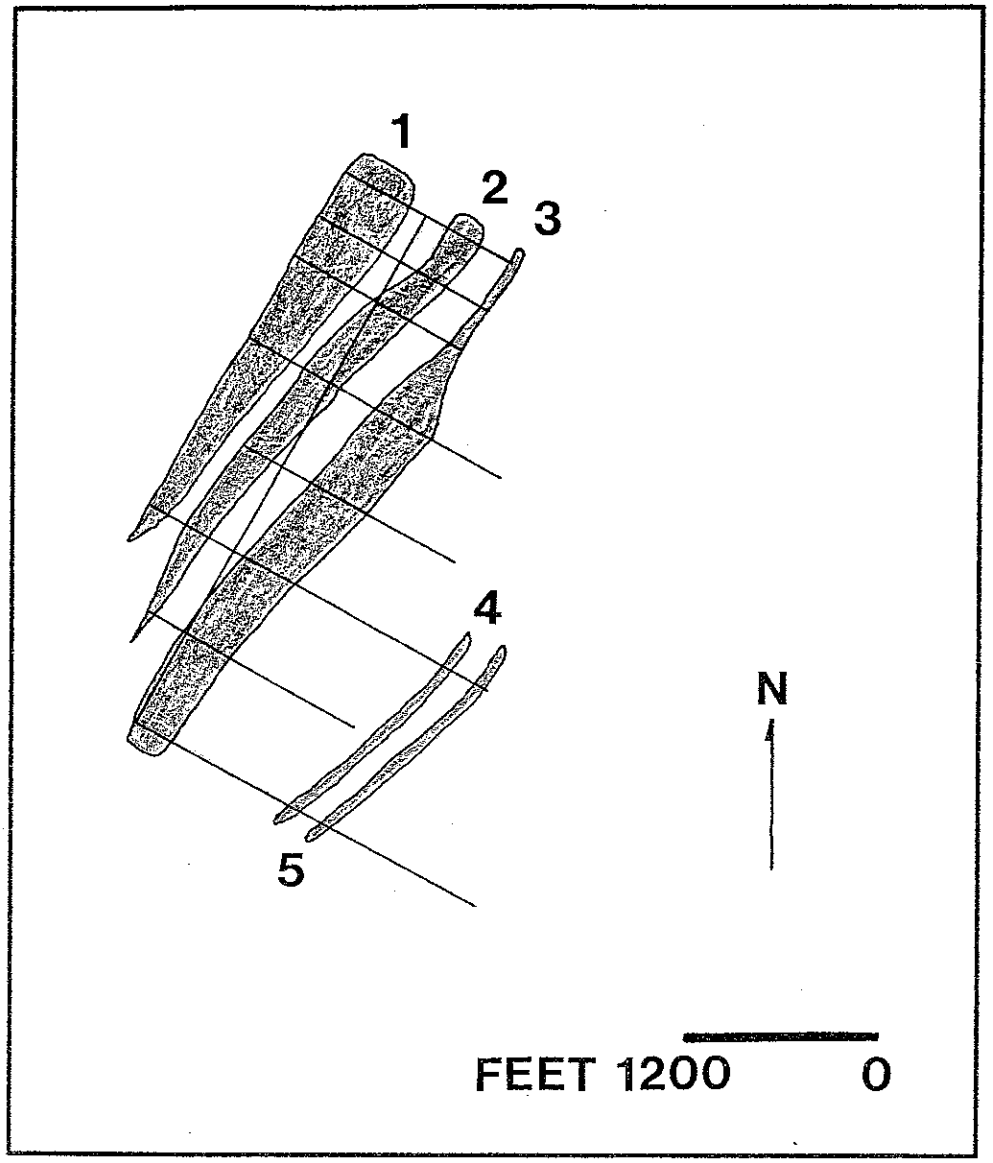


PLATE 2. Interpretation of location of ore bodies based on magnetic signatures depicted in Plate C. Ore bodies are numbered 1-5.

PLATE 3. Major Minerals

The percentages listed below are the highest values taken from a range shown in Appendix C.

Section #	Feld	Qz	Px	Hbd	Bio	Mag	Pyrite	Plag	Zircon
1	40%	5%	20%	10%		40%			
2	90%	20%							
3		50%		20%			1%	45%	
4	45%	3%	15%	40%					
5	40%		7%	15%	40%				
6	45%	40%	2%			15%			1%
7	30%	45%			3%	30%			
8	40%	50%	10%			3%			
9	45%	15%	20%	15%	10%	3%			
10	55%	50%	1%			5%			
11	65%	30%	15%	1%					
12	55%	10%	15%	15%		5%			
13	50%	5%	20%	30%		1%			
14	45%	30%		20%		1%			
15	65%	25%		5%					
16	40%	20%		40%					
17	60%	10%	25%			5%	1%		
19	60%	30%		7%					
20	45%	15%	40%			5%			
21	40%	20%				40%			
22	50%	5%	25%			30%			
23	30%	20%	20%			40%			
24	40%	40%	5%			10%	10%		
25	65%	5%	15%	30%					
26	60%	10%	15%	15%					
27	60%	15%	25%						
28	45%		55%						

APPENDIX A

HAND SAMPLE DESCRIPTIONS, COLLECTION LOCATIONS AND STRIKE AND DIP OF FOLIATION

KEY

MAP LOCATION = collection location of sample on PLATES A, B or C
no = collection location is off map
(#)= collection location number
NE,SW,NW= samples from rubble piles (NW-PLATE A, SW- PLATE B, NE- PLATE 1, Locality 3)

SAMPLE # = identification number found on hand sample
(#) = number on thin section that was cut from hand sample

ROCK TYPE = based on hand sample identification and thin section analysis
Gr.= Granite
Gn.= Gneiss

STRIKE/DIP= strike and dip of foliation

COORDINATES = bearings and distances to off map units from control points on PLATE A or PLATE 1

MAP LOCATION	SAMPLE #	ROCK TYPE	STRIKE/DIP	COORDINATES
1	BRFCE1(1)	Mg-Plag-Px Banded Gn.	N17E 69SE	
2	BRFCE2	Leucocratic Plag-Qz Gn.	N20E 59SE	
2	BRFCE3	Plag-Px Banded Gn.	N20E 59SE	
2	BRFCE4(3)	Plag-Qz-Hbd BandedGn.	N20E 59SE	
2	BRFCE5	Coarse KSPAR-Hb Gn.		
2	BRFCE6	Coarse KSPAR-Bio Gn.		
2	BRFCE7	Coarse		

		KSPAR-Hb Gn.	
2	BRFCE8	KSPAR Qz-Hbd Gn.	
3	BRFCE9(5)	Bio-Hbd-Plag N42E 40SE Gn.	
no(9)	BRFCE10(19)	KSPAR Qz-Hbd N45E 32SE Gn.	
4	BRFCE11	Mag-Plag-Px N20E 53SE Banded Gn.	
4	BRFCE12	Mag-Plag-Px N20E 53SE Banded Gn.	
6	BRFCE13	KSPAR Qz-Hbd N38W 36NE Gn	T4 is 100' from 6 at N43E from T4 T1 is 73' from 6 at S19E from T1
7	BRFCE14	Coarse KSPAR N54E 51SE Qz-Hbd Gn.	
7	BRFCE15	Coarse KSPAR N54E 51SE Qz-Hbd Gn.	
5	BRFCE16(2)	Leuc. Plag-Qz N20E 53SE Gn.	
5	BRFCE17	Leuc. Plag-Qz N20E 53SE Gn.	
5	BRFCE18	Plag-Px Gn. N20E 53SE	
no(8)	BRFCE19	KSPAR Qz-Hbd Gn. N38E 54SE	T3 is 18.7' from 8 at N22E from T3 T4 is 222.4' from 8 at N1W from T4 T5 is 78.6' from 8

				at N75W from T5
no(9)	BRFCE20	KSPAR-Qz-Hbd Gn.	N26E 64SE	T3 is 98.5' from 9 at N27W from T3 T5 is 153 ' from 9 at N54W from T5 B35 is 160.2' from9 at N42W from B35
7	BRFCE21	KSPAR-Qz Hbd Gn.	N28E 57SE	
13	BRFCE22	KSPAR-Qz Hbd Gn.	N27E 52SE	
14	BRFCE23	KSPAR-Qz-Hbd Gn.	N11E 49SE	
14	BRFCE24	coarse KSPAR-Qz-Hbd Gn.	N11E 49SE	
14	BRFCE25	KSPAR-Qz Hbd Gn.	N11E 49SE	
no(15)	BRFCE26(20)	KSPAR-Qz-Hbd Gn.	N45E 32SE	T7 is 125' from 15 at S64W from T7 T8 is 31.2' from 15 at N79W from T8
no(15)	BRFCE30	KSPAR-QZ-Hbd Gn.	N45E 32SE	18" W of BRFCE10
no(16)	BRFCE27	Coarse KSPAR-Qz-Hbd Gn.	N38E 60SE	T7 is 81.7' from16 at N65W from T7 T2 is 83.3' from 16 S70W from T2
no(16)	BRFCE28	Pegmatoidal KSPAR-Qz-Hbd Gneiss		2" up from BRFCE27
no(17)	BRFCE29	Coarse KSPAR-Qz-Hbd Gn.		T8 is 99.3' from 17 at N76W from T8

16 is 125.1' from 17
at S51W from 16

18		BRFCE31	
5		BRFCE32(4)	Leucocratic Plag-Qz Gn. to Hbd-Plag-Bio Gn.
5		BRFCE33	Leucocratic Plag-Qz Gn.
18	19	BRFCE33(8)	Qz-Plag-Px Gn. N35E 53SE
18		BRFCE34	Qz-Plag-Px Gn.
18		BRFCE35	KSPAR-Qz-Hbd Gneiss
18		BRFCE36	N20E 53SE
18		BRFCE39	
18		BRFCE40	
18		BRFCE41	Mag-Feld-Hbd Gn.
18		BRFCE42(10)	Coarse Mag-Plag-KSPAR Qz Banded Gn. ore
19		BRFCE43a	Mag-Plag-Px- Banded Gn. N31E 41SE
19		BRFCE43b	Mag-Plag-Px- Banded Gn. N31E 41SE
19		BRFCE43c	Mag-Plag-Px- Banded Gn. N31E 41SE
19		BRFCE43d	Mag-Plag-Hbd- N31E 41SE

Banded Gn.

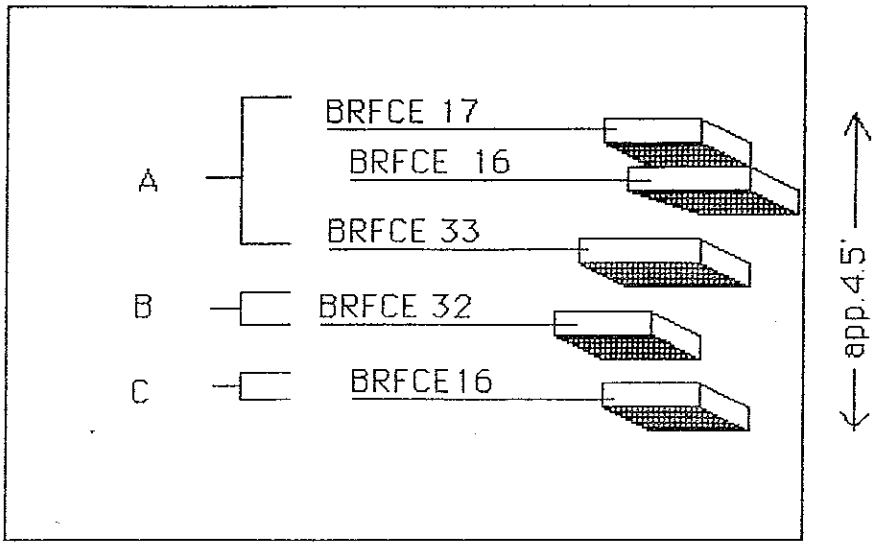
19	BRFCE44	Mag-Plag-Px- N31E 41SE Banded Gn.
19	BRFCE45	Mag-Plag-Px- N31E 41SE Banded Gn.
19	BRFCE46	Plag-Px-Qz Gn. N31E 41SE
19	BRFCE47	Plag-Px-Qz Gn. N31E 41SE
19	BRFCE48	Plag-Px-Qz Gn. N31E 41SE
19	BRFCE49	Plag-Hbd Px Gn.
19	BRFCE50	Bio-Plag-Hbd Gn. N32E 41SE
19	BRFCE51	Bio-Plag-Hbd Gn. N32E 41SE
19	BRFCE52	Bio-Plag-Hbd Gn. N32E 41SE
NW	BRFCE53(22,23)	Mag-Plag-Px Banded Gn. ore
NW	BRFCEL1	
NW	BRFCEL2	
NE	BRFCEL7(6)	Pegmatoidal Mag- Plag-Qz Gn.
NE	BRFCEL5(7)	Pegmatoidal Mag- Qz-Plag-Bio Gn.
NE	BRFCEL6(9)	Mag-Feld-Hbd Gn.
SW	BRFCELT1(11)	Leucocratic N51E 47SE Feld-Qz-Px Gn.
20	BRFCET1(12)	Feld-Px-Hbd Gn. N51E 47SE

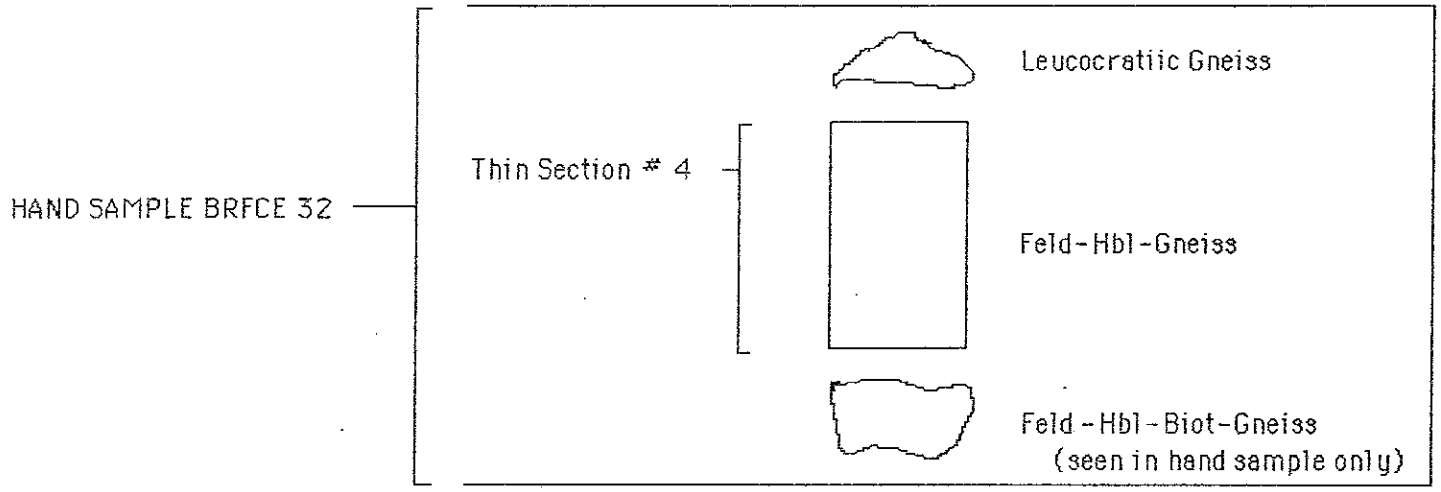
20	BRFCET2(13)Coarse Feld-Hbd Px Gneiss	N51E 47SE	
20	BRFCET3(14)Pegmatoidal Mag- Feld-Hbd-Qz	N25W	
21	BRFCET4(15)Pegmatoidal Feld-Hbd-Qz	N25W	
21	BRFCET5(16)Pegmatoidal Mag- Feld-Hbd-Qz	N25W	
25	BRFCET6(17)Plag-Px-Qz Gn.		
none	BRFCES1	Mag-Feld Banded Gneiss	N35E 53SE N63W from station 6 on baseline(93.8')
none	BRFCES2	Mag-Feld Banded Gneiss	N35E 53SE N63W from station 6 on baseline(93.8')
none	BRF90 4.1.2(28) Px-Plag Gn.		S59W from station 8 on baseline(79')
none	BRF90 4.1.1B(27) Pegmatoidal Plag-Px-Qz Gn.		S59W from station 8 on baseline(79')
none	BRF90 4.1.1A(26) Pegmatoidal Plag-Px-Hbd Gn.		S59W from station 8 on baseline(79')
none	BRF90 1.5.1(25) Pegmatoidal Plag-Hbd-Px Gn.		66ft. from station 6 on baseline
NW	BRF90 1.6.1(24) Qz-Plag-Px-Mag Gn.		
none	BRF 3.3.1(23) Pegmatoidal Mag-Plag-Qz Gn.		S59W from station 8 on baseline(79')

APPENDIX B
SAMPLE LOCATION SITES

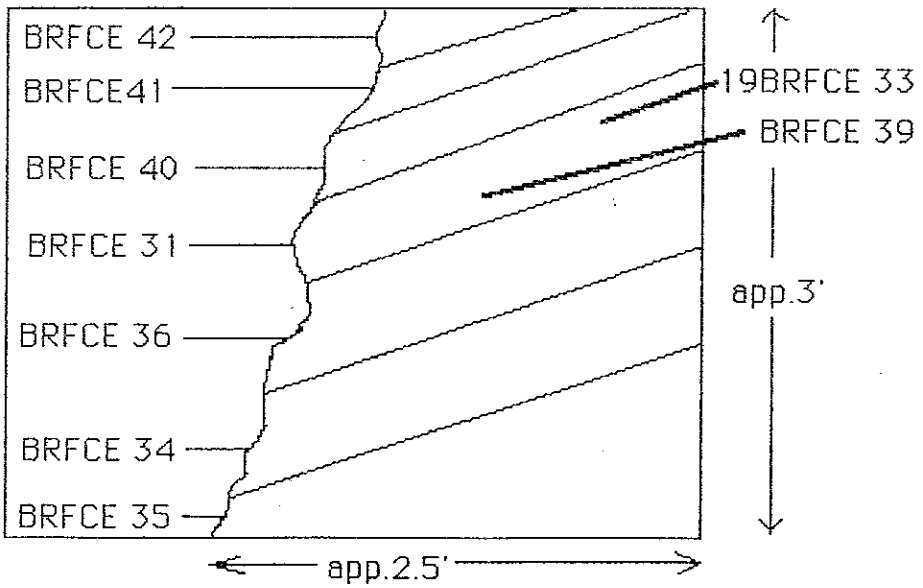
APPENDIX B. MAP LOCATIONS, HAND SAMPLES AND THIN SECTIONS

MAP LOCATION 5
(LOOKING EAST)

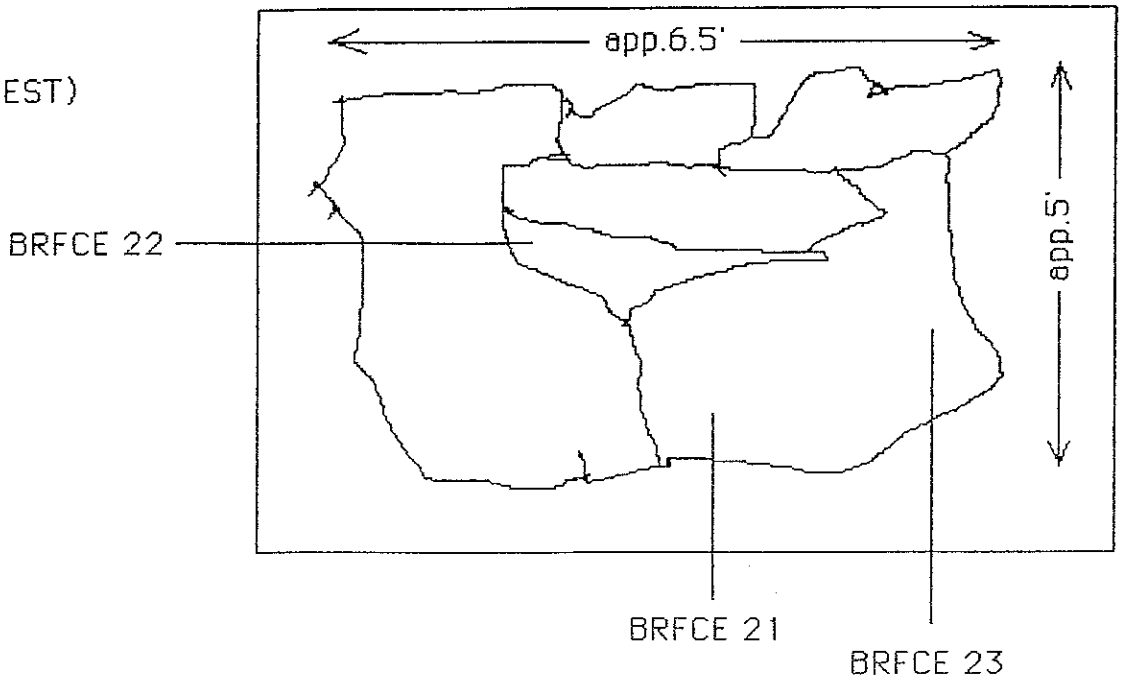




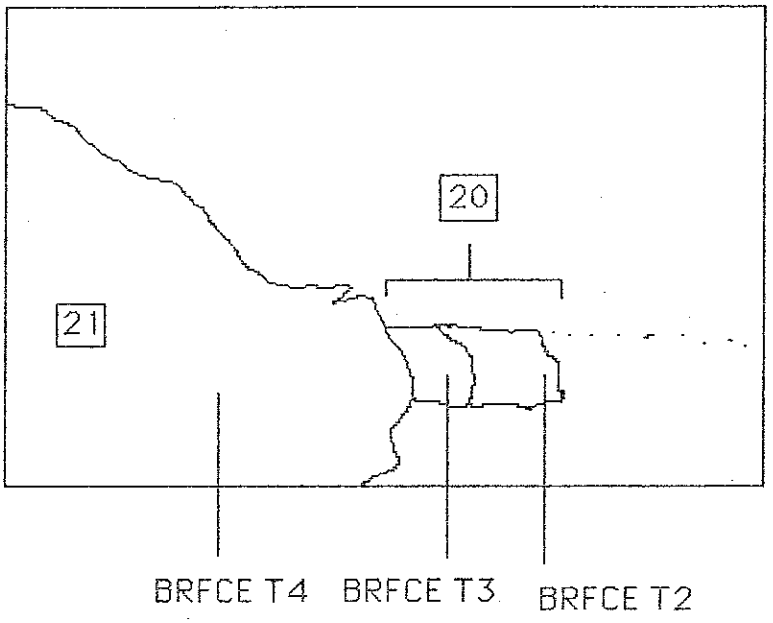
MAP LOCATION 18
(LOOKING SOUTH)



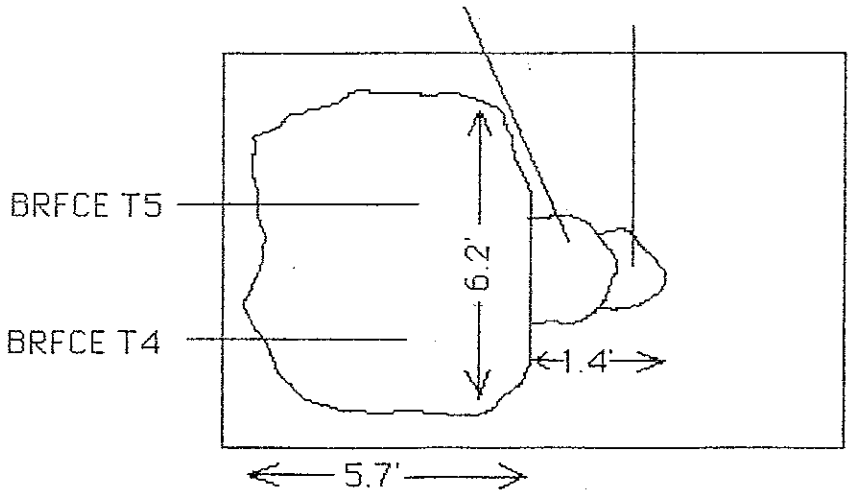
MAP LOCATION 14
(LOOKING NORTH WEST)



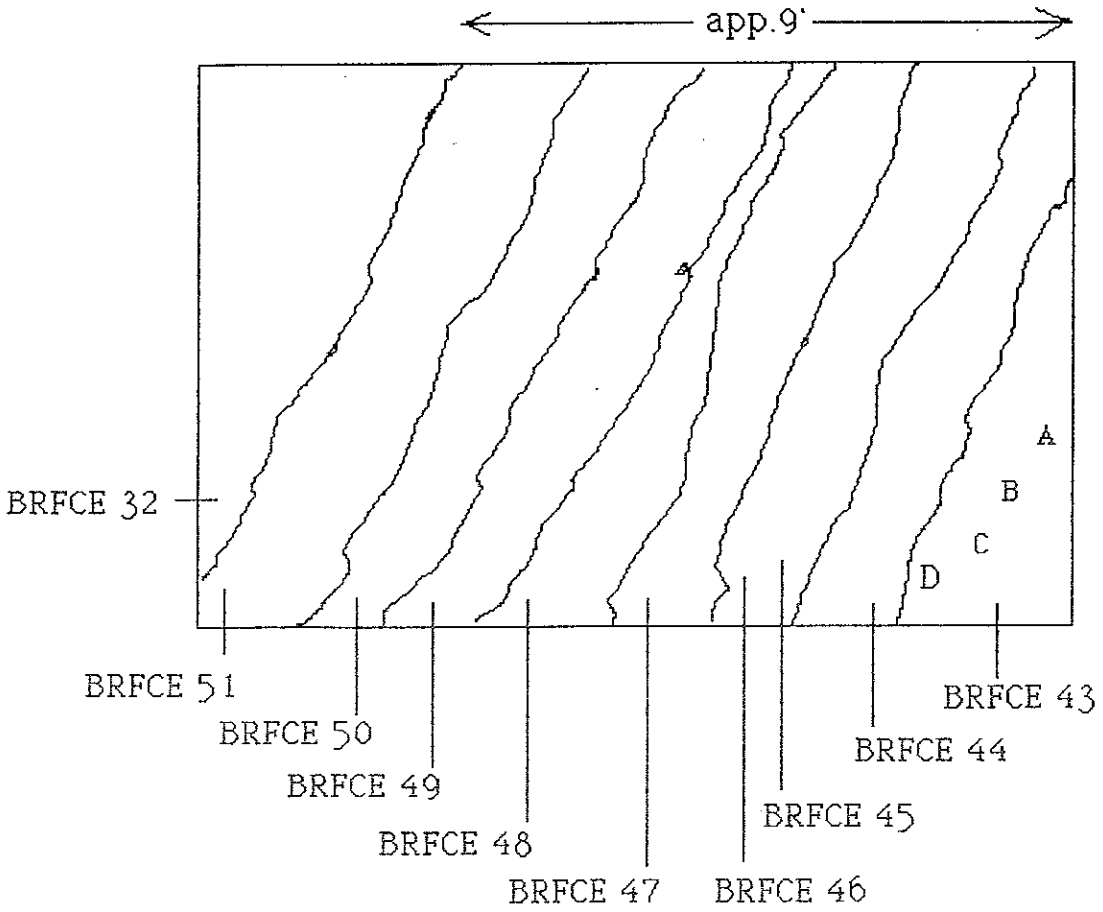
MAP LOCATION 20 , 21
(LOOKING NORTH)



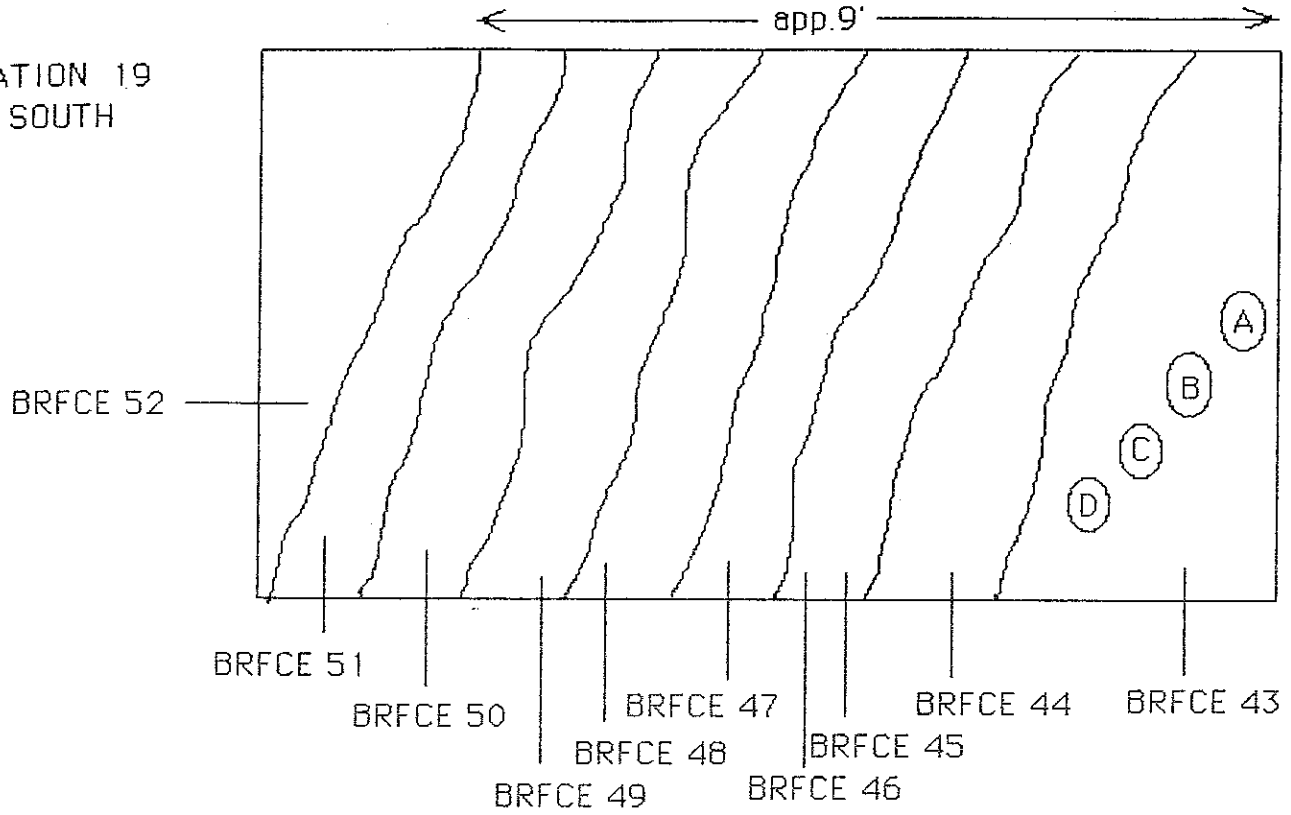
(TOP VIEW)



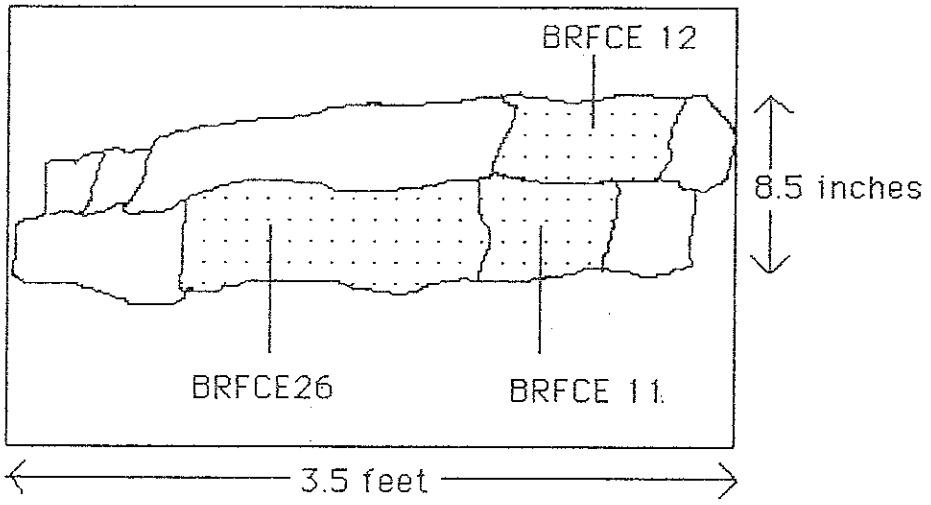
MAP LOCATION 19
(LOOKING SOUTH)



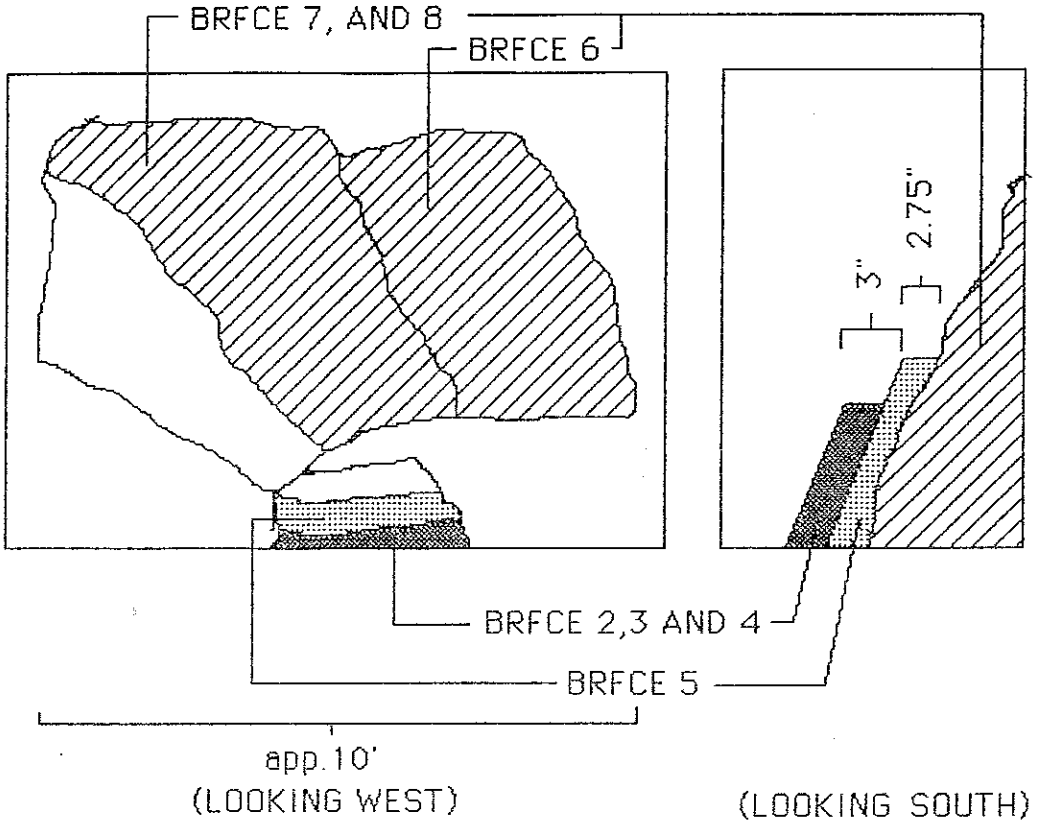
MAP LOCATION 19
(LOOKING SOUTH



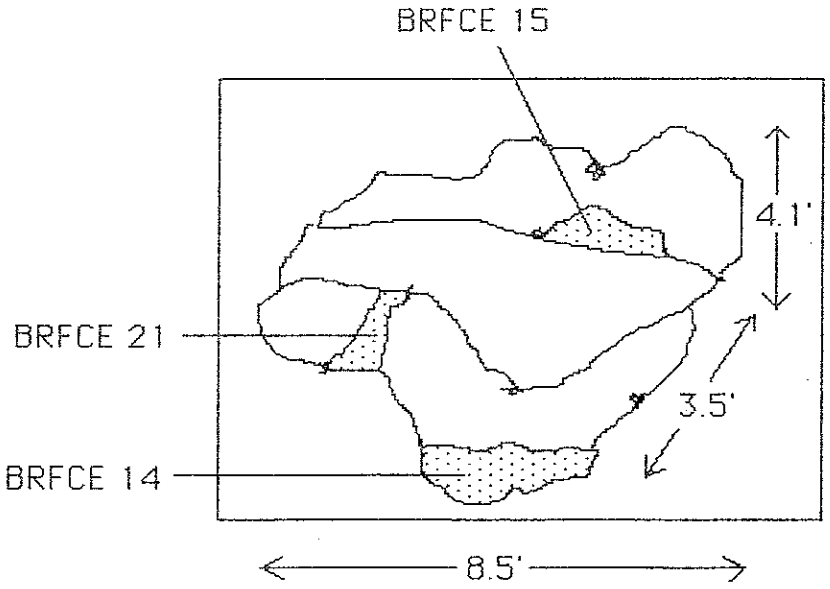
MAP LOCATION 4
(LOOKING EAST)



MAP LOCATION 2



MAP LOCATION 7
(LOOKING NW)



ADDED NOTE

The Stations which are referred to in this Appendix lie on the baseline that was used for collecting magnetometer data. The Stations are 300 feet apart, and they are numbered consecutively starting at the southern end of the line. Station 6, for example, is located on the baseline 1800 feet from its southern end.

APPENDIX C
THIN SECTION DESCRIPTIONS

ADDED NOTE

The term zoning in this Appendix should be understood to mean rimming.

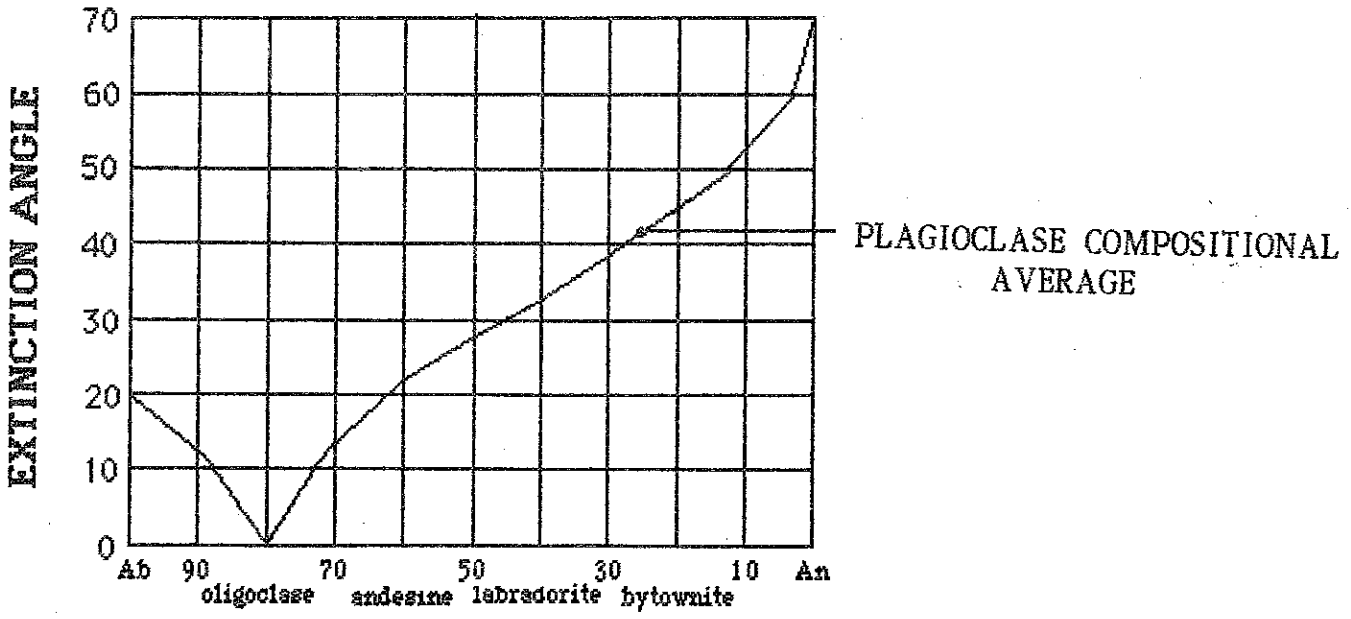
Diagnostic Features

FELDSPARS

Plagioclase- Biaxial (-)

- Color: plane polarized light(P.P.L.) - colorless
  : x-nicols - 1st order white
- displays polysynthetic twinning
- sericitized often
- compositionally, the plagioclase falls into labradorite(Ab_{50}-Ab_{30}) to bytownite(Ab_{30}-Ab_{10}) range. This was figured using the Michel Levy Law. Averages of the twinning lamellae's extinction angles were: 42,42,43,40,41,43,42,42,41,42- total average 41.8. Extinction angles measured were from thin section #4, BRFCE 32.

GRAPHIC REPRESENTATION OF PLAGIOCLASE COMPOSITION
BASED ON THE MICHEL LEVY LAW



Antiperthite- Biaxial(-)
- Color: P.P.L. -colorless
- plagioclase host containing "spheres" of K-Feldspar exsolution
-host composition falls in the same range as the clean plagioclase (labradorite- bytownite) already described
- sericitization is a common alteration feature

Microcline- Biaxial (-)
- color: P.P.L.- colorless
: x-nicols- 1st order white-grey
- under x-nicols the mineral gives fibrous light to dark grey appearance
- undulating extinction similar to quartz except for the mineral's fibrous features

Microcline perthite- biaxial(-)
- color: P.P.L.- colorless
: x-nicols- dark to light grey 1st order color
- microcline host with exsolving twinned plagioclase appearing as inclusions in the host
- grid iron twinning
- vein and braided textures

OTHER MINERALS

Hornblende- biaxial (-) (difficult to obtain)
- color: P.P.L.- medium to high pleochroic light to dark green and dark green to brown
- brown color is due to greater amounts of Fe^{+3}, TiO_2, $K_2O+Al_2O_3$ and Na_2O, and lower amounts of SiO_2(Heinrich)
- near 60° to 120° cleavage
- often intergrown with magnetite(sometimes mimicking the Hbl.) and zoning the magnetite itself
- reacting with pyroxene and often zoned by it

Pyroxene- biaxial(-)
- color: P.P.L.- slightly pleochroic faint: yellow, green, blue and pink colors
- medium to high relief
: x-nicols- 2nd to 3rd order colors
- highly fractured and strained with Fe oxidation along these faults

- mosaic texture
- near 90° cleavages
- exhibit diallage parting
- contains blades of an opaque mineral(titaniferous magnetite(Heinrich)) depicting material exsolved with slow cooling
- exsolution lamellae both fine(.2mm at 40x) and coarse(.5mm at 4x)
- two types of crystals seen: [1]those with exsolution lamellae and diallage parting and those [2]without; the pyroxene with diallage displays polysynthetic twinning and is most likely a clinopyroxene; this supposition is highly likely due to the large amounts of calcium in these systems and the common occurrence of the pyroxenes with calcium rich hornblendes
- also found as inclusions within hornblende

Quartz- uniaxial (+)
- color: P.P.L.- colorless
- negligible relief
: X-nicols- 1st order yellow
- lacks cleavage
- conchoidal fracturing
- undulating extinction
- found within feldspars as myrmekite

OPAQUES

Magnetite- color: P.P.L. and x-nicols- opaque
: reflected light- dull grey sheen
- often disseminated
- embayed or as inclusions within in hornblende or pyroxene
- occasionally armored by quartz
- found embayed and reacting with pyrite

Pyrite- color: P.P.L. and x-nicols- opaque
: reflected light- bright pale yellow
- in thin section reacting with the major minerals and magnetite

Hematite- color: P.P.L. and x-nicols- deep red internal reflection
- found associated with magnetite in thin section

Sericite- color: P.P.L.- colorless
- medium relief
- very fine mica; .5mm at 40x magnification

- elongated blades
- zoned birefringence
- associated with the alteration of plagioclase and antiperthite; if listed in thin section descriptions as an accessory mineral, then sericitization of feldspars is occurring

Zircon- color: P.P.L.- colorless
- high relief
- x-nicols- high birefringence and zoned
- euhedral crystals

Chlorite- color: P.P.L.- plechroic olive green
: x-nicols- fibrous, dusky blue
- seen as alteration product of hornblende, biotite, and pyroxene

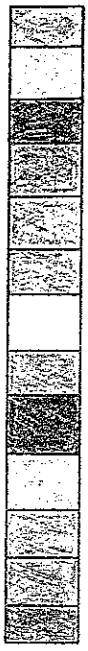
Epidote- color: P.P.L.- yellow
- found in cleavage planes of feldspar and pyroxene

Apatite- color: P.P.L.- colorless
: x-nicols- 1st order blue-grey
- euhedral in shape

GRAIN SIZES - The samples are primarily course grained if they are not labeled as pegmatoidal in their rock type description. Some samples include porphyroblastic crystals and this feature is listed in their textures description.

KEY TO THIN SECTION DESCRIPTIONS

COLOR CHART TO IDENTIFYING THIN SECTION DIAGRAMS



PLAGIOCLASE
SERICITIZED PLAGIOCLASE
MAGNETITE
PYROXENE
HORNBLENDE
CHLORITE
ZIRCON
QUARTZ
MUSCOVITE
HEMATITE
BIOTITE
EPIDOTE
PYRITE

Numbers that adjoin some diagrams refer to position of thin section slide on the microscope stage. The first number is the setting on the x-axis of the counter, and the second number refers to the y-axis setting.
Example: 2.3-65.3

Magnification is at 4x power unless specified differently.

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE 1 Thin Section #1
Collection Site: NW Pit Map Location 1
Collector: Chemych Date: August 8, 1990'
Rock Type: Magnetite-Feldspar-Pyroxene Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
magnetite	30-40%	zircon
feldspar	30-40%	epidote
pyroxene	15-20%	hematite
hornblende	5-10%	sericite
quartz	3-5%	

Textures- myrmekitic quartz and feldspar mixtures
- reaction rims
- embayed hornblende, pyroxene, magnetite and feldspar
- porphyroblastic hornblende

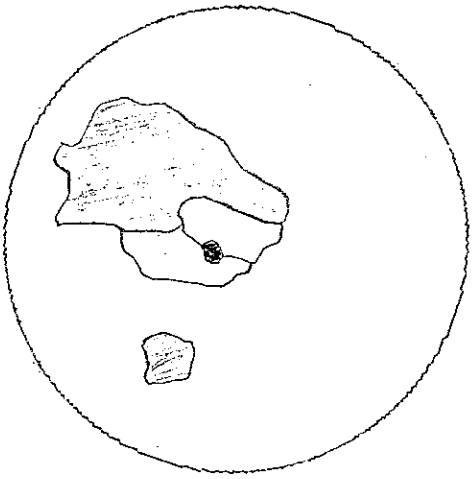
Altered minerals- antiperthite, plagioclase and pyroxenes

Other notes

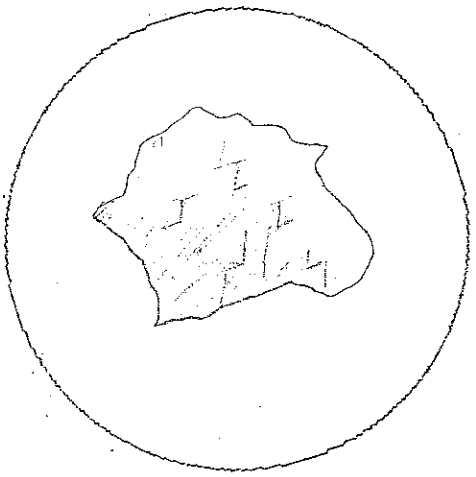
Feldspars - antiperthite and plagioclase
Hornblende - dark to light green
-half of section is Mgt-Pyr-Hbl-Feld-Qtz gneiss and half Feld-Pyr-Qtz gneiss
Hand sample- .5 to 1 inch magnetite bands

REPRESENTATIVE FIGURE

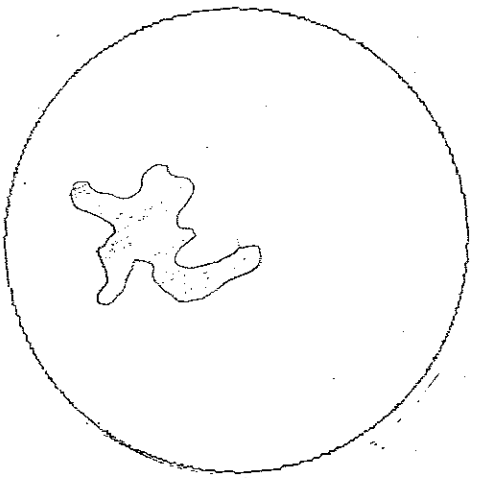
Sericite replacing plagioclase along fractures and cleavage planes
(30-57)

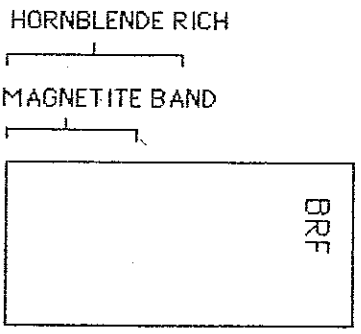


Pyroxene- Biaxial (-)
(30-67)



Hornblende
(5.2-62.2)





stage settup

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE16 Thin Section #: 2
Collection Site: NW Pit Map Location: 5
Collector: Chemych Date: August 18, 1990'
Rock Type: Leucocratic Feldspar-Quartz Gneiss

MINERALOGY:

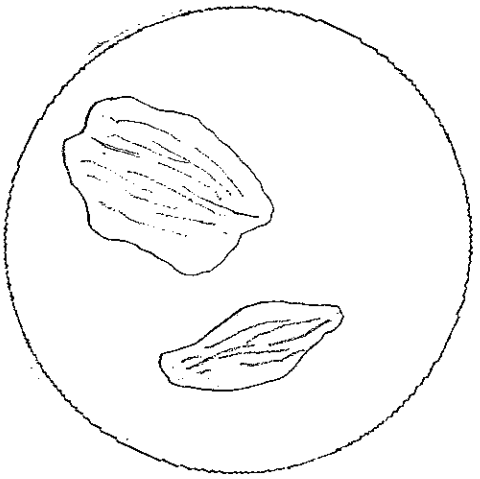
Major Minerals	% in Sample	Accessory Minerals
quartz	10-20%	sericite
feldspar	80-90%	chlorite
		zircon
		pyroxene
		hornblende
		epidote
		magnetite

Textures- micrographic granite

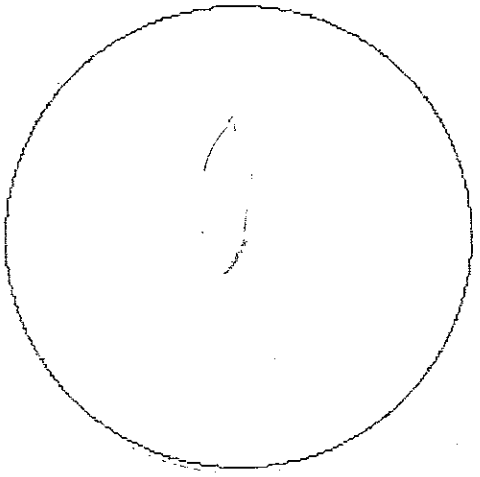
Altered minerals- Chlorite and epidote replacing former ferromagnesian phase
- feldspars and old ferromagnesian minerals

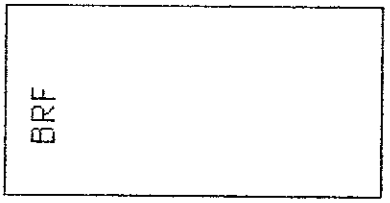
Other notes
disseminated magnetite
Feldspar- Plagioclase and antiperthite

Chlorite
(30-75.5)



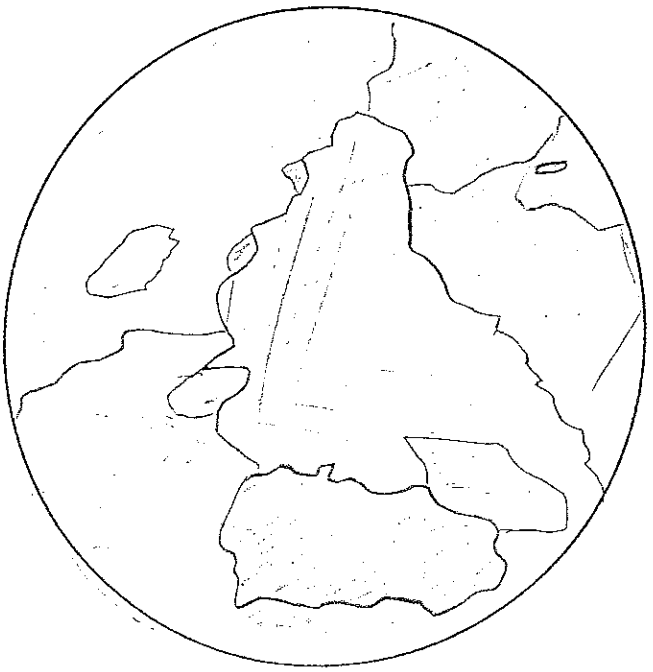
Zircon- high relief
(38.3-72)





stage settup

REPRESENTATIVE FIGURE



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE4 Thin Section #: 3
Collection Site: NW Pit Map Location: 2
Collector: Chemych Date: August 8, 1990
Rock Type: Quartz-Plag.-Hornblende Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
plagioclase	35-45%	pyroxene
quartz	40-50%	magnetite
hornblende	10-20%	zircon
pyrite	1%	sericite

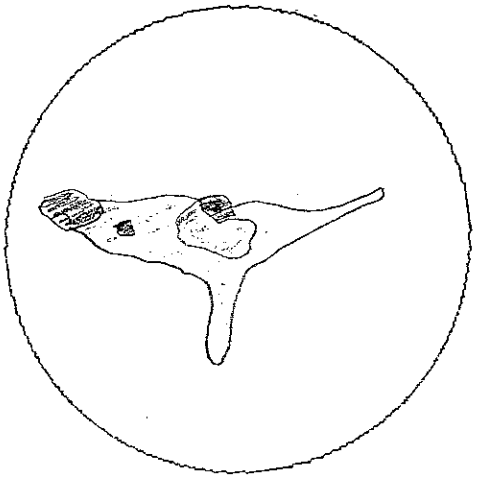
Textures-embayed hornblende
-gneissic banding
-porphyroblastic

Altered minerals-pyroxene, antiperthite, plagioclase, hornblende replaced by magnetite and chlorite, hornblende replacing pyroxene

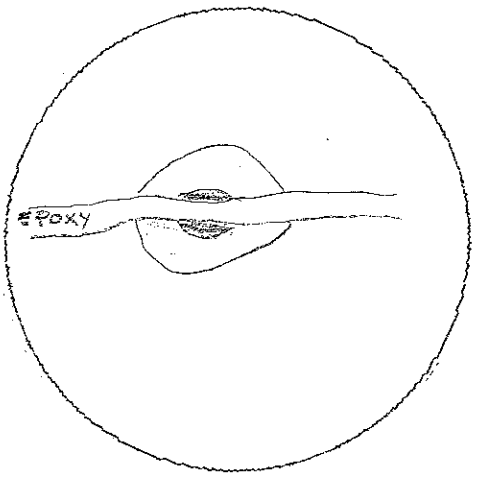
Other notes

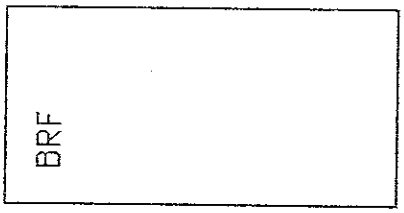
Half of section is Plag-Qtz-Hbl gneiss and half pegmatoidal leucocratic Qtz-Plag gneiss
Felspars-antiperthite and plagioclase
Hornblende-brown
Pyroxene found in hornblende
Pyrite within hornblende

Pyroxene and magnetite in hornblende
(27.8-62.8)



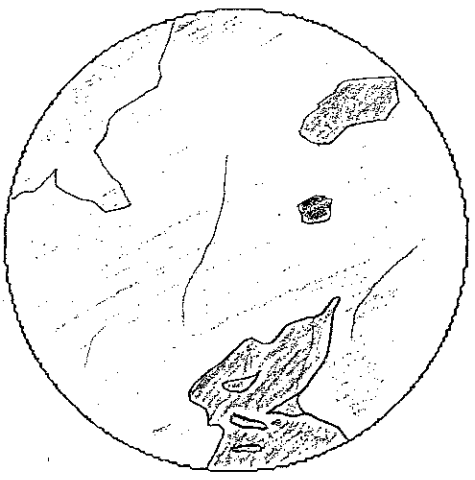
Magnetite zoned gy quartz





stage settup

Representative Diagram of Sample



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE32 Thin Section #: 4
Collection Site: NW Pit Map Location: 5a
Collector: Chemych Date: August 28,1990'
Rock Type: Feldspar-Hornblende-Pyroxene Gneiss

MINERALOGY:

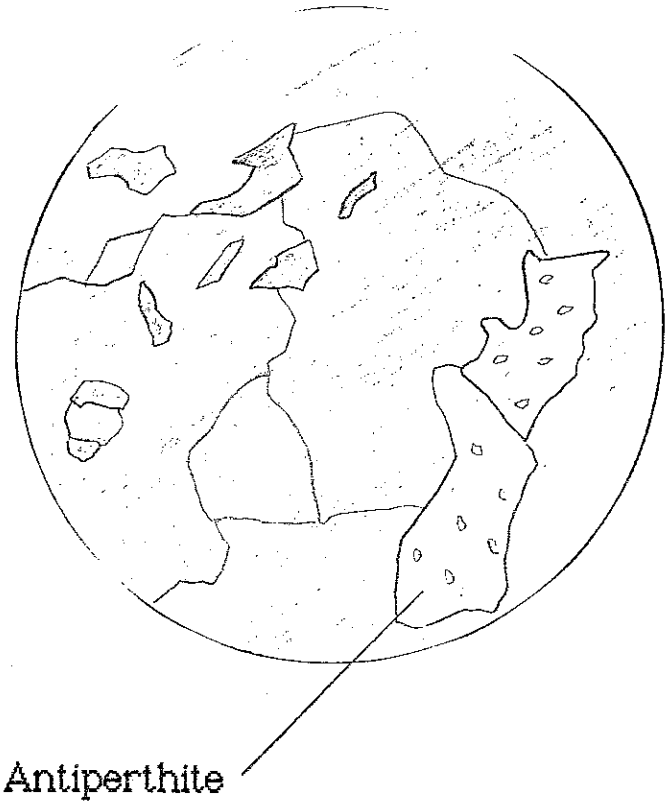
Major Minerals	% in Sample	Accessory Minerals
feldspar	35-45%	sericite
hornblende	30-40%	magnetite
pyroxene	10-15%	pyrite
quartz	1-3%	

Textures- gneissic banding
- porphyroblastic

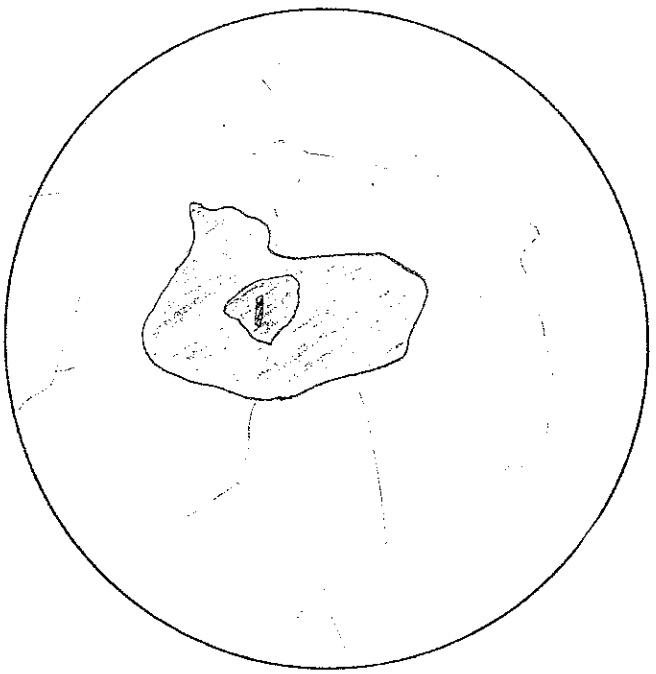
Altered minerals- pyroxene
NOTE: very clean minerals

Other notes
Feldspars- plagioclase, antiperthite
Hornblende- brown
Hand samples- specimen grades from leucocratic gneiss to a hornblende-biotite gneiss related to BRFCE 9, thin section #5
Magnetite within hornblende

Representative Diagram of Sample



Plagioclase zoned by hornblende and magnetite is within that plagioclase (29.9-77) 40x power



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE9 Thin Section #: 5
Collection Site: NW Pit Map Location: 3
Collector: Chemych Date: August 20, 1990'
Rock Type: Biotite-Plag-Hornblende Gneiss

MINERALOGY:

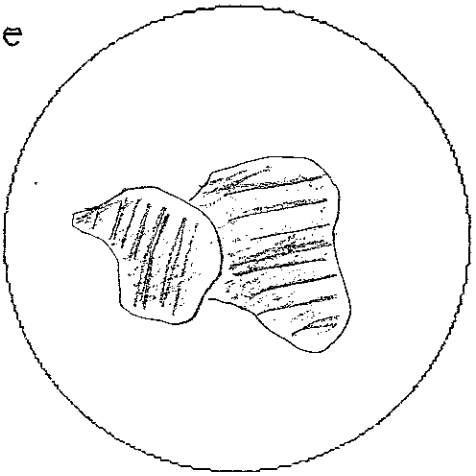
Major Minerals	% in Sample	Accessory Minerals
biotite	30-40%	zircon
feldspar	30-40%	apatite
hornblende	7-15%	magnetite
pyroxene	3- 7%	pyrite
		chlorite

Textures- embayed biotite and hornblende
-porphyroblastic
-gneissic banding
-diallage parting in pyroxene

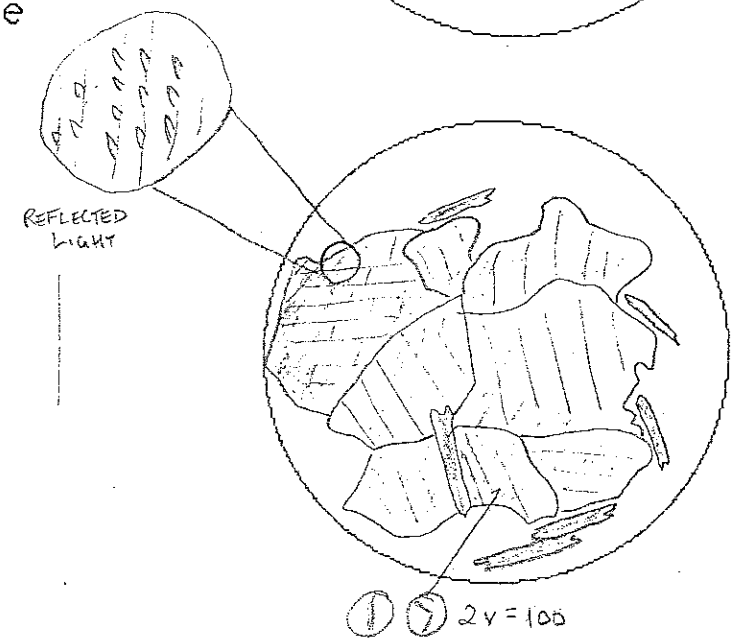
Altered minerals- pyroxene and plagioclase(sericitized) altered by carbonate

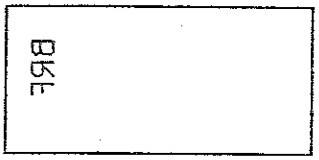
Other notes
Feldspars- plagioclase and minor microperthite
Hornblende- green to brown
Biotite- reddish brown
Pyroxene- diallage and second type is with random fractures
Reactions- magnetite(amoeboid) and pyrite with microperthite
- biotite with plagioclase

Epidote within cleavage planes of pyroxene
(26.1-70.3)

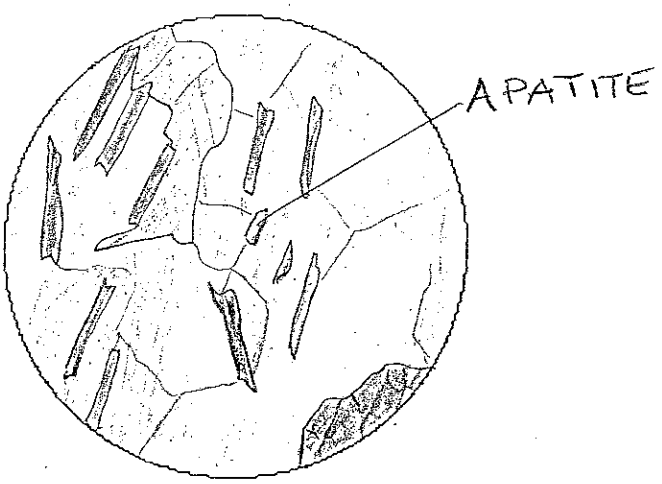


Pyroxene with exsolution lamellae,
plagioclase is altered, biotite
(19.6-67.85)





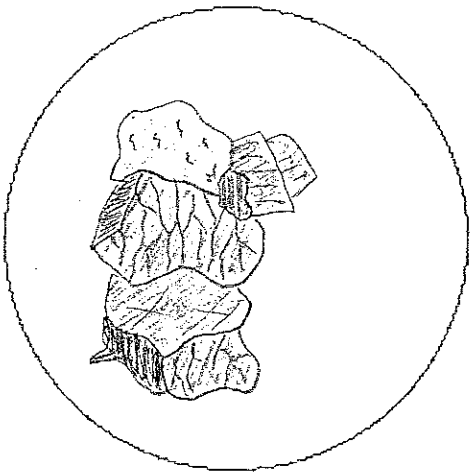
stage settup (this settup is used throughout
in future diagrams

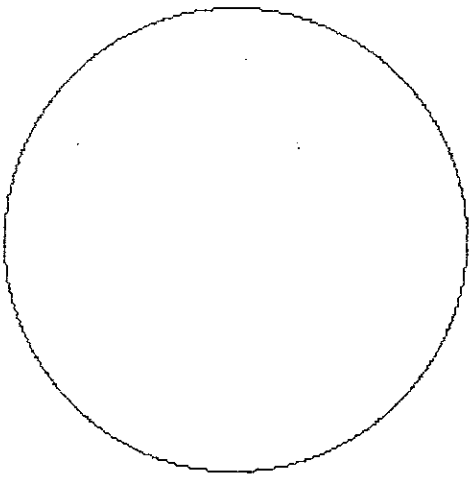


Representative Diagram of Sample

Embayed crystals of quartz, plagiclase, hornblende and pyrite
Biotite is also present
(8.95-57)

Fractured pyroxene associated with hornblene, quartz pyrite and magnetite
(9.1-56.6)





SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE L7 Thin Section #: 6
Collection Site: NE Site Map Location: Float
Collector: Chemych Date: September 90'
Rock Type: Pegmatoidal Feldspar-Quartz-Magnetite Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	30-45%	hematite
quartz	25-40%	biotite
magnetite	7-15%	
pyroxene	1-2 %	
zircon	.5-1%	

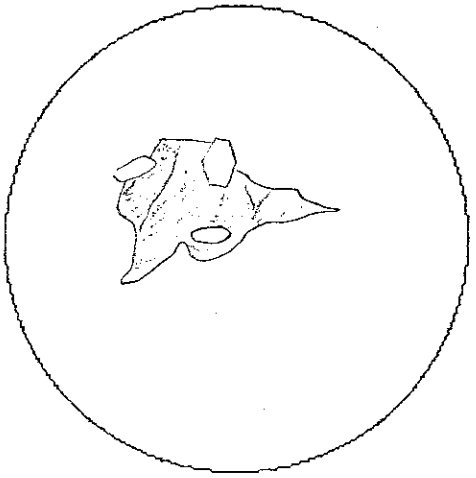
Textures-porphyroblastic
- -myrmekitic quartz-plagioclase
- -embayed Qtz-Feld-Mgt
- -amoeboid magnetite(Collins)

Altered minerals- pyroxenes and feldspars

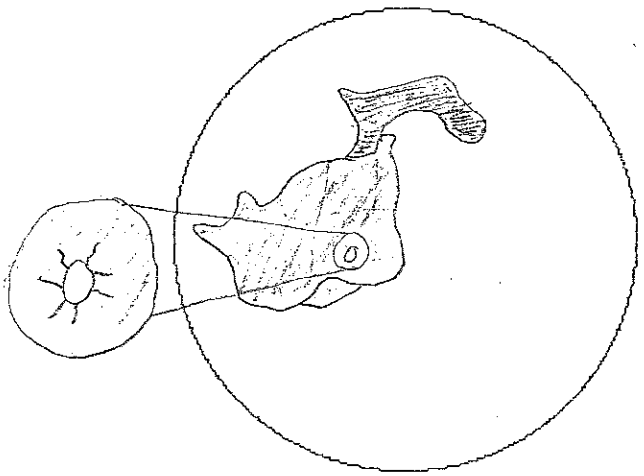
Other notes
- Feldspars- antiperthite and plagioclase
- Reactions- hornblende with pyroxene
- - magnetite-quartz-feldspar
- Original rock may have been a Biot-Hbl granite gneiss(J.W.)
- Minerals are highly strained

Hand sample- pegmatoidal

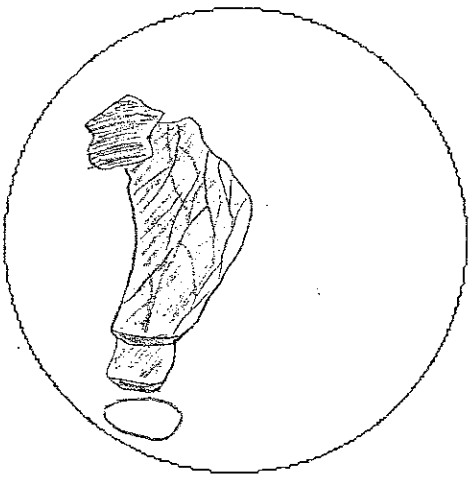
Pyroxene with unknown crystal and zoning a zircon
29,25-68.4)

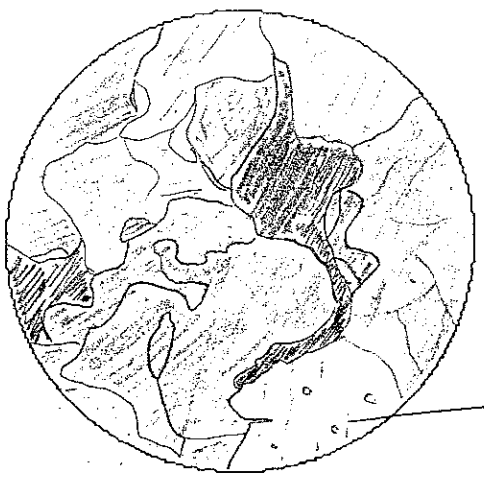


Zircon within a pyroxene exhibiting stress along the crystal boundary
(28-64.5)



Hematite staining along pyroxene's fractures
(6.8-69.3)





REPRESENTATIVE DIAGRAM

ANTIPERTHITE

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE L5 Thin Section #: 7
Collection Site: NE Site Map Location: Float
Collector: Chemych Date: September 90'
Rock Type: Pegmatiodal Quartz- Feldspar- Magnetite Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
quartz	35-45%	epidote
magnetite	25-30%	sericite
feldspar	25-30%	hematite
biotite	2-3 %	chlorite
		pyroxene

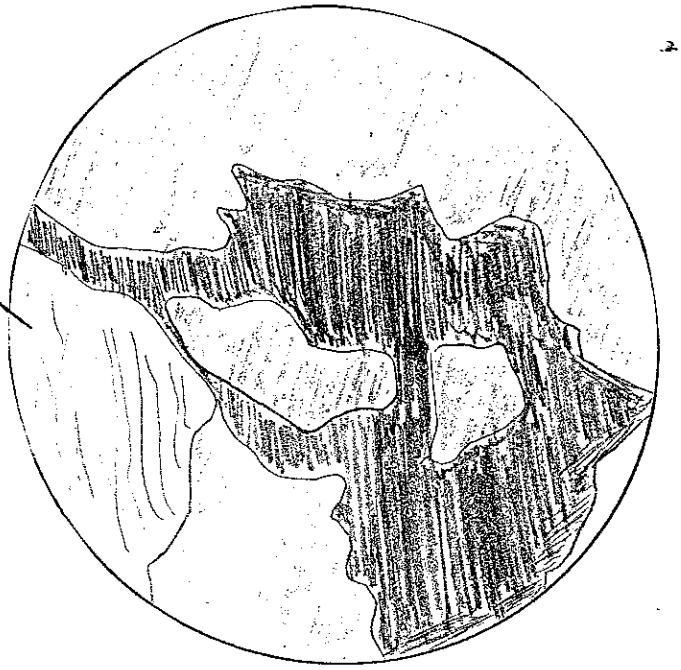
Textures- amoeboid magnetite
-pyrite in magnetite
- pegmatiodal

Altered minerals- chlorite with biotite
- sericitization of feldspars
- chlorite altering magnetite

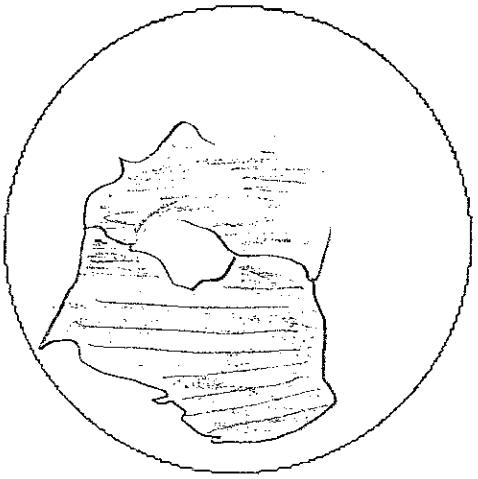
Other notes
Feldspars - plagioclase, antiperthite, microcline and microperthite
Biotite - reddish brown
Unknown mineral in magnetite
Pyroxene in hornblende

Hand sample- pegmatoidal

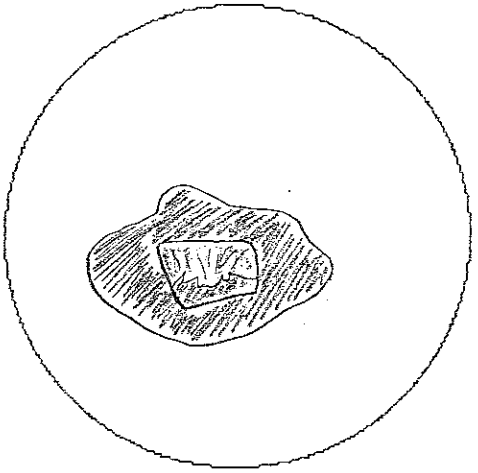
Representative Diagram of Sample



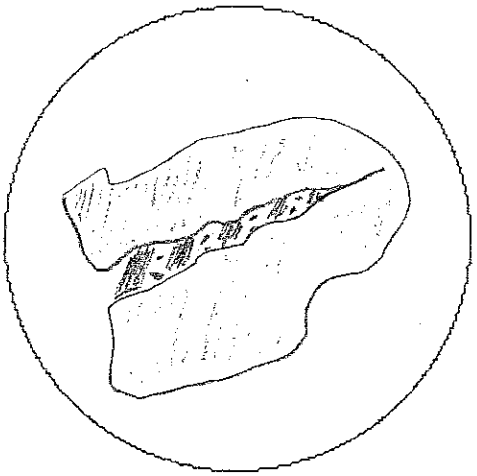
Epidotized mineral(unknown) adjacent to a biotite "book"
(18.3-56)



Hematite and chlorite in magnetite
(8.95-74.1)



Magnetite and sericite along fracture in plagioclase
(2.8-65.95)40x-power



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE33 Thin Section #: 8
Collection Site: NW Pit Map Location: 18
Collector: Chemych Date: August 27, 1990'
Rock Type: Quartz - Feldspar- Pyroxene Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
quartz	40-50%	zircon
feldspar	30-40%	pyrite
pyroxene	7-10%	epidote
magnetite	2-3%	hornblende

Textures - embayed quartz and feldspar
- porphyroblastic
- gneissic banding
- quartz, hematite, magnetite and pyrite zoned by plagioclase

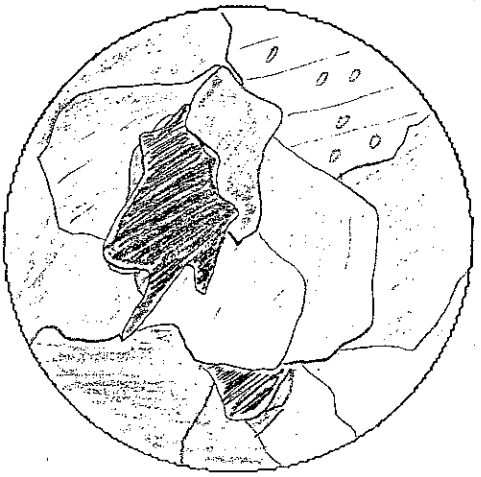
Altered minerals - pyroxene

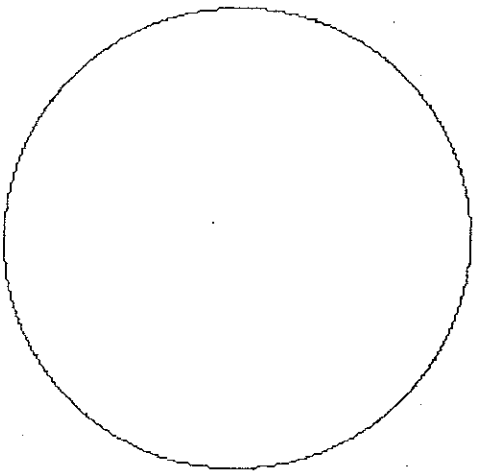
Other notes
- Feldspars - antiperthite and plagioclase
- Biotite - brown
- Hornblende - green
- Pyroxene - both diallage and fractured

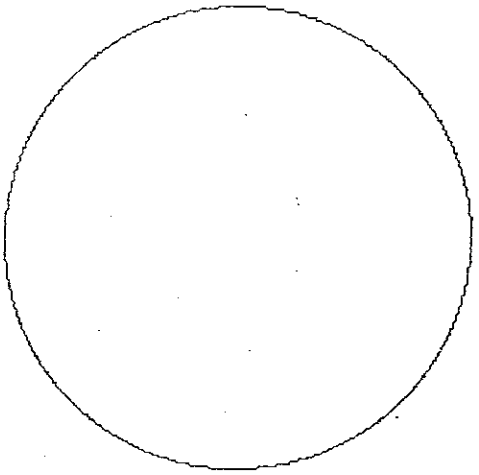
Hand sample- Fe stained leucocratic sample

Antiperthite

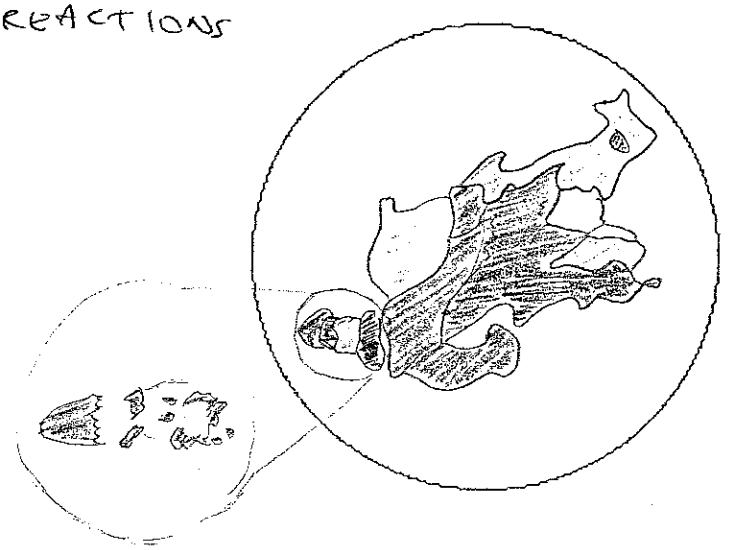
Representative Diagram of Sample





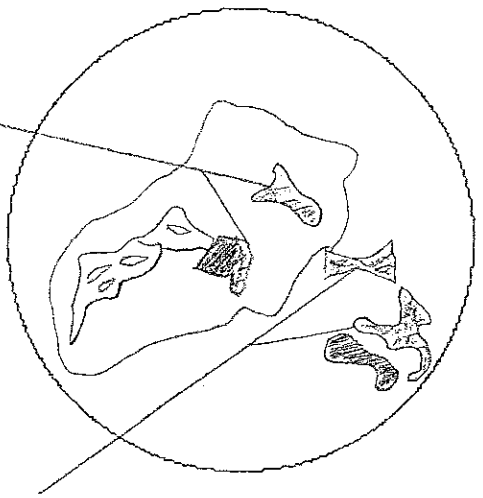


MAGNETITE, PYRITE AND
QUARTZ RELATIONSHIP REACTIONS



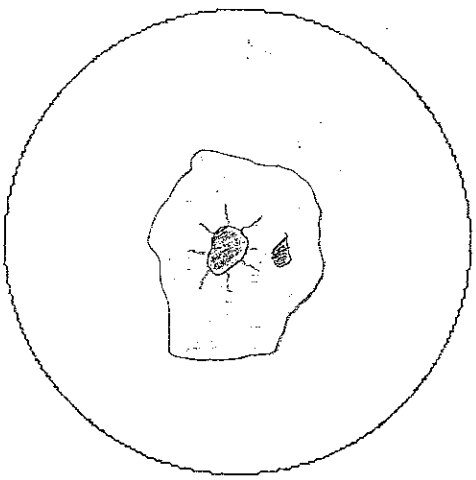
34-74

LAMELLATED AND FRACTURED
PYROXENE IN FELDSPAR



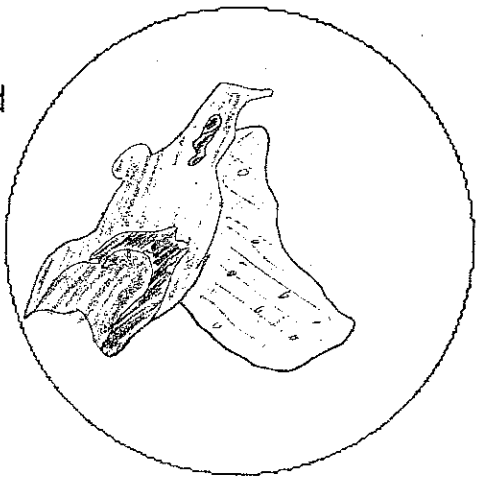
.2-55.4

PYRITE IN PLAGIOCLASE WITH
THE PLAGIOCLASE SHOWING STRAIN
NEAR AREAS BORDERING THE PYRITE

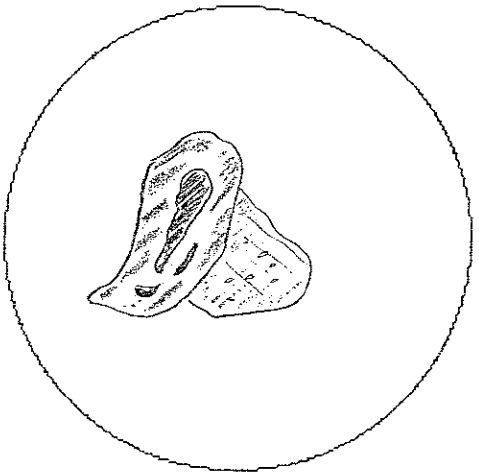


5-59.2

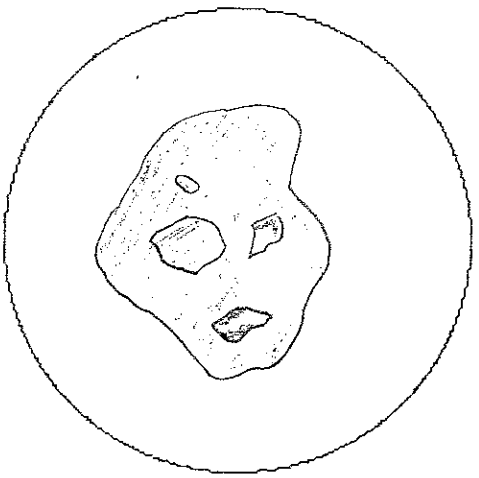
Hornblende with amoeboid magnetite and hematite
(7.6-61)



Hematite, magnetite, epidote (disseminated)
(12-77.5)



Plagioclase with weathered out magnetite and hematite remnants
Plagioclase also zones zircon and quartz
(4.2-71.1)



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE L6 Thin Section #: 9
Collection Site: NE Site Map Location: Float
Collector: Chemych Date: September 90'
Rock Type: Feldspar - Pyroxene - Quartz Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	40-45%	sericite
pyroxene	15-20%	apatite
quartz	10-15%	
hornblende	10-15%	
biotite	7-10%	
magnetite	2-3 %	

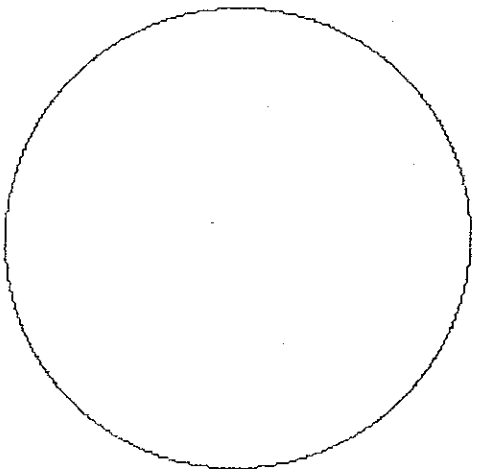
Textures - embayed quartz, feldspar and magnetite
- micrographic granite
- myrmekitic quartz - feldspar mixtures
- porphyroblastic

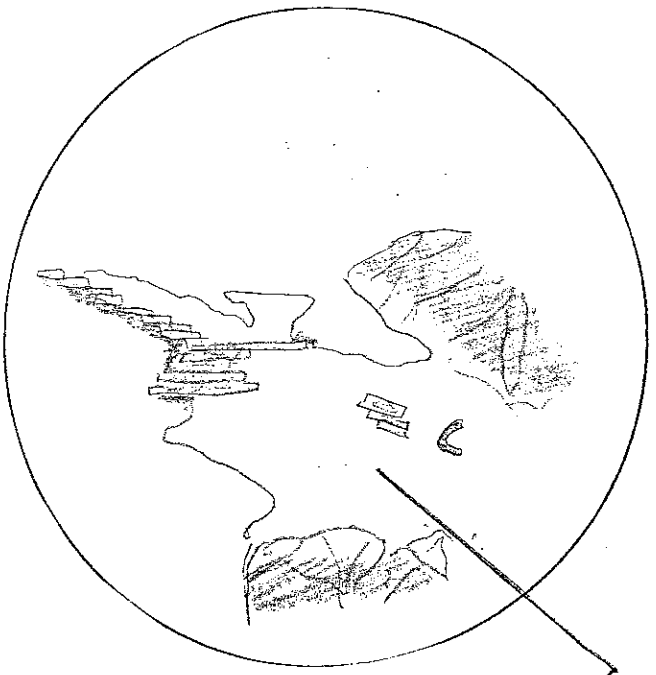
Altered minerals - pyroxene, feldspar and biotite

Other notes

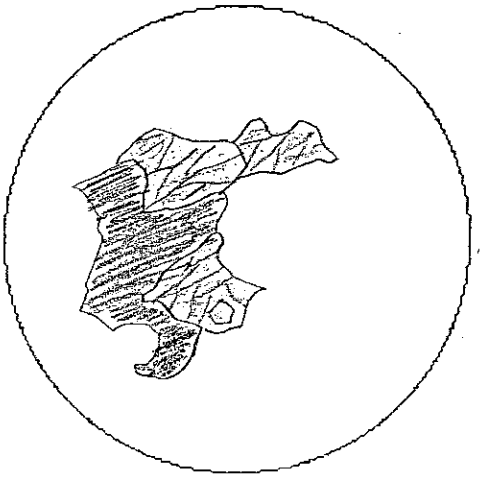
Feldspar - plagioclase, antiperthite, microcline and microperthite
Hornblende - green
Biotite - brown
Pyroxene - depicts a twinning

Representative Figure of Sample

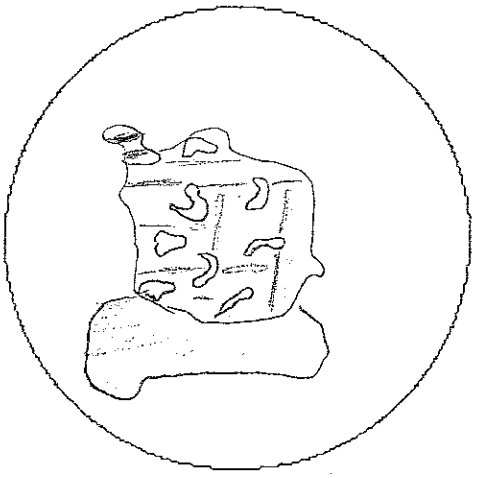




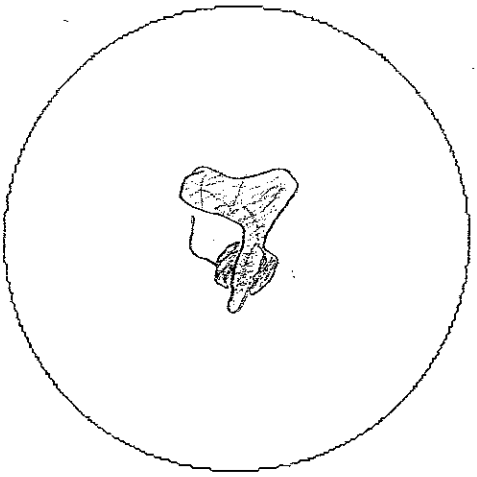
Pyroxene showing some twinning
(occurs throughout)
(23.1-72.8)



Feldspar depicting a mermekitic texture
(26.05-75)



Pyroxene cutting through magnetite
(2.3-60)



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE42 Thin Section #: 10
Collection Site: NW Pit Map Location: 18
Collector: Chemych Date: August 28, 1990'
Rock Type: Coarse Feldspar - Quartz - Pyroxene Gneiss

MINERALOGY:

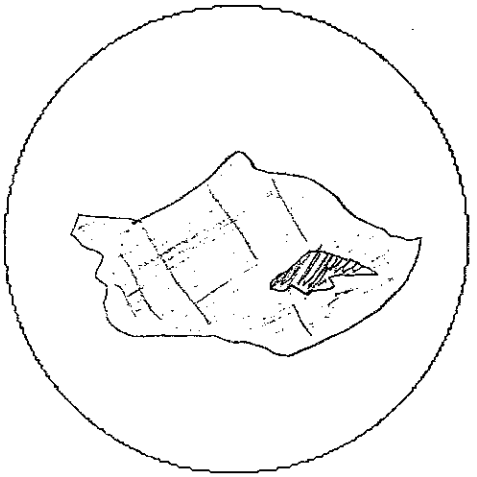
Major Minerals	% in Sample	Accessory Minerals
feldspar	45-55%	apatite
quartz	40-50%	hematite
pyroxene	.5-1%	hornblende
magnetite	2-5%	zircon
		minnesotaite
		pyrite
		epidote

Textures - gneissic banding
- diallage in pyroxene
- porphyroblastic
- embayed quartz - feldspar - magnetite

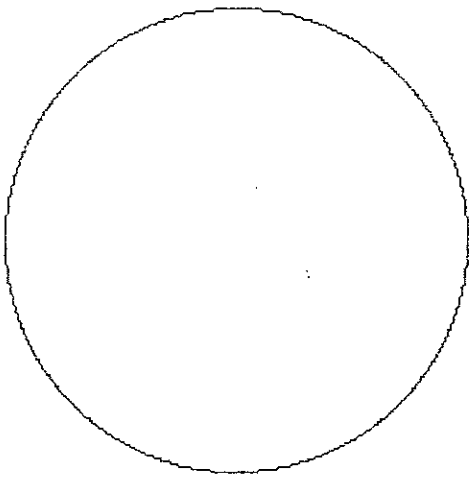
Altered minerals - pyroxene and feldspar

Other notes
Carbonate came after pyroxene
Feldspar - microcline, antiperthite and microperthite

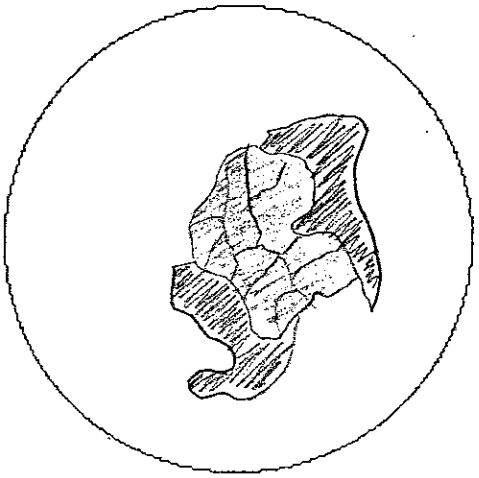
Magnetite in hornblende



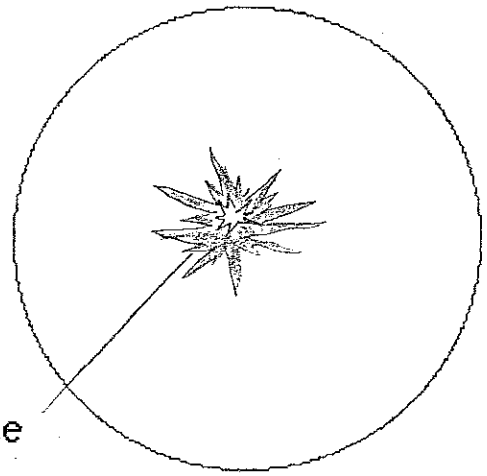
REPRESENTATIVE FIGURE



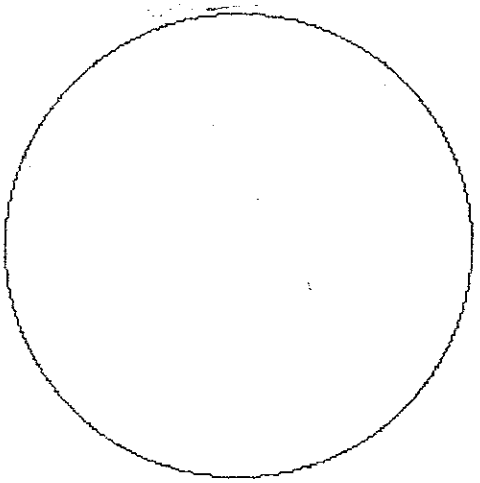
Pyroxene with ameoboid magnetite
(27.6-60.1)



Minnesotaite within hematite
Minnesotaite is the Fe end member of talc
(Atlas of Meta. Rocks, pg.48)
(22-69.2)



40X



 Apatite crystal (13.55-55.8)

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE LT1 Thin Section #: 11
Collection Site: SW Trench Map Location: Float
Collector: Chemych Date: October 4, 1990'
Rock Type: Leucocratic Feldspar-Quartz-Pyroxene Gneiss

MINERALOGY:

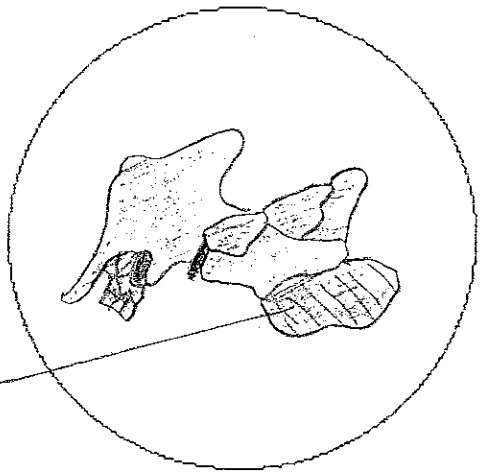
Major Minerals	% in Sample	Accessory Minerals
feldspar	45-65%	zircon
quartz	20-30%	magnetite
pyroxene	10-15%	muscovite
hornblende	.5-1%	chlorite

Textures - gneissic banding
- diallage quartz - feldspar - magnetite - hornblende

Altered minerals - pyroxene and feldspar

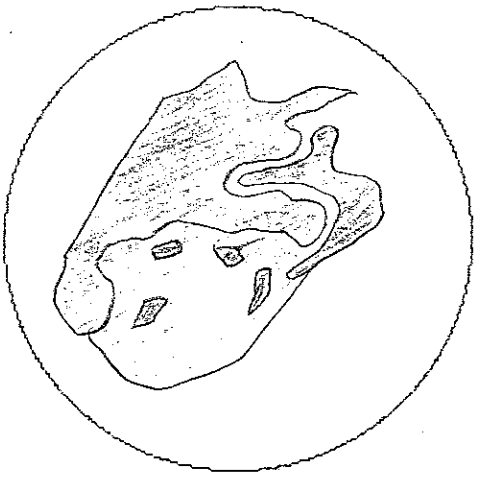
Other notes
Feldspar - plagioclase, antiperthite, microcline and antiperthite
Hornblende - green
Reactions - Magnetite - associated with hornblende - altered plagioclase
Pyrite - replacing pyroxene
Hornblende found in plagioclase
- similar to leucocratic from NW Pit

Diallage pyroxene with exsolution lamellae and its relationship with quartz, hornblende and plagioclase
(20-73.9)

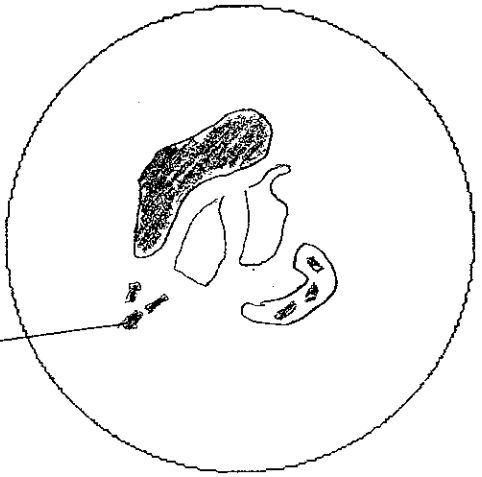


Lamellate pyroxene
(21-68.9)

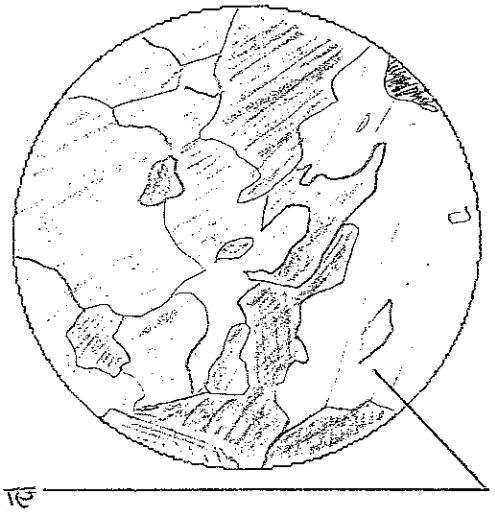
Hornblende clasts in plagioclase and amoeboid magnetite
(23.95-56.2)

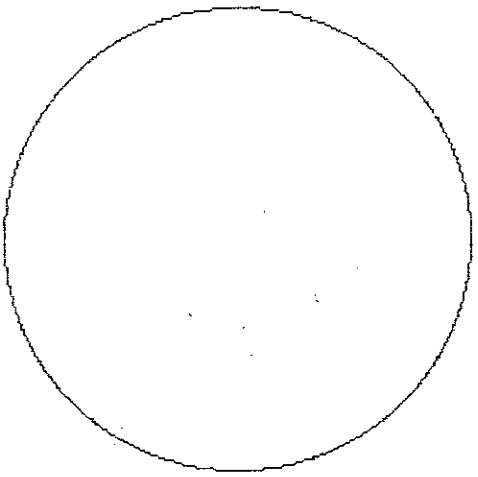


Muscovite and unknown mineral



REPRESENTATIVE FIGURE





SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE T1 Thin Section #: 12
Collection Site: SW Trench Map Location: 21
Collector: Chemych Date: October 4, 1990'
Rock Type: Feldspar - Pyroxene - Hornblende Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	45-55%	pyrite
pyroxene	7-15%	muscovite
hornblende	7-15%	biotite
quartz	5-10%	apatite
magnetite	1-5%	

Textures - gneissic banding
- porphyroblastic
- diallage parting in pyroxene
- embayed biotite and hornblende

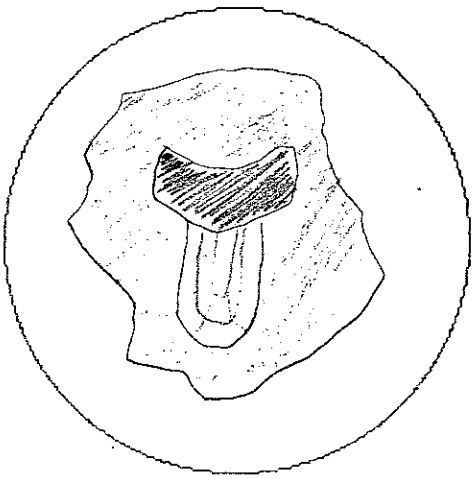
Altered minerals - plagioclase and pyroxene

Other notes

1/2 is hornblende rich
1/2 is pyroxene rich
Feldspars - plagioclase, microcline and microperthite
Hornblende - green to brown and red to brown (biotite-hornblende)
Reactions - sulfides and Fe staining along boundary
Magnetite and zircon zoned by plagioclase
Biotite - magnetite - hornblende minerals

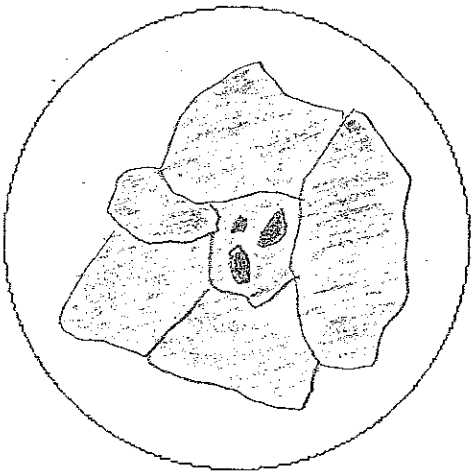
Hand sample- gneiss grading to pegmatoid

MAGNETITE AND ZIRCON IN PLAGIOCLASE

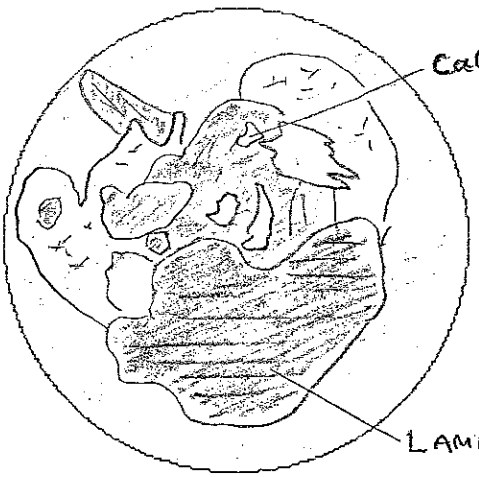


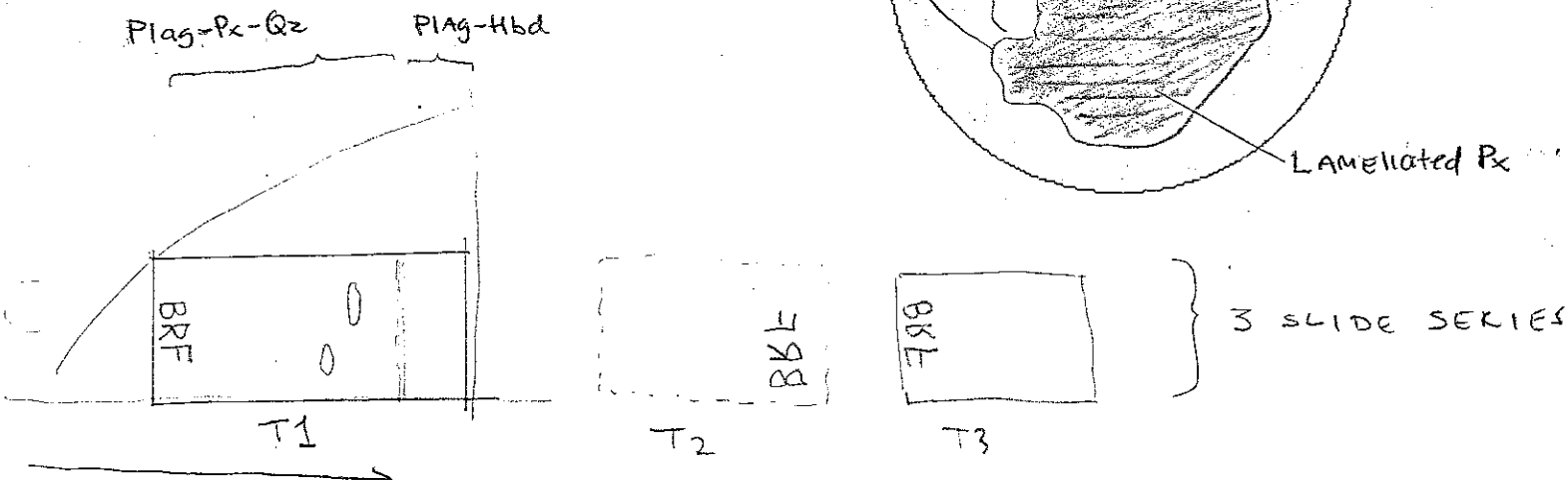
2-56.2

MUSCOVITE IN PLAGIOCLASE

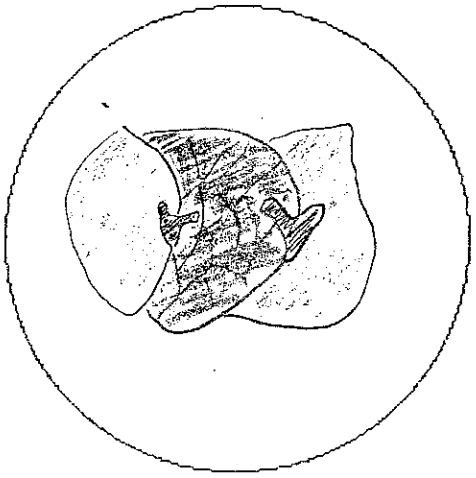


29.1-84.9



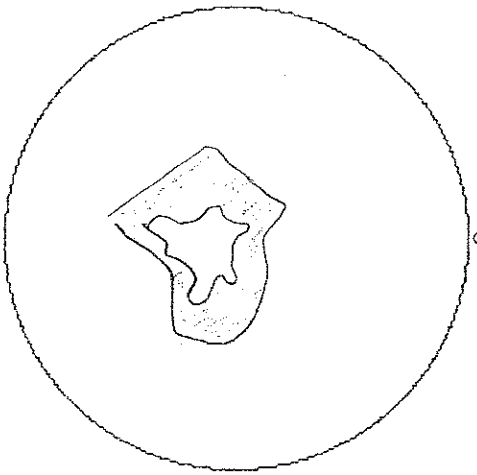


Pyrox., magnet. + feld relationship



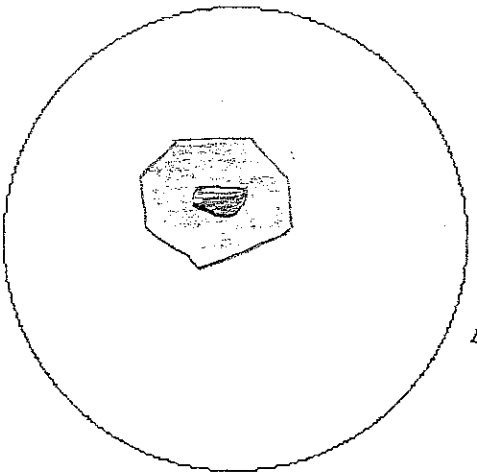
21.2 - 75.9

PEROXENE BEING REPLACED
By unknown mineral



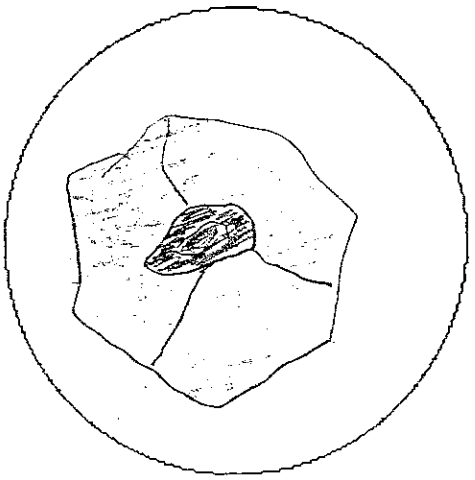
20.1 - 65.2

* MAGNETITE ZONED TO HORNBLENDE

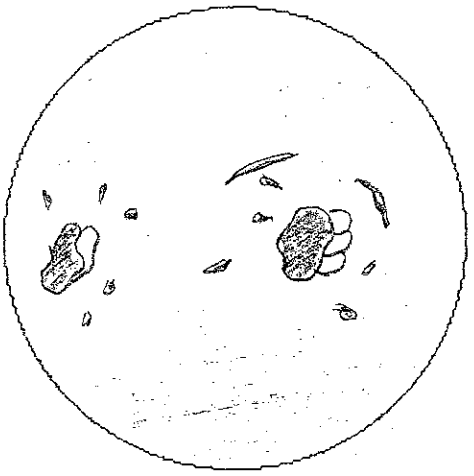


29.9 - 73.
also AT
4.6 - 74.55

TRIPLE ZONING: PYRITE
MAGNETITE
PLAGIOCLASE



11.6-67.2



Pyrite clasts in plagioclase

REPRESENTATIVE FIGURE

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE T2 Thin Section #: 13
Collection Site: SW Trench Map Location: 20
Collector: Chemych Date: October 4, 1990'
Rock Type: Feldspar-Hornblende-Pyroxene Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	40-50%	muscovite
hornblende	20-30%	pyrite
pyroxene	10-20%	zircon
quartz	3-5%	chlorite
magnetite	.5-1%	apatite
		sericite
		carbonate

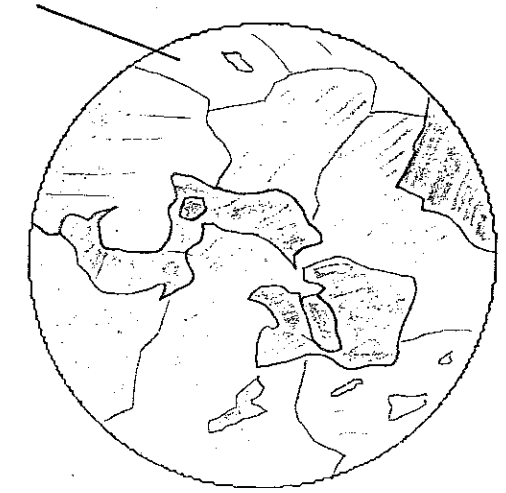
Textures - gneissic banding
- diallage parting in pyroxene
- embayed quartz - hornblende - feldspar - pyroxene

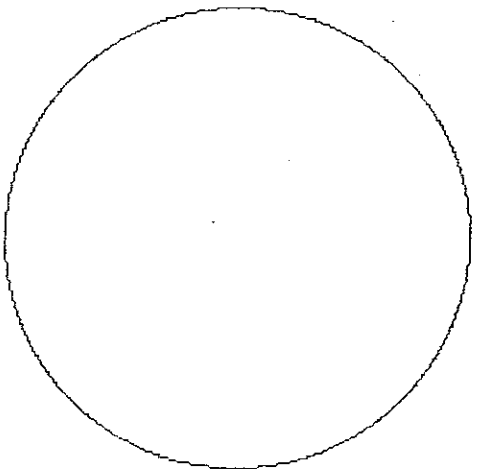
Altered minerals - plagioclase and pyroxene

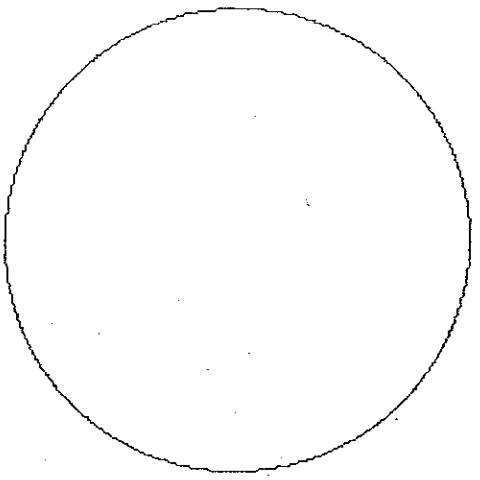
Other notes
Feldspars - plagioclase and antiperthite
Hornblende - green to green - brown
1/2 hornblende gneiss
1/2 pyroxene gneiss
Reactions - between quartz, feldspar and hornblende
Pyrite in magnetite

Hand sample- gneiss pegmatoid contact

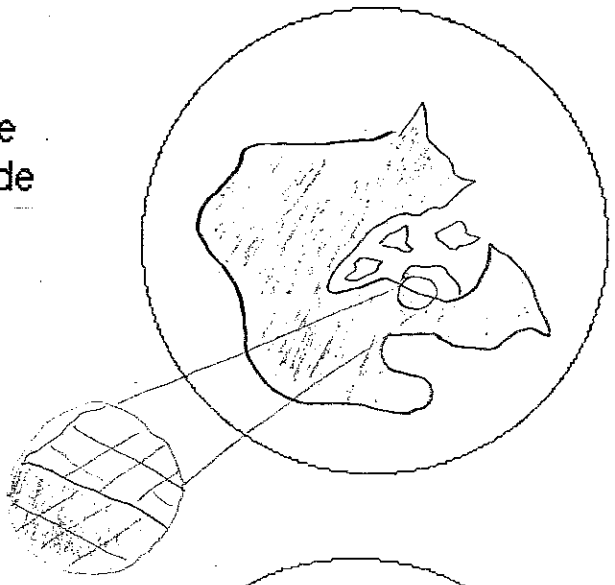
REPRESENTATIVE FIGURE







Altering mineral with high birefringence
Has same cleavage pattern as hornblende
hinting at an altered hornblende
(2.6-83.9)



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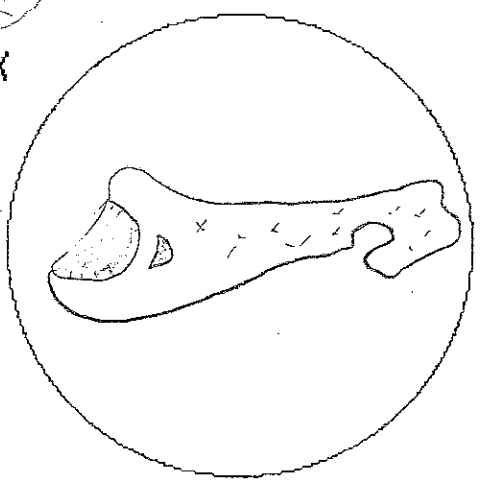
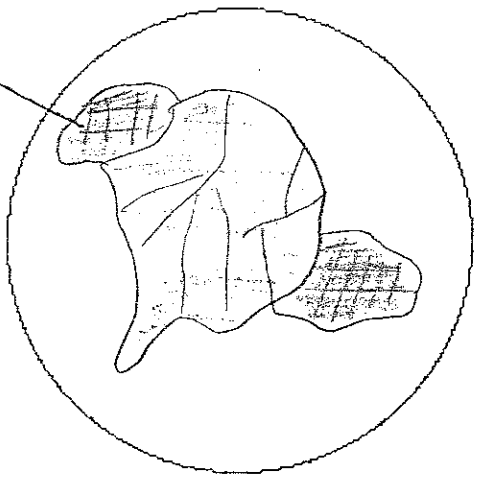
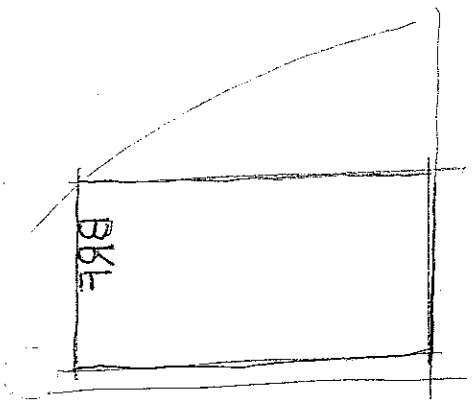


Originally plagioclase-has $CaCO_3$ alterations
and has been sericitized
(1.9-80.8)

Clinopyroxene with malacolite parting
(13.5-85.8)





AMT. HB + Plag increase QTZ AND CLEANER Hbd

AMT OF PYROXENES (Fe stained)

AMT OF PYROXENE ALTERATION

To Pyrox.

SAMPLE DESCRIPTION: BLACK ROCK FOREST, CORNWALL, N.Y.

Sample #: BRFCE T3 Thin Section #: 14
Collection Site: SW Trench Map Location: 20
Collector: Chemych Date: October 4, 1990'
Rock Type: Pegmatoidal Feldspar - Hornblende - Quartz Granite

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	35-45%	pyroxene
hornblende	15-20%	hematite
quartz	15-30%	epidote
magnetite	.5-1%	apatite
		chlorite

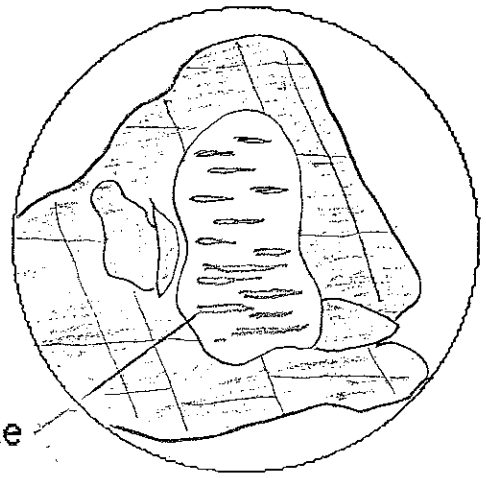
Textures - pegmatoidal grains
- embayed hornblende - quartz - feldspar
- braided microcline

Altered minerals - plagioclase and perthite

Other notes
Feldspars - plagioclase, perthite (trace) antiperthite
Hornblende - green - red- brown - replaced by chlorite
1/2 hornblende gneiss
1/2 pegmatoidal gneiss
Hornblende in microcline with stress fractures emanating from hornblende (showing microcline was there prior to hornblende)

Hand sample- pegmatoidal

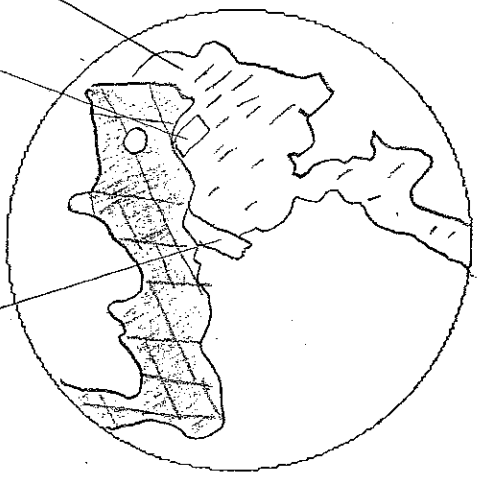
Microcline perthite zoned by hornblende and quartz
(1.05-75.2)



Microcline perthite

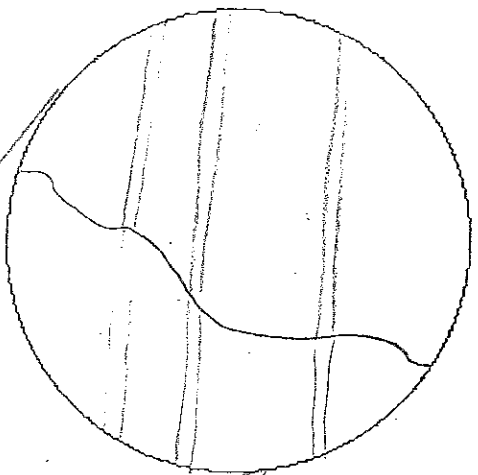
Sericitized microcline

Altering hornblende color is andulating green under cross polars



Highly altered biaxial mineral
(1.2-68.55)

Polysynthetic twinning continues through both the white and translucent minerals
The zoned mineral may be a plagioclase with a slightly different composition than the outer (white)
Replacement may also be occuring



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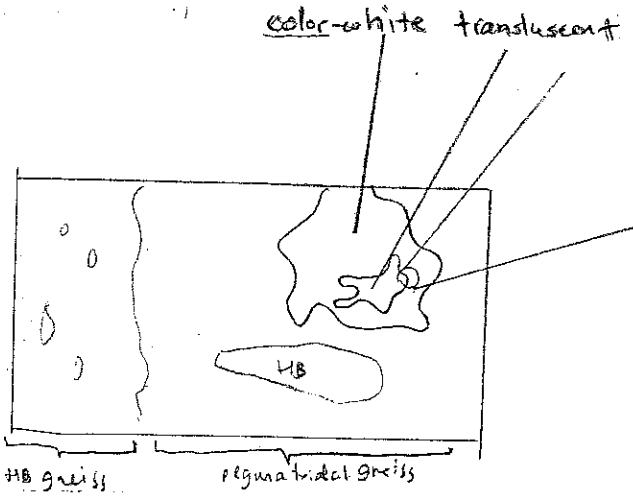
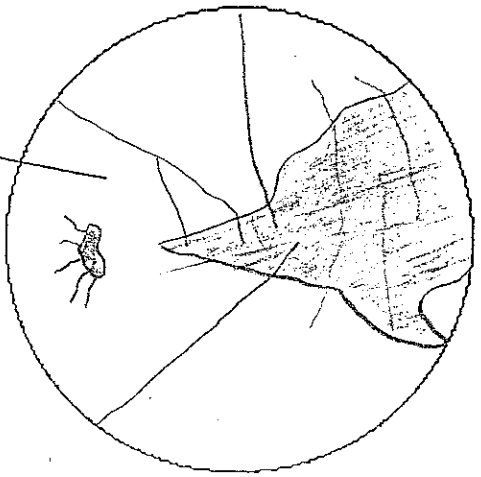
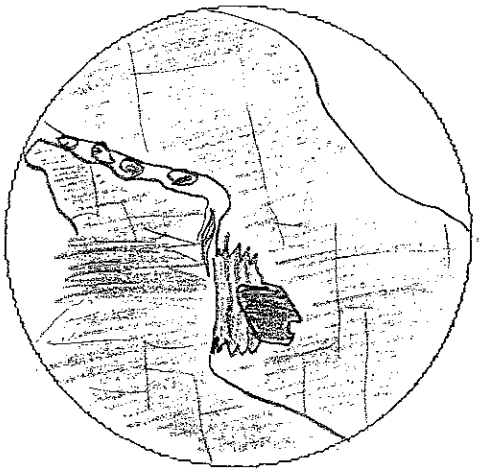


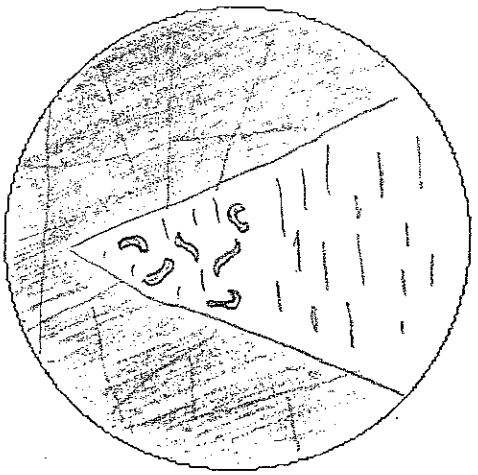
Microcline



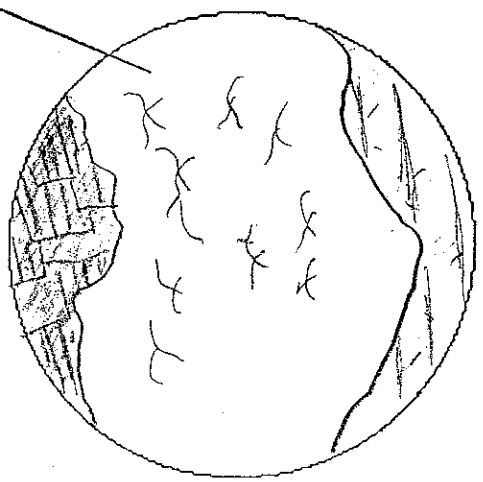
Stress fractures run through both the microcline and the hornblende
The small hornblende (center-west) has stress lines running just west of it
(8.2-60.9)



Altering minerals-hornblende chlorite magnetite, with magnetite in fracture zone of hornblende
(22.1-69.1)

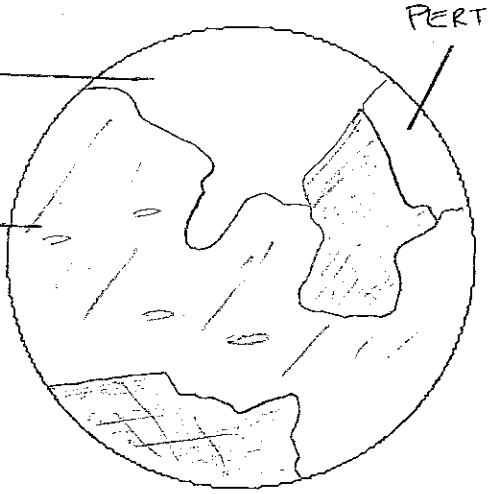


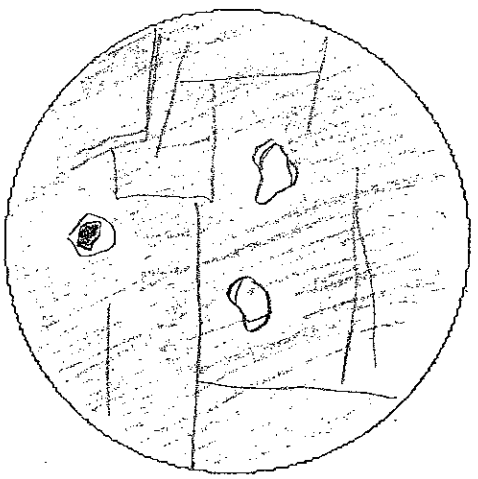
Mermekitic texture at edge of microcline-perthite wedge
(28.8-75.5)



RAIDED MICROCLINE WITH SERICITIZED PLAGIOCLASE AT RIGHT and FRACTURED PLAGIOCLASE TO THE LEFT

REPRESENTATIVE FIGURE





Hornblende zoning magnetite or remnants of magnetite and hematite

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE T4 Thin Section #: 15
Collection Site: SW Trench Map Location: 20
Collector: Chemych Date: October 4, 1990'
Rock Type: Pegmatoidal Feldspar - Quartz - Hornblende

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	50-65%	epidote
quartz	10-25%	hematite
hornblende	1-5 %	apatite
		zircon
		magnetite

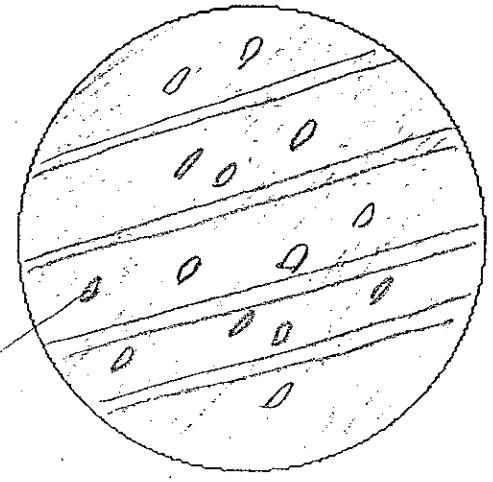
Textures - pegmatoidal size grains
- embayed quartz and feldspar
- braided microperthite

Altered minerals - plagioclase and antiperthite

Other notes
Feldspars - plagioclase, antiperthite and microperthite
Hornblende - green-brown
Braided microperthite in exsolved K-feldspar from antiperthite

Hand sample- pegmatoidal

Antiperthite



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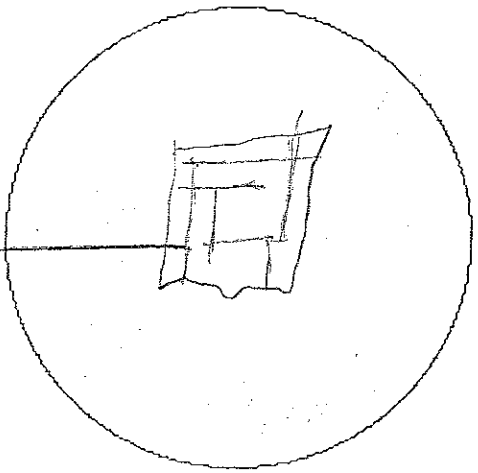
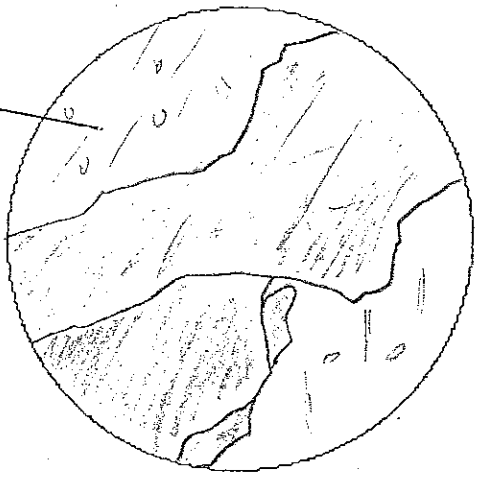


EPRESENTATIVE FIGURE



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE T5 Thin Section #: 16
Collection Site: SW Trench Map Location: 24
Collector: Chemych Date: October 4, 1990'
Rock Type: Pegmatoidal Feldspar - Hornblende - Quartz

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	30-40%	epidote
hornblende	30-40%	apatite
quartz	15-20%	pyrite
		magnetite
		pyroxene

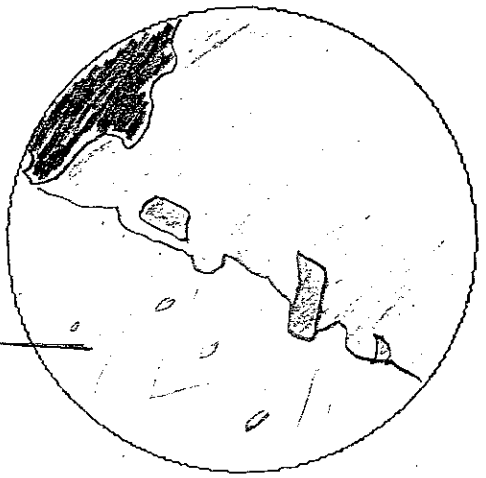
Textures - pegmatoidal sized grains
- myrmekitic feldspar - quartz mixtures
- braided plagioclase
- diallage parting in pyroxene

Altering minerals - magnetite

Other notes
Hornblende - green-brown

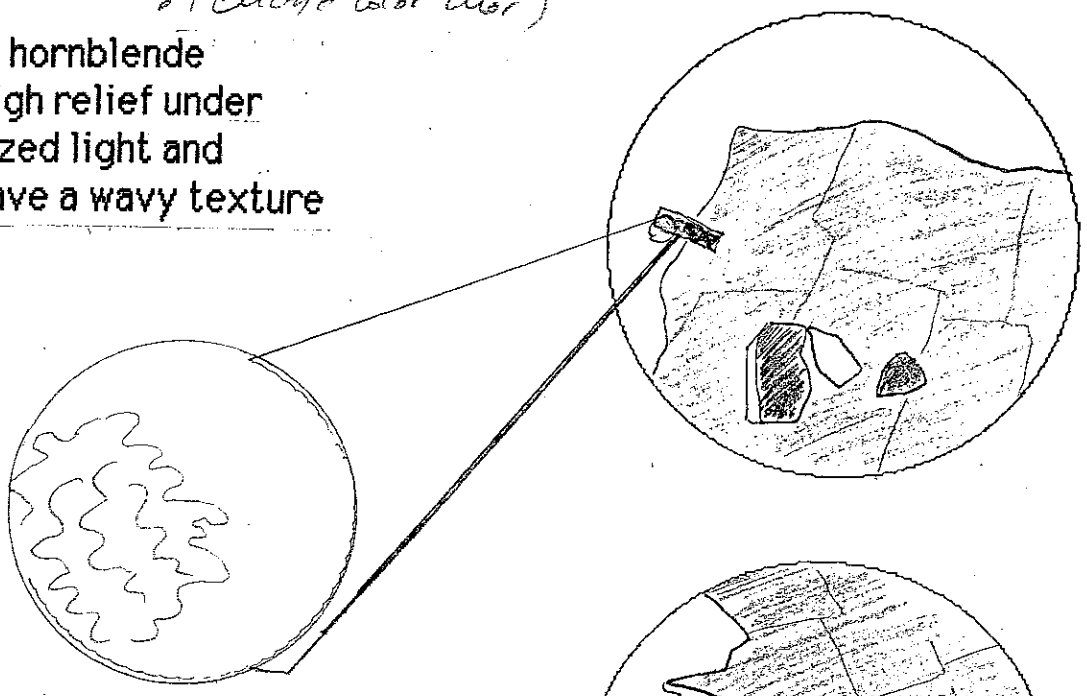
Hand sample- pegmatoidal

REPRESENTATIVE FIGURE



o (Change color due)

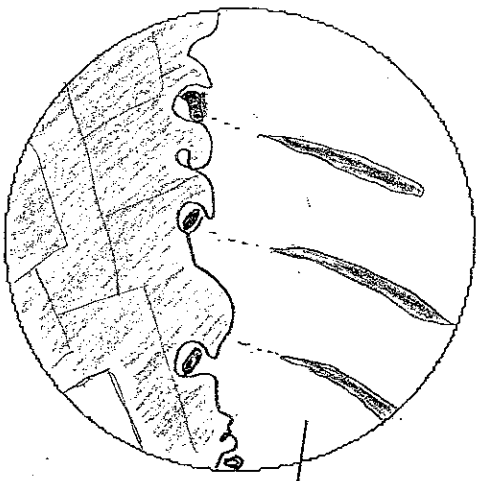
Pyroxene in hornblende
Both have high relief under plane polarized light and appear to have a wavy texture
(.7-73.6)



Plane polarized light

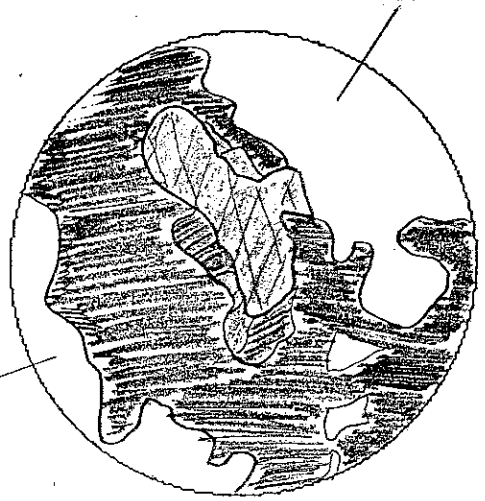
Altering hornblende
(4-67.1)

The epidote strands also contain Fe staining
(1.9-58.4)

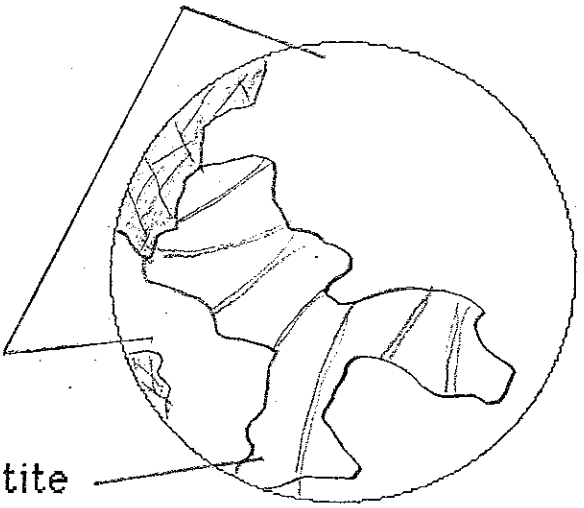


Microcline perthite

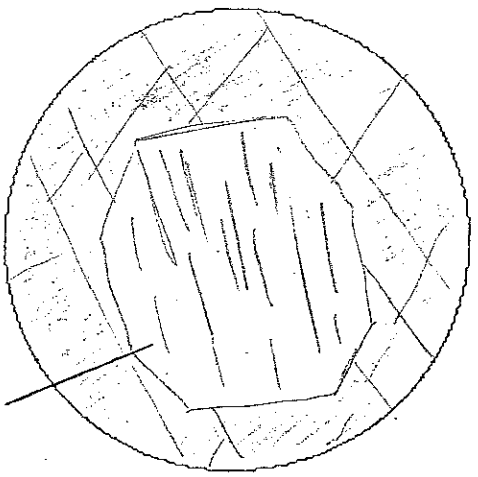
Pyroxene contains exsolution lamellae
Embayed pyroxene and magnetite
(1.9-55.05)



Disseminated magnetite seen in
reflected light
(9.1-70)



Microcline zoned by hornblende
(20-54.6)



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE T6 Thin Section #: 17
Collection Site: SW Trench Map Location: 25
Collector: Chemych Date: October 11, 1990'
Rock Type: Feldspar - Pyroxene - Quartz Gneiss

MINERALOGY:

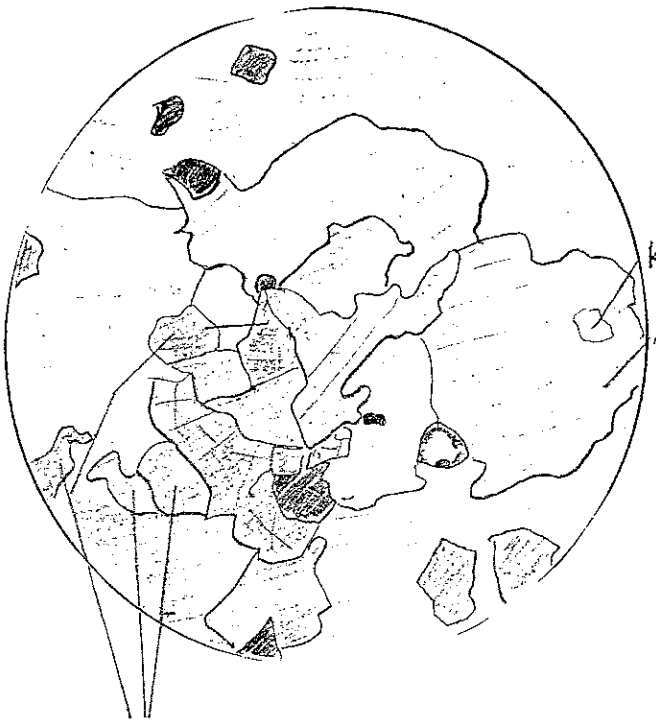
Major Minerals	% in Sample	Accessory Minerals
feldspar	40-60%	epidote
pyroxene	15-25%	zircon
quartz	5-10%	sericite
magnetite	2-5%	biotite
pyrite	.5-1%	apatite

Textures - gneissic banding
- embayed quartz - feldspar - hornblende
- porphyroblastic
- diallage parting in pyroxene

Altered minerals - feldspars and magnetite

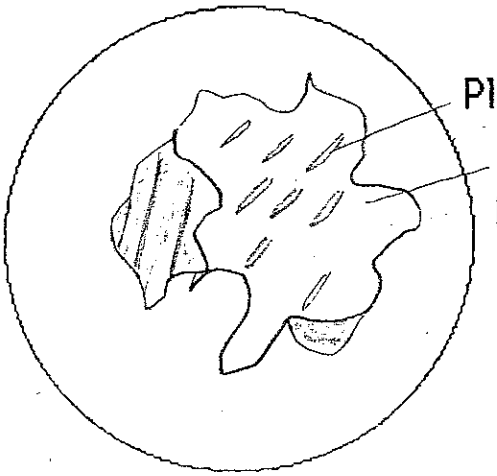
Other notes
- Some pyroxenes show polysynthetic twinning
Feldspars - plagioclase, perthite and antiperthite
Hornblende - green

REPRESENTATUE DIAGRAM

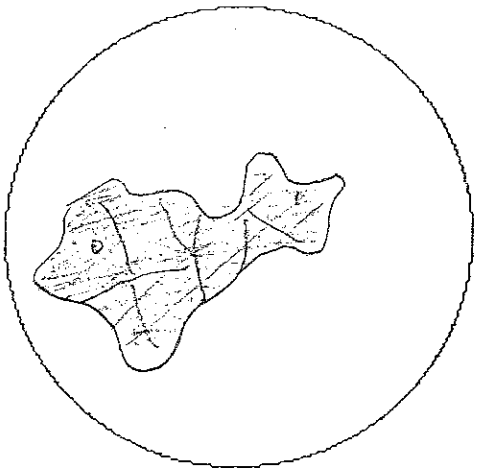


LAMELLATED
PYROXENE

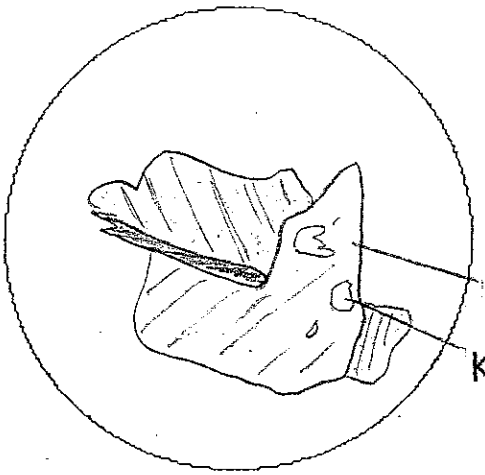
Microcline perthite
(23.6-78)

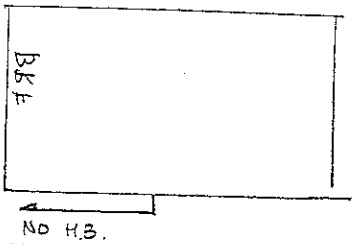


Pyroxene with polysynthetitc twinning
(1.2-57.05)



Antiperthite
(1.6-78)





SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE10 Thin Section #: 19
Collection Site: NW Pit Map Location: 159 ~ ?
Collector: Chemych Date: August 9, 1990'
Rock Type: Feldspar - Quartz - Hornblende Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
feldspar	50-60%	magnetite
quartz	20-30%	zircon
hornblende	3-7 %	epidote
		pyroxene
		biotite

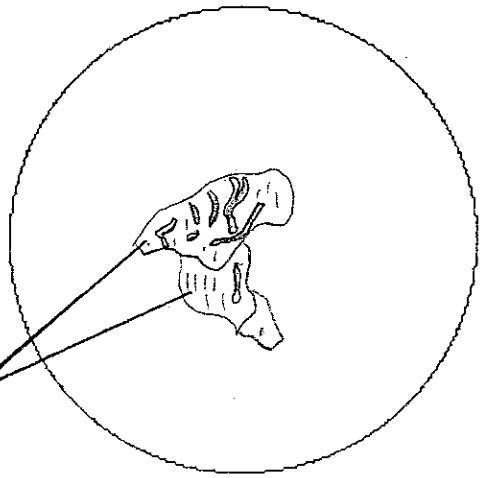
Textures - porphyroblastic
- myrmekitic microcline
- embayed hornblende and feldspar

Altered minerals - feldspar and hornblende are oxidized

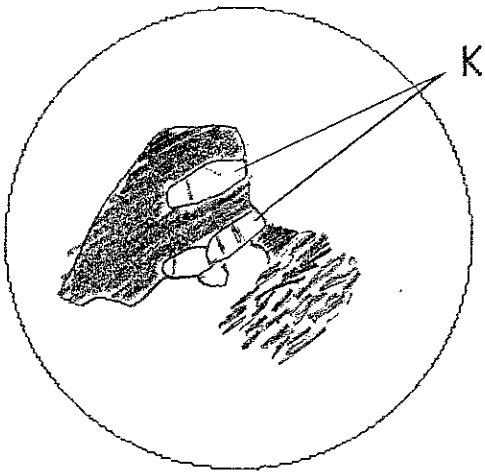
Other notes
Hornblende - green
Feldspars - microcline, plagioclase and microperthite
- Microcline is the predominant feldspar

Hand sample- has the distinct pink coloration of K Feldspar

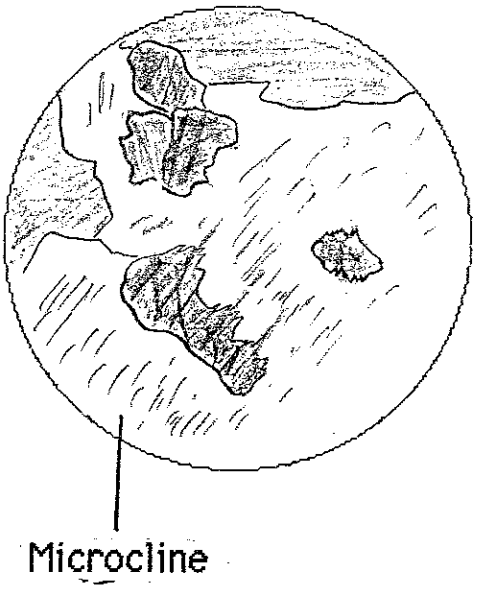
Microcline mermekite within a k-spar-quartz field (3.8-56.6)



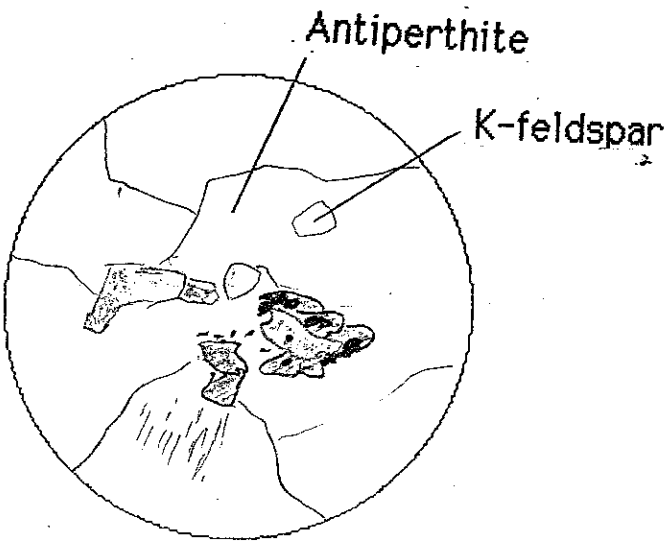
Magnetite with embayed K-feldspar near an altered magnetite
K-feldspar show lamellae of epidote (6-61)



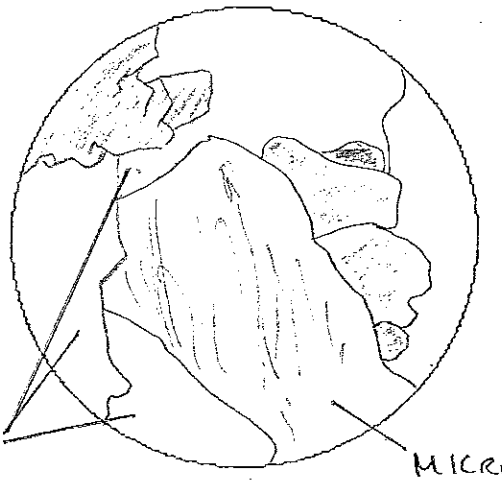
Altered hornblende reacting with the microcline

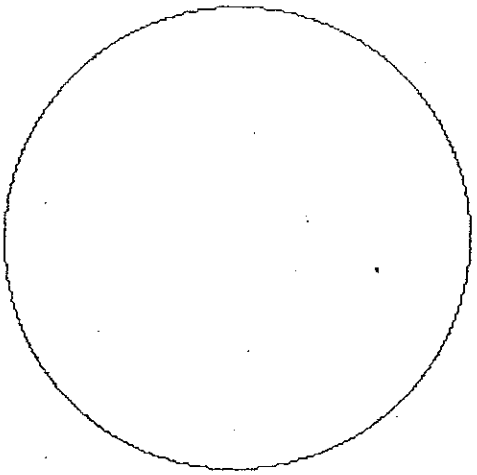


Altered hornblende surrounded by quartz, disseminated magnetite k-feldspar and antiperthite (14-62.6)



REPRESENTATIVE FIGURE





SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRFCE26 Thin Section #: 20
Collection Site: NW Pit Map Location: ■ 9
Collector: Chemych Date: August 28, 1990'
Rock Type: Feldspar - Pyroxene - Quartz Gneiss

MINERALOGY:

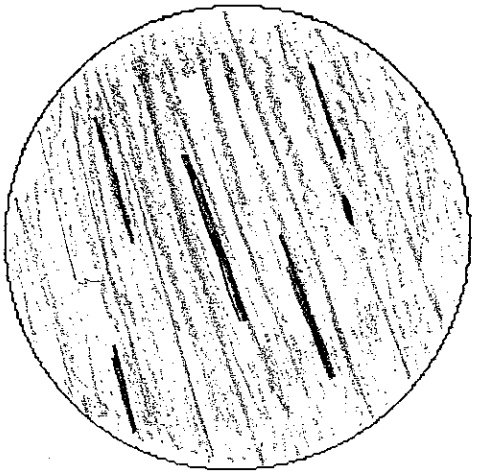
Major Minerals	% in Sample	Accessory Minerals
feldspar	30-45%	hornblende
pyroxene	30-40%	epidote
quartz	10-15%	zircon
magnetite	2-5 %	apatite
		hematite

Textures - gneissic banding
- porphyroblastic
- diallage parting in braided perthite

Other notes

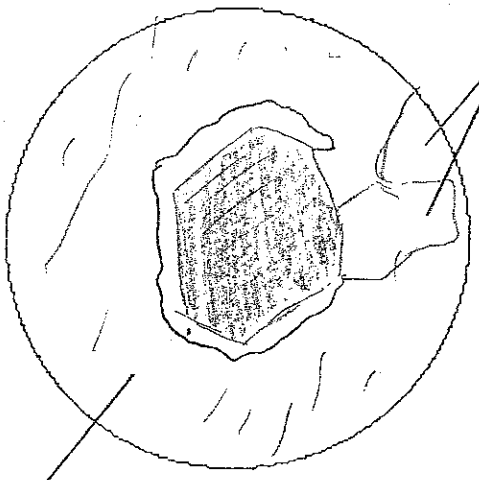
Feldspars - antiperthite and microcline
Hornblende - green - in pyroxene
Pyroxene replacing hornblende
Magnetite in hornblende mimicking the shape of the hornblende
Little alteration

Pyroxene with exsolution lamellae and magnetite lamellae (not always parallel with diallage parting)
(6-67)

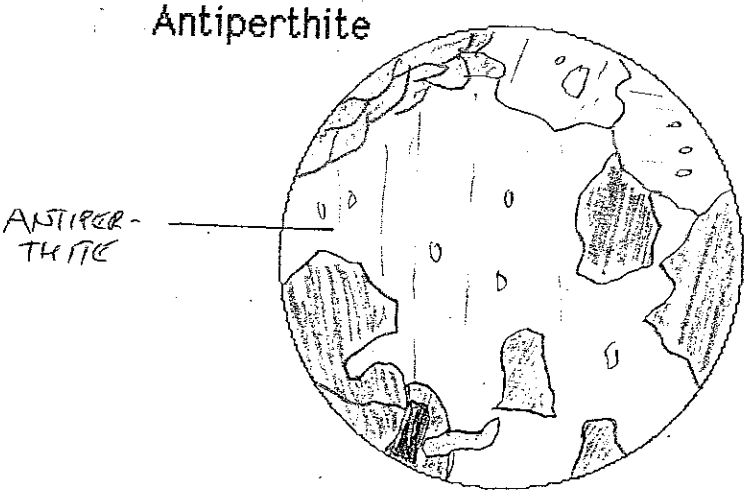


40X

Pyroxene in antiperthite with reaction ring
(12-54)



REPRESENTATIVE FIGURE



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample #: BRF3.3.1 Thin Section #: 21
Collection Site: SW Knob Map Location:
Collector: Webster Date: September 8, 1990
Rock Type: Pegmatoidal Magnetite - Feldspar - Quartz Gneiss

MINERALOGY:

Major Minerals	% in Sample	Accessory Minerals
Magnetite	30-40%	pyroxene
Feldspar	30-40%	epidote
Quartz	10-20%	hornblende
		biotite

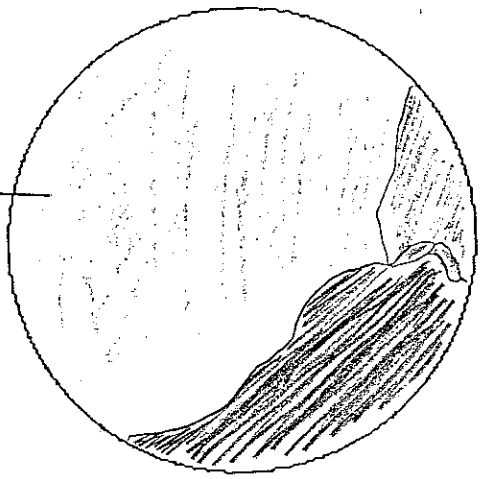
Textures - pegmatoidal
- embayed magnetite - quartz - feldspar

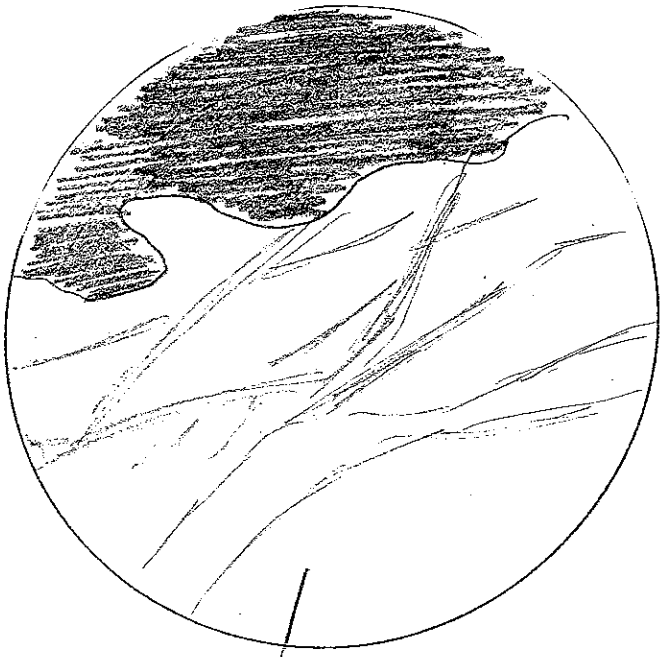
Altered minerals - plagioclase (chlorite and epidote)
- traces of relict pyroxenes and green hornblende replaced by magnetite and hematite

Other notes
Feldspars - antiperthite and plagioclase

REPRESENTATIVE FIGURE

SERICITIZED AND FRACTURED PLAGIOCLASE





ANTIPERTHITE WITH Fe STAINING AND EPIDOTE

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRFCE53a
Collection Site: NW Pit
Collector Chemych
Thin Section # 22
Map Location Float
Date August 17, 1990'
Rock Type: Feldspar- Magnetite - Pyroxene Gneiss

Mineralogy:

Major Minerals	% in Sample	Accessory Minerals
Feldspar	40-50%	zircon
magnetite	20-30%	epidote
pyroxene	15-25%	carbonate
quartz	2-5%	hematite

Textures-gneissic banding
-porphyroblastic to pegmatoidal
-diallage parting

Altered minerals-pyroxene

Other notes
Polysynthetic twinning in the pyroxene
Hornblende (relict) green replaced by pyroxene
Reactions - pyroxene rimmed by quartz and the quartz rimmed by magnetite
Feldspar - antiperthite and microperthite

Hand samples- Banded magnetite gneiss

REPRESENTATIVE FIGURE

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRFCE53b
Collection Site: NW Pit
Collector Chemych
Rock Type: Magnetite-Feldspar-Pyroxene Gneiss

Thin Section # 23
Map Location Float
Date August 17, 1990'

Mineralogy:

Major Minerals	% in Sample	Accessory Minerals
magnetite	30-40%	zircon
quartz	10-20%	
feldspar	20-30%	
pyroxene	10-20%	

Textures- Porphyroblastic magnetite and quartz
- gneissic banding
- sutured quartz-feldspar grain margins
- many fine quartz "grains"

Altered minerals- feldspar and pyroxene

Other notes
Hornblende-green
Pyroxene replacing green hornblende
Feldspar-antiperthite

Hand sample- banded magnetite gneiss

REPRESENTATIVE FIGURE

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRF 90 1.6.1 Thin Section # 24
Collection Site: NW Site Map Location
Collector: Webster Date: 6-15-90
Rock Type: Quartz-Feldspar-Pyroxene-Magnetite Gneiss

Mineralogy:

Major Minerals	% in Sample	Accessory Minerals
Quartz	30-40%	Hornblende
Feldspar	30-40%	Chlorite
Magnetite	5-10%	Zircon
Pyrite	5-10%	Sericite
Pyroxene	2-5%	

Textures - porphyroblastic
- embayed quartz-feldspar-ameboid
- gneissic banding
- diallage parting in pyroxene

Altered minerals-chlorite replacing ferromagnesian mineral (Hbl.)
-pyroxene and feldspar

Other notes
Hornblende-green
Feldspars-mostly antiperthite, some plagioclase
Magnetite- mimicking hornblende shape when associated with it

REPRESENTATIVE FIGURE

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRF 90 1.5.1 Thin Section # 25
Collection Site: SW Hbl.Pit Map Location
Collector: Webster Date: 10-5-90
Rock Type: Pegmatoidal Feldspar-Hornblende-Pyroxene Gneiss

Mineralogy:

Major Minerals	% in Sample	Accessory Minerals
Feldspar	55-65%	Sericite
Hornblende	20-30%	Epidote
Pyroxene	5-15%	Pyrite
Quartz	2-5%	Biotite
		Magnetite

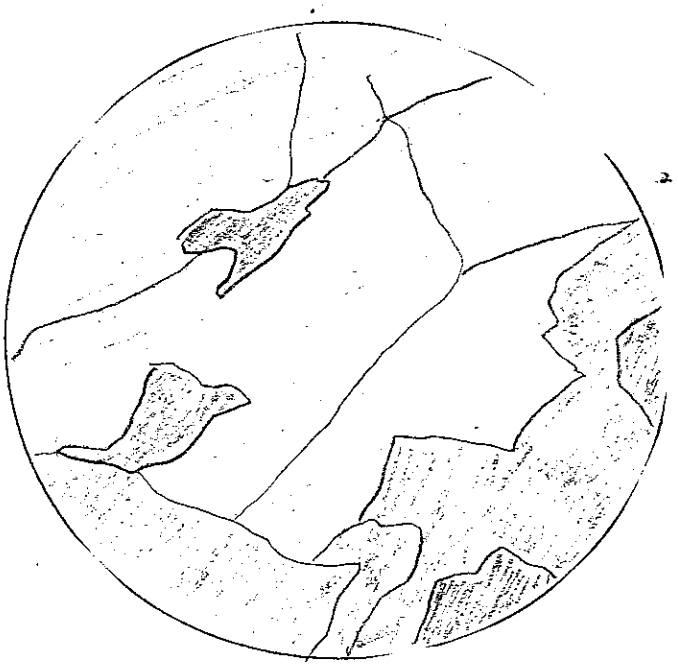
Textures - embayed pyroxene, hornblende and plagioclase
- plagioclase, pyroxene, pyrite and magnetite inclusions in hornblende
- magnetite armored in quartz
- pegmatoidal
- sutured, embayed major minerals
- diallage

Altered minerals - pyroxene and plagioclase
- sericitization along twins in plagioclase

Other notes

Magnetite mimicking hornblende
Hornblende-green and brown
Biotite-red-brown
Reaction-pyroxene with biotite
Pyroxene both types present
Feldspars-plagioclase,antiperthite

REPRESENTATIVE FIGURE



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRF90 4.1.1A — Thin Section # 26
Collection Site: SW Hbl. Knob — Map Location
Collector: Webster — Date: 9-29-90
Rock Type: Pegmatoidal Feldspar-Pyroxene-Hornblende Gneiss

Mineralogy:

Major Minerals	% in Sample	Accessory Minerals
Feldspar	50-60%	Epidote
Pyroxene	10-15%	Apatite
Hornblende	10-15%	Magnetite
Quartz	5-10%	

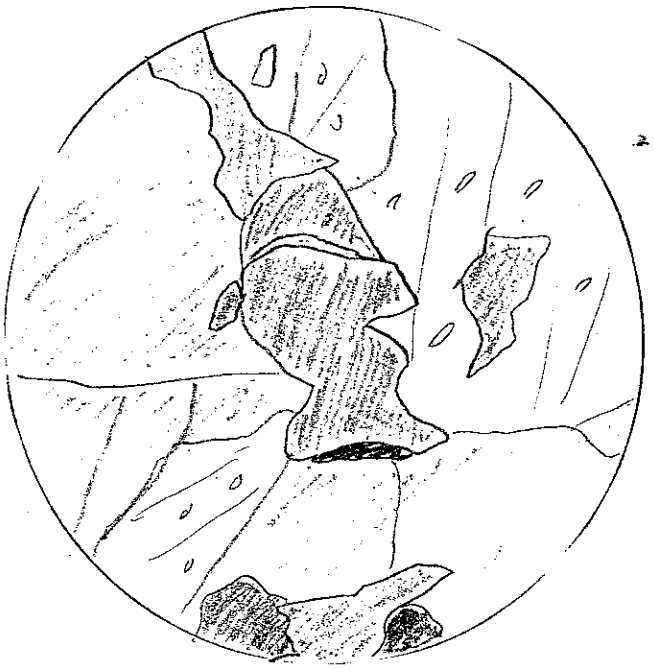
Textures - pyroxene with hornblende and plagioclase inclusions
- pegmatoidal
- sutured and embayed major minerals
- diallage
- porphyroblastic

Altered minerals - pyroxene and plagioclase

Other notes

Feldspars-antiperthite and plagioclase
Hornblende-green-brown
Magnetite mimicking hornblende

REPRESENTATIVE FIGURE



SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRF90 4.1.1B — Thin Section # 27
Collection Site: SW Hbl. Knob — Map Location
Collector: Webster — Date: 9-29-90
Rock Type: Pegmatoidal Feldspar-Pyroxene-Quartz Gneiss

Mineralogy:

Major Minerals	% in Sample	Accessory Minerals
Feldspar	50-60%	Chlorite
Pyroxene	15-25%	Sericite
Quartz	10-15%	Hornblende

Textures - inclusions of hornblende in pyroxene
- gneissic banding
- embayed major minerals and magnetite
- diallage

Altered minerals - pyroxene
- chloritization of hornblende

Other minerals

Feldspars-antiperthite and plagioclase
Magnetite mimicking hornblende
Hornblende reacting with pyroxene
Pyroxene mimicking hornblende
Hornblende-green
Pyroxene-both types

SAMPLE DESCRIPTION: BLACK ROCK FOREST CORNWALL, N.Y.

Sample # BRF90 4.1.2 — Thin Section #28
Collection Site: SW Hbl. Knob — Map Location
Collector: Webster — Date: 9-29-90
Rock Type: Pyroxene-Feldspar Gneiss

Mineralogy:

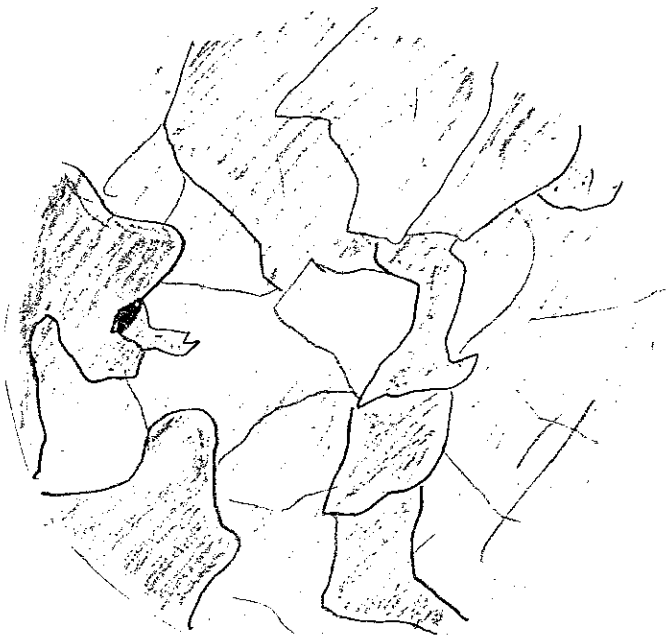
Major Minerals	% in Sample	Accessory Minerals
Pyroxene	50-55%	Chlorite
Feldspar	40-45%	Biotite
		Muscovite
		Hornblende
		Quartz
		Pyrite
		Sericite

Textures-gneissic banding
- porphyroblastic
- diallage

Altered minerals - biotite altered by chlorite and muscovite
- pyroxene and plagioclase

Other minerals
Biotite-red-brown
Intergrown hornblende and pyroxene
Quartz associated with magnetite
Hornblende-green-brown

REPRESENTATIVE FIGURE FOR THIN SECTION #27 AND #28



APPENDIX D
GROUND MAGNETICS DATA

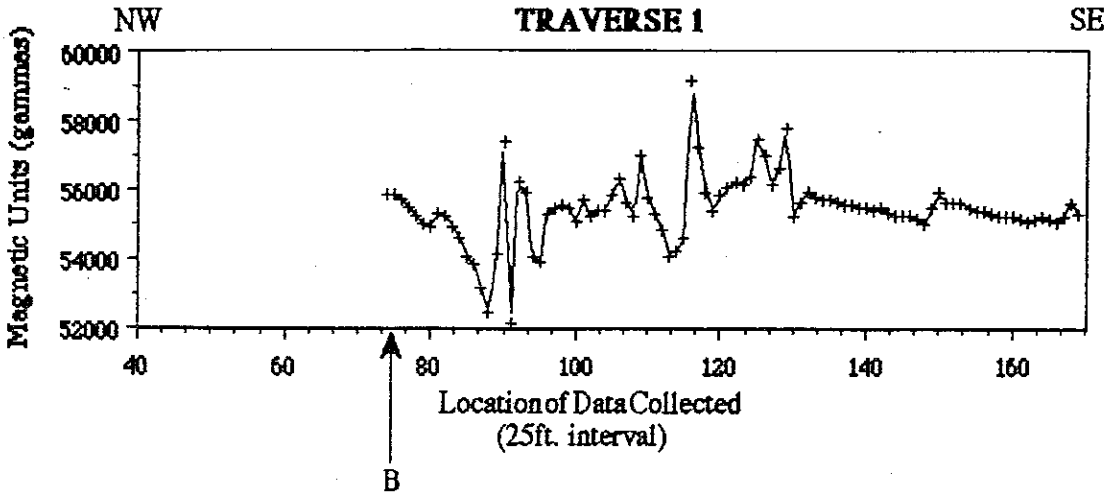
KEY

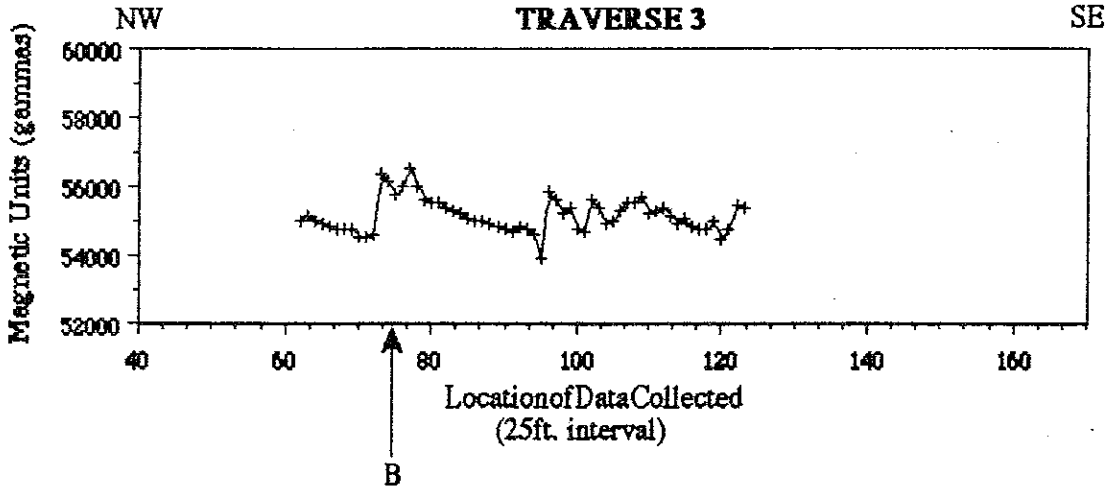
BASELINE X = the point at which Traverses 1-13 intersect the Baseline. This location also correlates to row number 25 in the leftmost column.

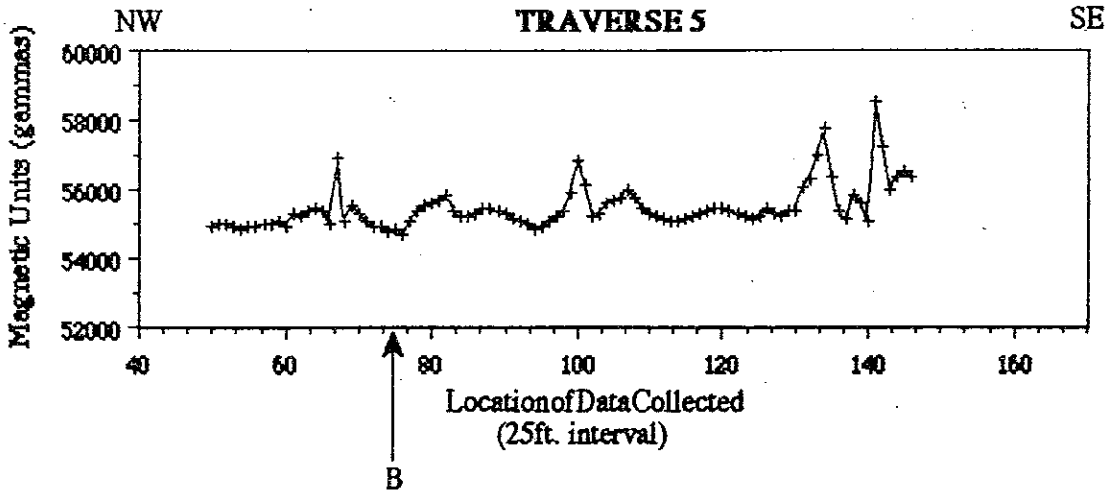
The data presented in Appendix E is raw data that has not been corrected for topographic effects and diurnal variations.

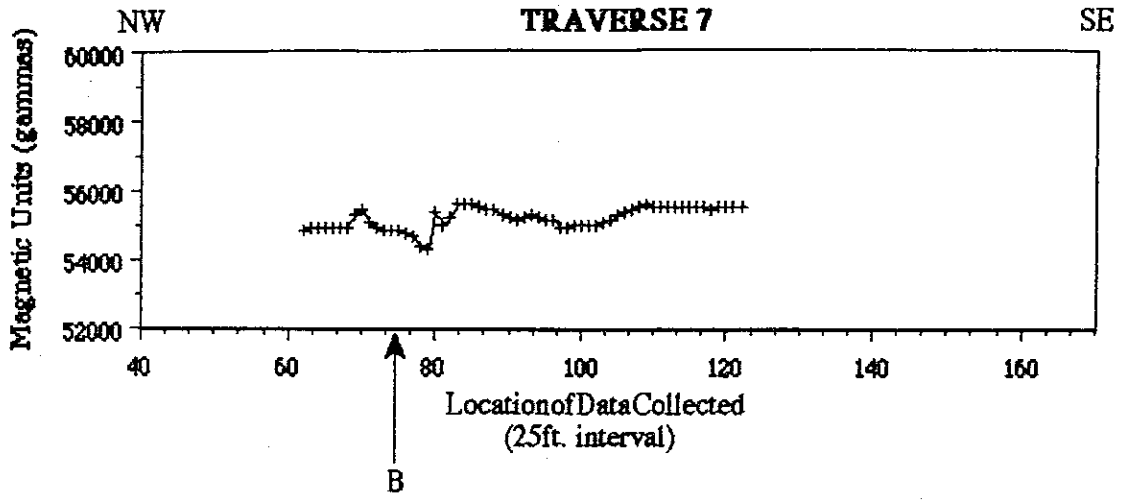
	NOTES	TRAVERSE 13	TRAVERSE 12	TRAVERSE 11	TRAVERSE 9	TRAVERSE 7	TRAVERSE 5	TRAVERSE3	TRAVERSE 1	BASELINE	TRAIL
1		55163.000	55159.000	55117.000	55115.000		54955.000			55825.000	54800.000
2		55152.000	55154.000	55106.000	55107.000		55004.000			56039.000	55231.000
3		55142.000	55150.000	55104.000	55104.000		54968.000			55372.000	55444.000
		55132.000	55142.000	55098.000	55099.000		54942.000			54894.000	55099.000
		55125.000	55133.000	55084.000	55085.000		54877.000			55616.000	55093.000
		55116.000	55126.000	55074.000	55073.000		54959.000			56378.000	55228.000
		55108.000	55120.000	55069.000	55059.000		54919.000			56502.000	55262.000
8		55098.000	55109.000	55059.000	55044.000		55000.000			57486.000	55088.000
9		55080.000	55100.000	55053.000	55046.000		54964.000			54556.000	55083.000
10		55056.000	55097.000	55049.000	55031.000		55079.000			54987.000	55203.000
11			55093.000	55052.000	55016.000		54944.000			55811.000	55228.000
12		55051.000	55076.000	55038.000	54986.000		55300.000			55767.000	55192.000
13		55064.000	55065.000	55034.000	54957.000	54856.000	55224.000	54969.000		56134.000	55253.000
14		55170.000	55063.000	55014.000	54939.000	54906.000	55411.000	55155.000		56946.000	55241.000
15		55078.000	55056.000	54989.000	54909.000	54956.000	55429.000	55050.000		55259.000	55372.000
16		55048.000	55050.000	54974.000	54913.000	54925.000	55428.000	54931.000		53901.000	55320.000
17		55026.000	55040.000	54969.000	55030.000	54917.000	54991.000	54834.000		55006.000	55253.000
18		55012.000	55017.000	54979.000	54829.000	54920.000	56886.000	54792.000		55084.000	55202.000
19		54995.000	55002.000	54941.000	55040.000	54916.000	55064.000	54764.000		54546.000	55162.000
20		54986.000	54979.000	54938.000	55116.000	55270.000	55352.000	54804.000		54693.000	55144.000
21		54963.000	54941.000	54908.000	54687.000	55460.000	55315.000	54575.000		54714.000	55170.000
22		54954.000	54926.000	54882.000	54126.000	55092.000	55086.000	54558.000		54705.000	55214.000
23		54958.000	54980.000	54974.000	56282.000	54897.000	54948.000	54624.000		54740.000	55247.000
24		54976.000	54940.000	54987.000	55363.000	54852.000	54928.000	56394.000		54814.000	55256.000
25	BASELINE X	54967.000	54896.000	54887.000	55111.000	54838.000	54795.000	56138.000	55831.000	54835.000	55266.000
26		54972.000	54925.000	55085.000	55019.000	54817.000	54814.000	55758.000	55808.000	54833.000	55282.000
27		55078.000	54858.000	55321.000	54958.000	54790.000	54708.000	56004.000	55692.000	54837.000	55291.000
28		55097.000	54972.000	55320.000	54887.000	54689.000	55075.000	56564.000	55479.000	55069.000	55280.000
29		55173.000	55074.000	56963.000	54891.000	54547.000	55362.000	56019.000	55212.000	54786.000	55255.000
30		55209.000	55252.000	56881.000	54869.000	54276.000	55571.000	55650.000	55028.000	54965.000	55226.000
31		55190.000	55153.000	55950.000	54905.000	55411.000	55579.000	55506.000	54902.000	54880.000	55244.000
32		55166.000	55212.000	54325.000	54696.000	55014.000	55670.000	55553.000	55324.000	54901.000	55297.000
33		55108.000	55504.000	54332.000	54420.000	55245.000	55846.000	55572.000	55197.000	54879.000	55382.000
34		55084.000	57900.000	54464.000	54949.000	55629.000	55365.000	55309.000	54988.000	54892.000	55461.000
35		55098.000	56458.000	54643.000	55388.000	55653.000	55227.000	55207.000	54599.000	54852.000	55514.000
36		55065.000	54916.000	54671.000	55621.000	55581.000	55221.000	55061.000	54075.000	54891.000	55543.000
37		55036.000	54654.000	54776.000	55472.000	55521.000	55326.000	54985.000	53826.000	54832.000	55579.000
38		55006.000	54640.000	54810.000	55447.000	55434.000	55441.000	54980.000	53150.000	54890.000	55643.000
39		54996.000	54742.000	54832.000	55956.000	55431.000	55433.000	54889.000	52474.000	54861.000	55738.000
40		54938.000	54792.000	54829.000	55631.000	55305.000	55380.000	54834.000	54118.000	55013.000	55809.000
41		54898.000	54808.000	54731.000	55403.000	55234.000	55316.000	54794.000	57391.000	55128.000	55860.000
42		54848.000	54767.000	54673.000	55274.000	55178.000	55191.000	54710.000	52178.000	55109.000	55909.000
43		54833.000	54756.000	54665.000	55225.000	55226.000	55092.000	54932.000	56231.000	55045.000	55968.000
44		54835.000	54771.000	55209.000	55235.000	55314.000	54983.000	54802.000	55896.000	54810.000	56021.000
45		55130.000	55102.000	55410.000	55260.000	55241.000	54875.000	54587.000	54091.000	54942.000	56059.000
46		55248.000	55410.000	55522.000	55204.000	55173.000	54945.000	55956.000	53899.000	54866.000	56037.000
47		55104.000	55345.000	55701.000	55141.000	55182.000	55070.000	55827.000	55330.000	54796.000	55976.000
48		55315.000	55719.000	55437.000	55076.000	54949.000	55231.000	55595.000	55450.000	55220.000	55931.000
49		55432.000	55467.000	55253.000	55120.000	54917.000	55400.000	55267.000	55518.000	55087.000	56034.000
50					55146.000	54978.000	55902.000	55384.000	55498.000	55127.000	56248.000
51					55051.000	54978.000	56874.000	54754.000	55095.000	55251.000	56337.000
52					55026.000	54971.000	56186.000	54720.000	55717.000	54494.000	56276.000
53					55013.000	55005.000	55232.000	55612.000	55246.000	55384.000	56275.000
54					54972.000	55060.000	55242.000	55862.000	55409.000	55843.000	56307.000
55					55028.000	55161.000	55580.000	54917.000	55384.000	56149.000	56309.000
					55062.000	55201.000	55682.000	54975.000	55845.000	55045.000	56206.000
					55106.000	55403.000	55775.000	55342.000	56326.000	54807.000	56125.000
					55092.000	55478.000	56014.000	55524.000	55687.000	55294.000	56181.000
59					55123.000	55562.000	55754.000	55852.000	55267.000	55028.000	56244.000
60					55196.000	55587.000	55450.000	55694.000	56999.000	54953.000	56166.000
61					55157.000	55575.000	55297.000	55220.000	55755.000	54912.000	56061.000
62					55218.000	55554.000	55210.000	55273.000	55284.000	54842.000	55999.000
63					55362.000	55524.000	55122.000	55365.000	54850.000	54729.000	55912.000
64					55606.000	55528.000	55105.000	55184.000	54115.000	54820.000	55856.000
65					55728.000	55529.000	55108.000	54956.000	54261.000	54931.000	55867.000
66					55536.000	55535.000	55127.000	55040.000	54582.000	54871.000	55873.000
67					55567.000	55526.000	55210.000	54837.000	59156.000	54884.000	55855.000
68					55580.000	55523.000	55297.000	54771.000	57266.000	54953.000	55841.000
69					55502.000	55494.000	55372.000	54779.000	55950.000	55015.000	55801.000
70					55503.000	55525.000	55462.000	54978.000	55421.000	54945.000	55749.000
71					55271.000	55542.000	55479.000	54488.000	55825.000	54995.000	55691.000
72					55277.000	55578.000	55586.000	54742.000	56069.000	54979.000	55642.000
73					55240.000	55537.000	55302.000	55496.000	56262.000	54987.000	55610.000
74							55229.000	55868.000	56182.000		55581.000
75							55147.000		56370.000		55576.000
76							55264.000		57439.000		55558.000
77							55424.000		56988.000		55543.000
78							55341.000		56168.000		55526.000
79							55247.000		56646.000		55416.000
80							55371.000		57748.000		
81							55401.000		55213.000		
82							56066.000		55625.000		
83							56324.000		55906.000		
84							57014.000		55775.000		
85							57746.000		55719.000		
86							56872.000		55712.000		
87							55357.000		55635.000		
88							55130.000		55537.000		
89							55031.000		55506.000		
90							55589.000		55447.000		
91							55056.000		55430.000		
92							55549.000		55417.000		
93							57245.000		55425.000		
94							55006.000		55322.000		
95							56395.000		55261.000		
96							56566.000		55218.000		
97							56377.000		55200.000		
98									55185.000		
99									55017.000		
00									55438.000		
01									55888.000		
02									55652.000		
03									55623.000		
04									55601.000		
05									55485.000		
06									55358.000		
07									55377.000		
08									55271.000		
09									55224.000		
10									55221.000		
11									55195.000		
12									55145.000		
13									55112.000		
14									55181.000		
15									55233.000		
16									55177.000		
17									55115.000		
18									55198.000		
19									55611.000		
20									55293.000		

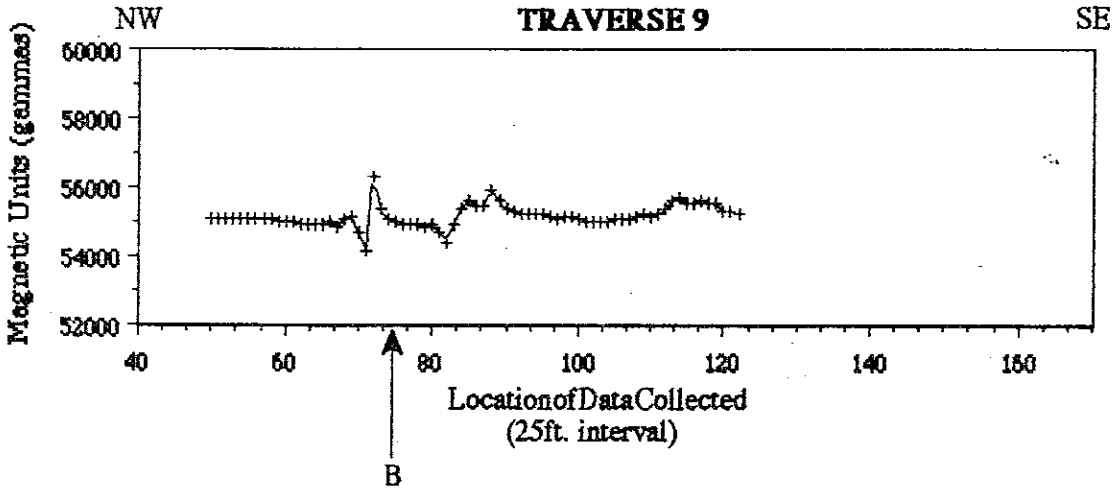
APPENDIX E
GRAPHIC REPRESENTATION OF GROUND MAGNETICS DATA

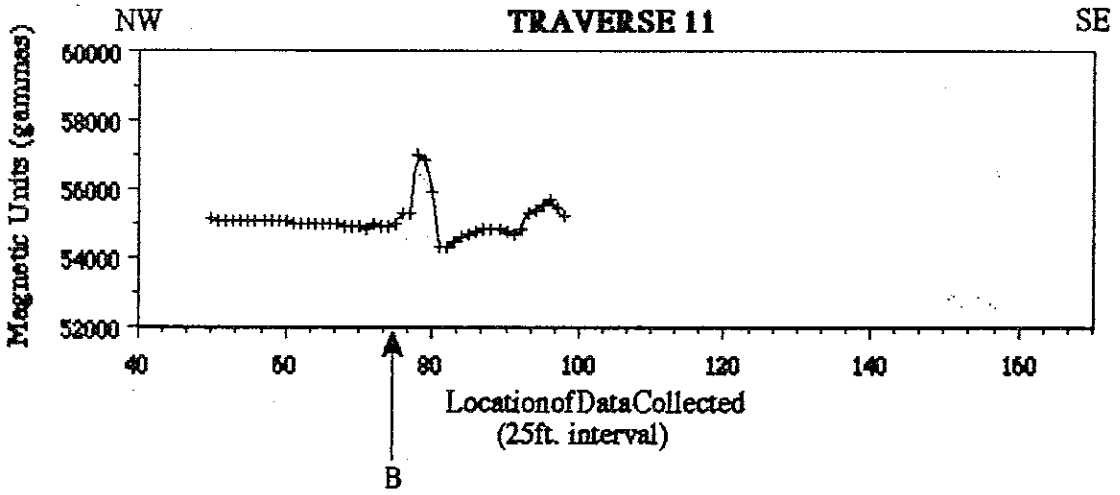

NW
TRAVERSE 1
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
Location of Data Collected
(25ft. interval)
B

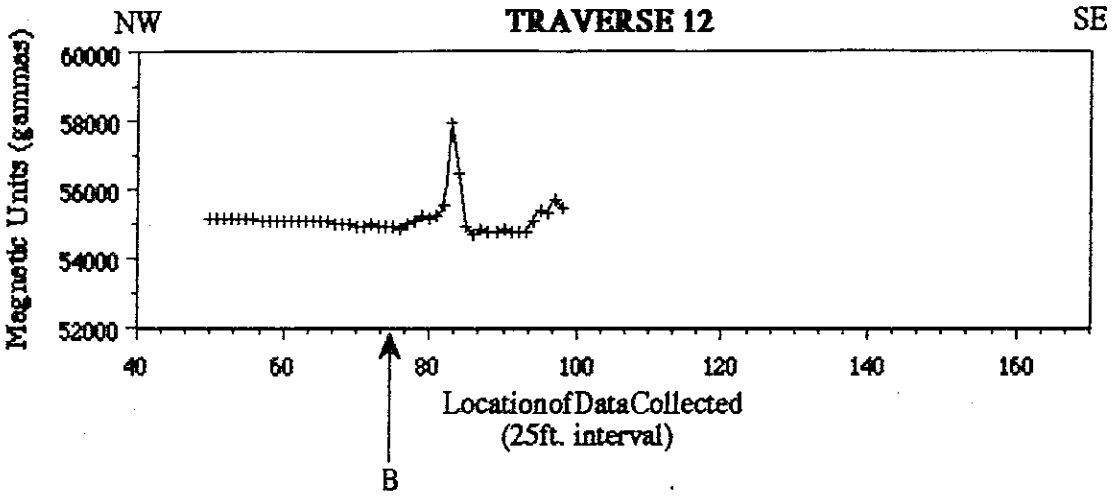

NW
TRAVERSE 3
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
Location of Data Collected
(25ft. interval)
B

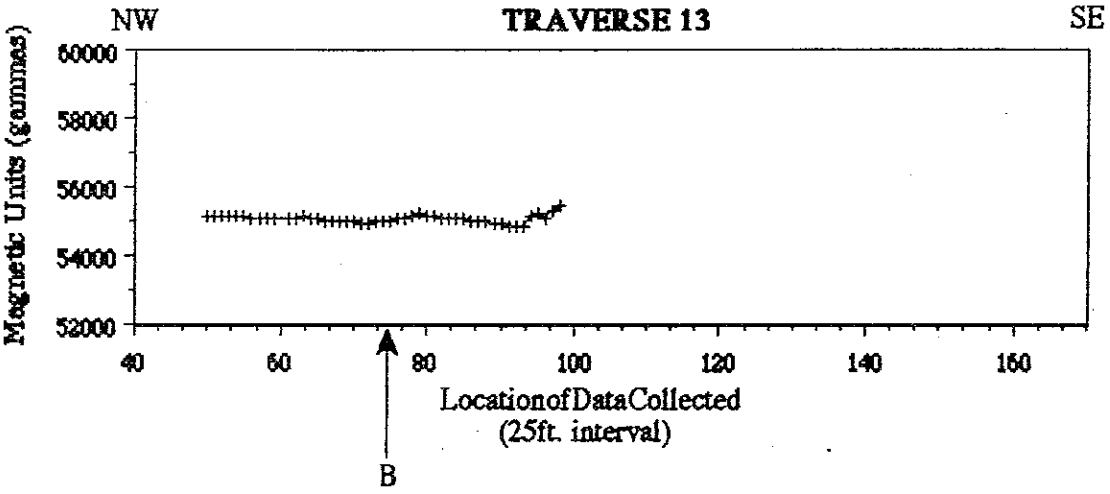

NW
TRAVERSE 5
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
Location of Data Collected
(25ft. interval)
B

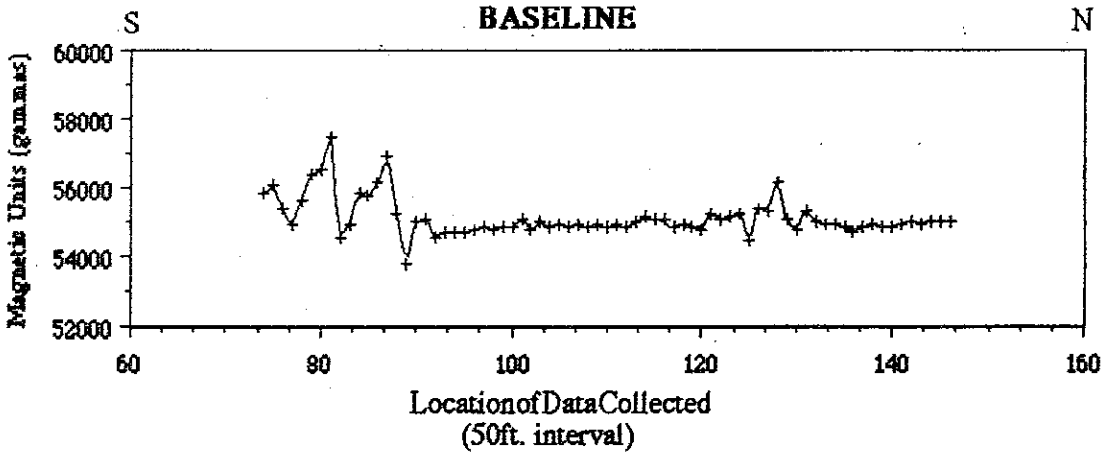

NW
TRAVERSE 7
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
LocationofDataCollected
(25ft. interval)
B

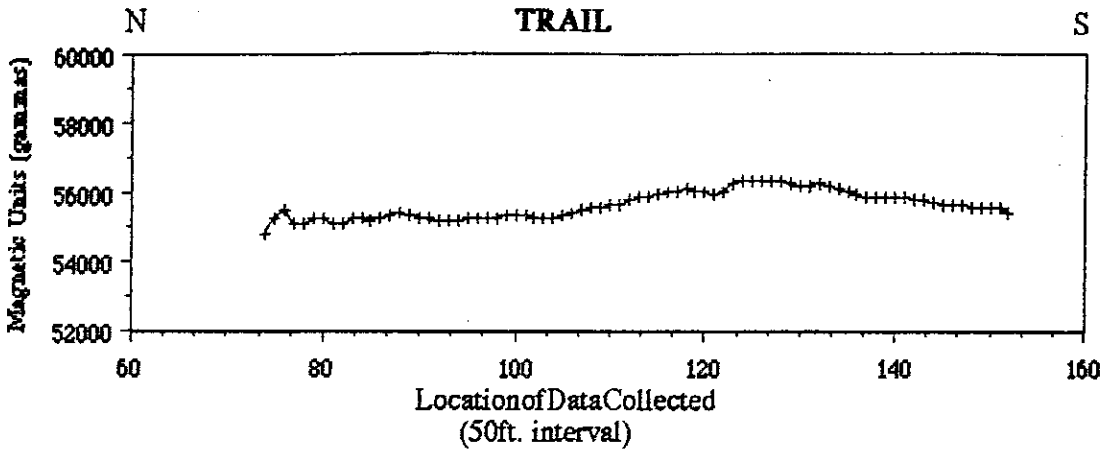

NW
TRAVERSE 9
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
LocationofDataCollected
(25ft. interval)
B

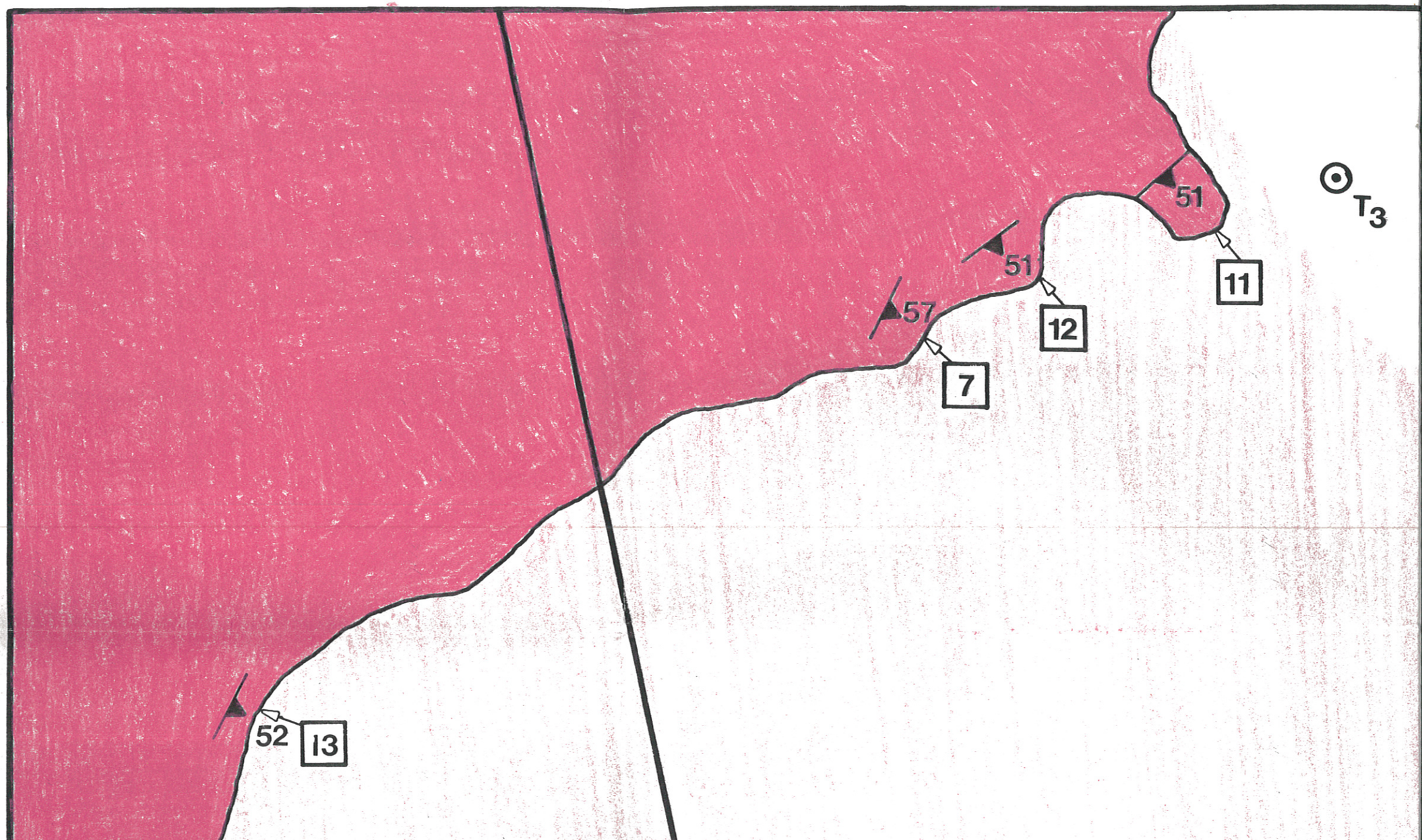

NW
TRAVERSE 11
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
LocationofDataCollected
(25ft. interval)
B

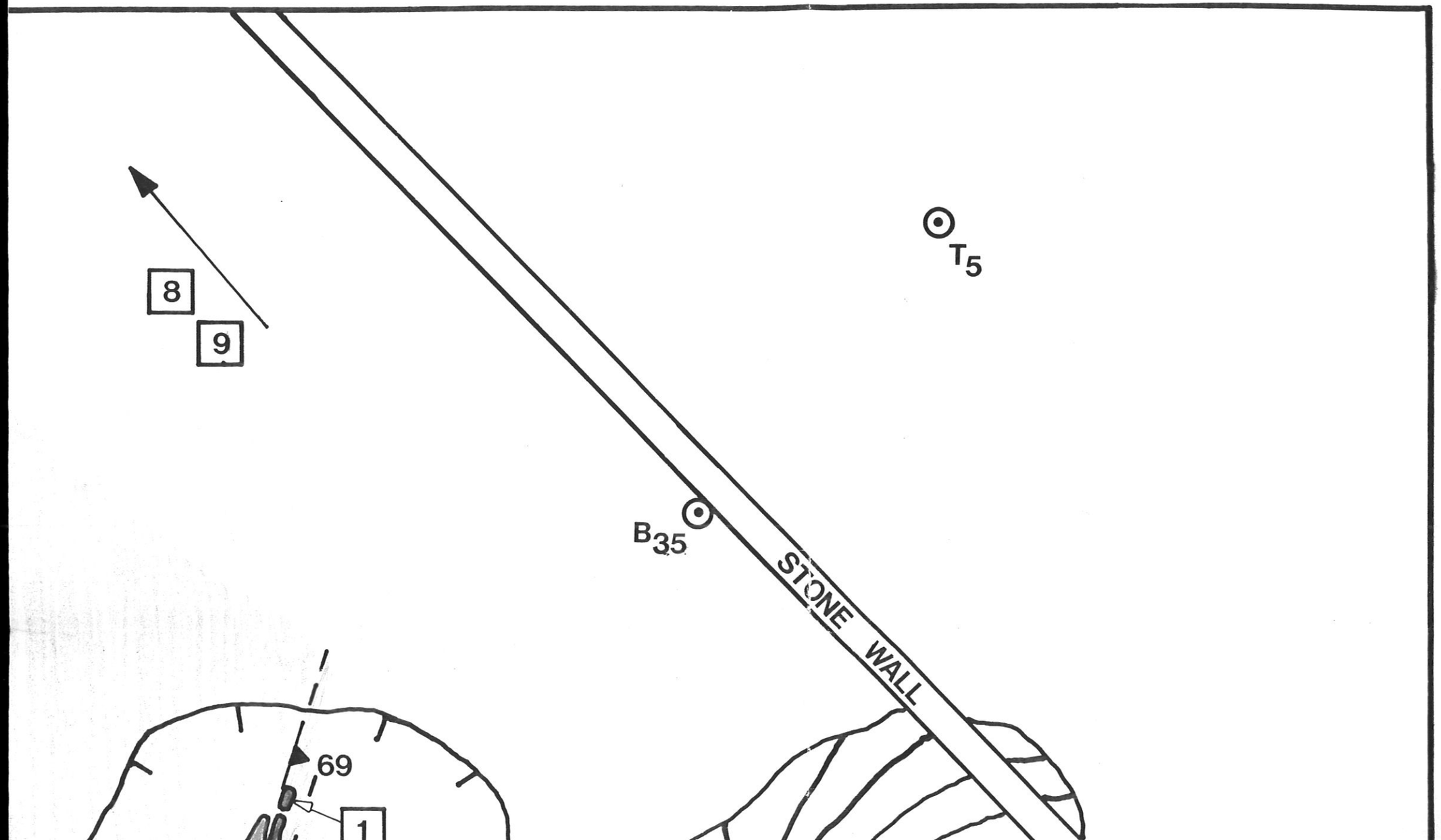

NW
TRAVERSE 12
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
Location of Data Collected
(25ft. interval)
B

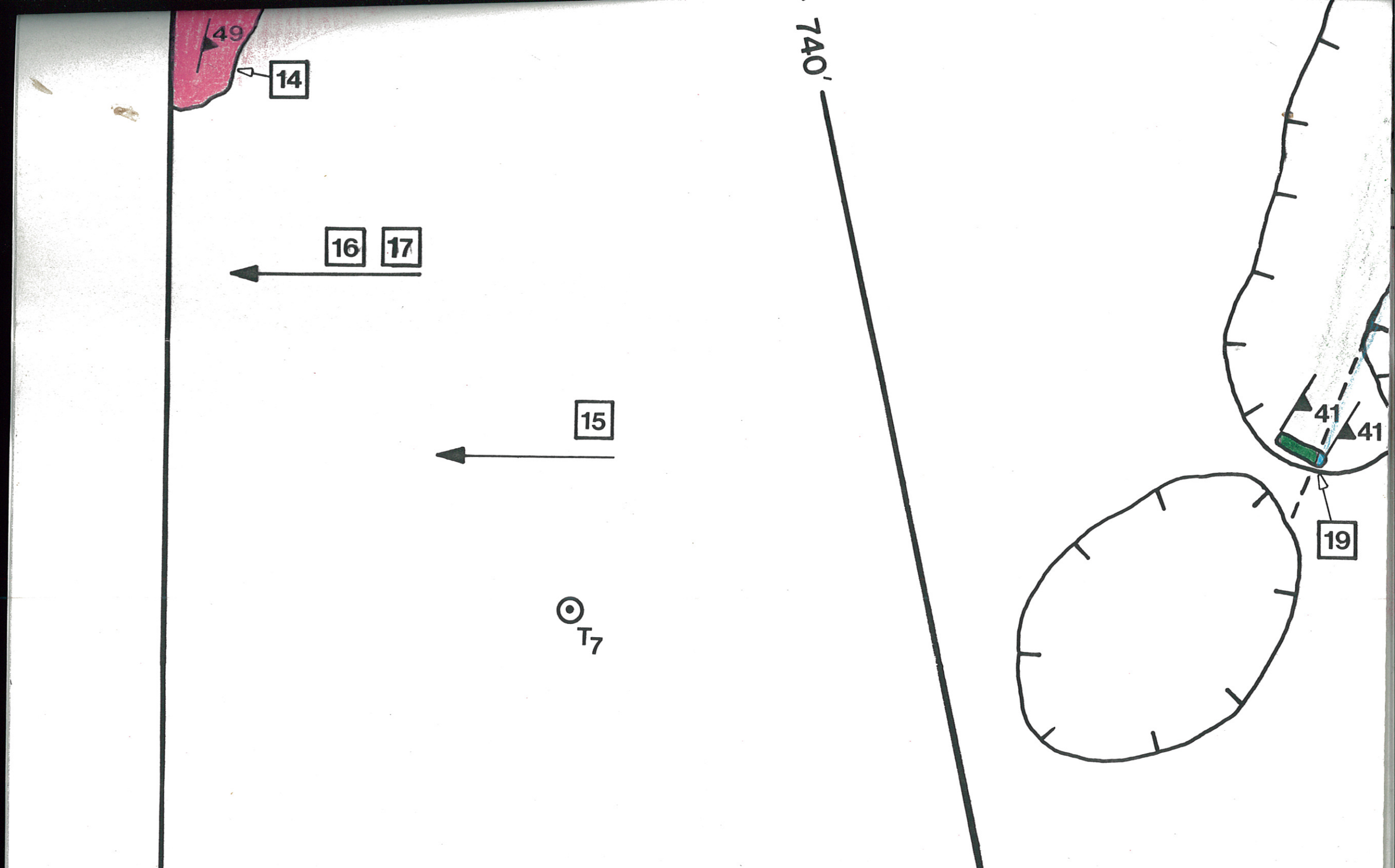

NW
TRAVERSE 13
SE
Magnetic Units (gammas)
60000
58000
56000
54000
52000
40
60
80
100
120
140
160
Location of Data Collected
(25ft. interval)
B

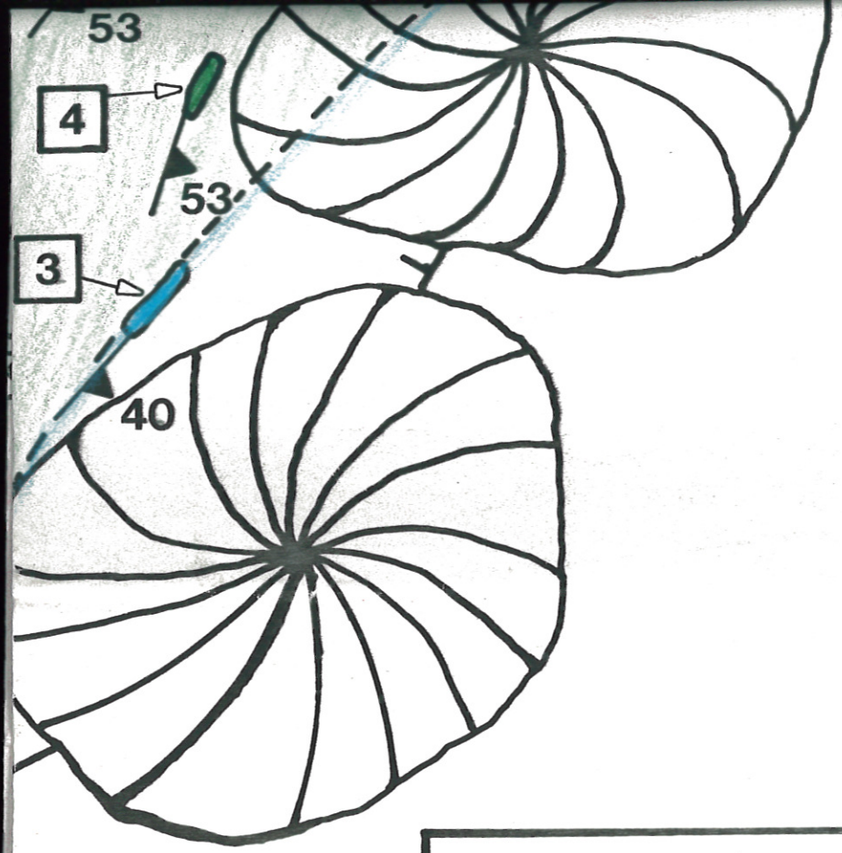

S
BASELINE
N
Magnetic Units (gammas)
60000
58000
56000
54000
52000
60
80
100
120
140
160
Location of Data Collected
(50ft. interval)


N
TRAIL
S
Magnetic Units (gammas)
60000
58000
56000
54000
52000
60
80
100
120
140
160
LocationofDataCollected
(50ft. interval)


T3
51
11
51
12
57
7
52
13


8
9
T5
B35
STONE WALL
69
1


49
14
16
17
15
T7
740'
41
41
19



10 0 10 20 FEET

PLATE A

GEOLOGIC MAP OF LOCALITY 1

Black Rock Forest, Cornwall, N.Y.

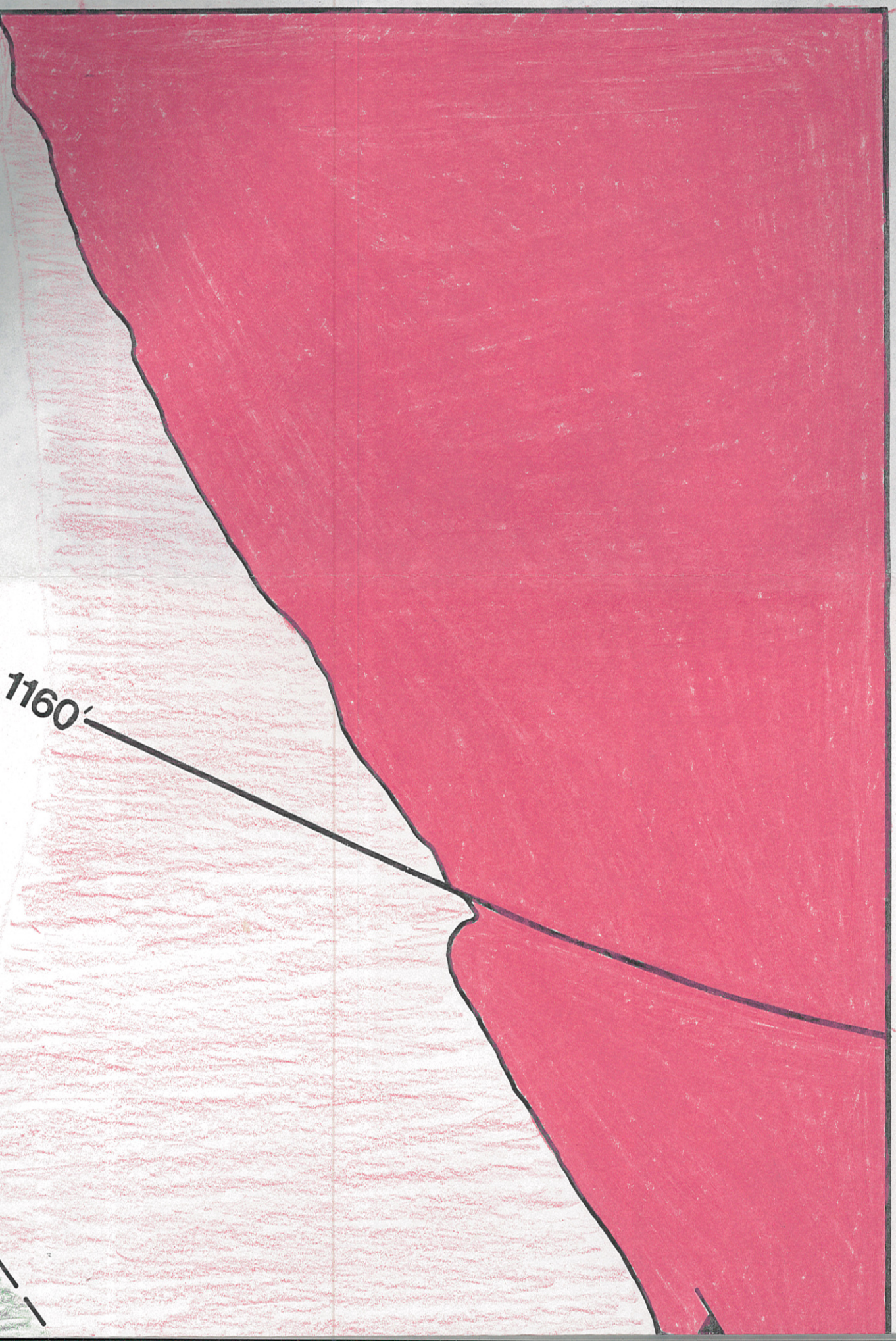
Geology & Drafting by Askold Chemych and Cheryl Eisenberg

Dept. of Geology & Geography, Hunter College Date 5/21/91

LEGEND

- Bio-Plag-Hbd Gneiss
- Mag-Plag-Px Banded Gneiss ore
- Mag-Plag-Px Banded Gneiss
- Leucocratic Plag-Qz Gneiss
- KSPAR-Qz-Hbd Gneiss

- Pit
- Rubble pile
- Control tree or stake
- Strike and dip of foliation
- Outcrop location number


1160'

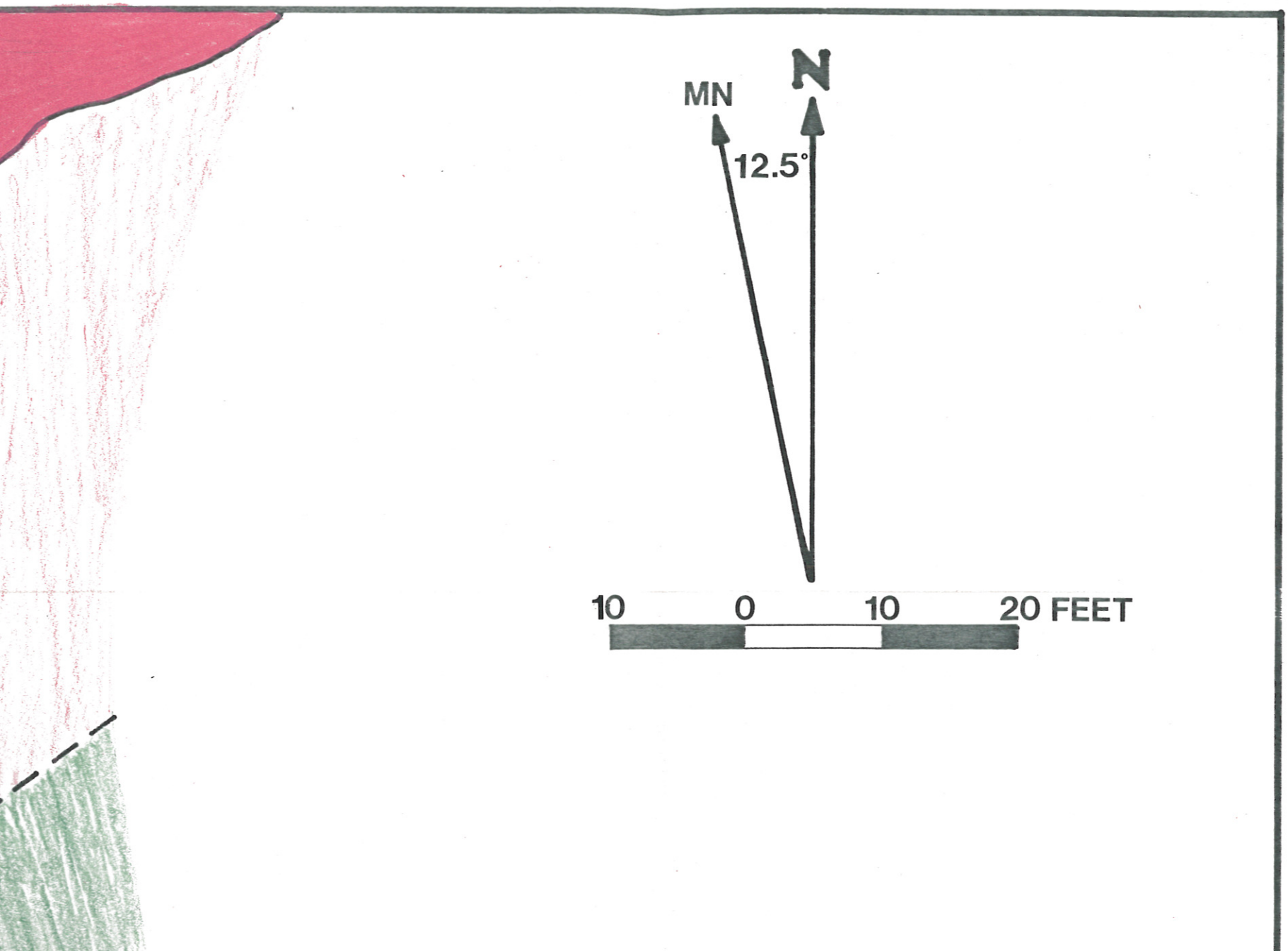

MN
N
12.5°
10
0
10
20 FEET

PLATE B

GEOLOGIC MAP OF LOCALITY 2

Black Rock Forest, Cornwall, N.Y.

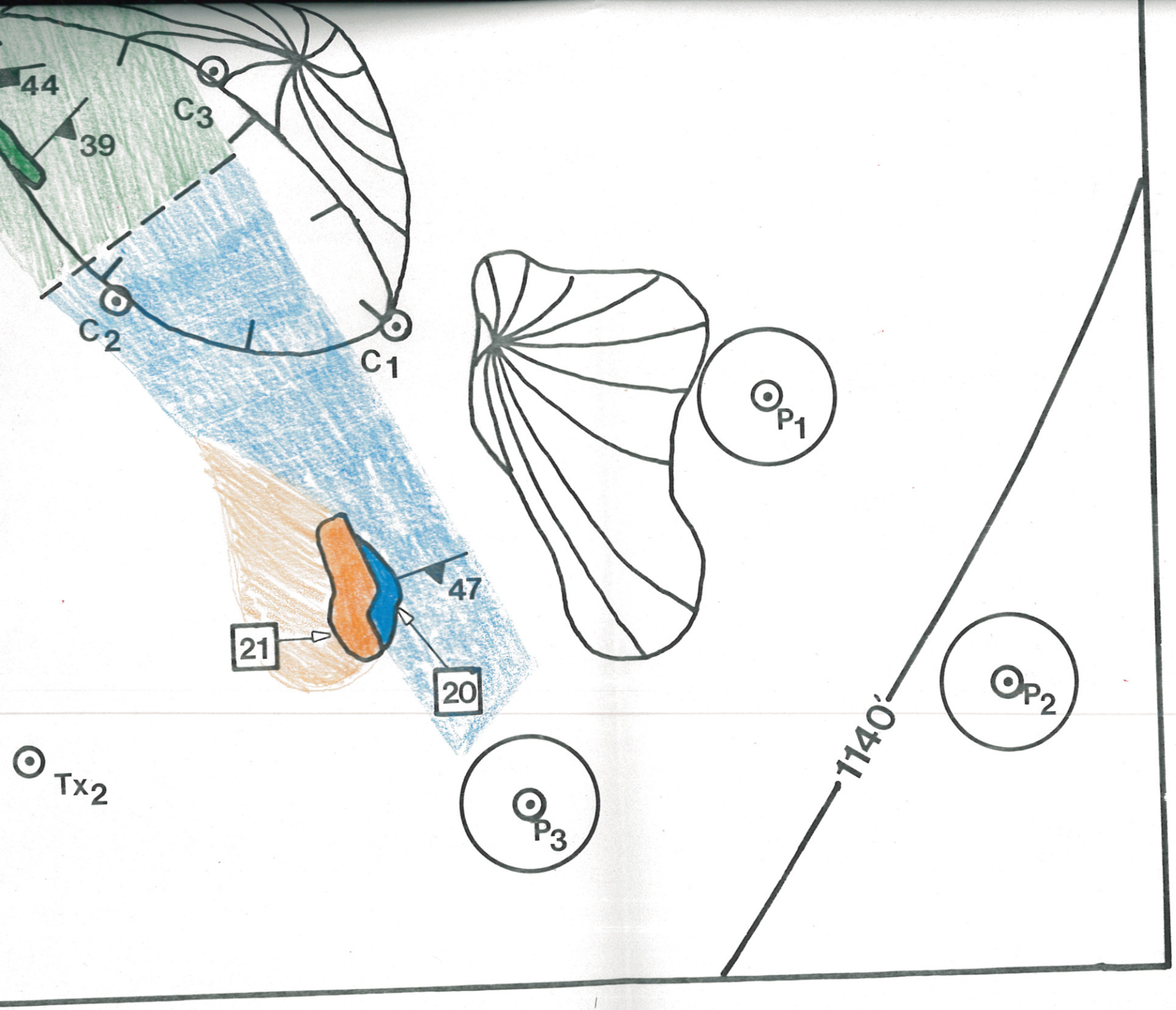
Geology & Drafting by Askold Chemych and Cheryl Eisenberg

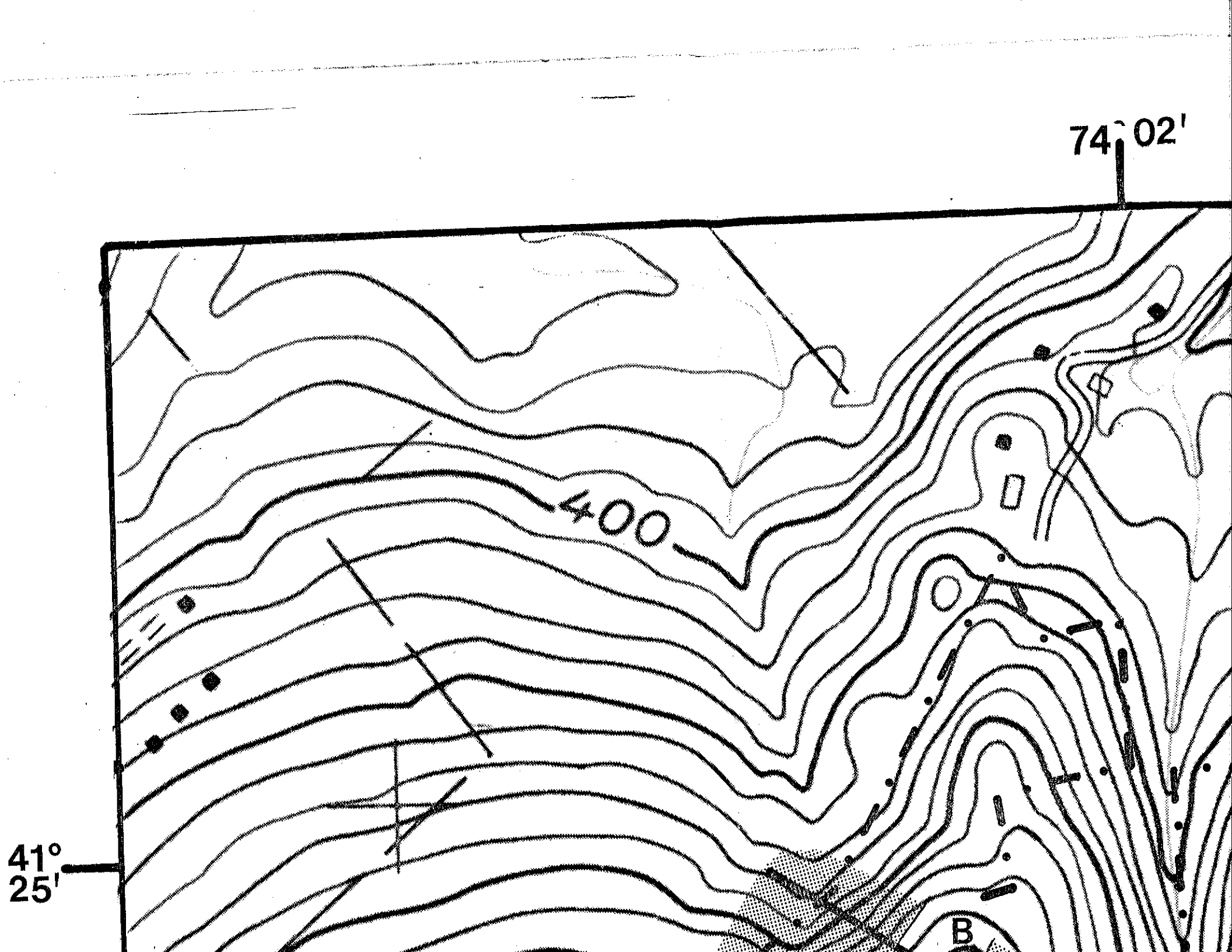
Dept. of Geology & Geography, Hunter College Date 5/21 91

LEGEND

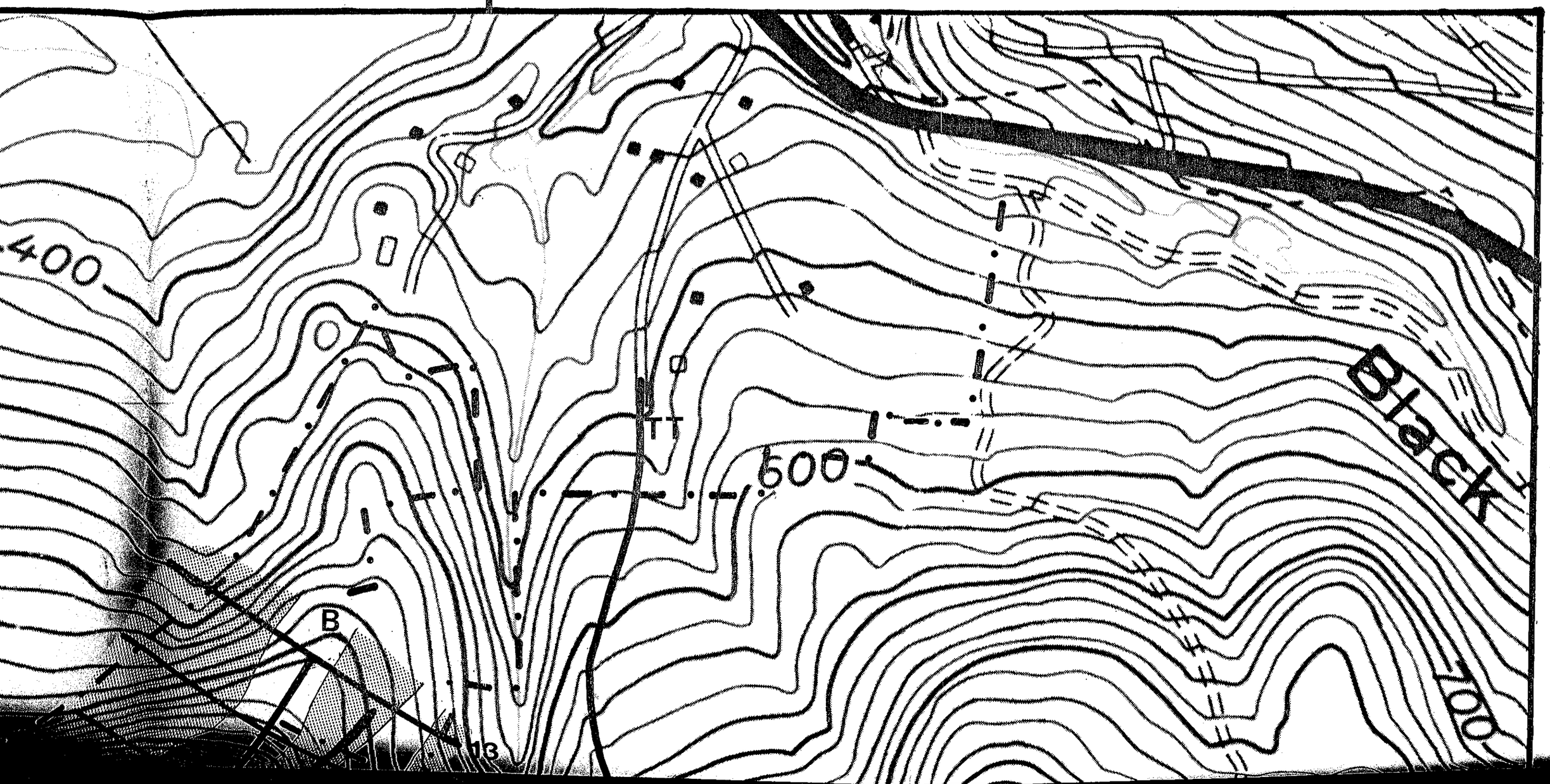
- Plag-Hbd-Px Gneiss
- Plag-Hbd-Qz Pegmatoid
- Mag-Plag-Px Banded Gneiss
- KSPAR-Qz-Hbd Gneiss

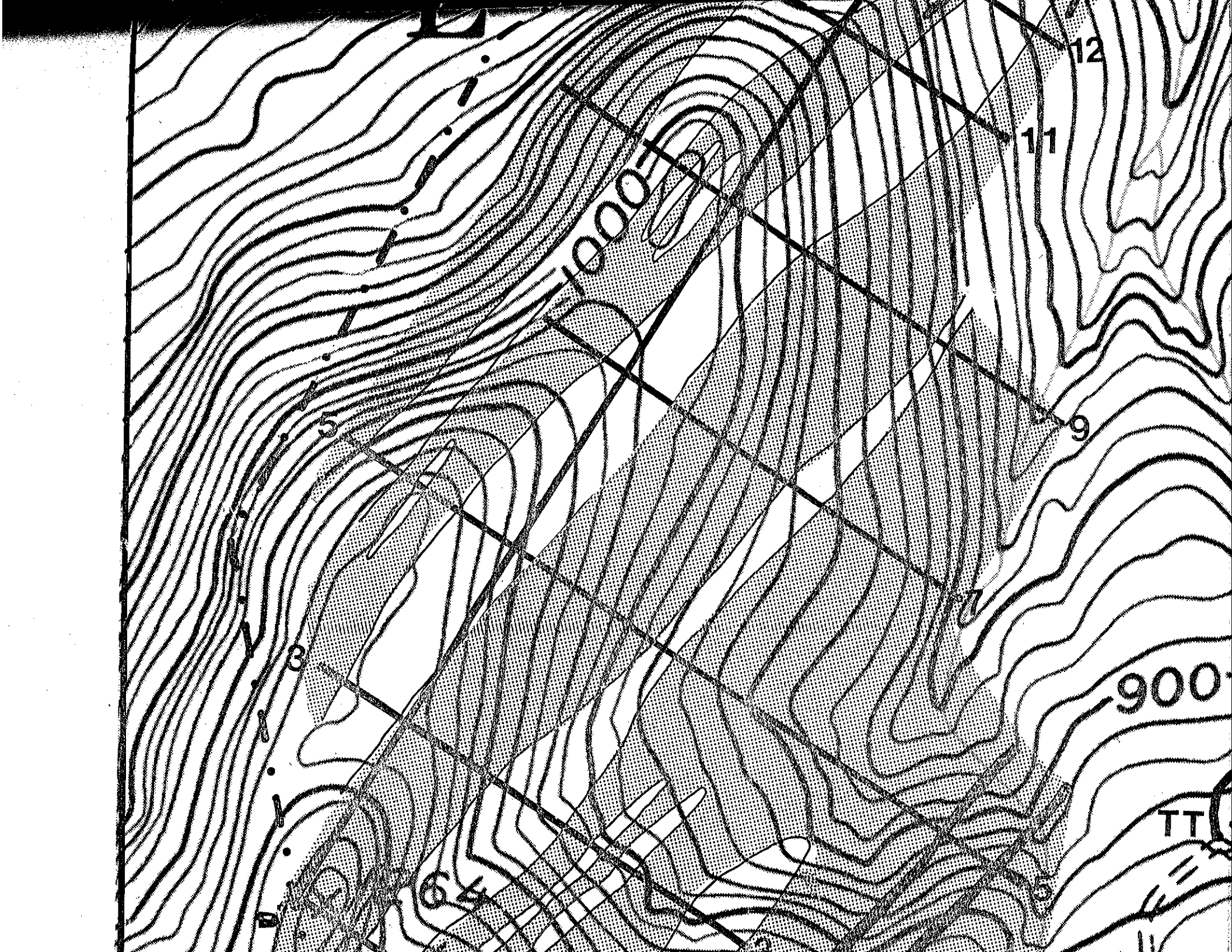
- Pit
- Rubble pile
- Tx Control tree
- C Control tree or stake
- P Control point in pit
- Strike and dip of foliation
- Strike and dip of joint
- Outcrop location number
- Inferred contact

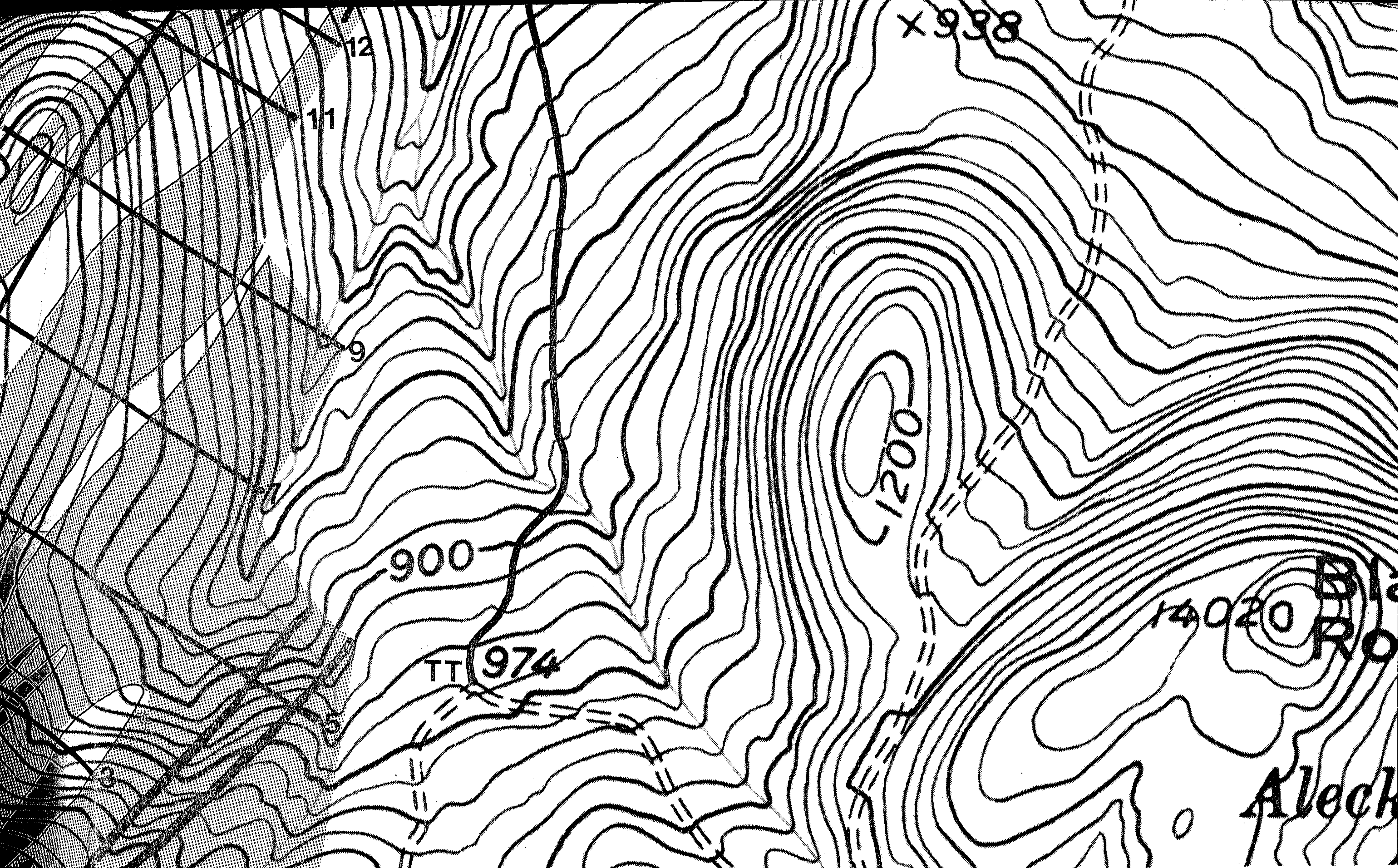

44
39
C3
C2
C1
P1
47
21
20
P2
1140'
Tx2
P3


74° 02'
400
41°
25'
B

74°02'




12
11
1000
9
5
3
900


×938
12
11
9
900
1200
TT 974
1402.0


1200
1300
1400

1226

1400

1251

Sphagnum
Pond

409

GROUND MAGNETICS MAP OF

Black Rock Fo

Topography From U.S.G.S. Cornwall

Interpreting Data and Drafting by

L

B Baseline

1-13 Traverse

TT Trail trave

Above 57 k

55-57 kil

Below 55 k

Forest bou

GROUND MAGNETICS MAP OF NORTHWEST BLACK ROCK FOREST

Black Rock Forest, Cornwall, N.Y.

Topography From U.S.G.S. Cornwall Quadrangle, New York, 7.5 Minute Series

Interpreting Data and Drafting by Cheryl Eisenberg and Askold Chemych

DATE 5-21-91

LEGEND

B	Baseline
1-13	Traverse lines
TT	Trail traverse
	Above 57 kilogammas
	55-57 kilogammas
	Below 55 kilogammas
—•—	Forest boundary