

**SUBSURFACE GEOLOGY OF THE COCHRAN
PEGMATITE, CHEROKEE-PICKENS DISTRICT,
GEORGIA**

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GEOLOGIC REPORT 5



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by

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ABSTRACT

Five core holes were drilled in the Cochran pegmatite located in northeastern Cherokee County, Georgia, in order to evaluate the subsurface features of this rock body. All five holes were started on or just below the hanging wall and vertically oriented to drill completely through the pegmatite body. The core holes ranged in depth from 115 to 170 feet and yielded information on pegmatite continuity, orientation, width (thickness), mineralogy, and weathering.

The following seven rock units were encountered in the core: 1) garnet-quartz-muscovite-biotite schist, the hanging wall host rock of the Cochran pegmatite belonging to the Dean Formation of the Late Precambrian Great Smoky Group; 2) border zone pegmatite consisting of a 6 inch to 1 foot wide zone of quartz, muscovite, tourmaline and feldspar; 3) weathered pegmatite, interior to the border zone, composed primarily of saproilitized feldspar and disseminated tourmaline, muscovite, quartz, and beryl; 4) partially weathered pegmatite characterized by the same mineralogy and textures as weathered pegmatite, but with feldspar that is significantly less decomposed; 5) quartz core consisting of a 1 to 15 foot wide zone of massive white or smoky quartz and surrounded by a zone containing 10 volume percent quartz veins in pegmatite; 6) fresh pegmatite with the same mineralogy as the partially weathered pegmatite (4 above), but with variable textures including graphic, fine- and medium-grained pegmatite; and 7) Dean Formation schistose metaconglomerate in the footwall of the pegmatite (at the bottom of all five drill holes).

Geophysical logs for gamma ray and self-potential were obtained for each of the drill holes. In general, however, neither logs revealed a direct correlation with identified lithologies. However, contacts between the lithologic units show significant positive or negative deflections in the gamma signal.

Introduction

The drilling project at the Cochran Mine is an outgrowth of previous pegmatite investigations conducted by the Georgia Geologic Survey. Detailed geochemical work by Gunow and Bonn (1989) provided a data base for detecting anomalous mineralization within the Cherokee-Pickens district. Early geologic investigations by Furcron and Teague (1943) and Galpin (1915) give descriptions of mica-bearing pegmatite throughout Georgia and are important references concerning production and historical records.

As part of the Accelerated Economic Minerals Program for the Georgia Department of Natural Resources, the Georgia Geologic Survey initiated a geochemical investigation of pegmatite districts within Georgia. The purpose of this geochemical investigation was to evaluate the economic potential of major and rare element mineralization within the associated pegmatites. In 1986, a geochemical study of the Cherokee-Pickens district pegmatites identified the Cochran Mine as anomalous with respect to several geologic and geochemical features and as having economically favorable characteristics (Gunow and Bonn, 1989). The favorable characteristics for this pegmatite include:

- 1) A significant outcrop exposure.
- 2) Mineral zonation and replacement features within the pegmatite.
- 3) Evidence for volatile enrichment within the pegmatite. (An abundance of hydroxyl- and boron-bearing minerals).
- 4) An exocontact zone of tourmalinization.
- 5) Anomalous enrichment of incompatible trace elements in associated muscovite. (High values for Rb, Nb, Li, F, and Be).
- 6) Extensive weathering of the pegmatite, making the deposit amenable for mineral extraction.

As a result of these favorable characteristics, five drill sites were selected at the Cochran Mine to evaluate the subsurface features of this pegmatite body.

The authors thank B. Thames and L. Gorday for their contributions in various phases of the drilling and geophysical logging operations. Helpful suggestions and reviews for this manuscript were provided by staff members of the Georgia Geologic Survey.

General Description

The Cochran Mine is located in northeastern Cherokee County, Georgia, approximately 2.6 miles N80°E of Ball Ground and 0.55 miles east of Long Swamp Creek (Figure 1). It includes two outcrop areas which have been mined; an active upper pit and an abandoned lower pit (Figure 2). When examined in 1986 the lower pit measured approximately 180 feet long by 60 feet wide and trended about N36°E. The pit walls are composed of saprolitized feldspar and perthite and contain significant quartz and muscovite with minor tourmaline, beryl and garnet. The pegmatite exhibits both fine- and medium-grained pegmatite textures.

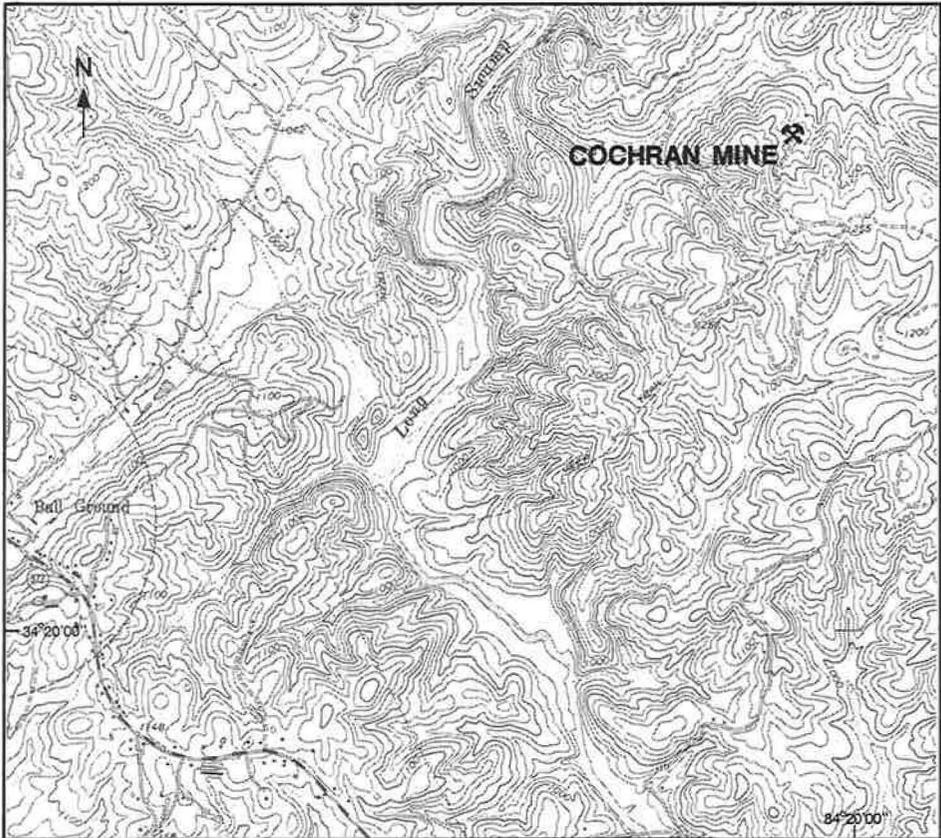
The pegmatite in the upper pit trends N70-75°E and dips 48-53° southeast. Present exposure (in 1986) in the upper pit measures roughly 30 by 300 feet. Although deeply weathered, this portion of the pegmatite exhibits a wide variety of textures including graphic, as well as fine- and medium-grained pegmatite. Individual crystals of tourmaline, beryl and muscovite up to 2 feet long are present in the upper pit.

Overall, the Cochran pegmatite is a zoned pegmatite containing a fine-grained, dark muscovite-bearing border zone up to 6 inches wide. The interior portion of the pegmatite consists of an intermediate zone dominated by perthite, medium-grained pegmatite and graphic granite. Locally, fine-grained pegmatite dikes up to 2 inches wide cut medium-grained pegmatite. The central portion of the pegmatite consists of a zone of massive quartz. Most of the beryl associated with this pegmatite is found either in the quartz core or in zones adjacent to the core.

The pegmatite has an apparent age of 356 ± 20 m.y. based on muscovite K-Ar methods (Gunow and Bonn, 1989). The surrounding country rock consists of quartz-muscovite-biotite schist and biotite-bearing metaconglomerate of the Late Precambrian Great Smoky Group. Detailed geochemical analyses were performed on samples from pegmatite and country rock outcrops. These and other data are given in Gunow and Bonn (1989).

Although the Cochran pegmatite exhibits many economically favorable characteristics, the geologic information concerning this deposit was limited to outcrop exposure. In order to assess this deposit more adequately, subsurface information was obtained by core drilling and geophysical logging. Desired information includes pegmatite continuity, orientation, width, and mineralogy.

Field investigations indicate that the pegmatite trends northeast and dips to the south. Consequently, all five holes were drilled on the hanging wall and vertically oriented to drill completely through the pegma-



Base from U.S. Geological Survey 1:24,000
 Ball Ground East, 1973, photorevised 1985.

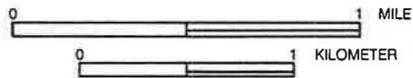


Figure 1. Location map of the Cochran Mine in northeastern Cherokee County (U.S. Geological Survey, Ball Ground East, Georgia, 1:24,000 topographic quadrangle).

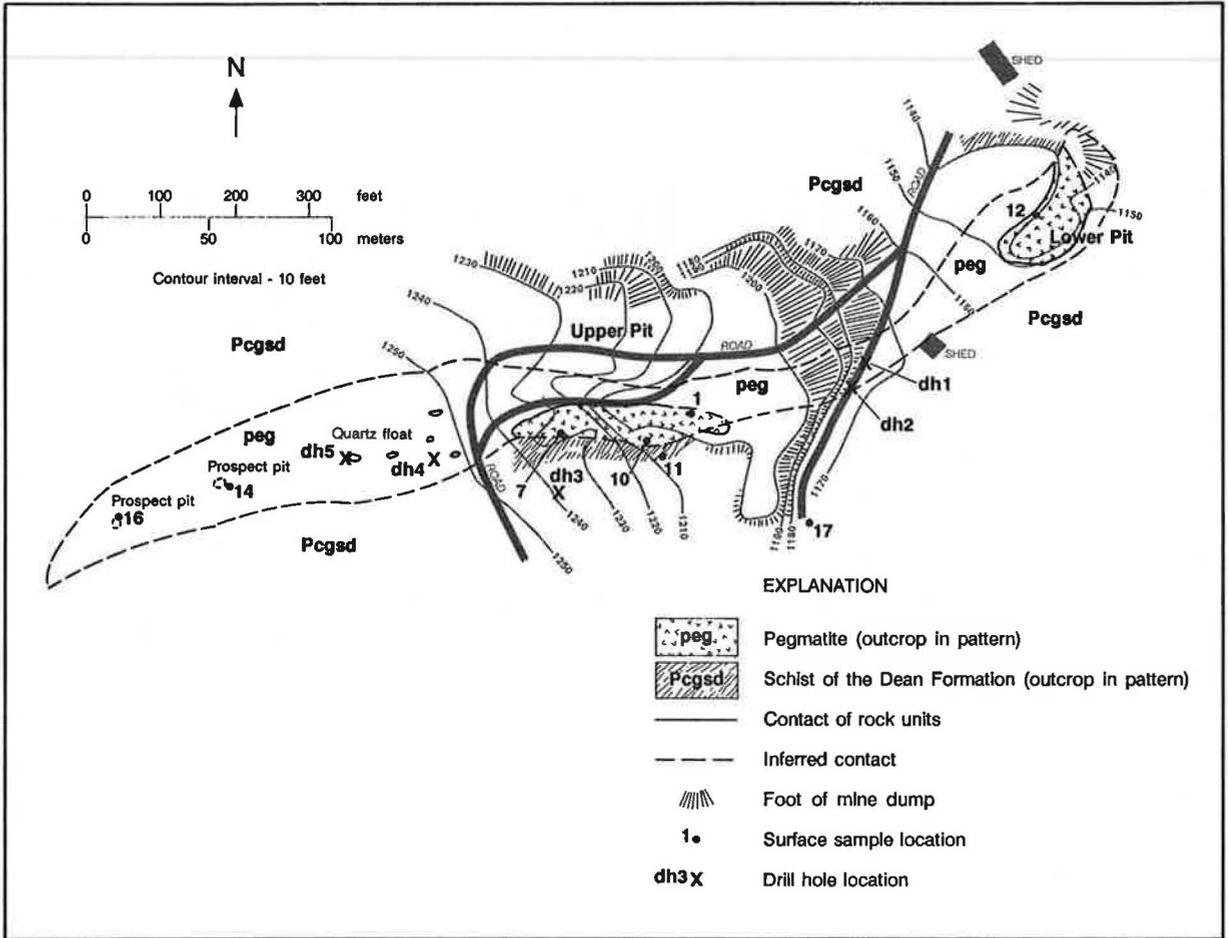


Figure 2. Geologic Map of the Cochran Pegmatite, Cherokee County, Georgia (after Gunow and Bonn, 1989, Figure 11).

tite body. The general orientation of the pegmatite and placement of drill holes were established by field mapping and are shown in Figure 2.

Results

Lithologic Description

NX drill core (1.875 inches in diameter) was obtained from all five drill holes by utilizing a combination of conventional single barrel methods and diamond core, wireline methods. The single barrel method was used to drill through hanging wall host rock and moderately weathered pegmatite. The wireline method was used through the highly weathered pegmatite, moderately weathered pegmatite, and below the moderately weathered zone. The holes were started on or just below the hanging wall and vertically oriented to drill completely through the pegmatite body. All holes were relatively shallow, vertical holes, ranging from 115 to 170 feet in total depth.

Lithologic logs were prepared for all of the core material using standard geologic methods of visual examination and mineral identification. The relative abundance of the mineral constituents were estimated visually for each 10 foot interval of core (see Appendix A). Lithologic descriptions were prepared based upon routine visual examination and are summarized in Appendix B. For this report the nomenclature for rocks of the Dean Formation, Great Smoky Group, and the Ocoee Supergroup, is that designated by McConnell and Costello (1980).

The following rock units were recognized within the core and outcrop:

- 1) Mica Schist: This is hanging wall host rock of the Cochran pegmatite. It consists of a well-foliated quartz-muscovite-biotite schist belonging to the Dean Formation of the Great Smoky Group. For the purpose of this paper, it is referred to as mica schist. This unit weathers to a distinctive red saprolite outcrop, which strongly contrasts to the white outcrop of the pegmatite. Mica schist is best exposed on the south side of the upper pit. Here, the foliation of the schist trends approximately N70° E and dips 50° SE. In general, the pegmatite is concordant with this host rock foliation. The mica schist contains 1-5% poikiloblastic garnets up to 1/8" wide and traces (<1%) of green disseminated tourmaline less than 1/8 inch wide. Weathered garnet from weathered portions of the mica schist exhibit a skeletal framework of hematite containing inclusions of quartz and biotite which are concentrated in separate zones

or sectors of the relict garnet. Replacement biotite after garnet is commonly observed at the edges of the poikiloblasts.

Near contacts with the pegmatite, the mica schist is locally tourmalinized. This alteration is characterized by coarse-grained quartz-muscovite-tourmaline lenses up to 6 inches wide and elongate parallel to the foliation trend. Individual tourmaline crystals within the podiform lenses are up to 0.5 inches wide.

- 2) **Border zone pegmatite:** A thin, 6 inch to 1 foot wide border zone of quartz-muscovite-tourmaline-feldspar is present as a border phase of the pegmatite. Muscovite from the border zone, occurring as crystals up to 2 inches wide, has a distinctive dark gray coloration. The crystals are generally oriented perpendicular to the contact with the pegmatite. Feldspar, a minor constituent of the border zone, is generally weathered to kaolinite. The border zone is best observed in outcrop at the hanging wall exposures in the upper pit.
- 3) **Weathered pegmatite:** Interior to the border zone is a zone of weathered pegmatite. This zone is primarily composed of saprolitized, crumbly feldspar. This material consists of white, powdery microcline, kaolinite, or a combination of these minerals. X-ray analyses of saprolitized feldspar indicate the presence of both minerals.

In outcrop, weathered pegmatite exhibits extremely well preserved textural features including graphic, perthitic, fine-grained pegmatitic, and coarse-grained pegmatitic textures. Locally, one foot wide, fine-grained pegmatite dikes cut coarse-grained pegmatite. Additional minerals within the weathered pegmatite include quartz, and disseminated muscovite, tourmaline, weathered garnet and beryl. Muscovite appears to be particularly stable in weathered pegmatite. Garnet typically weathers to 0.25 to 2 inch wide masses of dark gray iron and manganese oxides, and quartz. The tourmaline typically exhibits muscovite alteration rims. These rims are probably the result of endocontact replacement during the late stages of pegmatite crystallization. The disseminated tourmaline, muscovite and beryl crystals are as much as 8 inches long within the weathered pegmatite. Core recovery within weathered pegmatite varied from 54 to 94% (see Appendix B).

- 4) **Partially Weathered pegmatite:** Beneath the weathered pegmatite is a partially weathered zone characterized by the same mineralogy and textures as that from the weathered zone (3), but exhibiting

- feldspar that is significantly less decomposed. As a result, partially weathered pegmatite is a more competent rock and contains only minor kaolinite; but it is characterized by high friability. The friability is probably the result of partial decomposition that promotes splitting along the feldspar cleavage. Because of the friable nature of partially weathered pegmatite, drilling through this material yielded a core sample that had a distinctive granular appearance resembling granular sand. The poorest core recoveries in the drill holes were associated with this unit (7-40%).
- 5) **Quartz core:** A quartz core zone was encountered beneath partially weathered pegmatite. This zone contains a 1-15 foot wide zone of massive white or smoky quartz surrounded by a zone containing at least 10% (volume) quartz veins. Beryl is most common within quartz veins from this zone. Core recovery from the quartz core was highly variable due to pronounced variations in rock competency immediately adjacent to the quartz-rich zone.
 - 6) **Fresh pegmatite:** Fresh pegmatite was encountered beneath the quartz core in drill holes #3, 4 and 5. Fresh pegmatite is characterized by variable rock textures including graphic, fine-grained pegmatitic and medium-grained pegmatitic. Dominant minerals are identical to those within the altered portions of the pegmatite except that feldspar is unaltered. Perthitic texture within feldspar is common. Beryl is slightly less abundant than in the core zone. Fresh pegmatite contains interstitial clots of muscovite-tourmaline-quartz and beryl. Replacement features are common, indicated by muscovite envelopes and rims on the disseminated minerals. Some of these mineral segregations exhibit exceptional growth. Tourmaline and beryl crystals over 1 foot wide are common within this zone. Core recovery from this unit was highly variable (10-100%).
 - 7) **Biotite-bearing metaconglomeratic schist and schistose metaconglomerate:** This unit was found at the footwall of the Cochran pegmatite and was encountered in all five of the drill holes. It is a well-foliated, dark gray, fine- to medium- grained schistose rock containing 5-35 volume percent ellipsoidal, relict detrital clasts of feldspar, and lithic fragments up to 1 inch wide. The clasts are typically flattened parallel to the foliation within the rock (50-70° to the core axis). This unit is locally silicified and portions of this unit show relict sedimentary crossbedding or graded bedding. The percentage of coarse, relict detrital clasts

changes abruptly from layer to layer in the metaconglomerate. Fractures within the metaconglomerate typically contain chlorite. Pyrite is disseminated within this unit or along fracture planes. Disseminated almandine garnet, up to 1/8 inch in diameter, is occasionally observed within the metaconglomerate. Core recovery from this unit was excellent (70-100%).

A summary graphic lithologic log for each of the drill holes from the Cochran Mine is given in Plate 1. All five holes intersected pegmatite at depth and three of the five holes were started in pegmatite. Typical host rock-pegmatite contacts suggest that the contacts parallel the lineations and foliation in the metaconglomerate (50-70° to the core axis). If this is the case, the Cochran pegmatite is at least 90 feet wide and appears to widen towards the southwest.

Geophysics:

Geophysical logs for gamma ray and self-potential were obtained for most of the drill holes. Geophysical logs were not obtained from core hole #1, due to caving within the hole. The results of these logs are summarized in Plate 1. The geophysical logs in Figure 3 are plotted with zero as the base for relative comparison. Gamma intensity is plotted in counts per second and self potential is plotted in millivolts.

In general, neither the self-potential or gamma ray logs show a direct correlation with lithologies identified in the core. However, contacts between the lithologic units show significant positive or negative deflections in the gamma signal.

Discussion

The results from the drilling program verify the southeast dip of the pegmatite dike, suggest that the pegmatite is continuous between drill holes and that it is at least 90 feet wide. This information, combined with information obtained by surface exposures, suggests that the pegmatite is continuous from the lower pit through the upper pit and extends at least 600 feet west of the upper pit workings. Assuming an average minable width of 100 feet exposed at the surface, the following pegmatite reserves are estimated:

Proven reserves: 250,000 tons (25 foot depth)

Probable reserves: 550,000 tons (50 foot depth)

These estimates assume a maximum of 9 feet of overburden and that the pegmatite averages about 166 lbs/cubic foot.

Given the depth of weathering observed within these drill holes, the Cochran pegmatite should be amenable for relatively economical mineral extraction by open pit mining. Potentially economic or by-product minerals include feldspar, quartz (for high purity silica), kaolinite and beryl.

References

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APPENDIX A

Drill Hole Information and Mineralogy

Cochran Mine
Cherokee-Pickens District, GA

Drill Hole # 1 (GGS# 3563)

Elevation at collar: 1172 feet
Inclination: Vertical
Total Depth: 115 feet

Drill Hole # 2 (GGS# 3564)

Elevation at collar: 1175 feet
Inclination: Vertical
Total Depth: 131 feet

Drill Hole # 3 (GGS# 3565)

Elevation at collar: 1239 feet
Inclination: Vertical
Total Depth: 170 feet

Drill Hole # 4 (GGS# 3566)

Elevation at collar: 1254 feet
Inclination: Vertical
Total Depth: 151 feet

Drill Hole # 5 (GGS# 3567)

Elevation at collar: 1254 feet
Inclination: Vertical
Total Depth: 160 feet

Note: Structure and Foliation data indicate angular orientations relative to the long axis of the core.

Feld = feldspar; Qt = quartz; Tml = tourmaline; Tr = trace amount.
All percentages estimated visually and are approximate only.

APPENDIX A (cont.)

Hole # 1

12

Depth (ft)	%Recovery	%Qt	%Clay	%Mica	%Feld	%Tml	%Other	Structure
0-10	100	20	75	5	-	-	-	-
11-20	100	10	80	7	-	3	-	-
21-30	40	7	80	6	5	2	-	-
31-40	20	8	80	10	-	2	-	-
41-50	10	40	11	45	2	2	-	-
51-60	10	53	10	33	2	2	-	-
61-70	45	74	2	9	15	-	-	Foliation 50-60°
71-80	95	40	10	20	30	Tr	Tr	Foliation 40-50°
81-90	75	50	10	15	25	-	Tr	Foliation 50°
91-100	100	70	5	10	15	-	Tr	Foliation 30-50°
101-110	100	70	-	20	10	-	-	Foliation 50°
111-115	100	70	-	21	9	-	-	Foliation 60°
115 (= End of Hole)								

APPENDIX A (cont.)

Hole # 2

Depth (ft)	%Recovery	%Qt	%Clay	%Mica	%Feld	%Tml	%Other	Structure
0-10	100	20	70	10	-	-	-	-
11-20	100	30	60	9	-	1	-	-
21-30	78	30	38	11	20	1	Tr	-
31-40	18	10	30	9	50	1	-	-
41-50	40	10	35	9	45	1	-	-
51-60	20	25	15	14	45	1	-	-
61-70	26	15	10	59	15	1	-	50°
71-80	22	15	15	60	10	Tr	-	Foliation 20°
81-90	40	10	30	45	15	Tr	-	20°
91-100	100	40	10	20	30	-	-	20-30°
101-110	100	40	-	29	29	-	2	50-60°
111-120	100	49	-	25	25	-	1	60°
121-131	100	45	-	30	25	-	-	50-60°
131 (= End of Hole)								

APPENDIX A (cont.)

Hole # 3

Depth (ft)	%Recovery	%Qt	%Clay	%Mica	%Feld	%Tml	%Other	Structure
0-10	100	-	94	4	-	2	-	-
11-20	100	1	92	4	-	-	3	-
21-30	100	1	90	8	-	1	-	-
31-40	100	1	90	8	-	1	-	-
41-50	100	10	71	15	-	4	-	-
51-60	20	15	70	14	-	1	-	30-50°
61-70	100	6	85	8	-	1	-	-
71-80	58	39	50	6	4	1	-	-
81-90	20	77	10	8	4	1	Tr	-
91-100	89	15	38	5	40	1	1	Banding 60°
101-110	100	7	20	18	53	1	1	50-70°
111-120	100	7	10	16	64	1	2	50-70°
121-130	90	15	-	16	67	1	1	40-75°
131-140	100	19	-	20	59	1	1	50°
141-150	100	31	-	29	40	-	Tr	Gneissic layers 50°
151-160	100	30	-	30	40	-	Tr	60-70°
161-170	100	28	-	32	40	-	Tr	70-75°
170 (= End of Hole)								

APPENDIX A (cont.)

Hole # 4

Depth (ft)	%Recovery	%Qt	%Clay	%Mica	%Feld	%Tml	%Other	Structure
0-10	100	1	99	-	-	Tr	-	-
11-20	100	4	90	5	-	1	-	-
21-30	84	7	89	2	-	2	-	-
31-40	40	60	11	15	11	3	-	-
41-50	23	7	28	32	10	23	-	-
51-60	41	20	25	30	12	13	-	-
61-70	12	10	18	3	67	2	-	-
71-80	10	10	5	3	80	2	-	-
81-90	70	45	20	15	19	1	-	-
91-100	100	10	15	19	54	2	-	50-70°
101-110	100	10	10	10	68	1	1	50-70°
111-120	100	19	-	13	65	1	2	50-70°
121-130	100	15	-	15	67	2	1	50-70°
131-140	100	23	-	27	49	1	Tr	40-70°
141-151	96	35	-	40	25	-	Tr	50-70°

151 (= End of Hole)

APPENDIX A (cont.)

	Hole # 5								
	Depth (ft)	%Recovery	%Qt	%Clay	%Mica	%Feld	%Tml	%Other	Structure
16	0-10	100	17	72	10	-	1	-	-
	11-20	100	22	65	12	-	1	-	-
	21-30	75	35	45	10	5	5	-	-
	31-40	28	87	3	5	4	1	-	-
	41-50	5	72	4	7	15	2	-	-
	51-60	5	37	3	8	51	1	-	-
	61-70	5	30	5	6	58	1	-	-
	71-80	5	29	4	7	59	1	-	-
	81-90	5	20	4	6	69	1	-	-
	91-100	5	22	3	5	68	2	-	-
	101-110	18	35	11	10	43	1	-	-
	111-120	50	15	18	15	52	1	-	-
	121-130	55	15	10	25	49	1	-	50-70°
	131-140	100	18	5	39	38	Tr	-	50-70°
	141-150	100	10	2	37	37	Tr	14	60-70°
	151-160	100	10	-	40	35	Tr	15	60-70°
	160 (= End of Hole)								

APPENDIX B

Lithologic Description of Drill Core

Note: Kspar or K-feldspar = potassium feldspar (orthoclase or microcline) undifferentiated.

C.A. = Core Axis

Hole # 1

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
0.0 7.0	Mine tailings and alluvium consisting of weathered mica schist and pegmatite. Abundant clay.
7.0 10.0	Mine tailings and alluvium - same as above. Light brown clay and decomposed pegmatite containing white kaolinite clumps up to 4 inches in length.
10.0 16.0	Mine tailings and alluvium - same as 0-7 feet.
16.0 18.0	Mine tailings and alluvium - same as 0-7 feet. Clay diminishes; crushed, "sandy" fragments of quartz and feldspar predominate.
18.0 40.0	Kaolinized pegmatite with local dark 1/8 inch bands of tourmaline.
40.0 50.0	Kaolinized pegmatite - same as above. Muscovite is abundant, only minor K-feldspar.
50.0 55.0	Massive, friable, milky quartz, containing light green muscovite crystals up to 2 inches wide.

APPENDIX B (cont.)

Hole # 1, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
55.0 60.0	Kaolinized pegmatite containing white and gray quartz crystals, tourmaline, and muscovite crystals.
60.0 61.0	Biotite-rich metaconglomerate characterized by a dark gray, fine-grained groundmass exhibiting weak foliation, cross-bedding, and graded bedding. This unit typically contains white to light pink ellipsoids of sub-rounded feldspar and quartz (up to 1 inch) in a dark gray biotite-rich matrix. This unit is poorly sorted and exhibits varying degrees of weathering indicated by a brownish discoloration of the groundmass. Local lenses of muscovite schist are present. The metaconglomerate is cut by numerous pegmatite dikes and stringers composed of fine to medium-grained quartz and K-feldspar.
61.0 62.0	Massive gray quartz dike cutting kaolinized tan to gray metaconglomerate.
62.0 90.0	Biotite-rich metaconglomerate (same as 60-61 feet) which is deeply weathered and has the appearance of a tan arkosic conglomerate. Traces of pyrite at 70-80 feet.
90.0 92.0	Biotite-rich metaconglomerate - same as 60-61 feet.
92.0 100.0	Biotite-rich metaconglomerate - same as 60-61 feet. The metaconglomerate shows a pronounced foliation with thin laminations of biotite up to 1/8 inch wide. Contains traces of pyrite and chlorite.
100.0 115.0	Biotite-rich metaconglomerate - same as 60-61 feet.

115 = End of Hole

APPENDIX B (cont.)

Hole # 2

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
0.0 7.0	Light orange to reddish mine tailings composed of weathered mica schist, pegmatite and quartz fragments up to 2 inches across.
7.0 13.0	Light brown, deeply weathered pegmatite composed of clay, iron oxide, quartz and mica crystals. Mica crystals up to 3 inches across. White kaolinite clumps up to 6 inches wide.
13.0 25.0	Kaolinized pegmatite containing dark bands and clots of weathered, highly fractured and oxide-stained tourmaline up to 2 inches across. Muscovite has a greenish-gray coloration.
25.0 27.0	Quartz zone with traces of disseminated pyrite (crystals up to 1/8 inch across). Quartz (30%) is clear to milky.
27.0 61.0	Partially weathered, granular pegmatite. This interval contains both feldspar and quartz but the pegmatite appears to have been especially friable yielding a "sandy" texture. Minor disseminated tourmaline and muscovite are present in the crushed pegmatite zone. The clay content of the pegmatite within this zone decreases with depth.
61.0 63.0	Coarse-grained muscovite and tourmaline in weathered pegmatite; abundant quartz and kaolinite. Muscovite and tourmaline crystals up to 2 inches across.
63.0 64.0	Medium-grained, light tan-brown, iron oxide-stained, sericitized metaconglomerate cut by numerous pegmatite stringers. Moderate foliation at 20°C.A. (Core Axis). Muscovite crystals in metaconglomerate (?) up to 1/8 inch across.

APPENDIX B (cont.)

Hole # 2, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
64.0 72.0	Light gray-tan, fine-grained sericitized schist, well foliated (20° C.A.). Numerous iron oxide stains and coated fractures. Sericite up to 1/6 inch wide. Abundant tourmaline in sericitized schist and in quartz-mica stringers.
72.0 75.0	Kaolinized and granular pegmatite dike containing xenoliths of schist and weathered iron oxide bands.
75.0 81.0	Kaolinized, medium-grained, tan to light gray, sericitized schist. Dominant foliation 20-30° C.A.
81.0 85.0	Strongly weathered, fine to medium-grained, tan to light gray metaconglomerate with local schistose laminations. Strong foliation; K-feldspar and quartz-bearing.
85.0 93.0	Fine- to medium-grained biotite-rich metaconglomerate. This unit varies from tan to dark depending upon the degree of weathering in which biotite alters to sericite and iron oxide.
93.0 101.0	Metaconglomerate (same as above) containing numerous ellipsoidal clasts of quartz and feldspar elongate parallel to foliation. At 100 feet fresh biotite-rich metaconglomerate is encountered.
101.0 131.0	Metaconglomerate - same as 85-93 feet.
131 = End of Hole	

APPENDIX B (cont.)

Hole # 3

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
0.0 40.0	Dark red, highly weathered, tourmaline-bearing, muscovite-biotite schist containing several thin stringers of tourmaline-bearing pegmatite. The pegmatite stringers are identified by tan to white kaolinite lenses within the red schist. Tourmaline crystals up to 1/8 inch across are present within the kaolinite lenses. Abundant tourmaline and muscovite are present in the schist adjacent to the pegmatite stringers. Muscovite crystals range up to 1 inch across in stringers.
40.0 60.1	Weathered, kaolinized pegmatite characterized by white kaolinite with local bands of dark oxide minerals (brown to black) and crumbly tourmaline crystals. Pseudo-hexagonal muscovite up to 1 inch across throughout this interval. Trace greenish-black biotite crystals up to 1 inch across near schist/pegmatite contact. At 60 feet, pegmatite is less weathered and graphic granite textures are well defined.
60.1 60.4	Weathered zone of dark, banded tourmaline and coarse muscovite in kaolinized pegmatite.
60.4 65.0	Weathered pegmatite - same as 40-60.1 feet above. Kaolinite with local fractures which have limonite staining.
65.0 72.0	Weathered pegmatite - same as 40-60.1 feet.
72.0 78.0	Granular pegmatite composed of quartz, feldspar and muscovite.
78.0 88.0	Quartz core zone characterized by a massive gray to white quartz intermixed with minor granulated pegmatite (<10%). Trace tourmaline and pseudo-hexagonal mica (green).

APPENDIX B (cont.)

Hole # 3, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
88.0 90.0	Kaolinized, poorly consolidated pegmatite which contains intergranular growths of quartz and tourmaline. Pegmatite is predominantly fresh from 88-139 feet.
90.0 94.0	White, quartz-rich, tourmaline- and garnet-bearing pegmatite. Microcline is dominant mineral with graphic texture.
94.0 96.0	Microcline pegmatite with minor tourmaline and green muscovite.
96.0 100.0	Mottled, banded pegmatite containing muscovite, tourmaline, garnet, and quartz.
100.0 120.0	Partially kaolinized pegmatite with abundant muscovite as books and in veinlets. Large disseminated crystals of tourmaline and garnet up to 2 inches long. Diverse mineralogy and rock textures. Fracture-filled tourmaline and garnet with trace of pyrite. Trace of tourmaline associated with muscovite seams.
120.0 139.0	Fresh pegmatite with graphic texture characterized by K-feldspar, quartz and muscovite, with minor garnet and tourmaline. Contact with Dean Formation is sharp but undulatory.
139.0 140.0	Biotite-rich metaconglomerate characterized by a gray quartz-biotite groundmass containing ellipsoidal clasts of quartz and K-feldspar up to 1 inch wide. Muscovite-rich layers are found within the metaconglomerate.
140.0 140.5	Bluish-gray metaconglomerate containing ellipsoids of K-feldspar and quartz in a fine-grained biotite-rich groundmass.

APPENDIX B (cont.)

Hole # 3, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
140.5 150.0	Medium-grained metaconglomerate.
150.0 170.0	Bluish-gray metaconglomerate containing thin layers of mica schist up to 1/10 inch thick. Ground-mass consists of fine-grained biotite and quartz. Fine-grained pyrite at 152 feet. Local mica layers 1-2 inches thick.
170 = End of Hole	

Hole # 4

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
0.0 18.0	Highly weathered, saprolitized red to reddish-brown mica schist. This unit is poorly consolidated and contains minor disseminated black tourmaline crystals up to 1/8 inch across. The schist is cut by several kaolinized pegmatite stringers from 10-18 feet. Some of these stringers contain muscovite crystals up to 1 inch wide.
18.0 31.0	White, kaolinized pegmatite containing green muscovite crystals up to 2 inches wide. Quartz, K-feldspar, and tourmaline are present locally.
31.0 40.0	Partially weathered granular pegmatite, characterized by an abundance of granular quartz, mica or feldspar. Clay is significantly less abundant than the preceding interval.
40.0 54.0	Partially weathered pegmatite - same as above. Tourmaline is especially abundant.
54.0 56.0	Partially weathered pegmatite - same as 31-40 feet. Almost entirely composed of coarse-grained muscovite. This muscovite occurs as crystals over 1 inch across which exhibit ruling.

APPENDIX B (cont.)

Hole #4, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
56.0 61.0	Kaolinized pegmatite containing locally abundant quartz, tourmaline and muscovite. The muscovite is fine-grained with a distinct greenish cast.
61.0 70.0	Granular, partially weathered pegmatite contains abundant white K-feldspar.
70.0 71.0	Granular, partially weathered pegmatite (same as above) contains a small lens of quartz and black tourmaline.
71.0 72.0	Partially weathered pegmatite - same as 61-70 feet.
72.0 80.0	Granular, partially weathered pegmatite (same as 61-70 feet) with a white-buff hue.
80.0 81.0	Partially weathered pegmatite - same as 61-70 feet.
81.0 83.0	White, partially kaolinized, medium-grained pegmatite containing abundant massive quartz, with traces of tourmaline and muscovite.
83.0 86.0	White to light gray, massive quartz core.
86.0 87.0	Crystals of muscovite (over 1 inch wide) in partially kaolinized pegmatite.
87.0 134.0	Fresh, fine- to medium-grained pegmatite exhibiting perthitic and graphic granite textures. Composed of feldspar, muscovite, quartz, tourmaline, and garnet. Some of the textures within the pegmatite are brecciated (blocks of K-feldspar in a quartz matrix and blocks of quartz in a feldspar matrix). Plumose textures are present throughout this interval. Garnet crystals, with inclusions of biotite and tourmaline, are especially large (1-2 inches) in quartz at 123 feet. Traces of chlorite and tourmaline (?) occur along fractures in this

APPENDIX B (cont.)

Hole #4, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
	interval. Beryl crystals (1 inch across) present at 114.5 feet.
134.0 151.0	Dark gray, biotite-rich metaconglomerate. This unit exhibits apparent reverse grading and is characterized by a fine- to medium-grained groundmass containing 5-10% quartz and feldspar ellipsoids up to 1/4 inch wide. Pyrite and tourmaline are locally present. Metaconglomerate is interbedded with fine laminations of mica schist.
151 = End of Hole	

Hole # 5

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
0.0 25.0	Light brown to white, kaolinized, saprolitized pegmatite containing disseminated tourmaline and muscovite. The pegmatite exhibits relict fine- to medium-grained textures. Quartz is relatively abundant throughout this interval.
25.0 29.0	Granular pegmatite consisting of granular quartz, K-feldspar, tourmaline and muscovite.
29.0 42.0	Massive, white quartz core interlayered with granular pegmatite.
42.0 62.0	Granular pegmatite consisting of fresh K-feldspar, with abundant quartz, minor muscovite and 1-2% tourmaline.
62.0 62.5	A 6 inch-1 foot wide zone of massive quartz.
62.5 87.0	Granular pegmatite - same as 42-62 feet.

APPENDIX B (cont.)

Hole #5, cont.

<u>DEPTH (Ft.)</u>	<u>DESCRIPTION</u>
87.0 88.0	Massive gray-white quartz.
88.0 100.0	Granular pegmatite - same as 42-62 feet.
100.0 103.0	Massive gray to white quartz.
103.0 110.0	Granular pegmatite - same as 42-62 feet.
110.0 112.0	Partially kaolinized, fine- to medium-grained pegmatite consisting of K-feldspar with minor quartz, muscovite books and tourmaline.
112.0 113.0	Pegmatite has a distinct clastic texture and numerous fractures cut the pegmatite (filled with tourmaline and/or manganese oxide).
113.0 120.0	Fine- to medium-grained pegmatite exhibiting graphic texture. Dominant mineral intergrowths include quartz-feldspar-mica, quartz-mica, quartz-tourmaline and muscovite-K-feldspar.
120.0 120.5	A small, 6 inch wide, zone of massive quartz.
120.5 125.0	Partially kaolinized (white), fine- to medium grained pegmatite similar to 113-120. Graphic textures are dominant.
125.0 148.0	Partially weathered, biotite-rich metaconglomerate (dark gray) interlayered with thin laminations of biotite-muscovite schist. Local quartz-muscovite stringers cut the foliation. The metaconglomerate has a slight bluish hue and contains numerous ellipsoids of white-light tan feldspar up to 1/4 inch across. Apparent graded bedding is observed locally.

APPENDIX B (cont.)

Hole #5, cont.

DEPTH (Ft.)

DESCRIPTION

148.0 151.0

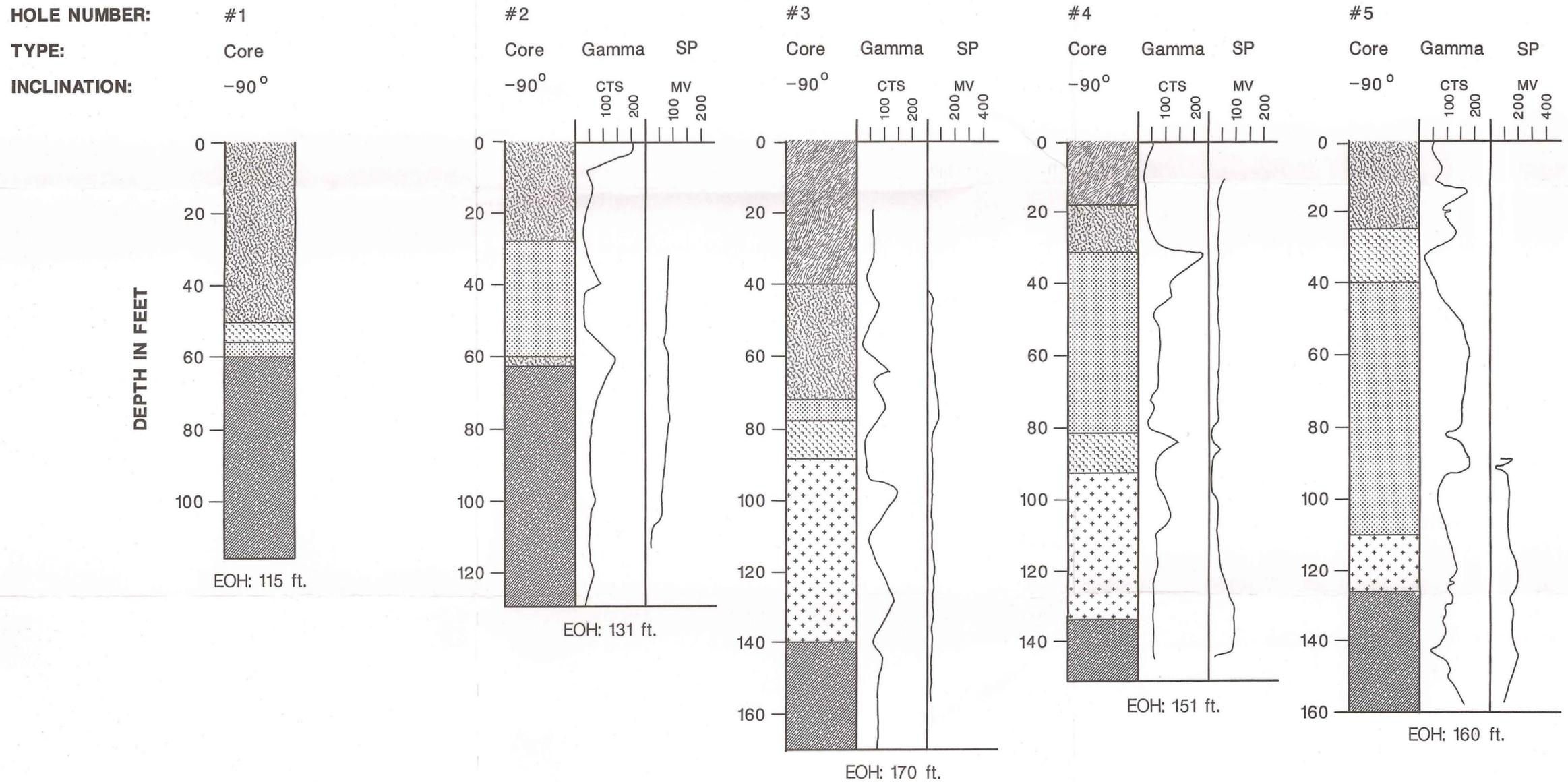
Medium-grained, hornblende- and biotite-bearing metagabbro (amphibolite): 70% hornblende, 20% biotite and 10% K-feldspar. The metagabbro (dike?) is concordant with the foliation of the metaconglomerate; both units cut the core axis at 70°.

151.0 160.0

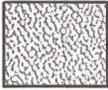
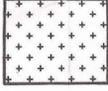
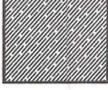
Partially weathered, biotite-rich metaconglomerate same as 125-148 feet.

160 = End of Hole

DRILL CORE, COCHRAN MINE, CHEROKEE COUNTY, GEORGIA



EXPLANATION

-  Weathered, kaolinized pegmatite. Muscovite stable.
-  Partially-weathered, quartz-bearing, granular pegmatite.
-  Fresh, unweathered pegmatite. Composed of feldspar and quartz with interstitial muscovite, tourmaline, garnet and beryl.
-  Pegmatite: quartz core.
-  Dean Formation: muscovite-biotite schist.
-  Dean Formation: biotite-rich metaarkose.

CTS = Count Per Second, Gamma Log.
 MV = Millivolts, Spontaneous Potential Log.
 EOH = End of hole, depth below surface.