Graves Mountain
and
Magruder Mine
Wilkes and Lincoln Counties, Georgia

Southeastern Geological Society
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April 23-25, 1999

Compiled and Edited by:
Marc V. Hurst and Cornelis Winkler III
GRAVES MOUNTAIN AND MAGRUDER MINE

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LOCATIONS OF GRAVES MOUNTAIN AND MAGRUDER MINE
Graves Mountain is a metavolcanic monadnock located approximately 5 miles Southwest of Lincolnton, Georgia. The site was mined for refractory kyanite from 1963 until the mid-1980's. Although active mining has ceased, the present owners, ABB, maintain an active reclamation program, and treat the runoff water to neutralize the acidity and precipitate the iron hydroxides formed from pyrite oxidation. The dominant rock is pyrite-sericite-kyanite-quartz, commonly referred to a kyanite quartzite. Graves Mountain is world renowned for mineral specimens, primarily rutile and lazulite crystals. At the present time Graves Mountain may be the most heavily visited mineral collecting locality in the Southeast.

Mineralogical investigations, mostly German, were carried out in the late 19th century, with lazulite and rutile crystal drawings appearing in the classic mineralogy texts. It was said that $20,000 worth of rutile specimens had been distributed to collections throughout the world by 1892. Several outstanding rutile finds have been made in the past few years, producing world class specimens. Additionally, at least 25 mineral species have been identified, many of interest to micromounters and species collectors.
Graves Mountain is a well known locality formerly mined for kyanite by Combustion Engineering. The mine was developed in a quartz-kyanite rock that is also rich in pyrite, pyrophyllite, rutile, and lazulite. The area is probably best known for the world class rutile crystals found there, but is also noted for specimens of lazulite and pyrophyllite. Until recently little attention was paid to the secondary phosphates and phosphosulfates present in the kyanite-quartz-lazulite rock. To date the area has yielded: lazulite, woodhouseite, variscite, strengite, phosphosiderite, cacoxenite, crandallite along with accessory quartz, pyrite, pyrophyllite, dickite, jarosite and sulfur crystals. Except for the lazulite, these are all micro crystals and are found in cavities that have distinct angular shapes, possibly reflecting where anhydrite was corroded and dissolved. Many of the species form pseudomorphs, notably crandallite, woodhouseite and phosphosiderite after lazulite and phosphosiderite after pyrite.
Phosphate Minerals

Lazulite:

Lazulite was one of the early minerals recognized at Graves Mountain and specimens were distributed worldwide over 100 years ago. Crystals to several inches are known, but the majority are under 2 centimeters in size. Two distinct types of specimen material are known. There is a gray hard kyanite-quartzite that contains lazulite crystals, and there is a whitish friable kyanite-quartzite that appears more like a sandstone. The latter yields, by far, the best crystals, but is no longer exposed in the mine area. While weathering would be considered a prime candidate for the friable matrix of these lazulites, there is little evidence that they have been altered and it is likely that the quartzite was not cemented or had the cement removed by some other process. Friable material containing highly altered lazulites and heavily stained with iron oxides was recovered in 1969, lending further credence to a non-weathering origin. The hard gray lazulite rock is in demand for lapidary material and also contains the vuggy material that yields unusual micromounts.

Variscite:

Variscite was not recognized as occurring at Graves Mountain until relatively recently. Prismatic green and colorless crystals to several millimeters occur in seams and vugs sporadically distributed in the kyanite-lazulite-quartzite unit. The colorless crystals are almost iron free. Early specimens of the green colored material were identified as wavellite, but no wavellite has been confirmed from Graves Mountain.
Rarely variscite is found as prisms on large quartz crystals in the quartz veins cutting the lazulite unit. Variscite is also a component, along with woodhouseite and crandallite of the white altered portions of lazulite crystals.

**Woodhouseite:**

Woodhouseite crystals were identified by XRD in 1991 and have since been recognized as a widespread component of the kyanite-lazulite-quartzite. The crystals are up to several millimeters in size and usually light tan in color. The woodhouseite is often an inclusion in variscite crystals, forms alteration zones in lazulite and also alters to chalky masses of crandallite.

**Strengite:**

Strengite was only recently collected as rather large pink prismatic crystals lining a vein in a very weathered kyanite-lazulite-quartzite boulder on the dump of the East pit. The crystals have not yet been analyzed, but the distinctive sword shape and pink color suggests that they are strengite.

**Phosphosiderite:**

In 1969, on the last organized field trip into the active mine, the author located a zone of granular, weathered, iron stained kyanite-lazulite-quartzite that contained corroded lazulite crystals and casts after lazulite. Most of the corroded lazulite had been converted to brilliant sulfur-yellow jarosite and transparent, light pink crystals of phosphosiderite. Despite numerous requests to collect more, the material was all run through the plant and only the sparse samples collected in 1969 were preserved.
Cacoxenite:

Weathered kyanite-lazulite-quartzite on the dumps of the East pit has yielded a few small cavities with tiny "puff-balls" of yellow cacoxenite fibers.

Crandallite:

Crandallite forms much of the white, chalky alteration product of the lazulite crystals. Some anhydrite (?) casts in the lazulite zone contained botryoidal crusts of crandallite and a few specimens exhibited tiny scalenohedral crystals coating the surfaces.

Accessory Minerals

Quartz:

Tiny clear quartz crystals typically line the casts found in the lazulite zone. The most interesting specimens are overgrowths on grains of blue quartz in the original quartzite that give the crystals a distinct translucent blue color. Inclusions of rutile and pyrite are common.

Kyanite:

Rare transparent blue crystals of kyanite are sometimes found in the casts, but most of the kyanite is altered to pyrophyllite and dickite.

Pyrite:

In places, excellent cubes and cubo-octahedrons of pyrite are found perched on the quartz and kyanite. Most of the pyrite is massive and contained in the quartzite groundmass and not in the cavities.
Rutile:

Tiny black to deep red blebs of rutile are found in the cavities, but are very seldom found as good crystals. While the larger rutiles are superb, good micromounts of rutile are rare at Graves Mountain.

Pyrophyllite:

Clear greenish prisms of pyrophyllite are common in the casts, but the pyrophyllite is extremely brittle and usually bridges any open cavities. Rare intact crystals are among the finest micros of pyrophyllite known.

Dickite:

Much of the interior of the casts is coated with a colorless micaceous material that proved to be dickite when analyzed. Some of the crystals form distinct pseudohexagonal platelets and are exceptional, if small, crystals of a true "clay" mineral.

Jarosite:

Crystals of jarosite ranging from sulfur yellow to deep brown are not uncommon in weathered portions of the lazulite zone. Yellow and pink pseudomorphs of jarosite and phosphosiderite after lazulite have been found and yellow pseudomorphs after pyrite crystals are not uncommon.

Sulfur:

Tiny transparent yellow crystals of sulfur are found in pyrite rich samples in the lazulite zone. They are hard to observe because of their size and transparency, but have been confirmed by X-ray analysis (and the fact they melt and evaporate in an electron beam!)
The Southern Appalachians were first subdivided on a geomorphological basis. Later they were subdivided into "belts" based on lithologies, structure, tectonostratigraphic assemblages, and metamorphic grades. From northwest to southeast these "belts" are the Cumberland Plateau, Valley and Ridge, Blue Ridge, Brevard fault zone, Inner Piedmont, Middleton-Lowndesville fault zone (Central Piedmont suture of some authors), Carolina Terrane (formerly Charlotte Belt and Slate Belt), Modoc fault zone (a suture for many authors), Kiokee belt, and Uchee belt. Graves Mountain is located within the Slate Belt.

The Piedmont is a wide lithotectonic belt consisting of a stack of nappes verging to the northwest. It is made up of paragneisses and orthogneisses, amphibolites, calcsilicate granofels, minor schists, quartzites, and iron formations. The Brevard fault zone and the Middleton-Lowndesville fault zone mark the northwest and southeast boundary of the Inner Piedmont.

The Charlotte belt is composed of gneisses, schists, amphibolites, and minor quartzites and aluminosilicate schists. These lithologies are intruded by a variety of pre- and post-kinematic plutons.
The Slate belt (commonly known as the Carolina Slate belt) is predominantly of volcanic origin. The main lithologies are dacites, dacitic pyroclastics, basaltic tuffs, pillowed basalts, tuffaceous argillites, pumice lapilli tuffs, argillites, minor quartzite (metachert) and iron formation. Cambrian fossils have been reported from a few localities. The grade of metamorphism varies from greenschist facies to amphibolite facies. Recent work by Mark Colberg at UGA (dissertation in progress) suggests that some of the rocks with a low grade appearance have suffered (or enjoyed?) high pressures and temperatures. The rocks of the Slate Belt originated in an island arc located in the proto-Atlantic and have been accreted to the North American craton. The rocks have been dated by many methods and most ages are around 560 Ma.

The relationships between the Charlotte belt and the Slate belt remain one of the major problems of Piedmont geology. Some authors proposed an unconformity, others a thrust, and others a gradational increase in metamorphism associated with the emplacement of the numerous plutons found in the Charlotte belt.

Allard and Whitney found a large number of small ultramafic bodies throughout their map-area. They generally lack metamorphic haloes and aeromagnetic signatures, in spite of the fine-grained magnetite accompanying the serpentinization process. These bodies are flat lying klippen and erosional vestiges of the Russell Lake allochton.

Graves Mountain Local Geology

The Lincolnton metadacite body outcrops approximately two miles north of Graves Mountain. It is a large elliptical body of felsic quartz porphyry with interbedded minor pyroclastic and sedimentary units. It is cut by many dikes varying in composition from andesite
to dacite. The Lincolnton metadacite probably represents a major subaqueous volcanic eruptive center associated with the surrounding metapyroclastic lithologies. The metadacite is a white rock containing phenocrysts of blue-gray quartz and saussuritized plagioclase in a fine to medium-grained matrix of quartz and feldspar. Chlorite, biotite, or hornblende are common mafic accessories.

Mafic metavolcanic units are present but make up only a small proportion of the lithologies. Amphibolites with preserved pillow structures, amygdules, and hyaloclastic textures have been observed. They are composed of plagioclase, chlorite, amphibole, epidote, sphene and iron-titanium oxides. With increasing grade, chlorite disappears, albite changes to oligoclase and andesine, and the amphibole goes from actinolite to hornblende. Quartz-epidote granofels form a distinct lithology, very resistant to erosion, occurring as abundant float blocks. The origin of the granofels is problematic, probably the metamorphism of altered rocks.

Metapyroclastic lithologies form one of the more voluminous sequences in the Slate belt. At low grades of metamorphism, they are very easy to identify. The most common types are the crystal tuffs, crystal-lithic tuffs, vitric tuffs, pumice lapilli tuffs, and blocky tuffs. The rocks of the Slate belt have a pronounced axial plane cleavage (hence the name) and, depending on the position within the folds, the clastic elements are flattened within the cleavage planes. Pumice is especially easy to deform and one can recognize without any doubt the flattened pumice which appears as large white fingernails within the plane of foliation and as thin white lenticular bodies when viewed across the foliation. The blocky tuffs are spectacular along certain stream beds and on the shores of Thurmond Lake (formerly Clark Hill Lake).
A number of features including graded bedding, interbedded metacherts, meta-argillites, iron formation, volcanic metagreywackes, suggest that the metapyroclastic sequence was deposited subaqueously. No evidence of welded tuffs was found to suggest subaerial deposition.

Numerous horizons of quartz-sericite schists and quartz kyanite granofels have been mapped. They are easy to explain and the same explanation can be used for Graves Mountain: the original pumice lapilli tuffs are porous and act as reservoirs and aquifers for synvolcanic hydrothermal fluids. The migration of those fluids leach the alkalies leaving an altered protolith which is metamorphosed to aluminosilicates, quartz, and muscovite. Pyrite is commonly added to the system and gives a purplish tint to those schists. With increasing grades of metamorphism, the most heavily leached horizons become quartz-kyanite schists and quartz-sillimanite schists.

Graves Mountain

Graves Mountain is the result of metamorphism of a hydrothermal alteration system located within the felsic metapyroclastic lithologies of the Slate belt. Graves Mountain has an average N 70 E strike and consists of interbedded and somewhat lensoidal kyanite granofels (improperly called quartzite by many authors because of the high quartz content) and sericite schist (with or without kyanite). The individual granofels units vary in thickness from 6 to 50 feet.

The principal lithology exposed at the mine is pyritiferous kyanite granofels. Relic quartz phenocrysts suggest that the rock formed by replacement of pre-existing crystal (quartz, feldspar) vitric (quartz, sericite, feldspar) tuffs. The protolith of the kyanite granofels was an assemblage of quartz, kaolinite (or other clays) and pyrite. Chemically, the replacement involved
leaching of Ca, Mg, Na, and to a lesser extent K. Numerous pods of massive quartz suggest that an extensive network of cavities existed during the hydrothermal leaching of the pyroclastics. Silica precipitated in the cavities. Locally, filling was incomplete, which accounts for vugs lined with large quartz crystals. Sulfur, phosphate, fluorine, barium, and titanium were introduced because pyrite, lazulite (hydrous iron-magnesium aluminum phosphate), topaz, barite, and rutile are notably more abundant in the kyanite granofels than in the surrounding pyroclastics (for more details on this process, see Allard and Carpenter, 1988). Note that the Al-enrichment is due to an alkali loss and not to an Al gain. A complete list of potential minerals to be found within such a metamorphosed hydrothermal system can be found in Allard and Carpenter.

Pyrophyllite has replaced the kyanite granofels, especially along faults and fractures. Gem-quality rutile crystals occur locally on the mountain. Very fine disseminated rutile crystals are ubiquitous in the kyanite granofel.

The quartz sericite schist horizons are also associated with banded iron formations (fine grained quartz and magnetite), and manganese deposits. Small amounts of massive sulfide have also been reported associated with such horizons. These altered and leached deposits are to be related to exhalative hydrothermal systems similar to those described at Otake, Japan, and to many mining camps throughout the world.

A map of the Slate belt and the location of Graves Mountain on strike with the many gold mines in the Carolinas (Barite Hill, Haile, Ridgeway, Brewer) brings up the gold question. Graves Mountain was mined for kyanite and the pyrite concentrate was sold to glass manufacturers to make green beer bottles. Bob Carpenter analyzed the pyrite concentrates and reports that the gold assays varied from 0.1 to 0.5 oz/ton. But selling the pyrite without having to use cyanide to extract the gold was more economical.
REFERENCES

NOTE: These notes were taken mostly from three sources which contain all the necessary bibliographies which will not be repeated here.


Introduction

The purpose of this report is to describe the geology and gold/base metal potential in the vicinity of the Magruder Mine and Chambers Prospect in Lincoln and Wilkes Counties, Georgia.

Location and Access

The Magruder Mine property (27.6 acres owned in fee simple surrounded by 901 acres of leased mineral rights), lies seven (7) miles west and slightly south of Lincolnton, the county seat of Lincoln County near the county line of Lincoln and Wilkes Counties. (See location map, Fig. 1). Figure 2 is a site map prepared by W.H. Fluker, an early worker in the area.

Description of Property

The property consists of 27.6 acres of fee simple land owned by Southeastern Explorations & Resource Management, Inc., Thomson, Georgia and is surrounded by 901 acres of leased mineral rights from which the surface ownership has been severed. Several land owners own the surface rights but additional research must be done to determine their exact location and present ownership.
History and Exploration to Date

Gold was first discovered in the stream that is now called Mine Branch Creek prior to 1850. Thomas Seay purchased approximately 900 acres in the vicinity about 1855 and later sold an interest to George Magruder. Initially the stream was worked for placer gold by sluice washing, and later, some time prior to the Civil War, gold was found along the Magruder vein. The operation was worked by slave labor intermittently and was known as the Magruder Gold Mine from 1852 until the Civil War caused operation to be suspended in 1861.

About 1874, Mr. Jackson of Atlanta, Georgia, bought the property. Under his supervision, a 125' shaft was sunk northwest of surface workings of the Magruder vein, and was connected to the vein by a 30' crosscut. A tunnel intended to drain these workings was started from the creek by the millsite and continued for 600 feet before stopping, cutting several mineralized zones. One of these zones, known as the Wardlaw (Wardlow) vein, was drifted and stoped by Jackson. Portions of the tunnel constituted part of the 90' level. This period of mining probably lasted until 1884. An unknown quantity of lead and copper (concentrates?) along with gold was reported shipped during this time.

Mining was next resumed by Carl Henrich, who organized the Seminole Mining Co. in 1900, after purchasing the property in 1897. Mining continued until some time prior to 1908. About 1910, Henrich disorganized the company, retained mineral rights to the total acreage, and sold all of the property but 27 acres in the vicinity of the mine.

Operations of the Seminole Mining Company included additional drifting along the Magruder vein and sinking a 3-compartment shaft to a depth of over 200' just north of the Wardlaw vein, with drifting and stoping from the 90', 125', 145', and 185' levels. The work on
the 145' level included a 285' crosscut to what was thought to be the Magruder vein, with a 70' drift along the vein. Ores were mined from the Magruder, Wardlaw, and Findley veins and processed through a 40-ton concentrating mill where the ore was crushed, passed over roller mills, and concentrated with Bartlett tables. Galena concentrates were separated with a Century jig. The concentrates were processed through a combined roasting and smelting furnace (approx. 15' x 40') and a 15-ton blast furnace. Copper, gold, and silver were secured in the mattes, which were shipped by team to the nearest railroad (15 mi.) in Washington, Georgia. Ore minerals included gold, pyrite, chalcopyrite, galena, and sphalerite, but the Seminole Mining Co. was best known as a copper producer.

In 1916, rail access was reduced to less than one mile (Lovelace, Georgia) when the Washington-Lincolnton Railroad was built.

In August, 1917, the property was purchased from Carl Henrich by the Georgia Copper Co. (M.N. Whitaker of Lincolnton, Ga., as president) for $50,000 plus $100,000 stock in the company. Henrich initially managed the mine for Georgia Copper, but after his death in 1917, management was turned over to C. W. Renwick, formerly of the Tennessee Copper Co., and later (Jan., '22 - Oct., '23) to R. J. Rundle. By 1918, dewatering of the underground workings and erection of a mill and mine plant designed to handle 300 tons of ore per day had begun, with a mine ore to concentrate ratio of 3 to 1. Copper-lead concentrates with gold and silver were being produced by 1920. And in 1921 cost per ton was estimated at $13.75 with a smelter return of $40.00. Mining continued until 1926 when the Washington-Lincolnton Railroad was discontinued. By 1928, the underground workings were under water and the mill had burned to the ground. Whitaker died in 1929 and the property passed to the National Bank of Wilkes in Washington, Georgia.
Operations of the Georgia Copper Co. at the Magruder Mine included deepening the main shaft to 285', crosscuts of 480' and 90' on the 200' (185') level, and stoping on the Wardlaw vein from the 145' level to within a short distance of the 90' level. Approximately 30 cars of concentrates were shipped during this period with an average profit of $20 per ton. Five "veins" were recognize at that time. From NW to SE, they were the Magruder, Murdock, Seminole, Findley and Wardlaw.

J. D. McCall, who bought the property in 1938 and operated it until 1940, shipped two or three cars of massive galena from the Magruder vein. From January to June, 1954, the J. T. Hanvey Mining Corp. dewatered the mine and cut several drifts and crosscuts to test for sericite mining potential.

Since 1954, the ownership and mineral rights have changed hands several times, but no additional mining has been conducted. The mine was diamond drilled in 1948-1949 by the U.S. Bureau of Mines (six holes totaling 2678'), and in 1955-1956 by Tennessee Copper Co. (three holes totaling 2712'). CONOCO drilled (four holes totaling 2680') in the mine vicinity in 1974.

On November 10, 1980, AMAX Exploration, Inc., leased the property from J. T. Hanvey of Fort Meyers, Florida and carried out a program of geologic mapping on a scale of 1"= 100' and collected approximately 200 rock chip and soil samples. In 1984, they dug 1145' of backhoe trench which was sampled on 5' intervals for a total of 229 rock chip samples. and developed a large (1200' x 1000') gold soil/rock chip anomaly which is open-ended to the west and northwest. Also, a magnetic survey was conducted.

The lease was terminated on June 3, 1985 by AMAX without drilling to test the gold potential of the previously mentioned soil and magnetic anomaly. AMAX was caught-up by the
Great Mining Depression of 1982-1987. They ceased all exploration activities in the Southeast; and tried and failed to find joint venture partners that would drill the property.

Geology of the Property

The Magruder Mine area lies within the Little River series of the Georgia extension of the Carolina Slate belt which is comprised predominately of metavolcanics and volcanioclastics and is considered to be a major center of Cambrian felsic volcanism named the Lincolnton Metadacite (See Fig. 1).

The seven individual rock types recognized and mapped on 132 acres of the mine area by AMAX geologists during 1983 and early 1984 are briefly described below in Table 1, in probable order of decreasing age.

Table 1. Rock Types Recognized by AMAX

<table>
<thead>
<tr>
<th>INTRUSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Mafic Feldspar Porphyry</td>
</tr>
<tr>
<td>(2) Intermediate Amphibole-bearing Intrusion</td>
</tr>
<tr>
<td>UPPER VOLCANIC UNIT</td>
</tr>
<tr>
<td>(1) Upper Volcanic Crystal Tuff, Unmineralized</td>
</tr>
<tr>
<td>LOWER VOLCANIC UNITS</td>
</tr>
<tr>
<td>(2) Broad Zone of Quartz-Sericite-Schist. Possibly a Stockwork mineralized and altered zone associated with Kyanite Formation. LVS-1r indicates a subzone of LVS-I of Gossanous Quartz-Sericite Schist Containing Randomly Oriented Micas.</td>
</tr>
<tr>
<td>(3) Quartz-Sericite-Kyanite Schist. Altered Volcanic Rocks.</td>
</tr>
</tbody>
</table>
Mineralization

The mineralized zone at the Magruder Mine is approximately 300 feet thick and the rock exposed at the surface consists of pyritic, siliceous, locally highly chloritized, sericitic vitric tuffs and cherts. Since the surface of the mine area has been trenched and test pitted along all known or suspected mineralization, no present surface exposure of the mineralized horizons exist.

However, most of the mine dumps contain mineralized siliceous pyritic sericite tuff, and one sample from the dump of the Jackson Shaft, probably ore from the Magruder "vein" contains interbedded horizons of quartz-barite, pyrite, pyrite-galena, and pyrite-sphalerite-galena.

Watson (1904), Jones (1909), Weed (1911), Fluker (1923) and Rundle (1942) provide first hand descriptions of the underground ore zones. Base/precious metal minerals noted in the literature include native gold, auriferous pyrite, argentiferous galena and chalcopyrite, galena, chalcopyrite, sphalerite and gahnite. Minerals attributed to secondary weathering include tenorite, malachite, pyromorphite, azurite, covellite, bornite, chalcosite, azurite, anglesite and native copper. Solid masses weighing hundreds of pounds composed of chalcopyrite-galena, and up to sixty pounds of native copper have been reported.

Drilling by the U. S. Bureau of Mines (6 holes) and by Tennessee Copper Co. (3 holes) in the mine area did not intersect massive mineralization, but did encounter many mineralized horizons with locally abundant Au, Ag, Cu, Pb, and/or Zn.
Geochemistry

AMAX's 156 soil geochemical samples resulted in the delineation of an area of gold mineralization on the Magruder Mine area. Most of the gold values are above 0.10 ppm and define a "Horseshoe Crab" shaped anomaly 1200 feet long by 1000 feet wide over the Quartz-Sericite Schists units. To the northwest the long axis of the "crab" strikes East and Northeast and the "tail" trends Southwest.

The gold in soil anomaly is further confirmed by approximately 50 rock chip samples taken from outcrops and mine dumps. A 900 foot long by 500 foot wide, NE by SW trending gold anomaly contains values ranging from a low of .016 ppm to a high of 8.2 ppm. Past drilling by the U. S. Bureau of Mines and Tennessee Copper Company will be discussed in the section entitled "Drilling".

Hurst, Crawford, and Sandy (1966) put in a 10,500 foot long E-W baseline and approximately 50,000 foot soil sampling grid to cover the Magruder Mine area, the Chambers Prospect and all the intervening area. Grid lines were run N-S 200 feet apart. Samples were collected at 200' intervals along the grid lines.

Strong anomalies were obtained for both copper and zinc. The largest is in the Magruder area. The anomalies extend to the northeast across Mine Branch Creek from the old workings and present placer workings into an area where no signs of prospecting are evident.

The copper and zinc anomalies in the Magruder area are the largest and strongest obtained anywhere in the CSRA. While the anomalies in the vicinity of the old workings have been drilled, (with generally poor core recovery, therefore poor samples were assayed) those to
the northeast and the northwest have not been explored. Obviously these anomalies represent excellent drilling targets for future work. No analysis for gold was done on these samples.

**Geophysics**

A ground magnetic survey was conducted by AMAX personnel during 1974 across the area of the gold soil geochemical anomaly previously discussed. The lines were spaced approximately 200 feet apart and the readings were taken at 50 foot intervals. This work indicated the presence of a large magnetic low which closely matches the altered and mineralized quartz-sericite schist as shown on the 132 acre geologic map of the Magruder Mine area.

However, a large 700 gamma "Low" indicates additional alteration is present South of the known mineralized area. Further geophysical work and expansion of this grid is recommended.

**Drilling**

From December 3, 1948, to June 23, 1949, the U. S. Bureau of Mines diamond drilled 6 holes on the Magruder Mine property. A total of 2,678 feet of 45 degree angle holes was drilled with an average total recovery of 85.6% for the cored portion of the holes. Due to the soft weathered material and (now obsolete coring tools) coring began at 120 feet in BM-1, 75 feet in BM-2, 100 feet in BM-3, 70 feet in BM-4, 100 feet in BM-6, and 50 feet in BM-7. Proposed hole BM-5 was not drilled. Only 70 samples were taken from selected galena, sphalerite and chalcopyrite mineralized zones and all were analyzed for Cu, Zn, Pb, Au, and Ag.
Hanvey Mining Corporation employed Mr. Lendall P. Warriner, Mining Engineer, to prepare a report on the Magruder Mine, dated September 23, 1954. Mr. Warriner also relogged the cores of Holes BM-1, 2, 3, 4, 6, and 7 at the Bureau of Mines Experiment Station, Mt. Weather, Virginia. A summary of the best assays are shown in Table 1.

Table 2. Summary of the Best Assays

<table>
<thead>
<tr>
<th>DRILL HOLE</th>
<th>FOOTAGE</th>
<th>%Cu</th>
<th>%Zn</th>
<th>%Pb</th>
<th>oz Au</th>
<th>%Ag</th>
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<td>3.12</td>
<td>3.86</td>
<td>0.09</td>
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<td>6.7</td>
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<td>0.02</td>
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<td>4.0</td>
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<td>0.03</td>
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<td>BM-2</td>
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<td>0.06</td>
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<td></td>
<td>5.0</td>
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<td>0.07</td>
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<td>0.03</td>
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<td>1.4</td>
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<td>0.9</td>
<td>0.42</td>
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<td>BM-4</td>
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<td>1.22</td>
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<td>BM-6</td>
<td>7.0</td>
<td>0.104</td>
<td>0.6</td>
<td>0.035</td>
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<td>7.2</td>
<td>0.031</td>
<td>0.087</td>
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<td>BM-7</td>
<td>NO SAMPLES TAKEN</td>
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The best intercept is in Hole BM-2 from 355.0 to 368.8 feet and assayed 13.81 feet @ 0.65 oz/ton Gold. Hole BM-3 contained 10 feet @ 0.32 oz/ton Au from 270.0 to 280.0 feet. Virtually all samples contained values ranging from 0.01 to 0.08 oz/ton Au. Poor core recovery, intermittent non-continuous sampling and unknown assay methods all contribute to the lack of
credibility for this data but it leaves no doubt that ore-grade gold mineralization exists and that modern drilling and sampling techniques will encounter a large tonnage of disseminated gold in quartz-sericite host rock.

CONOCO drilled four core holes (totaling 2689') in the mine vicinity in 1974. No analytical data is available at this time.

**Exploration Potential**

An area of 132 acres, or approximately 1/4 of a square mile, has been mapped on a scale of one inch to 100 feet. Soil and rock geochemical surveys have been accomplished on this small area. Copper and Zinc soil anomalies indicate that a much larger (greater than one square mile) area has excellent potential for additional drill targets to the east and west of the known mineralized Magruder Mine area. A ground magnetic survey indicates the presence of hydrothermal alteration in the known area as well as additional alteration to the south.

Nine diamond drill holes, containing a total of 5,390 feet, have been drilled into the gold geochemical and magnetic anomaly, but only 70 sporadic samples were taken and analyzed for gold in the late 40's and mid 50's using unknown analytical methods. These assay results indicate however, that ore-grade gold mineralization exists and that modern drilling and sampling techniques will encounter a large tonnage of disseminated gold with high grade zones of gold and base metals present. In view of the positive results obtained from all past and present geological mapping, geochemical, geophysical, and drilling exploration programs conducted on the Magruder Mine area, the potential for the discovery of an 8 to 10 million ton ore-body with 150 to 250 thousand ounces of contained gold makes the Magruder Mine project into an
excellent drill target. Although the placer gold deposit in Mine Branch Creek has been excluded from this report, it too has the potential for producing at least 25,000 ounces of gold.

REFERENCES


Sibley, M.J., 1982, Geology of the Magruder Mine-Chambers Prospect Area, Lincoln and Wilkes Counties, Ga.: Thesis submitted to the Graduate Faculty of the University of Georgia in partial fulfillment of the requirements for the degree Master of Science, Athens, Ga.


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Figure 1. Map showing the regional geologic setting of the Magruder Mine and other deposits in the Lincolnton-McCormick district of South Carolina and Georgia. Adapted from Carpenter, 1982; Secor, 1987; and Butler and Secor, 1991.