THE RUTHERFORD MINES, AMELIA COUNTY, VIRGINIA

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The vicinity of Amelia Court House, Virginia, has long been known as one that abounds in pegmatite dikes containing rare and unusual minerals. Since the first extensive account of the locality by Fontaine[1] in 1883 nearly forty papers have been published on various phases of the mineralogy of this region. The papers were either of a very general nature or restricted to the description of a particular mineral or group of minerals found. The purpose of the present paper is to review the geology and mineralogy of the deposits that have yielded so many minerals and to report certain new information, a recent survey having shown that the rare minerals for the most part are confined to two dikes at the Rutherford Mines and are not found in the greater number of dikes nearby. From the two dikes at the Rutherford Mines thirty-three species of minerals have been reported, while from the other dikes of the area only half a dozen or so varieties are known. The famous Amelia Court House mineral locality is really restricted to the dikes at the Rutherford Mines.

The locality is in the Virginia Piedmont a moderately dissected plateau without any marked elevations. The rocks enclosing the pegmatites are of pre-Cambrian age, the prevailing type being a biotite gneiss. Diorite and diabase dikes occur to a limited extent. The gneiss has a porphyritic to "augen" texture and a well developed gneissosity which has a general northeast strike that averages N 33°E.

An approximate mineral composition as determined by micrometer measurements is: feldspar 60 per cent, quartz 24, biotite 11, muscovite 3, garnet 1 and accessory minerals 1 per cent. A chemical analysis shows the gneiss to be between a sodipotassic *dacase* with the subrang name *adamellose* and a sodipotassic *monzonase* with the subrung name *monzonose.*

The Rutherford Mines are located one and one-fourth miles north of Amelia and one mile southwest of the main producing area in this district. The mines consist of two openings about

[1] Fontaine, W. H. Notes on the Occurrence of Certain Minerals in Amelia County, Virginia. *Am. Jour. Sci.*, **25**, pp. 330–339 (1883).

300 feet apart along a north-south line and are located on two parallel dikes that average 30 feet wide and are traceable along the strike for nearly one-fourth mile. The strike is east-west and the dip nearly vertical. The mines have not been operated in the last 40 or 50 years and the openings at the present time are nearly filled. In one of the openings there is a pond of water 150 feet long and 50 feet wide. It is reported that the deepest workings extended to a depth of 150 feet. Many mineral species can still be obtained from the dumps.

The prevailing texture of the pegmatites in these deposits is different from that of the other pegmatites in this area. The texture is determined largely by the principal mineral, albite, which occurs as beautifully crystallized, platy, reticulated, fragile masses. The rare and unusual minerals occur in the interstitial spaces. In addition to this texture there are occasional graphic intergrowths. Miarolitic cavities usually lined with quartz crystals are sometimes developed. A fourth kind of texture results from parallel growths of green microcline and muscovite. Occasional inclusions of the enclosing rock, biotite gneiss, occur along the contact. The dominant texture developed in the other dikes in this vicinity is pegmatitic, with occasional graphic and perthitic intergrowths. The nearest approach to the reticulated texture prevalent in the two dikes at the Rutherford Mines is a cellular texture developed in some of the dikes on the Jefferson property, about two miles northeast of these mines. Here the cell walls are of albite and are lined inside with small crystals of muscovite.

The minerals reported from the pegmatite dikes at the Rutherford Mines are given below. Those starred can be collected at the present time.

*Albite, three varieties
*Microcline, two varieties
*Muscovite
*Lepidolite
*Biotite
*Quartz, three varieties
*Garnet, three varieties
*Orthoclase
*Oligoclase
Fluorite
Apatite
Columbite
Allanite
Fergusonite
Topaz
*Tourmaline
*Beryl
Zircon
Ilmenite
Galena
Stibnite
Pyrite
Cerussite
Anglesite
*Calcite
*Hatchettolite

*Microlite	*Cyrtolite
*Manganotantalite	*Leverrierite
Monazite	Pyrochlore
Helvite	

Mineralogical Notes

Albite, the most abundant mineral, exhibits three varietal forms. The first form is a beautifully crystallized, reticulated, snow white, nearly transparent variety. It occurs in cleavable masses of considerable size and contains other minerals, as microlite, in the interstices. The second form is a pea green platy albite known as cleavelandite and is of a high degree of purity. This variety is not found elsewhere in this area, nor has it been reported from any other dikes in the state. In the interstices of this mineral there is often an amber colored calcite, which has taken its form from that of the cavity it filled, indicating that it has been formed subsequently to the albite. The third form is a pure white albite with a blue sheen. Under the microscope numerous gaseous inclusions were observed, which may account for the color effect. Good specimens of all three varieties can be obtained at the present time. The indices of albite are as follows: $\alpha = 1.528$; $\beta = 1.532$; $\gamma = 1.539$.

Microcline has two varietal forms. The first is pink to cream colored and occurs as graphic intergrowths with quartz. The second form is amazonstone, with a range in color from pea green to deep blue green. This variation may be gradational or sharply divided. Professor Papish of Cornell University kindly consented to make a spectroscopic analysis of this unusual variety. He found in addition to those elements appearing in the chemical analyses of this mineral, sodium in amounts over two per cent, a trace of lithium and a very small trace of barium, caesium and thallium. This variety occurs intergrown with quartz and with plagioclase feldspar and as parallel growths with muscovite, the individual bands being less than a centimeter thick. The cleavage lines of the muscovite can be discerned on the surface of the microcline.

Orthoclase is the least abundant of the feldspars and forms intergrowths with the other feldspars and with quartz.

Quartz is present in three varietal forms. Two of the varieties, amethyst and cairngorm, are no longer present in the dumps. Amethyst of the gem variety was reported by Page.[2] Several

[2] Page, C. C., The Virginias, Vol. 6, pp. 24–25 (1885).

beautiful specimens of cairngorm are in the possession of Mr. Pinchbeck, a farmer who lives in this locality. It was also reported by Fontaine.[3] The third variety is a transparent to semi-transparent quartz with a greasy to watery appearance. It occurs intergrown with feldspar.

Muscovite has two varietal forms. The first form is an amber colored muscovite, which in thin sheets has a light brown color. This variety has furnished the commerical grade. It is reported that about 200,000 pounds were taken from these mines. Some of the largest sheets measured 22 by 24 inches. This variety occurs as books, pockets and flakes distributed through the feldspar. The second form is light green and occurs as flakes and small books associated with albite chiefly cleavelandite. There is associated with this variety the pink lithium mica, lepidolite. Biotite is present in small amounts near the contact and is probably derived from the biotite gneiss.

Garnet occurs in three varietal forms. The first form is a red almandite occurring near the contact, both in the wall rock and in the pegmatite. The second form is a reddish-brown spessartite. Some of the largest ones measured three inches in diameter. A gem cut from this mineral has been pictured by G. F. Kunz.[4] A third variety, topazolite, has been reported by Dana.[5] Only the first variety, almandite, can be found in the dumps at the present time.

Apatite has been reported from the Rutherford Mines, though none has been found in recent years. It occurred as translucent, white crystals with a shade of violet and with a vitreous luster. The mineral was quite fragile. When heated the mineral phosphoresced with a yellow light. The formula as computed from the analysis made by G. H. Rowan[6] was $Ca_3P_2O_4 \cdot 1/3CaF_2$.

Fluorite and its phosphorescent variety, chlorophane, were reported and described by G. F. Kunz.[7]

The rare minerals, microlite, columbite, allanite, monazite, fergusonite were reported and described by W. H. Fontaine.[8]

[3] Fontaine, W. H., *op. cit.*

[4] Kunz, G. F., Gems and Precious Stones of North America, p. 180.

[5] Dana, J. D., System of Mineralogy, 6th Ed., p. 1071 (1892).

[6] Rowan, G. H., *Chem. News*, Vol. **50**, p. 208 (1884).

[7] Kunz, G. F., Chlorophane of Amelia Co., Va., *Amer. Jour. Sci.*, Vol. **26**, p. 235 (1884).

[8] Fontaine, W. H., *op. cit.*

Chemical analyses of microlite, columbite and allanite were made by F. P. Dunnington and reported in the *Amer. Jour. Sci.* and the *Amer. Chem. Jour.* during the years 1881 and 1882. Helvite was first identified by H. C. Lewis. It was analyzed by R. Haines[9] and Sloan.[10] Manganotantalite was first identified from this locality by O. I. Lee and E. T. Wherry.[11] Of these rare minerals the writer was able to find only microlite and manganotantalite. The microlite was found as small octahedral crystals occurring in the interstices of the reticulated, platy, pale green albite. The manganotantalite was found with a similar mode of occurrence and was present as blade-like fragments of a reddish brown to black color. It had a specific gravity of 6.66.

The sulphides, galena, stibnite and pyrite, also the sulphate and carbonate of lead were reported by the earlier writers but none of these have been reported in recent years.

Tourmaline is quite frequent in its occurrence. It is present usually as radiating masses of columnar crystals included in quartz or in the gneiss along the contact. The masses are made up of columnar three sided, prismatic crystals of a jet black color that vary in size from six inches in diameter and several feet long, to those that have a hair-like form and size. No gem variety has been reported.

Beryl, of a bluish green to dingy yellow color, has been reported as occurring in crystals three to four feet long and eighteen inches in diameter. Specimens though not as good as these, are still obtainable.

Ilmenite has never been reported from these mines, though a specimen was presented to the late Dr. T. L. Watson, which was said to have been obtained here.

Zircon was reported from these mines by Watson[12] but no analyses were made.

Calcite occurs as a filling in the interstices of the crystalline masses of the blades of pea green cleavelandite. It is of an amber color and has assumed the shape of the cavity it fills showing that

[9] Haines, R., Analysis of Helvite from Amelia County, Va., *Amer. Jour. Sci.*, Vol. 24, p. 155 (1882).

[10] Sloan, B. E., *Chem. News*, vol. 46, p. 493 (1882).

[11] Lee, O. I. and Wherry, E. T., *Amer. Mineral.*, vol. 4, No. 7, pp. 80–83 (1919).

[12] Watson, T. L., Zircon Bearing Pegmatites in Virginia, *Amer. Inst. Min. Eng.*, Vol. 55, pp. 936–947 (1917).

it is later than the albite. Some of the largest crystals are a centimeter long and a half centimeter wide.

Cassiterite, hatchettolite, cyrtolite and leverrierite were reported by S. G. Gordon.[13]

Graphite was found by the writer in some of the smaller dikes nearby, as well as in the biotite gneiss, but none was found in these particular dikes.

Origin

The unusual texture and composition of the dikes at the Rutherford Mines can be explained best, it seems, as resulting from a replacement process as set forth by W. T. Schaller.[14] In this paper he writes as follows, "Pegmatites containing rare minerals are made up chiefly of albite which has replaced more or less completely the original feldspar." The pegmatites in the area nearby are of the usual pegmatitic texture. The feldspar is chiefly orthoclase and microcline, the latter predominating. It seems quite likely that the dikes at the Rutherford Mines were originally of a composition similar to those of the other dikes in the area. Later they were replaced by the soda feldspar. This replacement was accompanied by, or followed, by the introduction of such minerals as microlite, manganotantalite, etc. These rare minerals are always found in the interstices of the reticulated albite or partially embedded in the feldspar itself. Such minerals as calcite and leverrierite were formed still later.

[13] Gordon, S. G., Famous Mineral Localities, Amelia Court House, Virginia, *Am. Mineral.*, Vol. 3, pp. 27–29 (1918).

[14] Schaller, W. T., Mineral Replacement in Pegmatites, *Am. Mineral.*, vol. 12, pp. 59–63 (1927).