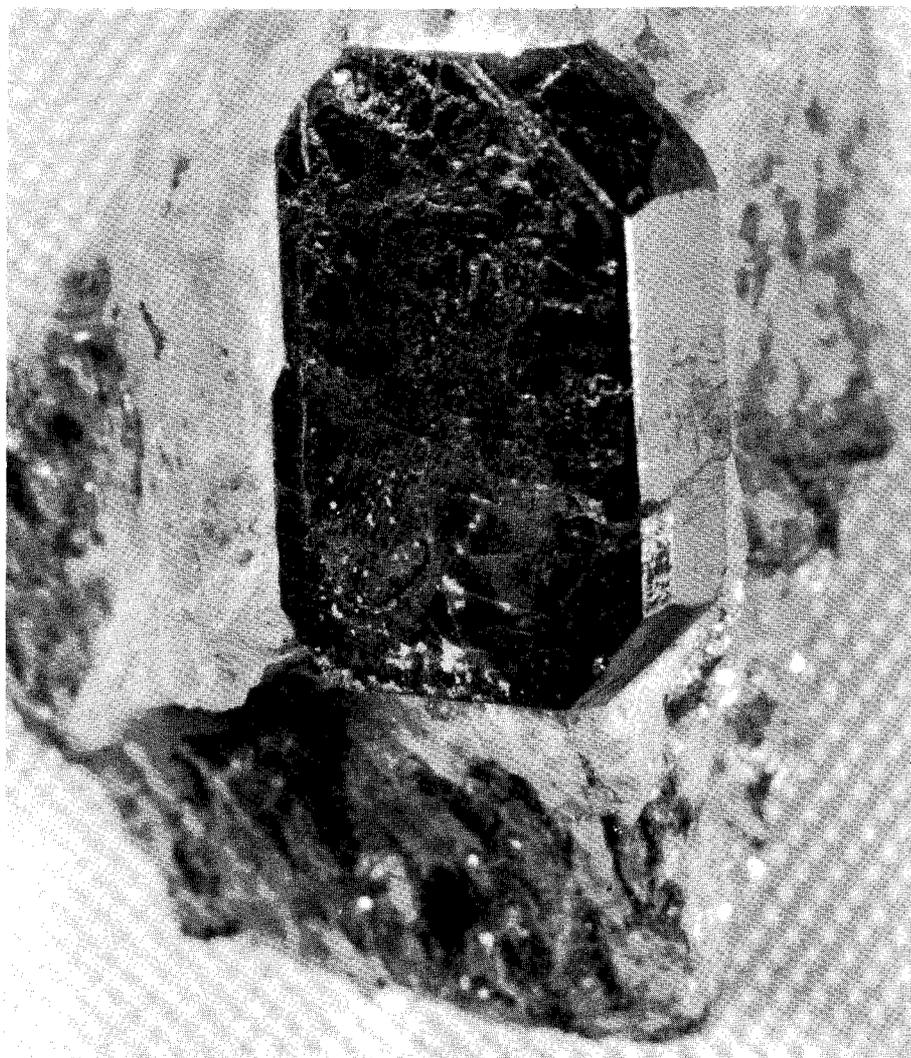


VIRGINIA DIVISION OF MINERAL RESOURCES
PUBLICATION 115

TANTALIAN AND NIOBIAN RESOURCES IN VIRGINIA

William F. Giannini
and
Palmer C. Sweet



COMMONWEALTH OF VIRGINIA

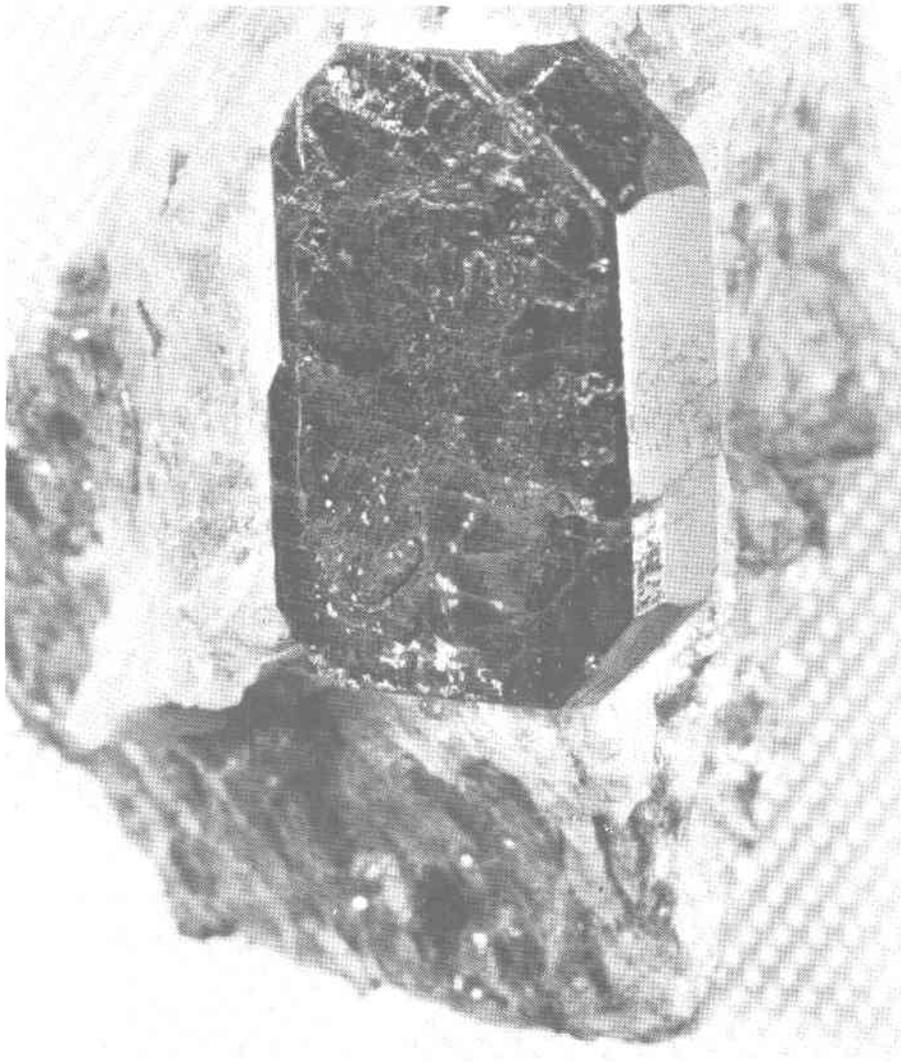
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINERAL RESOURCES
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FRONT COVER: Columbite-tantalite crystal from Mitchell Mine, Bedford County, Virginia (approximately 37 x 25 x 9 mm - photograph from R. V. Dietrich's collection).

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DEPARTMENT OF MINES, MINERALS AND ENERGY
RICHMOND, VIRGINIA
O. Gene Dishner, Director

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TANTALIAN AND NIOBIAN RESOURCES IN VIRGINIA

William F. Giannini and Palmer C. Sweet

ABSTRACT

Tantalum- and niobium (columbium)-bearing mineral series which contain the major sources of tantalian and niobian metals in Virginia are tantalite or columbite, wodginitite, and pyrochlore or microlite. Minerals that contain minor amounts of tantalum or niobium include euxenite or aeschynite, samarskite, fergusonite, cassiterite, and wolframite.

Seventeen samples from 11 sites in eight counties in Virginia were examined to identify the tantalian and niobian minerals; a maximum of 46.8 percent tantalum (Ta_2O_5) and 76.9 percent niobium (Nb_2O_5) was found in the samples. Brief descriptions of the sites as well as notes on production, exploration, and potential resources are included in this report. The appendix contains references to reported occurrences of tantalian and niobian minerals in Virginia.

INTRODUCTION

In Virginia, tantalum and niobium occur in pegmatites and with cassiterite and wolframite in a greisen at the Irish Creek tin mine, Rockbridge County. Tantalian metal is tough and durable with a high melting point and combines easily with other metals to form alloys that are strong and stable at high temperatures. Major uses of tantalum are for electronic components (capacitors), transportation, oil and gas industries (drilling equipment), and machinery. Niobium has its major uses in construction and transportation (ferrocolumbium by the steel industry and as an alloyed metal by the aerospace industry). Niobium is also used in the oil and gas industries and in machinery (Cunningham, 1991). The primary minerals from which tantalum and niobium are obtained are tantalite (Fe, Mn) Ta_2O_5 and columbite (Fe, Mn) Nb_2O_5 which are a series of iron and manganese oxides. When the amount of tantalum is high, the mineral is tantalite. When there is more niobium, the mineral is columbite.

Sample locations and sites are shown on a map of Virginia and also portions of 7.5-minute topographic maps (Figures 1-3, 5-10, 13, and 14). Table 1 gives results of the analyses of the 17 samples from 8 counties for this report. The appendix contains reported tantalian and niobian occurrences in Virginia.

It should be stressed that before attempting to visit a site on private property, one should make himself known to the owner and obtain permission. *Entering private property without permission violates trespass laws and is punishable under law.*

Tantalian minerals at the Morefield mine in Amelia County and the Herbb No. 2 mine in Powhatan County were examined by several companies in the early 1980s when the price of tantalite was high (Table 2).

SAMPLED LOCALITY DESCRIPTIONS

Rutherford Mine: The Rutherford pegmatite mine is located in Amelia County 0.95 mile north of Amelia Court House, 0.5 mile off the west-southwest side of State Road 609, approximately 0.3 mile by road north of its intersection with the U.S. Highway 360 by-pass. The location is shown on the Amelia Court House 7.5-minute quadrangle (Figure 2).

Three mines in the complex pegmatite have been worked for mica and rare and semi-precious stones, especially amazonite. Fontaine (1883) noted that the deposits may have been worked by Indians in prehistoric times. Earliest recorded mining was in 1873 for mica. Subsequently, mica was mined in 1894; amazonite was mined from 1908 to 1910 and in 1931; mica mining was conducted again in 1943 and in 1958-59. The mine was then opened to mineral collectors for a fee until the mid 1980s.

Two samples from the Rutherford mine, Table 1, numbers 1 (columbite) and 4 (pyrochlore or microlite), are described together with their chemical analyses. Sample 1 was obtained from the University of Virginia collection and sample 4 was donated by the Department of Mineral Sciences, Smithsonian Institution.

Morefield Mine: The Morefield pegmatite mine is located in Amelia County 3.8 miles east-northeast of Amelia Court House, 0.4 mile off the northeast side of State Road 628. The location of sample U.S.N.M. 108-386-1 is shown on the Amelia Court House 7.5-minute quadrangle (Figure 3).

This complex pegmatite has a proven length of 1000 feet, is 30 feet wide and is more than 200 feet deep; drill holes indicate that the pegmatite narrows with depth. The pegmatite was first mined in 1929 and in 1930 was worked for mica and feldspar. It was intermittently worked until 1940, Metals Reserve Company dug the Moorefield shaft in early 1942. In 1942 and 1943, the U.S. Bureau of Mines carried out experimental development and mining. The Bureau recovered about 500 pounds of placer beryl from an alluvial deposit south of the pit. In 1948, the Bureau of Mines leased the property from the owner, dewatered the mine, and deepened the Moorefield shaft to 115 feet (Figure 4).

Glass (1935) describes the zonation at the Morefield pegmatite as irregular but quite distinct with a middle zone (core) of quartz, an intermediate zone on both sides of the core, and a wall zone on each side bordering the intermediate zone and the country rock. Brown (1962) further noted that the core quartz is not everywhere present and locally, amazonite of the intermediate zone gives way to buff perthitic microcline, into which it is gradational. Crystals and masses of topaz, mica (zinnwaldite), phenacite, and beryl occur with perthite near or within quartz of the core. Tantalite and columbite occur in perthite of the intermediate zone. Lemke,

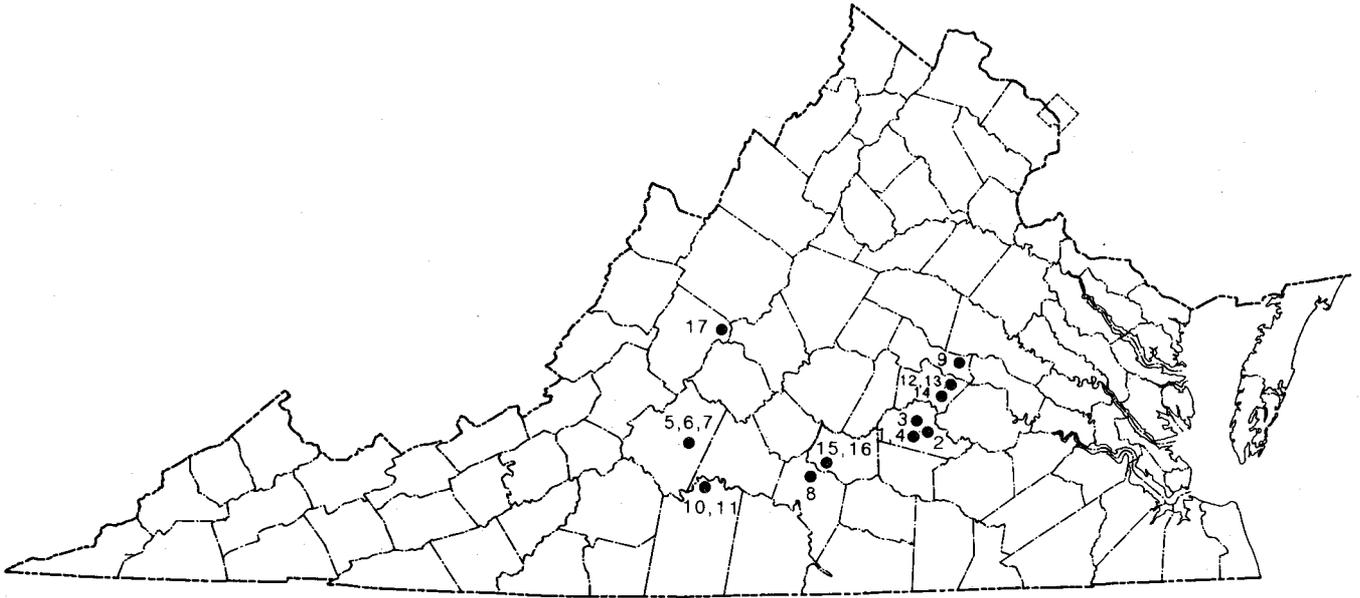


Figure 1. Map of Virginia showing the 11 sites and 17 samples containing tantalum- and/or niobium-bearing minerals.

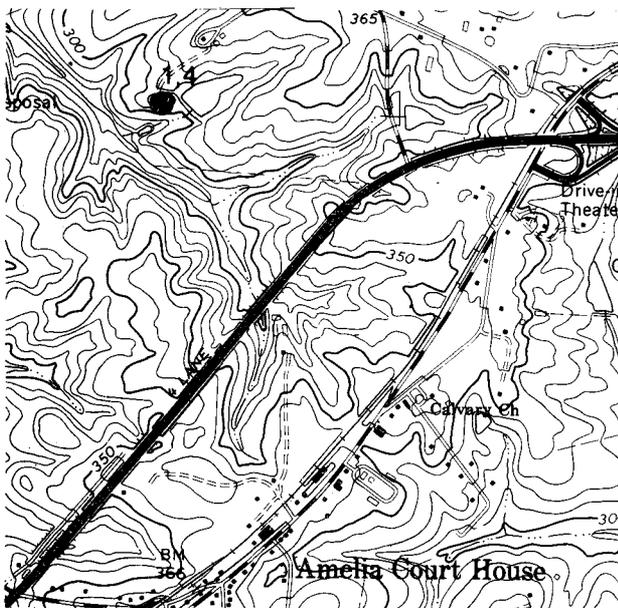


Figure 2. Location of the Rutherford pegmatite mine, Amelia Court House 7.5-minute quadrangle, Amelia County.

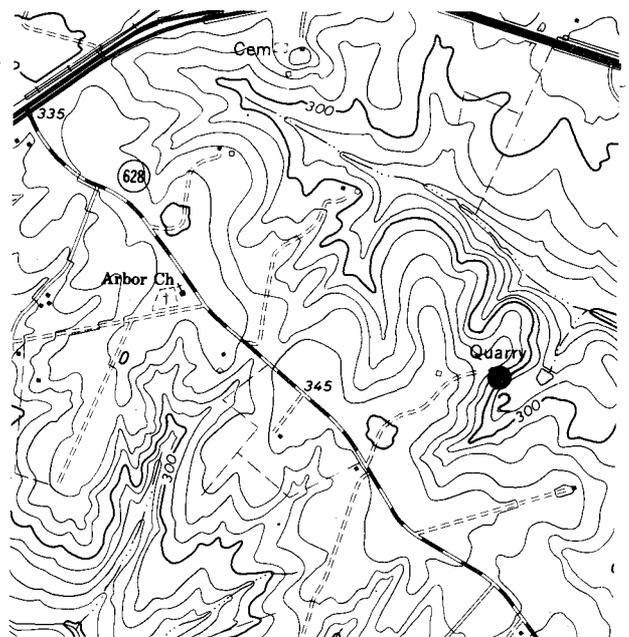


Figure 3. Location of the Morefield pegmatite mine, Amelia Court House 7.5-minute quadrangle, Amelia County.

Table 1. Tantalum- and niobium-bearing samples tested.

Mine, Prospect or Occurrence	Mineral	Sample		UTM Location	Sample Source and Number	Chemical Analyses (%)	
		Number	County			Ta ₂ O ₅	Nb ₂ O ₅
Rutherford Mine	Columbite	1*	Amelia	N4,138,538 E241,900 (Zone 18)	U.Va. ¹ (V-3402) (A-2)	27.05	48.41
Morefield Mine	Columbite	2**	Amelia	N4,138,640 E241,880 (Zone 18)	U.S.N.M. ² (108,386-1)	25.6	54.7
Champion Mine	Tantalite	3*	Amelia	N4,141,160 E237,410 (Zone 18)	U.Va. ¹ (V-3015-D)	46.80	24.47
Rutherford Mine	Pyrochlore or Microlite	4***	Amelia	N4,138,538 E235,900 (Zone 17)	U.S.N.M. ² (538-4)	—	4.78
Mitchell Mine	Columbite	5**	Bedford	N4,125,920 E638,440 (Zone 17)	Ms. Hamlett (#1)	9.5	70.7
Mitchell Mine	Columbite	6***	Bedford	"	Ms. Hamlett (#2)	4.91	45.79
Mitchell Mine	Columbite	7**	Bedford	"	Dr. Leach (#3)	6.7	69.8
Crews Prospect	Columbite	8**	Charlotte	N4,112,580 E706,480 (Zone 17)	U.Va. ¹ (V-3394)	0.0	76.9
Nuchols Farm Prospect	Rutile	9**	Goochland	N4,174,250 E262,150 (Zone 17)	Giannini (#1)	0.0	0.1
Pittsylvania Wayside Occurrence	Ferrocolumbite	10**	Pittsylvania	N4,105,910 E648,960 (Zone 17)	Freeland (#1)	0.2	1.3
Pittsylvania Wayside Occurrence	Ferrocolumbite	11**	Pittsylvania	"	Freeland (#2)	0.9	5.0
Herbb #2 Mine	Tantalite with Cassiterite and Wodginite	12**	Powhatan	N4,159,940 E254,250 (Zone 17)	Giannini (#1)	16.6	3.5
Herbb #2 Mine	Tantalite with Cassiterite and Wodginite	13**	Powhatan	"	Giannini (#2)	33.0	21.2
White Peak #2	Columbite	14*	Powhatan	N4,158,450 E253,110 (Zone 17)	U.Va. ¹ (V-3397)	16.29	61.85
Darlington Heights Occurrence	Columbite	15**	Prince Edward	N4,121,140 E717,790 (Zone 17)	Giannini (#1)	23.1	58.1
Darlington Heights Occurrence	Columbite	16**	Prince Edward	"	Giannini (#2)	28.1	53.2
Irish Creek Tin Mine	Cassiterite	17**	Rockbridge	N4,190,530 E661,520 (Zone 17)	Watson's Concentrates (#1)	0.8	0.3

* - Sample analyzed by Cabot Mineral Resources, New York, New York.

** - Sample analyzed by Virginia Division of Mineral Resources, Charlottesville, Virginia.

*** - Sample analyzed by Chemex Labs, Ltd., North Vancouver, B.C., Canada.

¹ - U.Va. (University of Virginia, Charlottesville, Virginia)

² - U.S.N.M. (Smithsonian Institution, Washington, D. C.)

Table 2. Value of tantalite and columbite*.

Year	Tantalite Dollars/lb.	Columbite Dollars/lb.
1979	\$ 65.50	\$ 5.34
1980	103.50	10.96
1981	81.50	9.83
1982	40.91	8.88
1983	25.06	6.00
1984	30.66	5.50
1985	27.58	4.25
1986	19.44	3.67
1987	22.18	2.25
1988	38.80	2.25
1989	36.80	2.65
1990	31.44 (estimated)	3.25 (estimated)

* Values from U.S. Bureau of Mines (1991) - price is average value, 60% basis of contained tantalum pentoxide, Ta_2O_5 , for tantalite and contained pentoxide for columbite having a Nb_2O_5 to Ta_2O_5 ratio of 10 to 1.



Figure 4. Morefield shaft at the Morefield pegmatite mine, Amelia County.

Jahns, and Griffiths (1952) report production of 1423 pounds of tantalite minerals (then valued at \$1542.75) between 1929 and 1944. When the price of tantalite was \$100/pound in the early 1980s, several companies conducted preliminary sampling at this mine. Trench-cuts were made across the strike of the pegmatite in several places. Analytical results of samples taken at this time generally indicate higher amounts of niobium than tantalum. Samples taken south-southwest of the main shaft are as high as 1.3 pounds of niobium per ton of "ore". The largest concentrations of tantalum (.58 pounds per ton) were found in the dump just northeast of the shaft.

Sample 2 of columbite was supplied by the Department of Mineral Sciences, Smithsonian Institution and an X-ray fluorescence analysis was performed at the Division of Mineral Resources. The analysis indicates that the sample contains 54.7 percent Nb_2O_5 and 25.6 percent Ta_2O_5 . The remainder of the sample consists of Fe and Mn.

Champion (Jefferson No. 4) Mine: The Champion pegmatite mine is located in Amelia County 3.5 miles west of Chula, on the west side of State Road 630 approximately 1 mile by road southeast of its intersection with State Road 609. The location of sample V-3015-D is shown on the Chula 7.5-minute quadrangle (Figure 5).

The pegmatite occurs as an irregularly shaped lens, about 80 feet long and 20 feet wide. The quartz core and wall zone make up the majority of the pegmatite. A three-quarters inch long tantalite crystal was found on the site in the 1940s. The mine was reportedly worked for mica first in 1873 and subsequently in 1895, 1904, and in 1913. About 200,000 pounds of mica was produced during this period (Brown, 1962). Exploration work took place in the mid 1940s, and in 1944 the Champion Mining Corporation sold 20 tons of scrap mica and 4700 pounds of strategic sheet mica valued at \$32,000.

In August 1984, the mine had been covered and the dumps had been leveled. Tantalite is reported at this mine but none was found during the field visits in 1983 and 1984. Sample 3 of tantalite was supplied from the University of Virginia collection. The analysis indicates that the sample contains 46.8 percent Ta_2O_5 and 24.5 percent Nb_2O_5 .

Mitchell Mine: The Mitchell pegmatite mine is located in Bedford County 1.05 miles northeast of Otter Hill, and 0.4 mile southwest of the intersection of State Roads 714 and 715. The locations of the three samples are shown on the Goode 7.5-minute quadrangle (Figure 6).

The pegmatite was worked in 1928 for feldspar. It was reopened in 1949 and closed the same year, was reopened again in 1955 and worked through 1957. In 1959, Clinchfield Sand and Feldspar Corporation reopened the mine. In 1960, the pit was 440 feet long, up to 50 feet wide and 150 feet deep in the southwestern end. The mine was closed around 1965. White massive quartz and perthitic-plagioclase feldspar are present in the intermediate zone. The feldspar was the mineral mined. Six small crystals of tantalite or columbite were found during two field visits in 1983. Three donated samples (5 and 6 by Ms. Hamlett and 7 by Dr. Leach) of columbite were analyzed for this project. Results indicated that they contain 70.7 percent, 45.8 percent, and 69.8 percent

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1988	38.80	2.25
1989	36.80	2.65
1990	31.44 (estimated)	3.25 (estimated)

*Values from U.S. Bureau of Mines (1991) - price is average value, 60% basis of contained tantalum pentoxide, Ta_2O_5 , for tantalite and contained pentoxide for columbite having a Nb_2O_5 to Ta_2O_5 ratio of 10 to 1.



Figure 4. Morefield shaft at the Morefield pegmatite mine, Amelia County.

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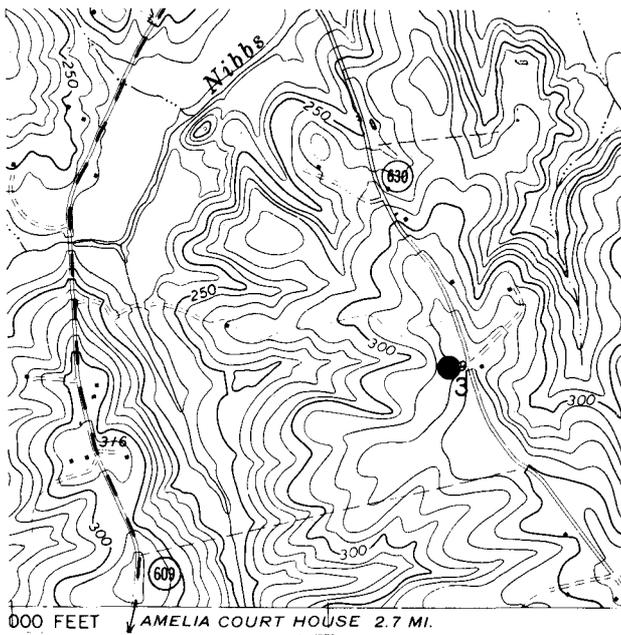


Figure 5. Location of the Champion (Jefferson No. 4) pegmatite mine, Chula 7.5-minute quadrangle, Amelia County.

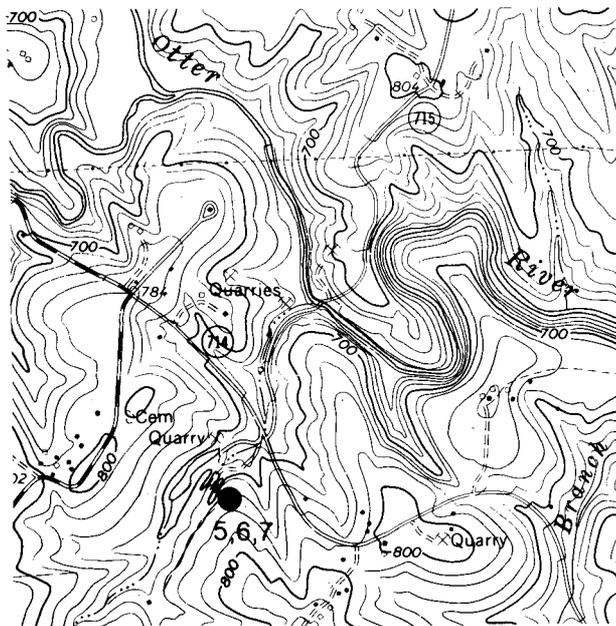


Figure 6. Location of the Mitchell pegmatite mine, Goode 7.5-minute quadrangle, Bedford County.

Nb_2O_5 respectively.

Crews Prospect: The Crews pegmatite prospect is located in Charlotte County, 3.5 miles south of Madisonville, and about 150 feet southeast of the intersection of State Roads 649 and 689. The location of sample V-3394 is shown on the Madisonville 7.5-minute quadrangle (Figure 7).

Two small pits were originally dug on the C. T. Crews property in a small pegmatite composed of pink feldspar and black-stained mica. During a visit to the prospect in July, 1983, no tantalum minerals were found. Sample 8, a sample of columbite from this prospect, was supplied from the University of Virginia collection. X-ray fluorescence analysis indicates that the sample contains 76.9 percent Nb_2O_5 with detectable Ta_2O_5 .

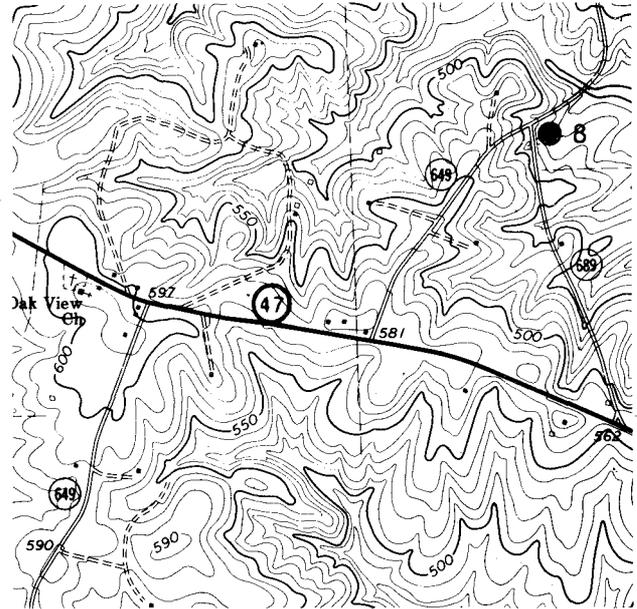


Figure 7. Location of the Crews pegmatite prospect, Madisonville 7.5-minute quadrangle, Charlotte County.

Nuchols Farm Prospect: The Nuchols farm rutile prospect is located in Goochland County 1.2 miles northwest of Centerville, and 0.35 mile off the north side of State Road 621 approximately 1 mile by road northeast of its intersection with U.S. Highway 250. The location is shown on the Hylas 7.5-minute quadrangle (Figure 8).

Brown (1937) notes that some prospects on the farm were probably dug in pegmatite in the 1830s for rutile which was believed to be ruby silver. Some prospecting was done in 1910 when the ore was found to contain rutile and ilmenite. A 60-foot shaft was dug in 1918. Brown (1937) noted an abundance of 2-3 pound masses of rutile on the property with some masses weighing to 30 pounds. A sample of rutile (sample 9) was collected in 1984 from the site and an X-ray fluorescence analysis indicates 0.1 percent Nb_2O_5 is present in the sample.

Pittsylvania Wayside Occurrence: The Pittsylvania Wayside pegmatite occurrence is located in Pittsylvania County 2.5 miles southwest of Altavista, and 0.15 mile off the northwest side of U.S. Highway 29 (Business) at a point 1.45 miles by road southwest of its intersection with State Road 924. The location of the samples is shown on the Altavista 7.5-minute quadrangle (Figure 9).

The pegmatite that occurs in this area contains columbite and yellow beryl. Howard R. Freeland donated several pieces

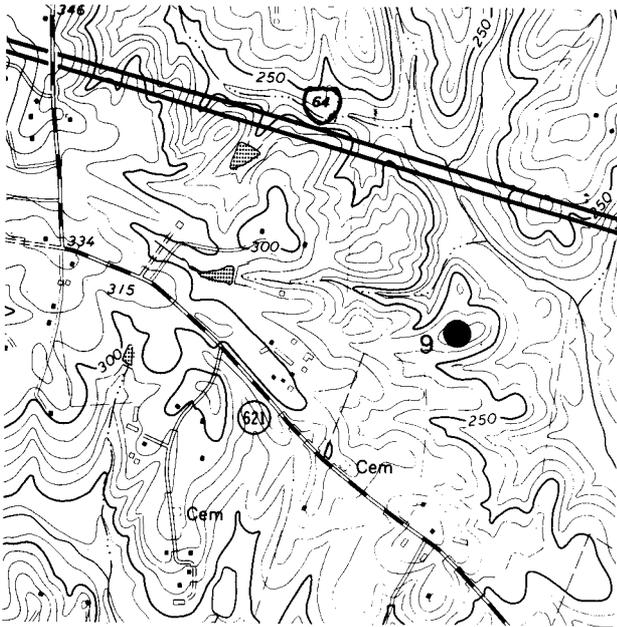


Figure 8. Location of the Nuchols farm rutile prospect, Hylas 7.5-minute quadrangle, Goochland County.

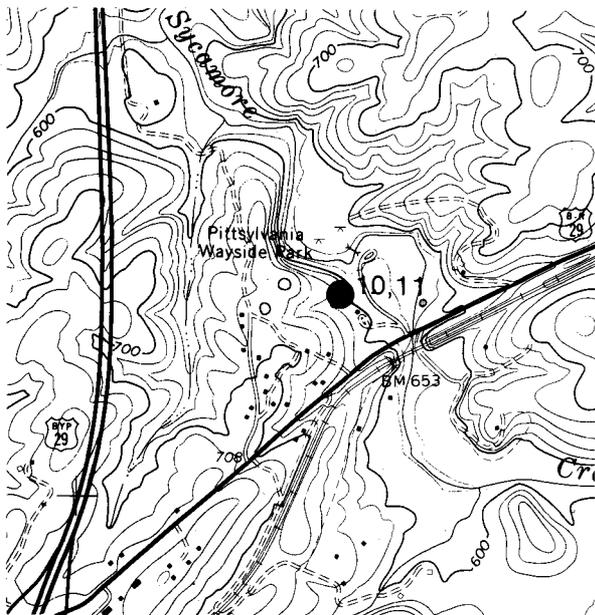


Figure 9. Location of the Pittsylvania Wayside pegmatite occurrence, Altavista 7.5-minute quadrangle, Pittsylvania County.

of ferrocolumbite from this site for analyses. X-ray fluorescence analysis indicates that sample 10 contains 1.3 percent Nb_2O_5 and 0.9 percent Ta_2O_5 .

Herbb No. 2 Mine: The Herbb No. 2 pegmatite mine (12,13) is located in Powhatan County 3.95 miles northeast of Flat Rock and north of State Road 716. The locations of the two samples are shown on the Fine Creek Mills 7.5-

minute quadrangle (Figure 10).

This complex pegmatite is about 240 feet long and 40 feet wide and was briefly worked in 1944 for mica. The massive quartz core in the pegmatite is bordered by intermediate zones containing amazonite and beryl. The intermediate zones as well as the wall zone, contains feldspar, mica, spessartite garnet, and tantalite-columbite. Giannini and Penick (1983) note the discovery of a gem quality 8.9-pound topaz crystal that was found in the dump in September 1982.

Two samples, 12 and 13 (tantalite with cassiterite and wodginite) were collected from the dumps (Figure 11). Wise (1983) notes that his discovery of wodginite (tin-rich tantalum oxide) at the Herbb No. 2 mine is the first reported United States occurrence.

In the early 1980s, samples were taken from the main trench and 2 pits on the site. Location of the samples collected that contain the largest analyzed concentrations of tantalum (Ta_2O_5), niobium (Nb_2O_5), and tin (SnO_2) are noted on Figure 12.

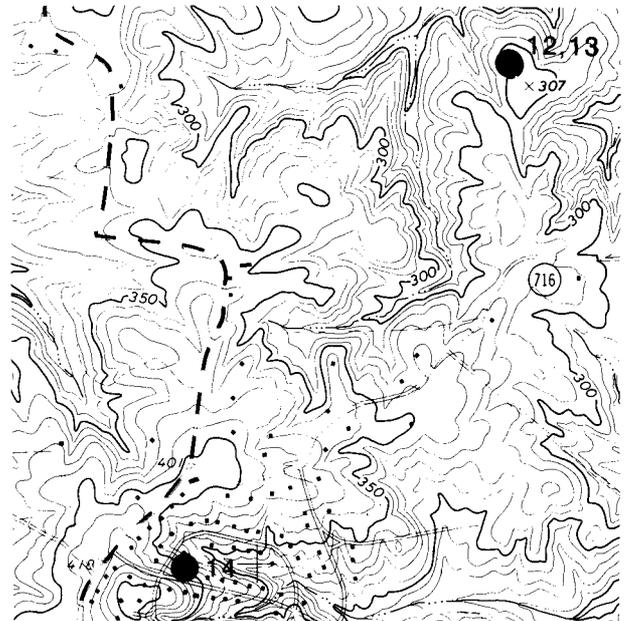


Figure 10. Location of the Herbb No. 2 pegmatite mine (12,13) and White Peak No. 2 pegmatite prospect (14), Fine Creek Mills 7.5-minute quadrangle, Powhatan County.

White Peak No. 2 Prospect: The White Peak No. 2 pegmatite prospect (14) is located in Powhatan County 2.0 miles northeast of Flat Rock, and 0.1 mile off the east side of State Road 613 approximately 0.25 mile by road north of its intersection with State Road 723. The location of sample V-3397 is shown on the Fine Creek Mills 7.5-minute quadrangle (Figure 10).

Five small prospect pits were dug in a pegmatite approximately 150 feet long with a maximum thickness of 16 feet. The pegmatite was cross-cut by trenches in 4 places in 1944 by the Virginia Manganese Corporation. Quartz, perthitic



Figure 11. Dumps and northernmost trench, Herbb No. 2 pegmatite mine, Powhatan County, 1983.

feldspar, and dark rum-colored mica is present on the site. A small amount of mica was recovered from the prospect.

Sample 14 was obtained from the University of Virginia collection. The sample analysis shows 61.85 percent Nb_2O_5 , and 16.29 percent of Ta_2O_5 .

Darlington Heights Occurrence: The Darlington Heights pegmatite occurrence is located in Prince Edward County 2.1 miles east of Darlington Heights, about 50 feet off the north side of State Road 667. The locations of the two samples are shown on the Abilene 7.5-minute quadrangle (Figure 13).

A pegmatite with milky and dark gray smokey quartz and with many other pegmatite minerals was observed in June, 1983. Two samples (15 and 16) of columbite were collected for evaluation. X-ray fluorescence analysis indicates that sample 15 contains 58.1 percent Nb_2O_5 and 23.1 percent Ta_2O_5 and that sample 16 contains 53.2 percent Nb_2O_5 and 28.1 percent Ta_2O_5 .

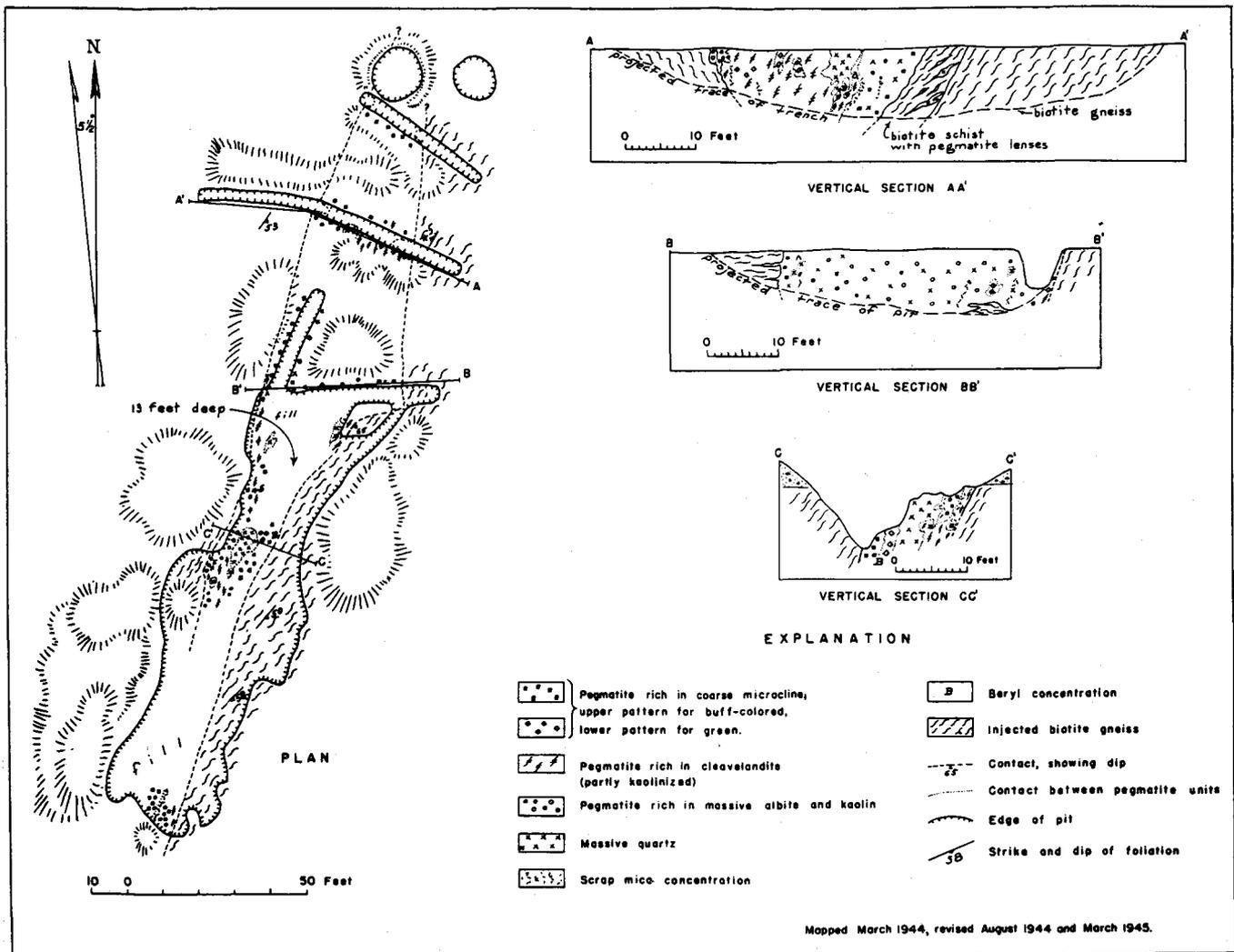


Figure 12. Sketch map of Herbb No. 2 pegmatite mine, Powhatan County. Highest analyzed concentrations from this site of Ta_2O_5 is 68.3 percent; Nb_2O_5 , 46.8 percent; and SnO_2 , 88.8 percent (Cerny and Wise, 1984).



Figure 11. Dumps and northernmost trench, Herbb No. 2 pegmatite mine, Powhatan County, 1983.

feldspar, and dark rum-colored mica is present on the site. A small amount of mica was recovered from the prospect.

Sample 14 was obtained from the University of Virginia collection. The sample analysis shows 61.85 percent Nb_2O_5 and 16.29 percent of Ta_2O_5 .

Darlington Heights Occurrence: The Darlington Heights pegmatite occurrence is located in Prince Edward County 2.1 miles east of Darlington Heights, about 50 feet off the north side of State Road 667. The locations of the two samples are shown on the Abilene 7.5-minute quadrangle (Figure 13).

A pegmatite with milky and dark gray smoky quartz and with many other pegmatite minerals was observed in June, 1983. Two samples (15 and 16) of columbite were collected for evaluation. X-ray fluorescence analysis indicates that sample 15 contains 58.1 percent Nb_2O_5 and 23.1 percent Ta_2O_5 and that sample 16 contains 53.2 percent Nb_2O_5 and 28.1 percent Ta_2O_5 .

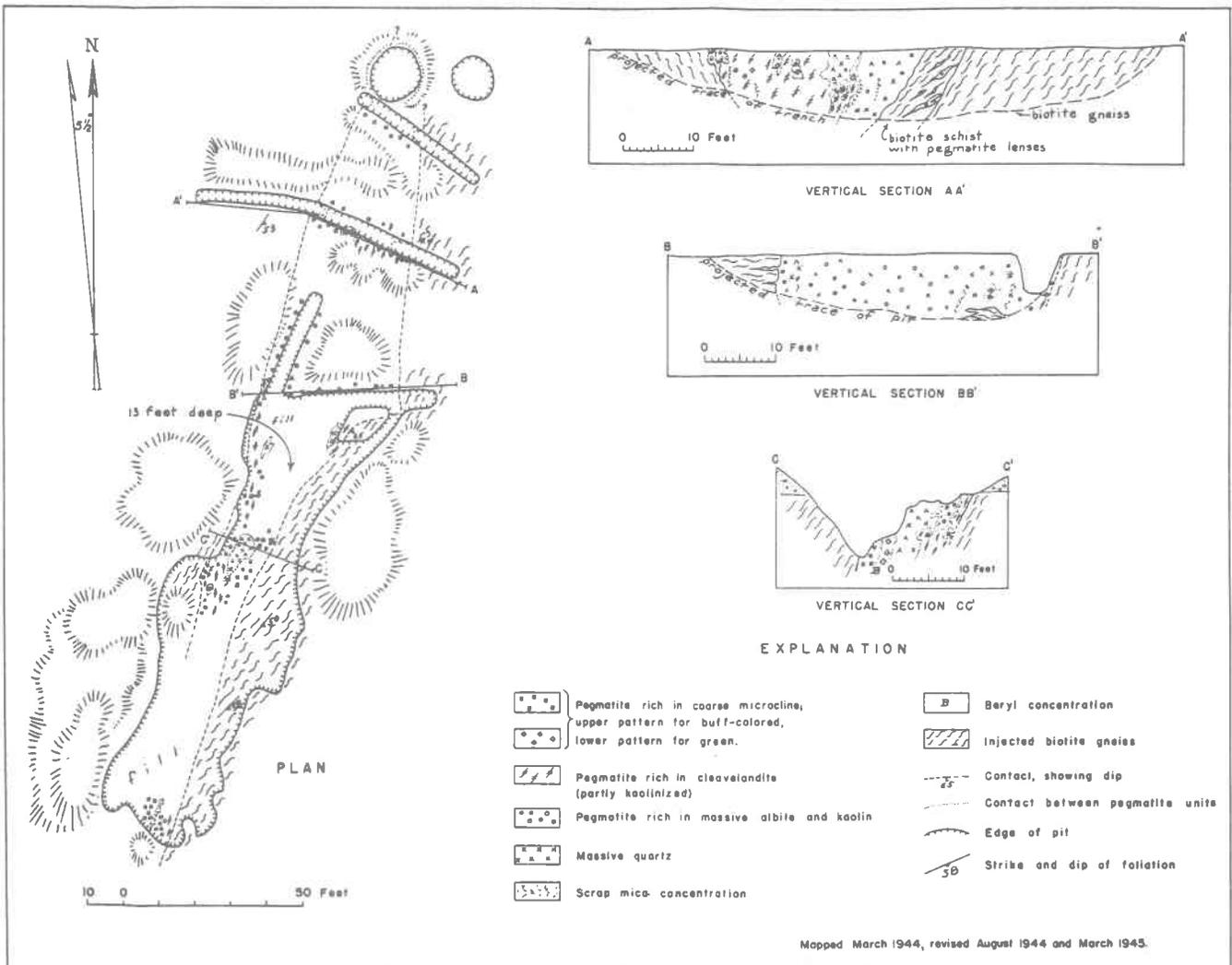


Figure 12. Sketch map of Herbb No. 2 pegmatite mine, Powhatan County. Highest analyzed concentrations from this site of Ta_2O_5 is 68.3 percent; Nb_2O_5 , 46.8 percent; and SnO_2 , 88.8 percent (Cerny and Wise, 1984).

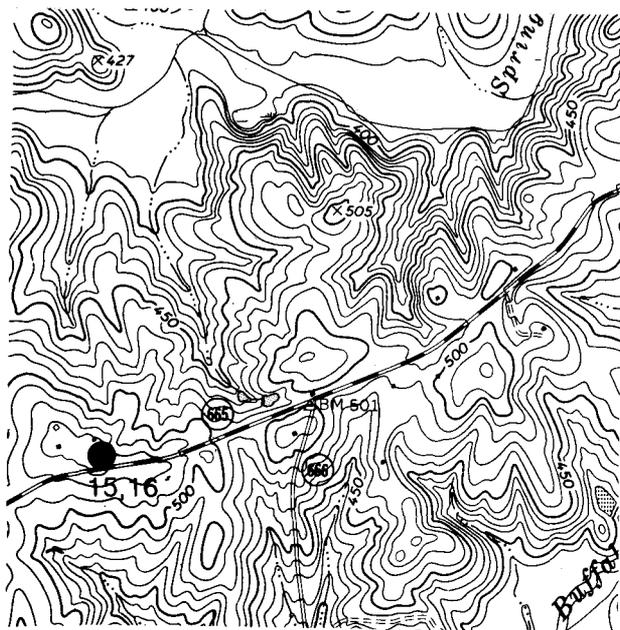


Figure 13. Location of the Darlington Heights pegmatite occurrence, Abilene 7.5-minute quadrangle, Prince Edward County.

Irish Creek Mine: The Irish Creek tin mine is located in Rockbridge County 1.5 miles east of Irish Creek, 0.15 mile off the southeast side of State Route 603 approximately 1.4 miles by road southwest of its intersection with the Blue Ridge Parkway. The location of the sample is shown on the Montebello 7.5-minute quadrangle (Figure 14). A sample (17) of cassiterite was supplied from the University of Virginia collection. X-ray fluorescence analysis indicated that sample 17 contains 0.3 percent Nb_2O_5 and 0.8 percent Ta_2O_5 .

CONCLUSIONS

Two references regarding tantalum resources in Virginia are Lemke (1952) and Geehan (1953). Lemke (1952) states that during the period 1929 to 1944, 1423 pounds of tantalite and columbite were produced at the Morefield mine in Amelia County. This 1423 pounds had a value of \$1,542.75. He notes that portions of the Morefield pegmatite contain 2 or 3 pounds of tantalite or columbite per ton of pegmatite and in some areas as high as 5 pounds per ton. Lemke also mentions a small placer occurrence southeast of the main open cut that contains 0.21 pound of tantalite or columbite per cubic yard and an old dump on the site that contains 0.25 pound of tantalite-columbite per cubic yard. Geehan (1953) reports 4 pounds per ton for one sample from the Morefield mine and an average of 0.10 pound per ton for six samples. Analyses from work in the early 1980s indicates values as high as 1.3 pounds of niobium per ton and 0.58 pound per ton for samples of dump material containing tantalite or columbite originally from the intermediate zones of the pegmatite.

Dietrich (1970) notes that between 400 and 500 pounds of "tantalite" were sold from the Craighead mine just south of

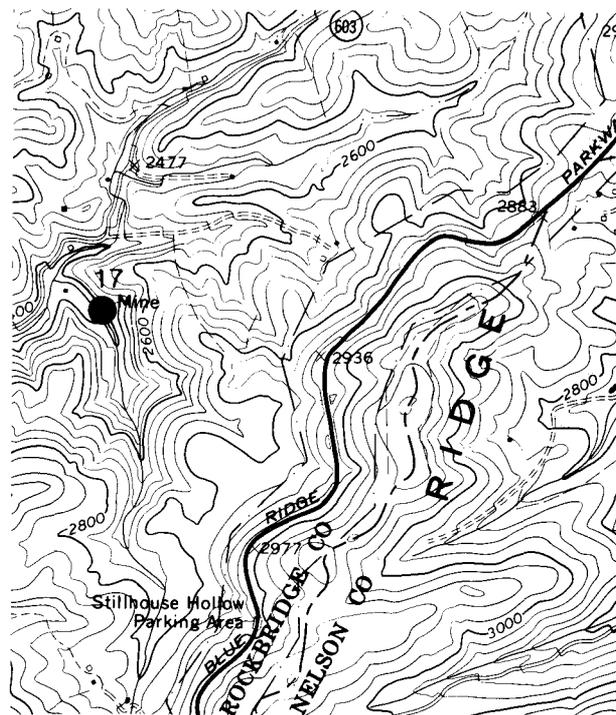


Figure 14. Location of the Irish Creek tin mine, Montebello 7.5-minute quadrangle, Rockbridge County.

Otter Hill in Bedford County. Jahns and Griffiths (1952) state that about 40 pounds of tantalite was recovered during the early operations of the Wheatly (Moneta) mine in Bedford County. Both the Craighead and Wheatly mines are located on Figure 3.

A renewed interest in the tantalum- and niobium-bearing pegmatites in Virginia probably will occur with an increase in the value of tantalum. Some of the streams that drain the pegmatites may also be potential sources for resources. Extensive sampling and analyses of the pegmatites will provide additional data that could determine the potential tantalum and niobium resources in Virginia.

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APPENDIX

TANTALUM-NIOBIUM BEARING MINERALS REPORTED FROM VIRGINIA

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY									
Amelia County	Tantalite	—	—	—	Schrader, F. C., Stone, R. W., Sanford, S. S. Barton, W. R.,	(1917)	—	—	—
Amelia Courthouse Area	Columbite	—	—	—	" "	(1962)	—	—	—
"	Manganotantalite	—	—	—	" "	(1962)	—	—	—
Amelia District	Columbite-Tantalite	—	—	—	Dietrich, R. V.	(1970)	—	—	—
Amelia Mica Mines	Columbite	—	—	—	Schrader, F. C., Stone, R. W., Sanford, S. S.	(1917)	—	—	—
Berry Mine	Columbite	—	—	—	Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)	—	—	—
"	"	—	—	—	Sterrett, D. B.	(1923)	—	—	—
Champion Mine	Columbite-Tantalite	—	—	—	Dietrich, R. V.	(1970a)	—	—	—
"	"	—	—	—	Mitchell, R. S.	(1965)	—	—	—
"	"	—	—	—	" "	(1966)	—	Yes	Reported by others
"	"	—	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	"	—	—	—	Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)	—	—	—
"	"	—	—	—	" "	(1952)	—	—	—
"	Manganotantalite	—	—	—	Parker, R. L.	(1963)	—	—	—
"	Tantalite-Columbite	—	—	—	Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)	—	—	—
"	Tantalite	—	—	—	" "	(1952)	—	—	—
Jefferson Mine No. 2	Columbite-Tantalite	—	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	Tantalite	—	—	—	Dietrich, R. V.	(1970a)	—	—	—
Morefield Mine	Columbite-Tantalite	—	—	—	Brown, W. R.	(1962)	—	—	—
"	"	—	—	—	Geehen, R. W.	(1953)	—	—	—
"	"	—	—	—	Pegau, A. A.	(1932)	—	N	2 to 3 pounds tantalaite-columbite per ton of rock in Morefield pegmatite
"	"	—	—	—	Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)	—	—	—
"	"	—	—	—	Penick, D. A., Jr.	(1987)	—	—	—

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY (continued)									
Morefield Mine	Columbite				Mitchell, R. S.	(1970)		Yes	Associated with Sample V-4162 (samarskite)
"	"				Brown, W. R.	(1962)			
"	"				Fontaine, W. M.	(1883)		No	
"	"				Geehan, R. W.	(1953)			
"	"				Glass, J. J.	(1935)			
"	"				Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)			
"	"				Morefield, S. V.	(1933)			
"	"				Pegau, A. A.	(1932)		No	
"	"				Stripp, D. M.	(1987)			
"	"				Sweet, P. C.	(1974)			
"	"				Sweet, P. C., Penick, D. A., Jr.	(1985)			
"	"				" "	(1986)			
"	"				Geehan, R. W.	(1953)			
"	Manganocolumbite- Tantalite				Pegau, A. A.	(1932)			
"	Mangano-Columbite- Tantalite				Brown, W. R.	(1962)			
"	Manganotantalite				Geehan, R. W.	(1953)			
"	"				Glass, J. J.	(1935)			
"	"				Lee, O. I., Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1919) (1952)		No	Contains Sn
"	"				Stripp, D. M.	(1987)			
"	"				Sweet, P. C.	(1974)			
"	"				Sweet, P. C., Penick, D. A., Jr.	(1985)			
"	"				Sweet, P. C., Penick, D. A., Jr.	(1986)			
"	Tantalite-Columbite				Geehan, R. W.	(1953)			
"	"				Parker, R. L.	(1963)			
"	Tantalite	45.7	31.2	Chemical	Geehan, R. W.	(1953)			
"	"			"	Lemke, R. W.	(1952)			
"	"				Jahns, R. H., Griffitts, W. R.	(1987)			
"	"				Stripp, D. M.	(1987)			

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY (continued)									
Pinchback Property	Manganotantalite	—	—	—	Pegau, A. A.	(1932)	—	—	Near mine
Pinchback Mine No. 1	"	—	—	—	Dietrich, R. V.	(1970)	—	—	
Rutherford Mine	Columbite-Tantalite	—	—	—	"	(1970a)	—	—	
"	"	—	—	—	Mitchell, R. S.,	(1970)	—	Yes	Associated with Sample V-407
"	"	—	—	—	Zulkiewicz, R. J.		—	—	
"	"	—	—	—	Penick, D. A., Jr.	(1987)	—	—	
"	Columbite	—	—	—	Bastin, E. S.	(1911)	—	—	
"	"	84.81	—	Chemical	Dunnington, F. P.	(1882)	—	No	
Rutherford Mine (?)	"	53.	31.4	Chemical	"	(1882-83)	—	No	[Actually tantalite]
"	"	—	—	—	Fontaine, W. M.	(1883)	—	No	
"	"	—	—	—	Glass, J. J.	(1935)	—	—	
"	"	—	—	—	Hotchkiss, J.	(1884)	—	No	
"	"	—	—	—	Hotchkiss, J.	(1885)	—	No	
"	"	—	—	—	Lemke, R. W.,	(1952)	—	—	
"	"	—	—	—	Jahns, R. H.,		—	—	
"	"	—	—	—	Griffitts, W. R.		—	—	
Rutherford Mine (?)	Columbite	84.81	—	—	Mallet, J. W.	(1882)	—	No	Analyses by Dunn- ington, F.P. (includes SnO ₂)
"	"	—	—	—	Pegau, A. A.	(1928)	—	No	
"	"	—	—	—	"	(1932)	—	No	
"	"	—	—	—	Sinkankas, J.	(1968)	—	—	
"	"	—	—	—	Sterett, D. B.	(1923)	—	No	
"	"	—	—	—	Sweet, P. C.	(1974)	—	—	
"	"	53.41	31.40	Chemical	Watson, T. L.	(1907)	—	No	Analyses by Dunn- ington, F.P. [actually tantalite]
"	"	—	—	—	Glass, J. J.	(1935)	—	—	
"	Manganotantalite	—	—	—	Lee, O. I.,	(1919)	—	—	
"	"	—	—	—	Wherry, E. T.		—	—	
"	"	—	—	—	Lemke, R. W.,	(1952)	—	—	
"	"	—	—	—	Jahns, R. H.,		—	—	
"	"	—	—	—	Griffitts, W. R.		—	—	
"	"	—	—	—	Pegau, A. A.	(1928)	—	—	
"	"	—	—	—	"	(1932)	—	—	
"	"	—	—	—	Sinkankas, J.	(1964)	—	—	
"	"	—	—	—	"	(1968)	—	—	
"	"	—	—	—	Sweet, P. C.	(1974)	—	—	
"	"	—	—	—	Parker, R. L.	(1963)	—	—	
"	Tantalite-Columbite	—	—	—	Lemke, R. W.,	(1952)	—	—	
"	Tantalite	—	—	—	Jahns, R. H.,		—	—	
"	"	—	—	—	Griffitts, W.R.		—	—	

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY (continued)									
Amelia Area	Microcline	—	—	—	Amott, R. J.	(1950)	—	—	Mitchell, 1970, states microcline from Rutherford mine
"	"	—	—	—	Barton, W. R.	(1962)	—	—	Mitchell & Zulkiewicz, 1970, state microcline from Rutherford mine
"	"	—	—	—	Kerr, P. F., Holmes, R. J.	(1945)	—	—	Mitchell & Zulkiewicz, 1970, state microcline from Rutherford mine
"	"	—	—	—	Kulp, J. L., Volchok, H. L., Holland, H. D.	(1952)	—	—	Mitchell & Zulkiewicz, 1970, state microcline from Rutherford mine
"	"	—	—	—	Lime-de-Faria, J.	(1958)	—	Yes	" " "
"	"	—	—	—	Reuning, E.	(1933)	—	—	" " "
"	"	—	—	—	Schrader, F. C., Stone, R. W., Sanford, S. S.	(1917)	—	—	" " "
"	Pyrochlore	—	—	—	Barton, W. R.	(1962)	—	—	Reported by others
Amelia District	Microcline	—	—	—	Dietrich, R. V.	(1970)	—	—	Yes
Champion Mine	Microcline	—	—	—	Dietrich, R. V.	(1970a)	—	—	Yes
"	"	—	—	—	Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)	—	—	Yes
"	"	—	—	—	Mitchell, R. S.	(1965)	—	—	Yes
"	"	—	—	—	Mitchell, R. S.	(1966)	—	—	Yes
"	"	—	—	—	Parker, R. L.	(1963)	—	—	Yes
"	Pyrochlore-Microcline	35.	35.	Semiquantitative Spectrographic	Mitchell, R. S., Zulkiewicz, R. W.	(1970)	V-3027	Yes	Reported by others
"	Pyrochlore	—	—	—	Dietrich, R. V.	(1965)	—	Yes	Not unambiguous
"	"	—	—	—	Dietrich, R. V.	(1970a)	—	Yes	Not unambiguous
"	"	—	—	—	Fitzgerald, F. B., III, Mitchell, R. S.	(1961)	—	Yes	Not unambiguous
"	"	—	—	—	Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)	—	—	Not unambiguous
Champion Mine	Pyrochlore	—	—	—	Mitchell, R. S.	(1965)	—	—	Reported by others
"	"	—	—	—	" "	(1966)	—	—	Reported by others

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅	ANALYSES (%) Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
AMELIA COUNTY (continued)									
Morefield Mine	Microcline				Brown, W. R.	(1962)			
"	"				Dietrich, R. V.	(1963)			
"	"				Dietrich, R. V.	(1970a)			
"	"				Donnay, J. D. H.	(1941)			
"	"				Fontaine, W. M.	(1883)			
"	"				Geehan, R. W.	(1883)			
"	"				Glass, J. J.	(1935)			
"	"				Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1952)			
"	"	40.	15.	Semiquanti- tative Spect- rographic	Mitchell, R. S., Zulkiewicz, R. W.	(1970)	V-406	Yes	Abnormally high Pb, Th, & Ce rare- earths
"	"				Pegau, A. A.	(1932)			
"	"				Penick, D. A., Jr.	(1987)			
"	"				Sinkankas, J.	(1968)			
"	"				Strupp, D. M.	(1987)			
"	"				Sweet, P. C.	(1974)			
"	"				Sweet, P. C., Penick, D. A., Jr.	(1985)			
"	"				Sweet, P. C., Penick, D. A., Jr.	(1986)			
"	"				Bastun, E. S.	(1911)			
"	"				Dietrich, R. V.	(1953)			
"	"				Dietrich, R. V.	(1953)			
"	"				Dietrich, R. V.	(1960)			U hachettolite
"	"				Dietrich, R. V.	(1960)			Hachettolite, a uranium microcline
"	"				Dietrich, R. V.	(1970a)			
"	"	68.43	7.74	Chemical	Dunnington, F. P.	(1881)		No	1.59% UO ₃
"	"	68.43	7.74	Chemical	Dunnington, F. P.	(1881-82)		No	
"	"				Feist, F.	(1885)		No	
"	"				Fitzgerald, F. B., III, Mitchell, R. S.	(1961)		Yes	
"	"				Fontaine, W. M.	(1883)		No	Pegmatites 1 and 2, contain Be and Sn
"	"				Glass, J. J., Hidden, W. E.	(1935) (1885)		No	Hyacinth-red vari- ety cut as a gem

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY (continued)									
Rutherford Mine	Microilite	—	—	—	Hotchkiss, J. Lemke, R. W., Jahns, R. H., Griffitts, W. R.	(1885) (1952)	—	No	—
"	"	—	—	—	Mallet, J. W.	(1882)	—	No	—
"	" (?)	35.	30.	Semiquan- titative	Mitchell, R. S., Zulkiewicz, R. W.	(1970)	V-3048	Yes	—
"	"	68.43	7.74	Spectrographic Chemical	Palache, C., Berman, H., Frondel, C., Parker, R. L.	(1944)	—	No	From F. P. Dunnington, 1881-82
"	"	—	—	—	Pegau, A. A.	(1928)	—	—	—
"	"	—	—	—	Pegau, A. A.	(1932)	—	—	—
"	"	—	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	"	—	—	—	Sinkankas, J.	(1964)	—	—	—
"	"	—	—	—	Sinkankas, J.	(1968)	—	—	—
"	"	—	—	—	Sterrett, D. B.	(1923)	—	—	—
"	"	—	—	—	Sweet, P. C.	(1974)	—	—	—
"	"	68.43	7.74	Chemical	Vlasov, K. A.	(1966)	—	—	From F. P. Dunnington, 1881-82
"	"	68.43	7.74	Chemical	Watson, T. L.	(1907)	—	No	Analyses by Dunnington, F. P., 1881
Rutherford Mine (?)	Microilite	—	—	—	Watson, T. L.	(1907)	—	—	—
"	Pyrochlore-Microilite	30.	30.	Semiquan- titative Spectrographic	Mitchell, R. S., Zulkiewicz, R. W.	(1970)	V-3218	Yes	—
"	Pyrochlore	—	—	—	Dietrich, R. V. Gordon, S. G.	(1960) (1918)	—	—	Hatchettolite [erroneous- ly listed per Mitchell & Zulkiewicz, 1970]
"	"	30.	35.	Semiquan- titative Spectrographic	Mitchell, R. S., Zulkiewicz, R. W.	(1970)	V-407	Yes	—
"	"	30.	35.	"	"	"	V-410	Yes	—
"	"	25	40	"	"	"	V-408	Yes	—
"	"	—	—	—	Pegau, A. A.	(1928)	—	—	Hatchettolite
"	"	—	—	—	Pegau, A. A.	(1932)	—	—	—
"	"	—	—	—	Sterrett, D. B.	(1923)	—	—	—

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY (continued)									
Amelia County	Euxenite	—	—	—	Mitchell, R. S.	(1972)	—	Yes	Priorite at all temperatures (specimen donated by W. D. Baltzley)
Amelia Court House Carl Wagner Property	"	—	—	—	Dietrich, R. S.	(1970a)	—	—	Priorite at all temperatures
John Patterson Mine	"	—	—	—	Mitchell, R. S.	(1972)	—	Yes	
"	"	—	—	—	Mitchell, R. S.	(1966)	—	Yes	
"	"	—	—	—	Mitchell, R. S.	(1972)	—	Yes	Priorite phase at lower temperatures.
Morefield Mine	"	—	—	—	Mitchell, R. S.	(1972)	U.S.N.M. #105564	Yes	euxenite at 1000°C Persistent priorite phase even at 1,000 C. for Smithsonian Institution sample. Listed as samarskite, R. V. Dietrich, 1963.
Rutherford Mine	"	6.	Principal Semiquantitative Spectro- graphical	—	Mitchell, R. S.	(1972)	V-4393	Yes	Euhedral specimen, euxenite morphology, priorite X-ray pattern persists for heat-treated samples. Sample collected by R. J. Bland, Jr.
Morefield Mine	Samarskite	—	—	—	Samarskite		U.S.N.M. #105564	—	Smithsonian Institution labelled specimen samarskite (X-ray study by R.S. Mitchell, 1970, indicated euxenite- priorite)
"	"	—	—	—	Mitchell, R. S.	(1970)	V-4162	Yes	Very rare in the deposit; only one specimen found
Rutherford Mine	"	—	—	—	Dietrich, R. V.	(1953)	—	—	

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅ Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
AMELIA COUNTY (continued)								
Rutherford Mine	Samarskite	—	—	Dietrich, R. V.	(1960)	—	—	—
"	"	—	—	Dietrich, R. V.	(1963)	—	—	—
"	"	—	—	Dietrich, R. V.	(1970a)	—	—	—
		—	—	Froehling, H., Robertson, A.	(1904)	—	—	—
Rutherford Mine	Samarskite (?)	—	—	Mitchell, R. S.	(1970)	—	—	Could not find the mineral, even in museums or private collections
Fergusonite-Formanite								
Amelia County	Fergusonite	—	—	Mitchell, R. S.	(1967)	—	—	Somewhat brighter in luster than Amherst County fergusonite
Amelia Courthouse Area Amelia Mica Mines	"	—	—	Barton, W. R.	(1962)	—	—	—
		—	—	Schrader, F. C., Stone, R. W., Sanford, S. S.	(1917)	—	—	—
Champion Mine	"	—	—	Dietrich, R. V.	(1965)	—	—	—
"	"	—	—	Dietrich, R. V.	(1970)	—	—	—
"	"	—	—	Mitchell, R. S.	(1965)	—	Yes	American Mineralogist, vol. 50
Rutherford Mine	"	—	—	Mitchell, R. S.	(1967)	—	Yes	—
"	"	—	—	Dietrich, R. V.	(1960)	—	—	—
"	"	—	—	Dietrich, R. V.	(1970a)	—	—	—
"	"	—	—	Fitzgerald, F. B., III, Mitchell, R. S.	(1961)	—	—	—
"	"	—	—	Glass, J. J.	(1935)	—	—	—
"	"	—	—	Hidden, W. E.	(1891)	—	No	First mention of fergusonite in Amelia area
"	"	—	—	Mitchell, R. S.	(1967)	V-3016d	Yes	J.J. Glass (1935) and A. A. Pegau erroneously referred to W.M. Fontaine (1883) for the original description of fergusonite at Amelia; W.E. Hidden, 1891, was first to mention.
Rutherford Mine	Fergusonite	—	—	Mitchell, R. S.	(1968)	—	—	J. Sinkankas suggested fergusonite may be zircon; assumption not correct.

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
AMELIA COUNTY (continued)									
Rutherford Mine	Fergusonite	—	—	—	Pegau, A. A.	(1932)	—	—	
"	"	—	—	—	Penick, D. A., Sinkankas, J., Sweet, P. C.	(1987) (1964) (1974)	—	—	
AMHERST COUNTY									
Columbite-Tantalite									
Amherst County Pegmatites	Columbite-Tantalite	—	—	—	Barton, W. R.	(1962)	—	—	Erroneously reported quoting A. A. Pegau, 1932
Fergusonite (Sipylyte)-Formanite									
Little Friar Mtn. Occurrence	Fergusonite	—	—	—	Dietrich, R. V.	(1970a)	—	—	New analyses showed that the sipylyte is fergusonite
"	"	—	—	—	Goldschmidt, V. M., Thomassen, L.	(1924)	—	—	Also samples V-701, V-3036d, V-2993d
"	"	—	—	—	Mitchell, R. S.	(1967)	V-3035d	Yes	R.S. Mitchell, 1967, examined this specimen, V-3585, and found it to be zircon
"	"	—	—	—	Parker, R. L. Pegau, A. A.	(1963) (1932)	—	—	
"	"	—	—	—	Penick, D.A., Jr. Watson, T.L., Taber, S.	(1987) (1913)	—	No	
"	Sipylyte	—	—	—	Delafontaine, M. Mallet, J. W.	(1878) (1877)	—	No	Ta ₂ O ₅ may be assumed equal about 2 %
"	"	48.66	—	Chemical			—	No	Crystal angles show close relation to fergusonite
"	"	48.66	—	Chemical	Mallet, J. W. Mallet, J. W.	(1877a) (1881)	—	No No	
" (Massie Mine)	"	—	—	—	Schrader, F. C. Stone, R. W., Sanford, S. S. Watson, T. L.	(1917)	—	—	
"	"	—	—	—		(1907)	—	—	

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅	ANALYSES (%) Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
AMHERST COUNTY (continued)									
Lowesville Occurrence	Fergusonite	—	—	—	Dietrich, R. V.	(1970a)	—	—	—
"	"	—	—	—	Mitchell, R. S.	(1967)	—	Yes	—
BEDFORD COUNTY									
Columbite-Tantalite									
Bedford County	Columbite-Tantalite	—	—	—	Barton, W. R.	(1962)	—	—	—
Bedford District	"	—	—	—	Dietrich, R. V.	(1970)	—	—	—
Craighead Mine	"Tantalite"	—	—	—	Dietrich, R. V.	(1955)	—	—	400 to 500 pounds sold from mine
"	"	—	—	—	"	(1960)	—	—	" " "
"	"	—	—	—	"	(1970a)	—	—	" " "
Mitchell Mine	Columbite-Tantalite	—	—	—	"	(1961)	—	Yes	—
"	"	—	—	—	"	(1970)	—	—	—
"	"	—	—	—	"	(1970a)	—	Yes	Sample from D. Leach
Mitchell Mine	Columbite-Tantalite	—	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	Columbite	—	—	—	Mitchell, R. S.	(1970)	—	Yes	Actually ferrocolumbite enveloping rounded anhedral grains of samarskite
"	"	—	—	—	"	(1970)	—	Yes	<0.5% U
Betafite									
"	Ferrocolumbite	1.	—	Principal Semiquanti- Constit- uent	Mitchell, R. S.	(1970)	V-3011	Yes	—
Wheatley Mine									
"	"	—	—	Spectro- graphic	Mitchell, R. S.	(1966)	—	Yes	—
"	"	—	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	Tantalite	—	—	—	Jahns, R. H.,	(1953)	—	—	About 40 pounds of tantalite recovered
"	"	—	—	—	Griffitts, W. R.	(1963)	—	—	—
"	"	—	—	—	Parker, R. L.	(1963)	—	—	—
Mitchell Mine									
"	Betafite (?)	—	—	—	Dietrich, R. V.	(1970a)	—	—	—
"	"	—	—	—	Mitchell, R. S.	(1966)	—	Yes	Proved to be U-rich samarskite, Mitchell, 1970

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅ Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
BEDFORD COUNTY (continued)								
			Euxenite-Aeschynite (Priorite)					
Mitchell Mine	Euxenite	—	—	Dietrich, R. V.	(1961)	—	—	[Actually smarskite per R. S. Mitchell, 1970]
"	"	—	—	Dietrich, R. V.	(1970a)	—	—	Sample from D. Leach
"	"	—	—	Mitchell, R. S.	(1970)	—	Yes	
Nance Mine	Euxenite	—	—	Dietrich, R. V.	(1970a)	—	—	R. S. Mitchell, personal communications
"	"	1.	Principal Constituent	Mitchell, R. S.	(1972)	WDR#77	Yes	According to Riesmeyer, 1969, unpublished manuscript.
Young Mine	Euxenite	—	Spectro-graphic	Mitchell, R. S.	(1972)	—	Yes	
			Samarskite					
Bedford County	Samarskite	—	—	Jahns, R. H., Griffiths, W. R., Henrich, E. W.	(1952)	—	—	In 2 unspecified pegmatites
"	"	—	—	Mitchell, R. S.	(1970)	—	—	R. H. Jahns and others, 1952, mention 2 unspecified pegmatites, however, later description (W.R. Griffiths and others, 1953) fails to mention mineral from specific pegmatites
Mitchell Mine	"	—	—	Dietrich, R. V.	(1963)	—	Yes	
"	"	—	—	"	(1965)	—	—	
"	"	—	—	"	(1970a)	—	—	
"	"	—	—	Fitzgerald, F. B., III, Mitchell, R. S.	(1961)	—	Yes	First report from this mine
"	"	.5	Principal Constituent	Mitchell, R. S.	(1970)	V-3011	Yes	Enveloped by euhedral crystals of columbite. At first, samarskite thought to be beta-fite (1966)
Mitchell Mine	Samarskite	—	Spectro-graphic	Penick, D. A., Jr.	(1987)	—	—	

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅	Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
BEDFORD COUNTY (continued)									
Patterson Mine	Samarskite	—	—	—	Mitchell, R. S.	(1970)	V-2977	Yes	One fragment found in dump. Betafite-like phase at lower temperature X-ray
Top of Thunder Hill Occurrence	"	—	—	—	Mitchell, R. S.	(1970)	—	Yes	Specimen from collection of Washington and Lee University, Lexington, Virginia
Fergusonite (Sipylite)-Formanite									
Wheatley Mine	Fergusonite	—	—	—	Dietrich, R. V.	(1970a)	—	—	R. S. Mitchell, 1967a
"	"	—	—	—	Mitchell, R. S.	(1966)	—	Yes	
"	"	—	—	—	"	(1967)	V-3055d	Yes	
"	"	—	—	—	Penick, D. A., Jr.	(1987)	—	—	
CHARLOTTE COUNTY									
Crews Prospect	Columbite	—	—	—	Dietrich, R. V.	(1967)	—	—	R. S. Mitchell, personal communication
"	"	—	—	—	Dietrich, R. V.	(1970a)	—	—	"
PITTSYLVANIA COUNTY									
Pittsylvania Wayside Occurrence	Columbite-Tantalite	—	—	—	Penick, D. A., Jr.	(1987)	—	Yes	H. K. Freeland, personal communication
POWHATAN COUNTY									
Herbb Mine No. 2	Cassiterite	0.6	0.6	Electron Microprobe	Wise, M. A.,	(1984)	VA-6B	Yes	Associated with wodginite
Cassiterite									

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅ Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
POWHATAN COUNTY (continued)								
Columbite-Tantalite								
Herbb Mine No. 2	Columbite	—	—	Sweet, P. C., Penick, D. A., Jr.	(1985)	—	—	—
"	Columbite-Tantalite	—	—	Dietrich, R. V.	(1961)	—	—	—
"	"	—	—	Dietrich, R. V.	(1970a)	—	—	—
"	"	—	—	Jahns, R. H., Griffitts, W. R.	(1953)	—	—	—
"	"	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	"	—	—	Zeiner, J. C.	(1968)	—	—	—
"	Manganocolumbite	—	Electron Microprobe	Wise, M. A.	(1983)	—	Yes	—
"	"	31.2	Electron	Wise, M. A., Cerny, P.	(1984)	VA-7	Yes	—
"	Tantalite-Columbite	—	Microprobe	Giannini, W. F., Penick, D. A., Jr.	(1983)	—	Yes	—
"	"	—	—	Jahns, R. H., Griffitts, W. R.	(1953)	—	—	—
"	"	—	—	Mitchell, R. S., Zulkiewicz, R. J.	(1970)	—	Yes	—
"	"	—	—	Parker, R. L.	(1963)	—	—	—
"	"	—	—	Richardson, D.	(1983)	—	—	—
"	Magantantalite	—	—	Dietrich, R. V.	(1961)	—	—	—
"	"	—	—	"	(1970a)	—	—	W. R. Brown, 1962
Herbb Mine No. 2	Manganotantalite	—	—	Jahns, R. H., Griffitts, W. R.	(1953)	—	—	—
"	Tantalite	—	—	Sweet, P. C., Penick, D. A., Jr.	(1985)	—	—	Personal communication, D. Richardson, 1983- analyses by U.S. Bureau of Mines
White Peak Mines	Columbite-Tantalite	—	—	Penick, D. A., Jr.	(1987)	—	—	—
White Peak Mine No.1	"	—	—	Mitchell, R. S.	(1965a)	—	Yes	—
"	Tantalite	—	—	Dietrich, R. V.	(1970a)	—	—	R. Kell, personal communications
Wodginite								
Herbb Mine No. 2	Wodginite	—	—	Penick, D. A., Jr.	(1987)	—	—	—
"	"	—	—	Sweet, P. C., Penick, D. A., Jr.	(1985)	—	—	—

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
POWHATAN COUNTY (continued)									
Herbb Mine No. 2	Wodginite	—	—	Electron Microprobe	Wise, M. A.,	(1983)	—	Yes	Tin-rich tantalum oxide
"	"	65.9	5.7	"	Wise, M. A., Cerny, P.	(1984)	VA-2	Yes	
"	"	66.7	6.3	"	"	(1984)	VA-3	Yes	
"	"	68.3	4.0	"	"	(1984)	VA-4	Yes	
"	"	67.8	5.0	"	"	(1984)	VA-6	Yes	
Pyrochlorite-Microlite									
Herbb Mine No. 2	Microlite	—	—	—	Dietrich, R. V.	(1961)	—	—	
"	"	—	—	—	"	(1970a)	—	—	
"	"	—	—	—	Jahns, R. H., Griffitts, W. R.	(1953)	—	—	[R. S. Mitchell, 1970, could not verify this occurrence]
"	"	—	—	—	Parker, R. L.	(1963)	—	—	
White Peak Mines	Pyrochlorite	—	—	—	Penick, D. A., Jr.	(1987)	—	—	
White Peak Mine No. 1	"	—	—	—	Mitchell, R. S., Zulkiewicz, R. J.	(1970)	—	Yes	Alteration crust on samarskite (?)
"	"	—	—	—	Mitchell, R. S.	(1970)	—	Yes	Alteration crust on samarskite. In some cases crust X-ray in- dicates an additional tapiolite phase
Betafite									
Powhatan County	Betafite	—	—	—	Dietrich, R. V.	(1963)	—	—	Data by F. B. Fitz- gerald, III, and R. S. Mitchell, gave data suggesting betafite
"	"	—	—	—	"	(1970a)	—	—	" and R. Kell personal communication
"	"	—	—	—	Fitzgerald, F. B., III, Mitchell, R. S.	(1961)	—	Yes	Data suggested betafite

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅ Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
POWHATAN COUNTY (continued)								
Euxenite-Aeschynite (Priorite)								
White Peak Mines	Euxenite	—	—	Penick, D. A., Jr.	(1987)	—	—	—
White Peak Mine No. 1	"	—	—	Mitchell, R. S.	(1965a)	—	Yes	—
"	"	—	—	"	(1972)	—	Yes	—
Samarskite								
White Peak Mines	Samarskite	—	—	Penick, D. A., Jr.	(1987)	—	—	—
White Peak Mine No. 1	"	—	—	Dietrich, R. V.	(1967)	—	—	—
"	"	—	—	"	(1970a)	—	—	—
"	"	—	—	Mitchell, R. S.	(1965a)	—	Yes	—
"	"	1.	20.	"	(1965a)	V-3023d	Yes	U=40%, may be new mineral or very altered uranium-rich samarskite
"	"	—	30.	"	(1965a)	V-3029d	Yes	U=principal constituent-may be new mineral or very altered uranium-rich samarskite
"	"	5.	Principal Constituent	"	(1970)	V-3002	Yes	—
"	"	1.	20.	Mitchell, R. S.	(1970)	V-3023d	Yes	Possibly samarskite with only pyrochlore alteration crust
"	"	—	30.	Zulkiewicz, R.J.	(1970)	V-3029d	Yes	"
PRINCE EDWARD COUNTY								
Columbite-Tantalite								
Darlington Heights Occurrence	Columbite	—	—	Dietrich, R. V.	(1963)	—	—	Radioactive sample (R.S. Mitchell, personal communication, 1962)
"	"	—	—	"	(1970a)	—	—	"
"	"	—	—	Heinrich, E. W.	(1962)	—	—	Radioactive sample (contains uranium and most likely euxenite)

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%) Ta ₂ O ₅ Nb ₂ O ₅	TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
PRINCE EDWARD COUNTY (continued)								
Darlington Heights Occurrence	Columbite-Tantalite	—	—	Mitchell, R. S., Zulkiewicz, R.J.	(1970)	V-3038	Yes	Associated with pyrochlore-microlite
Pyrochlore-Microlite								
Darlington Heights Occurrence	Pyrochlore-Microlite	—	—	Mitchell, R. S., Zulkiewicz, R.J.	(1970)	V-3038	Yes	E. W. Heinrich, 1962 thought this mineral might be euxenite
"	"	—	—	Mitchell, R. S.	(1972)	V-3038	Yes	" " "
Euxenite-Aschynite (Priorite)								
"	Euxenite	—	—	Heinrich, E. W.	(1962)	—	—	Mineral associated with columbite most likely euxenite [Mitchell & Zulkiewicz, 1970, identified as pyro- chlore-microlite]
ROCKBRIDGE COUNTY								
Cassiterite and Wolframite								
Irish Creek Tin Mine	Cassiterite	0.237	Chemical	Brown, W. G.	(1885)	—	—	Analyses by W. G. Brown, 1883
"	"	0.24	"	Ferguson, H. G.	(1918)	—	—	" " "
"	"	0.24	—	Palache, C., Berman, H., Fronzel, C.	(1944)	—	—	" " "
"	Wolframite	0.96	—	Barton, W. R.	(1962)	—	—	Analyses from F. L. Hess and W. T. Schaller, 1914
"	"	0.96	—	Ferguson, H. G.	(1918)	—	—	" " "
"	"	0.96	Chemical	Hess, F. L., Schaller, W. T.	(1914)	—	—	Analyses by J. G. Dinwiddie

APPENDIX (Continued)

MINE, PROSPECT, OCCURRENCE	MINERAL (AS REPORTED)	ANALYSES (%)		TYPE ANALYSES	AUTHOR AND	YEAR	SAMPLE NUMBER	MINERAL X-RAYED	COMMENTS
		Ta ₂ O ₅	Nb ₂ O ₅						
SPOTSYLVANIA COUNTY									
					Columbite-Tantalite				
Edenton Mine	Columbite-Tantalite	—	—	—	Penick, D. A., Jr. (1987)	—	—	Yes	X-ray by R.S. Mitchell
"	Tantalite (?)	—	—	—	Dietrich, R. V. (1970a)	—	—	—	R. Kell, personal communication
					Pyrochlore-Microlite				
"	Microlite	—	—	—	Dietrich, R. V. (1970a)	—	—	—	" "
WARREN COUNTY									
					Perovskite				
Peridotite Dike Occurrence	Perovskite	—	—	—	Young, R. S., Bailey, R. A.	(1955)	—	Yes	[Not tested for niobium content (normally contains this element)]

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