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GEOLOGY AND THE CIVIL WAR IN SOUTHWESTERN VIRGINIA: THE WYTHE COUNTY LEAD MINES

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INTRODUCTION

On December 31, 1981, the oldest continuously operating mines in the entire United States closed when New Jersey Zinc Company permanently shut down its lead and zinc works in southern Wythe County, Virginia (Weinberg, 1981). Thus ended the fascinating 225-year-long story of a mining complex whose history is intricately intertwined with that of southwestern Virginia, particularly as concerns the Civil War period.

In order to feed the huge Northern and Southern war machines that developed in the 1860s, certain mined resources were absolutely fundamental. These included salt, iron, niter (saltpeter), and lead. Salt was essential to pack and preserve meat and other foodstuffs; iron was needed for implements, armaments, and, very importantly, railroads; niter was the main ingredient for gunpowder; and lead was used to make bullets, which at that time were cast lead projectiles of approximately 50 caliber size. No state was more crucial to the Confederate war effort from the standpoint of providing these materials than Virginia (Boyle, 1936). The Old Dominion ranked first in the production of each of these resources except iron, where she was a close second to Alabama. Virginia also had the most railroad track mileage of any southern state over which these vital materials could move.

Of all her mineral contributions to the Confederacy, Virginia's production of lead might be the most significant. During the war years, the South had three principal sources of lead: domestic production, supplies stockpiled before the

war began, and stores smuggled in through the Federal blockade. So valuable was lead to the resource-strapped South that southern soldiers actually scoured the battlefields after engagements to recover spent lead ammunition. Civilians were asked to contribute lead in the form of utensils, pipes, roofing, and even window weights (Robertson, 1993). In the later years of the conflict, as pre-war stockpiles and smuggled quantities became increasingly scarce, the Confederacy came to rely almost exclusively on the one significant lead mining operation in the entire South: the lead mines in Wythe County, Virginia. At the same time, Northern military activities in southwestern Virginia focused more and more on the destruction of not only these crucial lead works, but the Saltville salt operations and the Virginia and Tennessee railroad as well.

GEOLOGY OF THE LEAD MINES AREA

In southwestern Virginia, lead and zinc mineralization occurs in a number of places in the Appalachian Valley and Ridge province, most typically in the carbonate rocks underlying the Great Valley. But systematic and continuous mining has taken place only in the concentrated deposits in the Austinville-Ivanhoe district in southern Wythe County (Currier, 1935), about twelve miles southeast of Wytheville (Figure 1). Weinberg (1980) described the main ore body at Austinville as an atypical, stratabound zinc-lead deposit located in a folded and faulted environment. The host rock is the Shady Formation of early Cambrian age, roughly 550

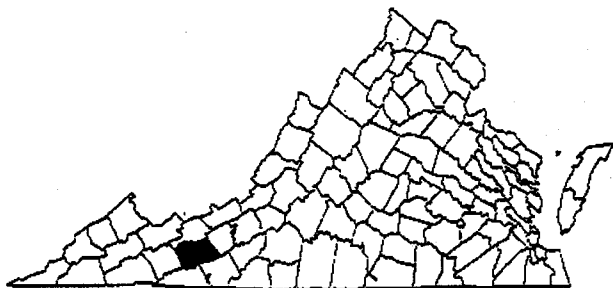


Figure 1. Index map of Virginia showing location of Wythe County (black).

million years old (Figure 2). The Shady is a dolomite throughout most of the mined area. Mining covered a stratigraphic interval of some 1400 feet.

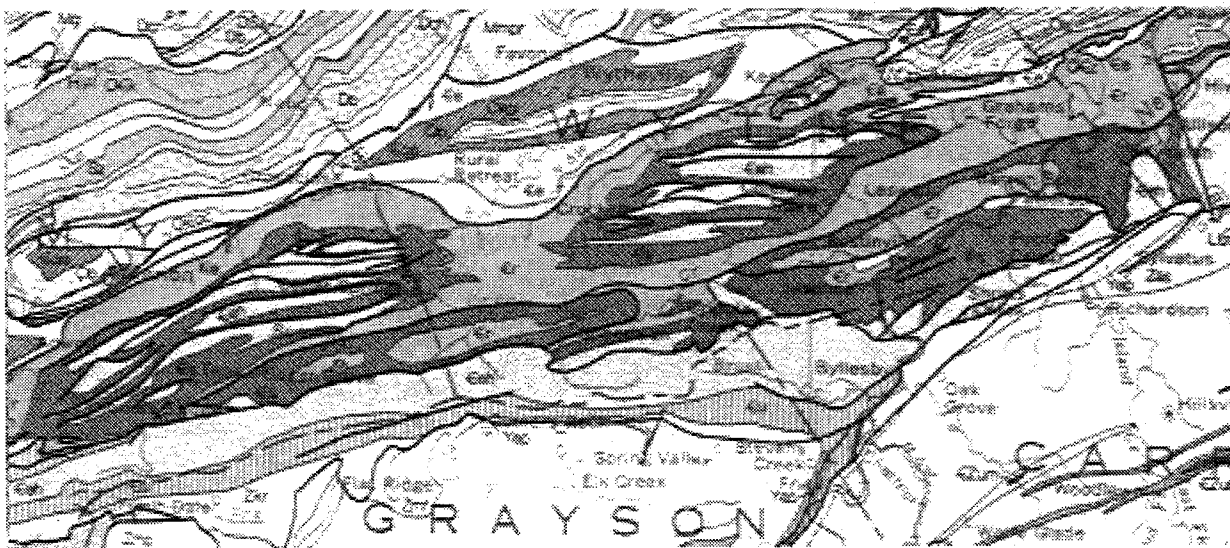


Figure 2. Portion of geologic map of Virginia showing formations cropping out in the Wythe County area (Virginia Division of Mineral Resources, 1993). Diagonal-ruled area (darker gray) in southern part of county is Shady Formation, host rock of the Austinville-Ivanhoe sulfide metal deposits.

According to Sweet and others (1989, p. 5), the Austinville-Ivanhoe district produced 34-million short tons (30-million metric tons) of 4.7 percent combined lead (0.8%) and zinc (3.9%) from 1756 to 1981. The ore mineralogy consists mostly of lenses of sphalerite-pyrite-galena, sulfides of zinc, iron, and lead, respectively. All of the ore is within dolomite and shows varying amounts of bleaching and recrystallization around the ore zone contacts.

The Austinville-Ivanhoe lead and zinc deposits are fairly typical Mississippi Valley-type, carbonate-hosted occurrences (Sweet and others, 1989). The ore fluids were warm, metal-rich brines perhaps generated from rift-related fractures during the early Paleozoic. Alternatively, the mineralizing solutions may have resulted from basinal compaction of metal-rich sediments that were remobilized during Taconic or post-Taconic deformation. The ores occur as breccia fillings and as thin lens-like replacements parallel to sedimentary layering. Multiple, imbricate, steep thrust faults cut the host rocks

in many places. Sedimentologically, the Shady carbonates are interpreted as an upward-shallowing carbonate platform margin sequence with skeletal algal reefs (Pfeil and Read, 1980). A very common facies in these carbonates is the "ribbon rock," composed of thin (few cms.), wavy limestone and dolomite interbeds. Indeed, much of the lead and zinc production was from the locally-named Ribbon Member of the Shady Formation.

Many years ago, Charles R. Boyd (1881) began to work out some of the geology described above. Boyd was a Wythe County native who served as a Confederate engineering officer during the Civil War (M. McKee, unpublished materials, 1995, Virginia State Library). After the war, he studied

geology at the University of Virginia, where one of his professors was Francis H. Smith, himself a student of William Barton Rogers, founder of the geological survey of Virginia in the 1830s. Boyd (1881) wrote presciently about the geology of the Wythe County lead and zinc deposits, correctly placing them "above the last of the Scolithus - marked sandstones," an obvious reference to the upper Erwin quartzites in the Chilhowee Group. He also called attention to the presence of faulting in the ore-bearing strata and noted the action of heat in changing the original character of the wall rocks in one of the Austinville mines. Most intriguingly, he wrote the following passage concerning the host carbonate rocks:

"The ore-bearing strata is [sic] marked all the way through by a wavy white and blue spotted limestone, looking as though it were once full of what now appears an indistinct fossil; or, perhaps, owing its appearance to gentle wave action in a shallow, chopping sea."

This must refer to the "ribbon rock" facies, so characteristic of the Shady carbonates in this area, and may constitute the first essentially correct interpretation of the shallow marine nature of the ore-bearing rocks.

PRE-CIVIL WAR HISTORY

The Wythe County lead mines that later came to be known variously as the mines on Cripple Creek, the Austinville mines, or the Wytheville mines (as they were commonly called during the Civil War) (Donnelly, 1959) were opened in 1756 by Colonel John Chiswell, a British officer who was a native of Wales and an early adventurer in southwestern Virginia (Watson, 1905). According to Austin (1977, p. 8), Colonel Chiswell discovered the lead deposits while hiding in a cave near the New River to escape pursuing Indians.

By the time of the Revolutionary War, Colonel Chiswell had died and the mines taken over by the state of Virginia. Famous visitors to the lead mines during colonial days included Daniel Boone, General Andrew Lewis, and Thomas Jefferson. Of great historical interest is the writing in 1775 of the "Fincastle Resolutions," which were drawn up at the Lead Mines (as the little mining community was then known), the Fincastle County Seat. These resolutions were addressed to the Virginia Delegate to the Continental Congress; later, they became the basis of the Declaration of Independence, of July 4, 1776, fame. During the Revolutionary War, the lead mines produced significant amounts of ammunition for George Washington's Colonial Army (Austin, 1977).

In 1780, the lead works were sold by the state at auction to two Austin brothers, Moses and Stephen. By 1798, the community of Lead Mines had become Austinville and Moses' son, Stephen F. Austin, later to become the "Father of Texas," had been born. The Austin family left Virginia for Missouri in 1800 to seek their destiny in the West. Thomas Jackson, an English immigrant who arrived in the lead mines area in 1785, and two other partners acquired the lead mines from the state at auction in 1806 for \$19,000.* Soon thereafter (1807-1812), the Shot Tower was built about three miles northeast of the lead works on the dolomite bluffs along the south bank of the New River at Jackson's Ferry (Figure 3). This interesting structure, one of the few historic shot towers still standing in the United States, was constructed to produce lead shot mainly for hunting. The then-current method of pouring melted lead through sieves and letting the droplets fall through the air to cool into nearly perfect little spheres is the same technology used today to produce lead shot.

Following Jackson's death in 1824, activities at the lead mines continued on a very limited scale. Eventually, a new operator, the Wythe Lead Mines Company, was organized in 1838, then reorganized in 1848 as the Wythe Union Lead Mine Company. On March 8, 1860, the Union Lead Mining Com-

pany was incorporated for the express purpose of mining and manufacturing lead and shot (Watson, 1905). Ironically, then, by the eve of the Civil War and throughout the conflict, the South's only substantial domestic lead source was operated as the Union Mines!

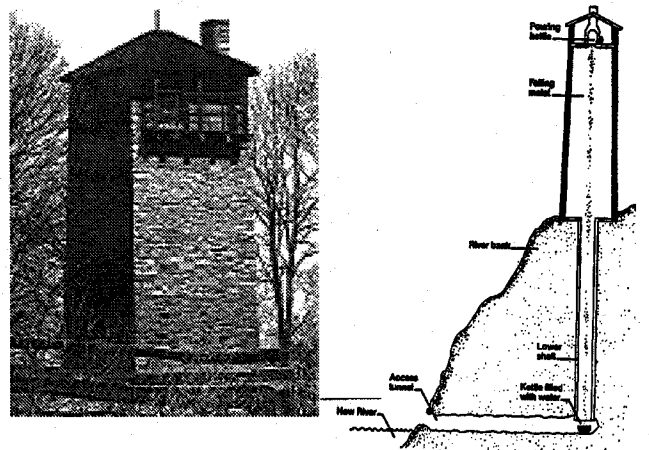


Figure 3. Old Shot Tower located along banks of New River near lead mines area. Photograph and line drawing from Sweet and others, 1989.

CIVIL WAR PERIOD

When fighting broke out between North and South in April of 1861, the Wythe County mines were a well-established lead producing complex (Figure 4). The mined ore was "reduced" (smelted) on site and lead pigs hauled by wagons to Max Meadows, about 10 miles north of the mines. Here, the lead was loaded onto railroad cars on the Virginia and Tennessee railroad and shipped to Richmond or Knoxville and Chattanooga for manufacture into bullets. Lead shot continued to be produced locally at the Shot Tower; some lead bullets may have been cast there, also (C. Spraker, oral commun., 1995, New River Trail State Park).

Shortly after the war began, Confederate officials told the mines management either to work the mines to their utmost capacity or surrender them for operation by the government (Donnelly, 1959). The company directors chose the former, and thus full-time war production commenced. Figures are spotty, but reports after the war by Confederate Ordnance officers indicate that around 3,500,000 pounds of lead were produced at the Wythe County mines during the war (Table 1). This constitutes fully one-third of the estimated 10,000,000 pounds of lead consumed by the entire Confederacy in the manufacture of 150,000,000 cartridges used by its armies (Robertson, 1993).

Interestingly, lead was not the only product from the Austinville area. Slag was shipped to the Petersburg Lead Works for use in the reduction furnaces there. Late in the

*New River Trail Park historian, Cecil "Pete" Spraker, (oral commun., 1995) tells that Thomas Jackson walked from the lead mines area to Richmond to tender the bid, no mean feat in the early years of nineteenth century Virginia. Not frequenting the bars and taverns along the route as his competitors did, Jackson arrived in Richmond ahead of the other would-be buyers and won the bid.

war, in March of 1864, the lead mines company sent about thirteen thousand pounds of zinc ore to Richmond (Donnelly, 1959).

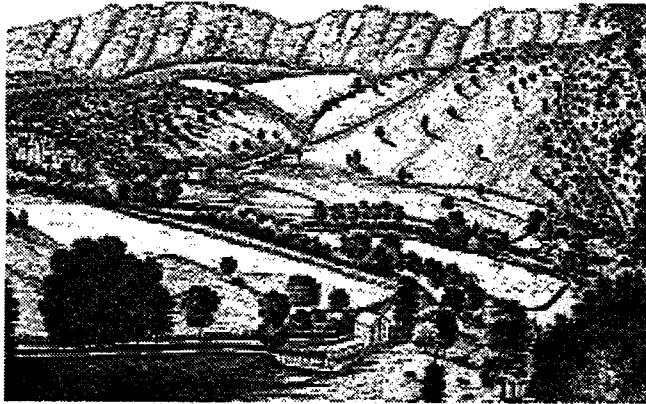


Figure 4. Late nineteenth-century illustration of lead mines area from Boyd (1881). Although published 16 years after the Civil War, this picture suggests how the lead operations might have appeared during the 1860s.

Table 1. Wythe County Union Lead Mines Production, 1861-1864.

	Pounds
May 1, 1861 - February 28, 1862	1,232,254
February 28, 1862 - February 28, 1863	842,378
February 28, 1863 - April 1, 1864	623,113
April 1, 1864 - December 17, 1864	585,571

The first two years of the Civil War saw little military action in southwestern Virginia. The most significant event during that time was the seizure by Federal forces of nearby West Virginia. Firmly in Union hands from 1862 on, West Virginia served as an important launching point for Union forays into southwestern Virginia. By spring, 1863, Federal strategists had begun to appreciate the military significance of the salt and lead operations in this area, as well as the importance of the Virginia and Tennessee Railroad. This great railroad, running from Lynchburg westward to Big Lick (Roanoke), and thence down the Great Valley to Bristol and beyond, provided the most direct rail link between Richmond and the western theater battlefronts (Noe, 1994). Both troops and wartime commodities, including the Wythe County lead, moved along this vital railroad.

Early in July, 1863, Lee was beaten at Gettysburg and in retreat. Federal high command in West Virginia decided that this was a good time to attack southwestern Virginia, in particular, the great salt works at Saltville (Walker, 1985). On July 13, Union Colonel John Toland (Figure 5) left Charleston with about 1,000 cavalry and mounted infantry. Coming into Virginia through Abbs Valley, Toland met and defeated a small rebel outpost in a brief skirmish there. Fearing that Saltville and its several hundred defenders would be forewarned, Toland switched his plans to an assault on Wytheville, hoping to destroy the railroad "High Bridge" west of town over Reed Creek. He also anticipated mounting an attack on

the lead mines.

By late afternoon on July 18, Toland was within sight of Wytheville. A small group of rebel defenders had been hastily assembled; these consisted of local armed citizens and about 130 troops from the Confederate Department of Southwest Virginia, sent down from department headquarters at Dublin by train. A sharp fight broke out along the streets of downtown Wytheville and Toland was killed. In about 45 minutes, the Union forces overpowered the southern defenders and the "Battle" of Wytheville was over. But the Union command was decimated and the surviving ranking officer gathered his troops and retreated to West Virginia.



Figure 5. Union officers John Toland (top) and William Averell (bottom). Although both commanders led troops into the Wythe County area during the war, neither got near the crucial lead mines (Toland credit: Massachusetts Commandery Military Order of the Loyal Legion and the US Army Military History Institute; Averell: Library of Congress).

The results of all this were negligible. Parts of Wytheville were burned and some railroad track was damaged that took about an hour to repair. The crucial High Bridge was untouched and the lead mines never attacked. Indeed, the lead mines home guard, consisting of two companies of miners, was called out to help defend Wytheville, but arrived too late to be of any consequence. They simply turned around and went back home (Donnelly, 1959).

One interesting footnote to this story involves the Confederate troops brought by train from Dublin (Walker, 1985; Marvel, 1992). The southern commander, Major Thomas Bowyer, firmly instructed the engineer to keep the train waiting at the depot in Wytheville should his men need to withdraw quickly. But when Bowyer and his retreating soldiers arrived at the depot after the fight, they found the train already departing, as the engineer had thrown the wheels into reverse and was backing the train home to Dublin. It was indeed a disgusted and dispirited group of Confederate troops, who first having lost the firefight for Wytheville, then had to walk the 25 or so miles back to Dublin to boot!

No real threats to the lead mines re-emerged until a year later. By May, 1864, Union Commander-in-Chief General Ulysses S. Grant had Federal forces on the move throughout Virginia (Marvel, 1992). In particular, General Benjamin Butler was coming up the James toward Richmond, General Franz Sigel was advancing southward in the Shenandoah Valley, and Grant himself was moving from the north toward the Wilderness area and ultimately Richmond. As part of this grand strategy, a Union force under General George Crook advanced into southwestern Virginia, again from West Virginia. This time the principal objectives were to attack Saltville and destroy the railroad "Long Bridge" over the New River at Central (Radford). Crook sent General William Averell (Figure 5) and his cavalry to wreck the salt works. But Averell learned that Saltville was defended by General John Hunt Morgan and his fearsome cavalymen and decided to move on to Wytheville and perhaps the lead mines. Morgan caught Averell at Crockett's Cove near Wytheville and drubbed him severely. Eventually, Averell and Crook returned to West Virginia without doing serious damage to the railroad or getting anywhere near the salt and lead operations (McManus, 1989).

December, 1864 - the rapidly weakening Confederacy tottered toward defeat and final oblivion. Grant was inexorably closing the ring around Richmond and Lee's trapped Army of Northern Virginia. In southwestern Virginia, Union scouting parties sometimes roamed at will. The citizens of this region, besides facing Federal troops, were equally terrorized by outlaw bands of bushwhackers, murderers, and deserters from the Confederate army (Walker, 1985). But, incredibly, even at this late stage in the war, the three great military targets of the region - the lead mines, the salt works, and the Virginia and Tennessee railroad - remained intact and operational.

General George Stoneman (Figure 6), an ambitious Union commander in eastern Tennessee, was determined to change all this. Stoneman left Knoxville, by now in Union hands, on

December 10 with 5,500 men plus artillery pieces. Stoneman's troops moved northeastward along the Virginia and Tennessee railroad, entering Virginia at Bristol. Advancing up the Great Valley, Stoneman drove the Confederate forces before him (Evans, 1993). Railroad trestles, rolling stock and depots were eventually burned from Bristol to 10 miles north of Wytheville. On December 16, Wytheville itself was taken and partly burned. Next day, Stoneman sent two regiments of troopers to attack the lead mines (Walker, 1985; Marvel, 1992).



Figure 6. Union General George Stoneman, whom Secretary of War Edwin M. Stanton characterized as "one of the most worthless officers in the service" (Library of Congress). Stoneman led raids in 1864 and 1865 that put the lead mines out of operation. After the war, he was made military governor of Virginia.

The Union raiders of December 17 met no attempt to defend the lead mines. Indeed, the small Confederate force assigned that task chose instead to retreat at the approach of Stoneman's troopers. The biggest obstacle to the Yankee soldiers was crossing the frigid New River to get at the mines. This they did successfully and, in only two hours, the mine offices, storehouses, stables, crushing machine, bellows, furnaces, and even the sawmill and gristmill, went up in flames (Marvel, 1992). Even with this much devastation, the mines were back again in production on March 22, 1865. By this time, all the accumulated reserves of lead had been used up and the eastern armies of the Confederacy were completely dependent upon the day-to-day production of the Wythe County mines (Donnelly, 1959).

His objectives accomplished, Stoneman withdrew from southwestern Virginia and returned to Knoxville on December 29. Behind him lay ruined railroad engines, cars, depots, and bridges, as well as the wrecked salt and lead production

facilities. Surprisingly, before the end of the war, both salt and lead works were once more operational and some traffic was moving on the railroad. On March 21, 1865, Stoneman returned to southwestern Virginia and completed its devastation. Federal troops revisited the lead mines on April 7 and destroyed the partially rebuilt plant as well as the assembled repair materials (Donnelly, 1959).

By then, it didn't really matter. Two days later Lee surrendered at Appomattox and the bloodiest war in American history was over.

SUMMARY AND CONCLUSIONS

How significant were the Wythe County lead mines to the Southern war effort? According to historian Ralph Donnelly (1959, p. 409), "the conclusion is inescapable that the Federal military authorities, almost without exception, failed to appreciate the importance of the Wytheville mines to the Confederate cause." He goes on to say that these lead works should have been the prime military target in southwestern Virginia, but generally seemed to fall below the salt operations at Saltville and the Virginia and Tennessee railroad in order of importance in Federal strategy.

After the war, Colonel William Broun of the Confederate Ordnance Department stated: "Our lead was obtained chiefly, and in the last years of the war entirely, from the lead mines at Wytheville, Virginia. The mines were worked night and day, and the lead converted into bullets as fast as received" (Robertson, 1993).

Today, few Virginians, much less other American citizens, are aware of the critical role played by the Wythe County lead mines in the epic struggle between North and South in the 1860s. The old Shot Tower, having survived the Civil War fighting and destruction that raged nearby, bears mute testimony to the rich history of the lead and zinc deposits in southwestern Virginia. (This remarkably well-preserved structure is now part of the New River Trail State Park system and is easily accessible from Interstate Highway 77 via the Poplar Camp exit. It is a "must-see" for anyone interested in the history of science and technology in the United States.)

The lead mines of Austinville and Ivanhoe are closed now and very little is there to see. State roadside historical markers for both the lead mines and Shot Tower and Jackson's Ferry fail to mention their roles in the Civil War (Figure 7). An yet, as suggested by Donnelly (1959), perhaps the strongest links between the Civil War period and the old lead mines are the descendants of the miners themselves, many of whom still live in that area and keep alive the memories of the workmen who provided lead for the Confederate armies of 1861-1865.

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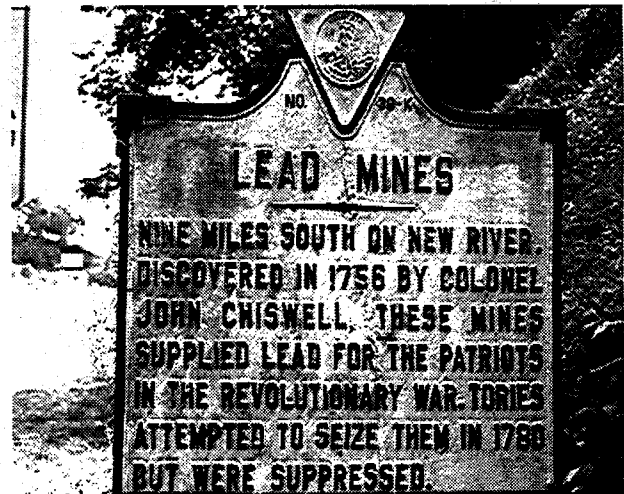


Figure 7. Historical markers along U.S. 52 in Wythe County tell part of the Shot Tower and lead mines stories. Neither mention the historic Civil War struggles in this area.

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MINERAL UPDATE

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BERMANITE FROM THE MOREFIELD PEGMATITE, AMELIA COUNTY, VIRGINIA

The hydrous manganese phosphate bermanite, $[\text{Mn}_3(\text{PO}_4)_2(\text{OH})_2 \cdot 4\text{H}_2\text{O}]$, has been added to the long list of mineral species at the Morefield pegmatite near Amelia, Virginia. Bermanite was found in material collected in December 1990 by Mr. W. D. Baltzley in a well developed replacement body at the 60 foot level. This is the same material in which strengite ($\text{FePO}_4 \cdot 2\text{H}_2\text{O}$) was recognized by Smerekanicz, et. al. (1991). Bermanite was first described by Hurlbut (1936) from a pegmatite in the Bagdad district of Arizona. Moore (1973) has noted its occurrence in moderate abundance from several pegmatites occurring as a late stage hydrothermal alteration of triplite ($\text{Mn}_2\text{Fe}_2\text{Mg}_2\text{Ca}_2\text{PO}_4(\text{F},\text{OH})$).

At the Morefield pegmatite, bermanite is found as small clusters of resinous brown crystals associated with triplite and strengite (Figures 1 and 2). It was identified by X-ray powder diffraction with chemical verification by EDAX analysis. This is the first reported occurrence of bermanite in Virginia.

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Figure 1. SEM photograph of bermanite with strengite. The bermanite is shown in the lower left (Mn-Phosphate). The strengite is in the upper right (Fe-Phosphate).

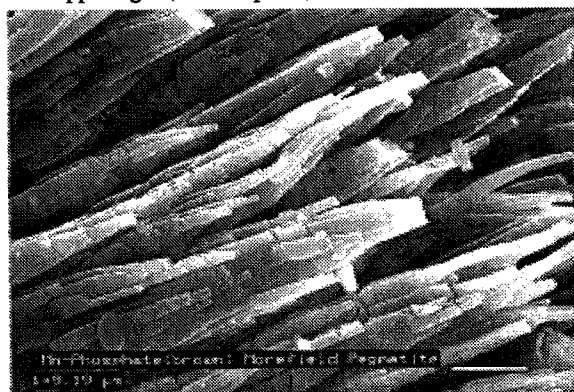


Figure 2. SEM photograph of Bermanite crystals.

LEUCOPHITE

A New Phosphate Mineral from the Dixie Mine,
Rockbridge County, Virginia

Several small specimens were recently submitted for identification by Mr. Fred Schaefermeyer of Alexandria, Virginia. These specimens were collected from the site of the old Dixie mine, Rockbridge County, Virginia (Kearns and Penick, 1989). Numerous small, transparent, yellowish-orange, diamond-shaped crystals were found with rackbridgeite and limonite in cavities of massive goethite. The crystals are monoclinic, and flattened on the {010}, with some notable high angle prism faces (Figure 1).

EDAX analysis shows significant concentrations of potassium, iron, and phosphorous. A computerized search (MINCAT) for minerals fitting the EDAX analysis produced only a single possibility: leucophosphate. X-ray diffraction analysis has not been obtained due to the scarcity and size of the crystals.

The earliest descriptions of leucophosphate are from Western Australia (Simpson, 1932) where it is found as fine-grained chalk-like masses, and from Western Liberia (Axelrod and others, 1952) where it forms colloidal masses. Bird guano and bat dug are suggested as the sources of phosphate, respectively. The first known occurrence of leucophosphate from a pegmatite, and the first occurrence of well developed crystals were from the Sapucaia pegmatite in Minas Gerais, Brazil (Lindberg, 1957). Other occurrence have

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been noted from several phosphate bearing pegmatites in the Black Hills. Fine crystalline material has been collected from the Tip Top mine, near Custer, South Dakota (Moore, 1972). Segeler and others (1981) describe leucophosphite as a rare mineral from the Palermo #1 pegmatite, where it is found with rockbrusgeite. A photograph (T. Kampf) of a leucophosphite crystal accompanying the article is identical in appearance and habit to the material from the Dixie mine.

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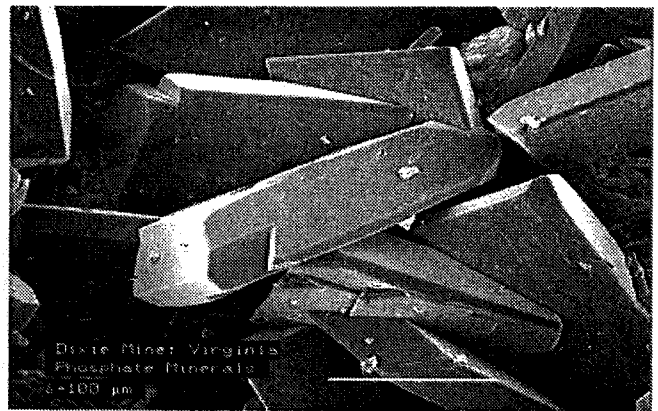


Figure 1. Leucophosphite crystal from the Dixie mine, Rockbridge County, Virginia

NEW RELEASE

Publication 140: Structural section across the Atlantic coastal plain, Virginia and southeasternmost Maryland, by R. C. Milici, J. K. Costain, C. Coruh, and P. A. Pappano, 2 plates with text, 1995.
Price: \$7.75