Mineral Resources – Region 1, con't.

Avalon Rocks

Mineral Deposit Processes

Hydrothermal processes associated with active Precambrian to Early Cambrian volcanic activity in the Avalon Rocks (before they were attached to North America) produced numerous deposits of sulfides (copper, lead, and zinc), gold mineralization, iron and manganese formations, barite, and a major tungsten deposit. Many of these deposits were modified, and in some cases further concentrated, by hydrothermal processes accompanying the Acadian and Alleghanian mountain building events.

Volcanic activity and igneous intrusions in the Avalon Rocks were often accompanied by hydrothermal alteration so intense that economic deposits of aluminum silicate minerals of the kyanite family were formed.

Metallic Mineral Deposits

The Avalon Rocks hosts a wide variety of metallic mineral deposits, but many are clearly associated with Precambrian to Cambrian volcanic activity and igneous intrusions that occurred before the terrane was attached to North America. Among the most interesting geologically and historically are the gold deposits.

Gold was first reported in North Carolina in 1774, but the Carolina Gold Rush began after 12 year old Conrad Reed found a 17-pound gold nugget on the family farm in 1799. Early gold mining in the Southeast exploited placer deposits and shallow enriched zones, using primitive, labor intensive techniques with little scientific or engineering consideration. Mining was largely a secondary, part-time enterprise in the agricultural Piedmont. Despite these limitations, mining had begun at deposits in five North Carolina counties by 1820, and 500 ounces of North Carolina gold arrived at the U.S. Mint in Philadelphia during 1824. Mining experts and engineers were recruited from Britain, Germany, Italy, and South Africa, and miners came to the Southeast from more than a dozen countries. New mining and milling technologies were introduced, including the first stamp mill in the United States, erected at the Capps Mine near Charlotte, North Carolina in 1829. The Carolina Gold Rush spread through the Southeastern Piedmont from Virginia to Alabama and westward across the Blue Ridge by 1830, and included the deposits of the Inner Piedmont.

Total gold shipments to the US Mint in Philadelphia from North Carolina during 1834 were over 18,000 ounces, with another 20,000 ounces from Georgia. Under intense lobbying pressure, Congress voted in 1835 to open a new US Mint in New Orleans, with branch mints in Charlotte, North Carolina and Dahlonega, Georgia. The Charlotte Mint was opened in 1837 to purchase the gold being produced in the piedmont of the Carolinas and Virginia and mint gold coins. The Dahlonega branch opened in 1838 to mint gold coins from the gold produced in the piedmont of Georgia.

Figure 5.11: Gold mining districts in the Avalon Rocks.

Major gold mining districts in the Avalon Rocks include the Gold Hill District (160,000 ounces) and the Charlotte District (100,000 ounces) in North Carolina, the Haile-Brewer Area (350,000 ounces) and Dorn Mine (50,000 ounces) in South Carolina (Figure 5.11). The deposits are volcanic hydrothermal gold and base metal sulfide mineralization, probably enhanced by tectonic-metamorphic hydrothermal processes.

CA Gold Rush

Some miners from the Southeast Piedmont joined the gold rush to California in 1849, although North Carolina gold production peaked that year. Spectacular placer discoveries were largely a thing of the past in the Southeast, and lode mining was hard, dangerous work. Many of the miners who joined the CA Gold Rush were looking for quick, easy riches. The thousands of miners who remained continued to work successfully until the beginning of the Civil War in 1861.

Modern-day Gold Rush

South Carolina was the scene of a modern-day gold rush between 1985 and 1999, with four major open-pit mines in operation, plus widespread exploration. At the peak of activity, the Ridgeway Mine (Fairfield County), Barite Hill Mine (McCormick County), Brewer Mine (Chesterfield County), and Haile Mine (Lancaster County) were in production. South Carolina produced about 400,000 ounces of gold from 1827 to 1939. Total production of about 1,650,000 ounces between 1985 and 1999 brings the total gold production for South Carolina to over 2 million ounces. Total gold production from the entire Southeastern Piedmont through 1969 is estimated at 2.7 million ounces. South Carolina production from 1985 to 1999 increases this figure to about 4.35 million ounces of gold.

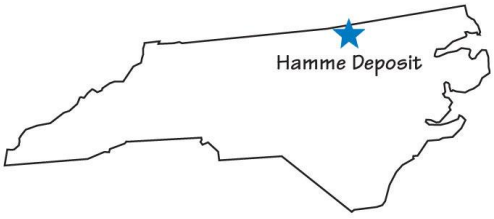

Figure 5.12: The Hamme deposit of North Carolina was an important tungsten mine.

In addition to gold, mines of the Avalon Rocks produced minor copper, zinc, lead, silver, and tungsten before 1939. Production came from numerous small (<500,000 tons) sulfide deposits and vein deposits of hydrothermal origin. Iron and manganese were produced during the 18th and 19th centuries. Like the gold deposits, these ores were from a combination of hydrothermal processes associated with volcanic activity and igneous intrusions, often concentrated by hydrothermal fluids associated with the Paleozoic mountain building events. The Hamme deposit in Vance County, North Carolina was the largest tungsten mine in the U.S. from 1951 to 1958, and produced over a million tons between 1942 and 1963 (Figure 5.12). The primary tungsten mineral is huebnerite and occurs in quartz veins as a result of hydrothermal processes associated with Precambrian igneous intrusions. Considerable reserves of tungsten ore remain in the area.

Banded iron formation deposits extend for almost 85 miles through the Avalon Rocks in North and South Carolina. Hydrothermal in origin, the iron was deposited as sediments on the ancient seafloor. These deposits were first mined for local forge products just before 1760, and supplied iron for the weapons of the Continental Army during the American Revolution. The profitability of these and similar small districts were greatly reduced after 1855 with the discovery and development of the vast iron deposits of the Lake Superior District in Michigan. The Avalon Rocks banded iron formations were a major source of iron for the weapons of the Confederate armies during the Civil War, including shot, cannonballs, and armor plates for naval ironclads. Production declined after the war and ended around 1900.

Weathering and stream erosion have produced residual deposits of heavy mineral concentrates in the eastern Avalon Rocks, especially in association with granite intrusions. Monazite deposits form an "Eastern Monazite Belt" in North Carolina and Virginia.

Non-metallic Mineral Deposits

Extensive deposits of barite (Fe3O4) are present in the Avalon Rocks, associated with gold and base metal mineralization, as well as extensive areas of hydrothermal alteration. Because it is heavy, soft, and chemically inert, barite is widely used as an additive and filler, largely to increase the density of lubricating muds used in oil and gas drilling.

The hydrothermal aluminum silicate deposits of the Avalon Rocks often contain a remarkable and highly prized assortment of rare and unusual minerals, formed by the concentration of insoluble elements in the host rock and the introduction of new elements. Some of these minerals, in addition to kyanite and pyrophyllite, include rutile, topaz, lazulite, diaspore, tourmaline, and pyrite. Many of these deposits contain abundant pyrite, sometimes in crystals up to eight-inches across. Major deposits of kyanite, pyrophyllite, and andalusite are also present in the Avalon Rocks. Major pyrophyllite deposits in the Avalon Rocks include those at Hillsborough, Snow Camp, Glendon, and Robbins in North Carolina and Boles Mountain in South Carolina. Important kyanite deposits include Henryís Knob, South Carolina and Graves Mountain, Georgia.

Aluminum Silicate Minerals

The kyanite family of minerals includes kyanite, sillimanite, pyrophyllite, and andalusite. All have the formula Al2SiO5 and are polymorphs, minerals with the same composition but different crystal structures. These different crystal structures form under different conditions of heat and pressure, and reflect the geologic history and degree of metamorphism of the rocks in which they are found. Pyrophyllite, kyanite, and sillimanite form a metamorphic progression of aluminum silicate minerals formed at increasingly higher temperature and pressure. Andalusite forms at high temperatures but low pressures. All of these minerals form mullite when heated to very high temperatures. Mullite is used in manufacturing glass and ceramics that can withstand very high temperatures.

Triassic-Jurassic Rift Rocks

Mineral Deposit Processes

Sedimentation was the dominant process occurring in the Mesozoic Basins. Igneous intrusions and local volcanic activity in the Jurassic was also accompanied by minor hydrothermal activity, and the formation of small deposits of copper and iron mineralization. Low temperature rift basin hydrothermal circulation of groundwater formed a few small copper deposits, and a major uranium deposit.

Metallic Mineral Deposits

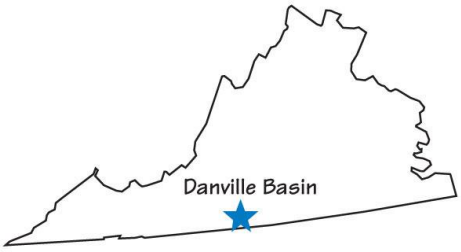

Figure 5.13: Virginia's Danville rift basin contains a uranium ore body.

Scattered small occurrences of copper sulfides and hematite (Fe3O4) formed in association with hydrothermal activity in the rift basins, and low temperature hydrothermal circulation of groundwater through the sediments, but none are of major economic importance in the Southeast.

In 1982 the Marline Uranium Corporation announced the discovery of a 30-million ton deposit of uranium ore in Pittsylvania County, Virginia. The ore body is developed in an intrusion of gneiss in the Danville rift basin (Figure 5.13). Uranium originated in the rift basin sediments, and was transported in dissolved form by groundwater, and deposited. The Uranium deposit was never developed, due to a drop in uranium ore prices and local opposition to the project.

Sources: http://geology.teacherfriendlyguide.org/index.php/minerals-se
http://geology.teacherfriendlyguide.org/index.php/minerals-se/region-1-blue-ridge

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