GOLD MINING IN SOUTH CAROLINA

PREPARED FOR

SOUTH CAROLINA STUDIES

8th GRADE CURRICULUM SUPPLEMENT

Unit 1 – South Carolina Statewide Overview

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(Excerpted from the SE Section NAGT Spring Field Trip Guidebook – April 1987 – edited by Philip M. Astwood)

The gold deposits of South Carolina formed within a narrow belt of rocks that extends southwestward from Virginia to Alabama through the Piedmont Region. Over 100 mine locations have been described in South Carolina, most of them within Cherokee, Chesterfield, Lancaster, and York Counties. However, seventeen of the state's Piedmont counties can claim at least one small mine or prospect. In the mid 1800's, North and South Carolina were the primary producers of gold for the entire country and the Haile Mine in Lancaster County holds the record for producing more gold than any other mine in the eastern United States.

Gold occurs in two primary types of deposits, **placers** and **lodes**. **Placers** are sediment deposits, usually associated with streams, which form as flowing water erodes gold or gold-bearing minerals from their places of origin in solid rock. Gold is one of a small group of chemical elements called "**native elements**" that occur naturally in a pure state (uncombined with other elements). Weathering processes separate the gold pieces (flakes and/or nuggets) from the host rock so that running water can pick them up and carry them away. The water flow carries the gold particles downstream and then deposits them, along with sand and other particles, as stream gravel in potholes or other points where the stream velocity slows down to the point where it loses the ability to transport these materials. Most placers exist in or near present day streams and are usually mined by individual '**prospectors**' in a process called '**panning** for gold'. In the **panning** process, stream gravel is placed in a shallow pan with lots of water and then gently swirled around so that the water carries away the lighter (less dense) particles, leaving the heavier (denser) particles - like gold - behind in the bottom of the pan. Gold is nineteen times as heavy (dense) as water and nearly six times as heavy as most common rock-forming minerals. The **prospector** then picks out the pieces (nuggets) of gold and discards the rest of the sediment. The size of the gold pieces can range from extremely small flakes to large nuggets weighing several kilograms. Rarely, placer deposits may be found high on the sides of hills at the sites of ancient stream valleys.

Lodes are the actual sites where gold has formed in solid rock. The typical host rock is a **metamorphic** rock that has been formed by heat, pressure, and chemically active hot water (a process known as **hydrothermal** alteration). Some lodes are **vein** deposits which form as hot, metal-rich liquids move upward through cracks and fractures in the host rock, reacting with existing minerals in the rock, and then solidifying. Such deposits are generally tabular in shape and may be traced for a fairly long distance (tens of meters) or be locally discontinuous throughout the rock. Although such **veins** contain some gold, they are filled primarily with quartz and often contain heavy deposits of pyrite (fool's gold) and other metallic minerals. A few **vein** deposits have produced gold masses the size of basketballs, but most discoveries are much smaller in size. Some **vein lodes** can be mined effectively with simple pick and shovel techniques.

The other type of **lode** formation is a deposit in which the local rock does not necessarily contain any original gold, but has been altered by chemically active solutions containing gold that enter with later **hydrothermal** activity. These introduced chemical solutions replace some of the original minerals in the rock with very tiny specks of pure gold. Unlike vein deposits, the replacement gold is not localized, but rather spread throughout the rock mass as finely disseminated, microscopic grains. The host rocks can vary greatly in shape and size, but generally contain abundant quartz along with pyrite (fool's gold), gold, and other metallic minerals. The mining of lodes is usually more complex and expensive because it requires the use of heavy equipment and environmentally dangerous chemicals. Large-scale gold mining of this type requires large tracts of land and can have serious environmental impacts.

The latest 'gold rush' in South Carolina occurred in the 1980's and 1990's as the price of gold worldwide rose to unusually high levels. Three mining operations became commercially profitable during that time; the Haile Gold Mine (operated by Piedmont Mining Company) in Lancaster County, the Brewer Mine (operated by Westmont Mining) in Chesterfield County, and the Ridgeway Mine (operated by Kennecott Ridgeway Mining Company) in Fairfield County. All three mines utilized the modern process of passing solutions of potassium or sodium cyanide through finely powdered ore to dissolve the gold. The gold is then precipitated and cast into bars.

The Reed Gold Mine

(Text and photos modified from Reed Gold Mine website < http://www.ah.dcr.state.nc.us/sections/hs/reed/reed.htm>)

Reed Gold Mine, near Charlotte, North Carolina, is the site of the first documented gold find in the United States. From this discovery, gold mining spread gradually to nearby counties and eventually into other southern states. During its peak years gold mining was second only to farming in the number of North and South Carolinians it employed. The estimated value of gold recovered reached over one million dollars a year.

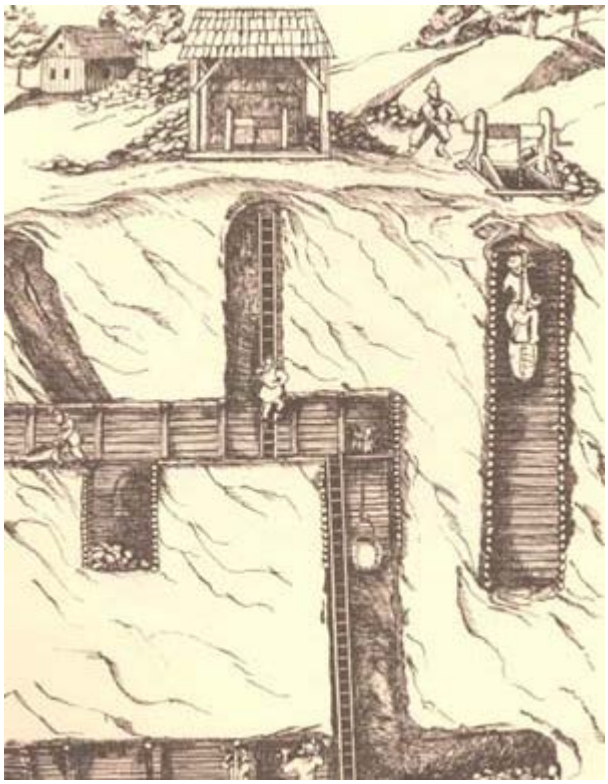
John Reed (Johannes Reith) was an illiterate Hessian mercenary from Germany—an illegal immigrant—who settled near Meadow Creek in Mecklenburg County, married, and raised a family. Most of the people in this rural area dwelt on modest family-run farms, where they raised small grain crops such as corn and wheat. The life of farmer Reed would have been long forgotten had it not been for a chance event one Sunday in 1799. On that day, Reed's son Conrad found a large yellow rock in Little Meadow Creek on the Reed farm. This rock reportedly weighed 17 pounds and for three years was used as a doorstop at the Reed house.

Many other large gold nuggets were eventually found at Little Meadow Creek. In fact, so many nuggets were found here that the area next to the creek was called "The Potato Patch", the digging of nuggets having been likened to digging up potatoes. Hearing of Reed's good fortune, other Piedmont farmers began exploring their creeks and finding gold. Men and women, both young and old, worked in the gold fields. Foreigners joined them, including the skilled Cornishmen from England.

Near this spot in 1799, young Conrad Reed found "a yellow substance shining in the water."

Little Meadow Creek

Placer or creek gold mining gave way to underground excavation when it was learned in 1825 that the metal existed also in veins of white quartz rock. Spurred on by that discovery—made by Matthias Barringer—a successful search for more veins was initiated. Much of the mining activity was centered in Mecklenburg County, where many vein mines appeared. Almost daily discoveries of gold were reported, with the mining region expanding to include still other counties.



Restored Mine Tunnel at Reed

The search for "lode" or vein gold required a great deal more money, machinery, and labor. At first, underground mining was simply the digging of large pits at random in hopes of uncovering subterranean ore. Gradually, pits were deepened into shafts; from the shafts, tunnels were extended out following the veins of ore. By the 1830s, centuries-old European mining techniques were being employed in North Carolina. Digging deep shafts and branched networks of tunnels (called drifts) extruding at various levels to follow the veins, the professional miners sometimes carved out a room, or "stope," in their efforts to remove the vein material. Working by candlelight, the miners pried apart the rocks at their natural joints or fractures using chisels, picks, shovels, crowbars, and gunpowder. Low wheelbarrows were used to haul ore along the drifts to the main shaft. In major Carolina mines, iron Cornish buckets called "kibbles" were commonly used to hoist ore and miners to the surface. At the Reed mine, frames or timber collars were built to reinforce the tops of the shafts. By mid-century some mines in the state had shafts extending down several hundred feet into the earth.

The Haile Gold Mine

(Text and photos copied and slightly modified from website <http://www.angelfire.com/sc2/tokenofthemonth006/>)

In 1827, Colonel Benjamin Haile, an early settler in the Kershaw area, discovered gold in one of the creek beds on his farm. He began to pan the placer deposits on his property on a regular basis, and did so for several years. In 1837, the first stamp mill was erected, and actual mining operations began in earnest. The mine continued to operate through the Civil War, as the Hailes had some sort of arrangement with the Confederacy to supply much needed gold and other minerals. Union General William T. Sherman destroyed the whole works during the closing days of the war.

The Haile family sold the mine in 1866 to James Eldridge who, in 1880, sold out to a New York syndicate. The new owners invested heavily in equipment and resumed operations on a large scale. In 1887, Dr. Adolph Thies was hired as foreman, and he soon perfected a process known as "barrel chlorination," which more easily extracted the gold from the ore. This process became the technical innovation of the day, so much so that Thomas Edison visited Thies to learn about it.

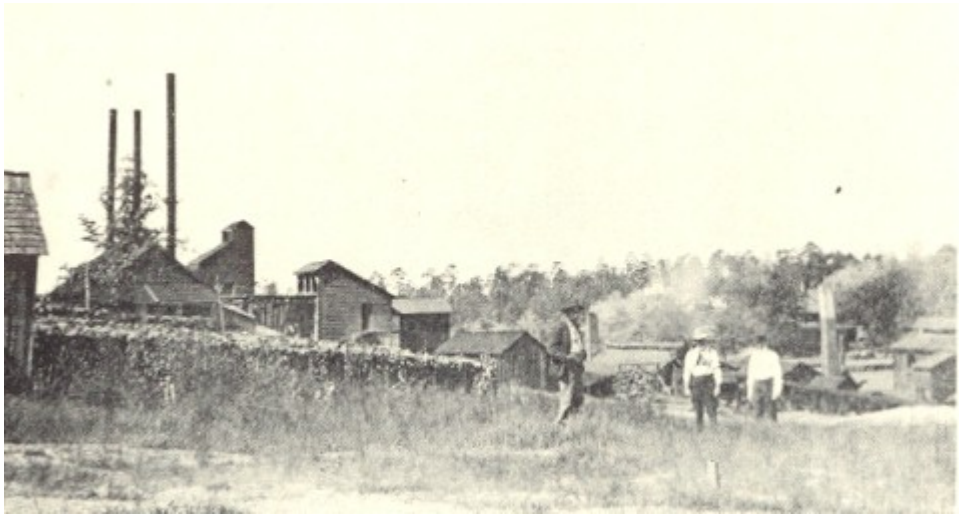
A photo of Dr. Adolph Thies, Sr., circa 1904.

During the 21 year period from 1887 to 1908, the mine did very well. Besides several large buildings that housed machinery for the mining operations, there was a large office building, a company store, a post office, and a boarding house, all of which covered an area of 1800 acres.

In 1904, Dr. Thies retired and his son, "Captain" Ernest Thies, took control of daily operations. On August 10, 1908, the huge boiler that provided power for all of the mining equipment exploded. The force ruined several buildings, killed Thies and another employee, and injured several other workers. The physical and emotional devastation was so great that the mine did not reopen for several years.

Several companies have attempted to work the mine since then. Most have had limited success. The mine was most recently reopened by the Piedmont Mining Company in 1984. The first gold from the reopened mine was poured in April, 1985. The mine was again closed down in the late 1990s.

A pre-1908 photo showing shaft workings, hoister building and rock crusher plant.



Kennecott Ridgeway Mining Company

is a part of Kennecott Minerals, a wholly-owned subsidiary of Rio Tinto,plc , one of the world's leading mining companies.
(Text and photos copied and slightly modified from Kennecott Minerals website <http://www.kennecottminerals.com/krmc>)

Kennecott Ridgeway Mining Company (KRMC) operated a 15,000 tons-per-day open-pit gold mine located approximately 5 miles east of the town of Ridgeway, and 25 miles north of Columbia, South Carolina. The mine operated 24 hours a day, 7 days a week, and employed over 100 people. For most of its active mine life, Ridgeway was the only producing gold mine in the Eastern United States, with production beginning in December 1988. The mine produced a gold/silver doré product from bulk-mineable, open-pit deposits, located one mile apart. The mill poured the millionth ounce of gold in 1995. The deposit consisted of two orebodies, the South Pit and the North Pit. Mining in the South pit finished first, and the bulk of the waste from the North Pit was directly backfilled into the South pit, as it was filling with water, on its way towards becoming a lake. Mining in the North Pit ended in November 1999. The whole site is currently being reclaimed.

Kennecott Ridgeway Mining Company (KRMC) operated a 15,000 tons-per-day (TPD) open-pit gold / silver mine. The mine and mill complex operated 24 hours a day, 7 days a week, and employed over 100 people. The mine utilized an assortment of mining equipment, ranging from blasthole drills, 85 & 100 Ton Haul Trucks, Front End Loaders, and ancillary support equipment. Blasting was performed by a contractor. On-site assaying of drill cuttings allowed engineering control (ore control) to be done on a timely basis, keeping the mine running, which in turn, allowed the mill to keep on producing. The mill, ground the ore to minus 200 mesh, then utilized a modified Carbon-In-Leach (CIL) circuit, followed by an electrowinning process, to extract and recover the precious metals. On average, 33 tons of ore were processed to recover 1 ounce of gold. Processed materials from the mill, were piped to the tailings facility for dewatering and internment.

Open Pit Mining at Ridgeway

Milling and Recovery

Gold ore was trucked up out of the Production Pits and tipped into the crusher hopper (far right of previous photo). There it was fed to a primary crusher and deposited in the stockpile cone (at the far left of the photo) awaiting drawdown to the belt feeding the mill (located out of sight behind the cone in this photo). The amount of gold that was available to extract through milling from each truckload of ore was approx. 1½ oz. – to 3 oz. This could also be the amount we retrieve from every other truckload from the mine, since we had to move approximately equal amounts of waste rock to get to the ore.

Ore was processed through successive crushing and grinding stages, breaking the rock into a talc-like powder before feeding it through a line of 10 agitation tanks where the gold was dissolved into solution. Gold was absorbed from the solution onto activated carbon granules which were treated in an enclosed tank, followed by a stripping column where the gold was dissolved in a hot caustic solution under pressure. From the stripping column, gold was electroplated onto steel wool cathodes, which were transferred to electro-refining cells where the gold was plated onto stainless steel sheets. Gold precipitates were then scraped from the stainless steel plates, melted in a crucible furnace at 2,000 degrees and cast as 700 oz. bars containing about 60% gold and 40% silver.

Cyanide is the most popular chemical used by mining corporations to extract gold from ore, despite the fact that leaks or spills of this chemical are extremely toxic to fish, plant life and human beings. The term "cyanide" refers to numerous compounds, both natural and human-made, having the chemical group CN, that is, one atom of carbon and one atom of nitrogen. Cyanide combines with up to 97% of gold, including particles of gold that are too small to be seen by the naked eye, making it one of the most efficient process chemicals for the extraction of the metal. Cyanide leaching involves spraying a sodium cyanide solution (at 250 to 500 parts per million) on finely ground ore or on old waste rock, known as tailings. The gold forms a water-soluble chemical compound with the cyanide which is then run over activated carbon to extract the gold. The cyanide waste that is left over is supposed to be stored in lined and covered ponds to prevent contact with local animals and birds. Some companies process the ore in vats allowing the cyanide to be recycled, but most operations store the waste cyanide in ponds with plastic liners that break easily, allowing the solution to contaminate the ground water.

[cyanide information copied and edited from website: < http://www.zpok.hu/~jfeiler/baiamare/docs/Drillbits.htm>]