INFORMATION CIRCULAR 21

ORMATION CIRCULAR 21 GOLD RESOURCES OF NORTH CAROLINA

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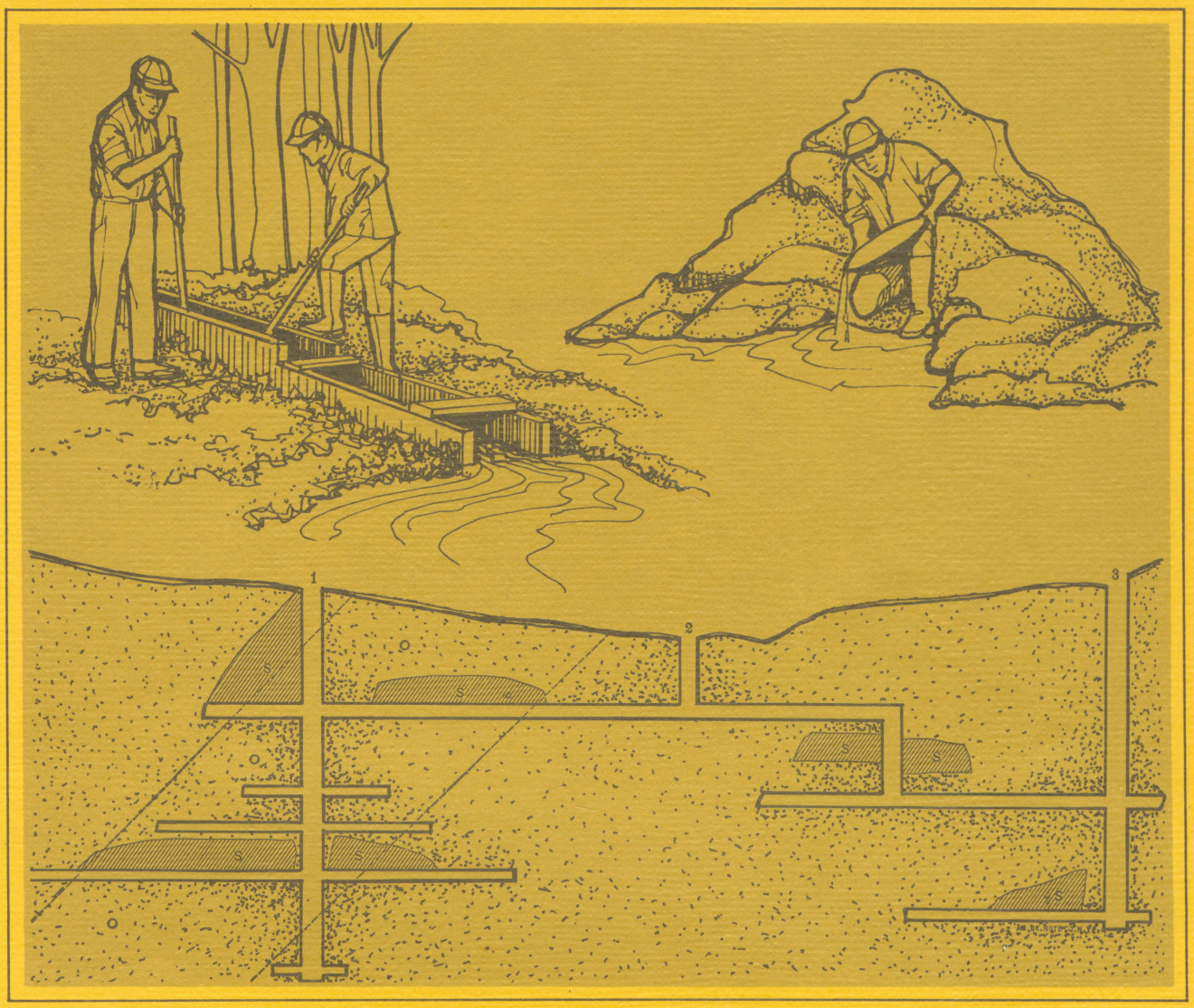

by

P.A. Carpenter, III

NORTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF LAND RESOURCES
GEOLOGICAL SURVEY SECTION

RALEIGH
1972
Revised 1978

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GEOLOGICAL SURVEY SECTION

The Geological Survey Section shall, by law "...make such examination, survey, and mapping of the geology, mineralogy, and topography of the state, including their industrial and economic utilization as it may consider necessary."

In carrying out its duties under this law, the section promotes the wise conservation and use of mineral resources by industry, commerce, agriculture, and other governmental agencies for the general welfare of the citizens of North Carolina.

The section conducts a number of basic and applied research projects in environmental resource planning, mineral resource exploration, mineral statistics, and systematic geologic mapping. Services constitute a major portion of the Section's activities and include identifying rock and mineral samples submitted by the citizens of the state and providing consulting services and specially prepared reports to other agencies that require geological information.

The Geological Survey Section publishes results of research in a series of Bulletins, Economic Papers, Information Circulars, Education Series, Geologic Maps, and Special Publications. For a more complete list of publications or more information about the Section please write: Geological Survey Section, P.O. Box 27687, Raleigh, North Carolina 26711.

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Cover Design -- Gay Brantley

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GOLD RESOURCES OF NORTH CAROLINA

by

P. Albert Carpenter, III

ABSTRACT

The beginning of "gold fever" in North Carolina dates back to 1799, when a young boy found a 17-pound gold nugget in Little Meadow Creek in Cabarrus County. This discovery initiated America's first gold rush. North Carolina soon became the Nation's first gold-producing state and was the only gold producer until 1828.

Over 600 inactive gold mines and prospects are scattered throughout the Piedmont and Mountain regions of the state. The deposits can be grouped into six belts: 1) the Eastern Carolina belt, 2) the Carolina slate belt, 3) the Charlotte belt, 4) the Kings Mountain belt, 5) the South Mountain belt, and 6) the Western belt. Even though some of the deposits never produced significant quantities of gold, many were major producers and were extensively developed. Total gold production in North Carolina through 1978 is estimated as high as $25,000,000.

Both placer and lode (vein and mineralized zones) deposits were mined in North Carolina. The placer materials were usually mined first, and later operations moved underground to obtain gold from the lodes. Copper, lead, zinc, and silver were also commonly associated with the deposits. These minerals were often mined along with the gold and were sometimes the major product.

Even though gold is an important part of North Carolina's past, there is currently no commercial gold mining in the state. The last major production was from 1954 to 1963, as a byproduct of copper mining. Many streams flowing through old mining districts still contain small amounts of placer gold that can be recovered by panning. Although it is not possible to obtain large quantities from these streams, the possibility of finding gold "colors" in a pan lures many weekend prospectors to the state.

Gold has always been highly valued, and it was one of the first metals used by man. Its rarity, beauty, and durability allow for a variety of uses in jewelry, electroplating, dentistry, decorative purposes, and medicine and as a monetary standard. Gold's unique physical properties, many of which cannot be duplicated by substitutes, will continue to make gold a valuable mineral resource.

INTRODUCTION

Acknowledgements

This information circular was prepared under the direction of Stephen G. Conrad, State Geologist. The information contained in this report is, for the most part, not new information, but represents a brief summary of information from many older, out-of-print reports dealing with the gold deposits of the state. In most instances, the information is not referenced in the text, but a complete list of references is included at the end of the report. Most of the information is from the reports by Bryson (1936), Pardee and Park (1948), and Stuckey (1965).

Mineralogy and Physical Properties

Gold, one of the native metals, is recognized chiefly by its weight, malleability, and yellow color. It is normally found in varying shades of yellow but may be silver-white to orange-red, depending upon the impurities present; has a hardness of 2.5 - 3; and has a specific gravity of 19.3 when pure. Gold normally contains some silver and frequently copper and iron. It is insoluable in all acids except aqua regia (a mixture of hydrochloric and nitric acids). Gold is a rare element. Even though it crystallizes in the isometric system, normally forming octahedral crystals, it usually is seen as irregular plates, scales, and masses rather than as crystals.

Occurrence

Even though gold is a rare element, it is widely distributed in small amounts in all igneous rocks. Concentrations of gold are most common in quartz veins associated with nearby felsic (silicic) igneous intrusive rocks. The gold in quartz veins is usually native gold, forming coatings, stringers, masses, or disseminations in the quartz; or it may be locked inside the sulphide minerals with which it is associated. In many instances, the gold is so finely disseminated that it cannot be detected with the unaided eye. Pyrite and other sulphides are usually associated with gold in quartz veins. Frequently, in near-surface portions of the veins, the sulphides are oxidized, thereby releasing the gold held in them. This process creates what is referred to as a "free-milling" ore because the gold can be recovered with little preparation by amalgamation with mercury.

Gold is also found as concentrations referred to as placer deposits and residual deposits. These deposits form when gold-bearing veins are weathered, and the gold is either washed away into the streams as placer deposits or is concentrated in the soils as residual deposits. Because of its high specific gravity, gold is mechanically separated from the lighter material in stream beds. In placer and residual deposits, gold is found as rounded or flattened grains, nuggets, and occasional crystals.

Gold occurs in nature mainly as the native metal and as alloys with other metals, primarily silver. Gold forms a complete solid-solution series with silver (ions of gold can substitute for silver ions and vice versa), and almost all gold contains some silver. When silver is present in amounts greater than 20 percent, the alloy is known as electrum. Gold is commonly referred to according to its fineness or purity, which is expressed in parts per 1000. Most gold contains about 10 percent other metals and thus has a fineness of 900. Gold is weighed according to the troy system which is based on 480 grains per troy ounce or 20 pennyweight.

1 troy ounce = 480 grains = 20 pennyweight = 1.097 ounces avoirdupois
12 troy ounces = 1 troy pound

Sources and Production

Approximately two-thirds of the Free World's gold production comes from the Republic of South Africa, which has produced more than 50 percent of the world total production during the last 25 years. Their current annual production is about 31 million ounces. Most of the Republic of South Africa's production comes from what is known as the Witwatersrand near Johannesburg in the Transvaal. Gold in the Witwatersrand is mined from metamorphosed conglomerate beds estimated to contain reserves of 600 million ounces. Over 40 large underground mines produce 75 million to 80 million tons of ore annually from which 25 million to 30 million ounces of gold are recovered.

Other major gold producers in order of rank are Russia, Canada, and the United States. Most of Russia's production is from placers in Siberia and from mines on the eastern slopes of the Ural Mountains. Canada's major production comes from lodes in Ontario and Quebec.

The largest gold producer in the United States is the Homestake Mining Company operation at Lead, South Dakota. Production from this mine has declined in recent years and, in 1975, was 304,877 ounces, down from 343,650 ounces in 1974. Average grade was 0.207 ounce per ton. The Carlin Mine of the Newmont Mining Corporation in Nevada was the second largest producer of gold in 1975, and had a production of 213,000 ounces from an ore grade of 0.292 ounces per ton. Kennecott Copper Corporation's open pit copper mine at Bingham, Utah, is also a large domestic producer of gold.

The 25 leading gold producers accounted for 95 percent of the total domestic production in 1975. Ten of these mines were operated primarily for gold or gold and silver. Two percent of the production came from placers. Five states accounted for 92 percent of the mine production with Nevada the leading producer

followed by South Dakota, Utah, Arizona, and Colorado. Total domestic production for 1975 was 1,052,000 troy ounces, continuing a downward trend since 1971. Total production for 1977 was 1,100,347 troy ounces.

Uses

Gold has always been highly valued, and it was one of the first metals used by man. Its primary use is as a monetary standard. In the early days of gold mining in the United States, gold coins were minted, but now gold is kept in reserve as bullion in Fort Knox, Kentucky, as support for paper currency issued by the United States government. Gold is also the standard of exchange in international trade. Even though most of the world's gold is horded by governments and central banks, its use in the arts and industry is increasing.

The jewelry industry uses over half of the total gold used annually for nonmonetary purposes. Most of that gold is alloyed, usually with copper. Much of the gold used in jewelry is used for electroplating and as rolled gold plate and gold fill. The gold is usually referred to in terms of karats. Karat means a 24th part, and gold is expressed according to its weight proportion in an alloy. An 18 karat alloy contains 18/24's or 75 percent gold. Gold is most widely used as a 14 karat alloy. Below this content, corrosion resistance drops sharply.

The largest industrial consumption of gold is in electrical components in the form of gold electroplate to make semiconductors, connectors, and printed circuits. Gold for dentistry purposes accounts for about 10 percent of the annual gold consumption. Other uses of gold include gold coatings for decorative purposes on glass and porcelain and in medicine as treatments for arthritis and certain types of cancer.

In 1975, gold was legalized for private ownership. As a result, gold can now be used in items for investment such as fabricated bars.

No metal or alloy has been developed that possesses all the desirable characteristics of gold. The use of substitutes is always done so at the risk of losing some of the desirable qualities of gold. Platinum and palladium are sometimes substituted for gold in jewelry; however, they are more expensive and lack the color and appeal of gold. Silver is occasionally substituted in electrical uses, but it is less resistant to corrosion than gold and less ductile. Other metals have applications in dental uses.

Mining Methods and Recovery

The method of mining and processing gold ore varies, depending upon the size and shape of the deposit, type of deposit (placer or lode), composition of the ore (minerals present other than gold), and depth of the deposit. The mining of lode deposits most commonly consists of one of two types -- open pit and underground. Open pit mining is much cheaper than underground mining and is most often used in deposits of large volume and low grade. Some deposits that can be worked profitably by open pit methods are unprofitable using underground methods. In open pit mining, the overburden is first stripped off, and then the ore is removed by using hammers or rotary drills to cut benches that spiral downward to the bottom of the pit. The ore and waste are removed from the pit by trucks or railroad cars. Underground methods vary depending upon the nature of the deposit. Normally, the ground is entered by a vertical or inclined shaft or, in mountainous areas, by tunnels (adits). Levels are then driven from the shaft to the ore at different depths down the shaft. The ore is removed by cutting drifts, cross-cuts, raises, winzes, and stopes. The ore is loaded into skips and hoisted to the surface. As the ore is removed, the remaining voids are frequently filled with waste rock or sand or supported by timber.

Small placer deposits can be worked by the simplest of methods and require only the removal of the material containing the gold and the recovery of the gold by mechanical devices such as sluices, pans, or rockers. These recovery methods are all based upon the principal that the gold is heavier than the other minerals

present in the deposit and can be concentrated at a specific location in the sluice, pan, or rocker. Occasionally, mercury may be used to concentrate the very fine or flake gold. Many of the devices used in small placer operations are portable and require only moderate expense, so they are popular with amateur prospectors.

In mining large-scale placer deposits, either hydraulicking or dredging methods are used. Hydraulicking is used in working unconsolidated gravels and requires the use of large amounts of water. The gravels are worked in place by forcing powerful jets of water onto the deposit and channeling the material into sluices. Dredging is used on a much larger scale than hydraulicking and can be used in deposits submerged in water. The dredging machine normally consists of a mechanical excavator and washing, screening, pumping, and propulsion equipment. A dredge can recover material to a depth of 100 feet below the water level and can process 300 to 500 cubic yards of gravel per hour.

After an ore has been mined, it must be milled or processed to obtain the desired final product. The type of processing required depends primarily upon the character of the ore and the desired product. When gold occurs as free-milling gold, it can be processed by the very simple, low-cost method of amalgamation. The ore is first crushed and then passed over amalgamating plates (plates covered with mercury) which absorb the gold. The gold can then be separated from the mercury by retorting or heating the mercury so that only the gold is left behind. Amalgamation is most commonly used in the recovery of placer gold.

Cyanidation is generally used in processing simple gold ores but cannot be used when copper is present. This process involves grinding the ore and putting it into large tanks through which a solution of potassium cyanide is passed to dissolve the gold. The gold is then precipitated by passing it through a filter containing zinc. It is then purified and cast into 35-pound gold bars.

Smelting is frequently used in the recovery of gold such as in massive sulphide deposits. This involves melting the ore and adding a collector, such as copper or lead, to carry down the molten droplets of gold. Flotation and gravity concentration are also used in gold processing. Sometimes it may be necessary to use a combination of processes in treating a gold ore.

Gold is refined either by the chlorination process in the molten state (Miller process) or by electrolysis (Wohlwill process). The fineness of gold refined by the Miller process is 996 to 997; whereas, gold refined by the Wohlwill process is 999.5 to 999.8 fine.

GOLD IN NORTH CAROLINA

History of Mining

The first gold mining in North Carolina may have been by the Indians in Cherokee County before the first white settlers arrived. There are also reports that, in 1540, Hernando de Soto attempted to mine gold along the Valley River northeast of Murphy. Early in the 20th Century, attempts at mining in that area intersected old mine workings, possibly those opened by de Soto, that contained bark rope, metal picks, and other materials used in mining in the 16th Century (Stuckey, 1965, p. 295). Reports also state that, prior to the American Revolution, the Oliver Mine in Gaston County and the Dunn Mine in Mecklenburg County were operated, and U. S. Mint records show the receipt of gold from North Carolina as early as 1793.

Since none of these early reports of gold have been substantiated, it is generally agreed that the first authenticated discovery of gold in the United States was 1799. This discovery was made by 12-year-old Conrad Reed on the farm of his father, John Reed. The nugget, supposedly weighing about 17 pounds, was found in Little Meadow Creek while Conrad and his sister and younger brother were shooting fish with a bow and arrow. Conrad showed the heavy, yellow rock to his father who took the rock to the silversmith in Concord. The silversmith said the rock had no value, so Reed returned home with the rock and used it for a doorstop for three years.

In 1802, Reed took the rock to a jeweler in Fayetteville. The jeweler recognized the sample as gold and purchased it for $3.50. Reed returned home but eventually learned that the jeweler had sold the gold for several thousand dollars. Reed returned to the jeweler in Fayetteville and received about $3000 additional compensation.

Following that experience, John Reed returned to the creek and began finding additional nuggets. Reed associated himself with three other men, and together they found nuggets ranging in size from 16 pounds down to small particles. In 1803, a 28-pound nugget was found. A total of 153 pounds of nuggets was found on the property.

Figure 1. The remains of the first Chilean mill erected in North Carolina at the Reed Mine. Standing beside the mill is Mack Cox, who found an eight-pound nugget at the mine in 1896.

The discovery of gold on the Reed farm initiated America's first gold rush. As word of the gold discovery spread, the search for gold began in nearby counties. Gold was soon discovered in Montgomery County and then in Stanly, Mecklenburg, Union, Gaston, Rowan, Davidson, and Randolph Counties. This early mining was restricted to the gravels along streams. On the Tobias Barringer farm in Stanly County, gold was mined from the alluvium along Long Creek and from a small tributary to the creek. As work progressed upstream, it was noticed that the gold disappeared. At this point Barringer decided to dig into the hillside to see if he could find the source of the gold. Within a few feet of the surface, a gold-bearing quartz vein was found. This discovery, in 1825, marked the beginning of lode mining in North Carolina (Figure 2). Other veins throughout the area were soon prospected, and, in 1831, the veins on the Reed property were discovered.

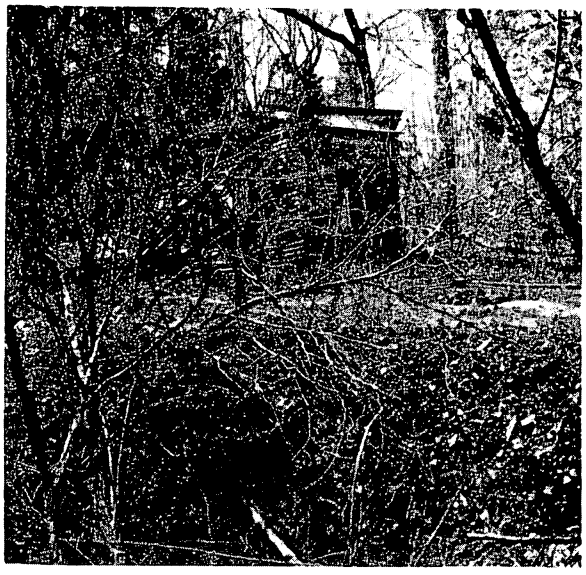


Figure 2. Barringer Mine, Stanly County site of the first gold lode to be worked in North Carolina, photo 1972.

About 1828, gold was first worked in the South Mountains district of Burke and McDowell Counties. Gold was supposedly discovered there when a traveler stopped at a shoemaker's home and spent the night. The next day the traveler, Sam Martin, noticed specks of gold in the mud that was used to fill the spaces between the logs of the house. This discovery led to the mining along Brindle Creek, and soon placer mining spread to the First and Second Broad Rivers, Muddy Creek, and Silver Creek. Mining in the South Mountains later spread to the hillsides where both bench gravels and lodes were worked.

By 1831, gold had become such an important resource in North Carolina that gold coins were minted to make the gold easier to handle. Gold coins, minted by Christian Bechtler, were minted as $1.00-, $2.50-, and $5.00-pieces and had the name C. Bechtler, Rutherford County, North Carolina on one side. On the reverse side was the value, number of grains, and karats fine. The gold coins of Bechtler were the first ones minted in America. In 1837, the United States mint opened a branch in Charlotte, and the first coin was struck in 1838. Because of the high quality of the Bechtler coins, the Bechtlers were allowed to continue minting. The Charlotte mint continued operation until 1861, when it's operation was halted by the Civil War. Coins were never produced there again, but the mint was later used as an assay office. The building was later moved and is currently the Mint Museum of Art. Production of coins by the Bechtlers ceased in 1847.

The discovery of gold on the Portis property, in Franklin County in 1838, initiated gold mining in the Eastern Carolina belt. Mining was soon undertaken in Nash, Halifax, and Warren Counties. About this same time, mining was begun in the Cid district of Davidson County.

In 1842, mining was begun in the Gold Hill district of southeastern Rowan County, perhaps the best known mining district in the state. The Randolph Shaft was opened at Gold Hill in 1843, and was the deepest and richest of the Gold Hill mines. By 1848, there were at least 15 active mines in the district.

Mining flourished in North Carolina until 1849, the date of the discovery of gold in California. With news of the great California gold deposits, many of North Carolina's most experienced miners left for the west. As a result, many of the state's mines closed. Some of the most profitable mines remained open until the Civil War, but then all of the mines closed. Following the war, many mines reopened and were producers until

1891, and again during the periods 1902-1906 and 1912-1915. Many of the mines during those later years were used as speculating properties for stock manipulation, although some were legitimate producers.

In 1934, when the price of gold was raised from $20.67 per ounce to $35.00 per ounce, the search for gold was again renewed. Only a few scattered mines were still operating at that time, but with word of a higher gold price, many of the old, abandoned properties were reworked, and exploration was undertaken for new deposits. This period of activity continued until about 1944. Since that time, most of the state's gold production has come as a by-product of other metal mines, primarily from the H and H Mine in Halifax County, the Ore Knob copper mine in Ashe County, and the Hamme (Tungsten Queen) Mine in Vance County.

In December 1971, the Federal government devalued the dollar, raising the official gold price by 8.57 percent to $38 per troy ounce. In 1972, the freemarket gold prices began to rise, and by mid-August, the London quotes were up to a record $70 per ounce. Gold prices continued to rise throughout 1974, reaching a high of $197.50 per troy ounce near the end of the year. In 1975, prices began a downward trend and were around $140 at year's end. Prices continued to fluctuate in 1976, but in 1977 began to rise, averaging $160 for the year. In July 1978, gold prices broke the $200 barrier for the first time in history. This most recent price rise is apparently closely related to weakness of the dollar in European money markets.

Several major mining companies are continuing to show an interest in base metals and gold in the southeast. The continuing increase in the price of gold should encourage sustained exploration efforts.

Production

From 1803 through 1828, North Carolina was the only recorded producer of gold in the United States. Approximately $156,000 of gold was produced during that period. The period 1829-1855 was the most important with 393,119 fine ounces of gold produced. Approximately thirty percent of the total state production was recovered during that time. The other main periods of production were 1882-1891, 1902-1906, and 1912-1915.

When the price of gold was increased to $35.00 an ounce in 1934, the state's gold production was revived. From 1935 to 1944, 17,241 fine ounces valued at $603,598 were produced. There was no production recorded from 1945 to 1948, and from 1950 to 1953.

Gold production figures for the state for 1804 through 1978 are shown in Table 1. Accurate figures were not kept until 1880, when the U. S. Bureau of Mines began publishing statistical reports on the mineral production of the United States. Prior to 1880, production figures were based on U. S. Mint returns and estimates.

General Geology

North Carolina's gold deposits occur as two main types, lode and placer. The lodes may be subdivided into veins and mineralized zones. The veins are generally narrow, less than four feet wide, but may be up to 30 to 40 feet wide. They pinch and swell along their length and depth, and frequently several veins may occur within close proximity to one another. The length of the veins varies from a few tens of feet to hundreds of feet. Most of the veins in North Carolina are steeply dipping and trend to the northeast. The veins normally have sharp contacts with the country rock which frequently is sheared to a phyllite or schist adjacent to the vein.

The veins are composed primarily of quartz with varying amounts of accessory minerals. Minerals most frequently associated with the veins include pyrite, limonite, magnetite, calcite, sericite, and chlorite. The most common ore minerals in the veins are gold, chalcopyrite, sphalerite, and galena. Not all of these minerals are found in each vein, and in places the veins are completely barren of mineralization.

The mineralized zones (often called replacement bodies) are zones in sheared country rock that have been altered and mineralized, chiefly to quartz, sericite, and chlorite. These zones are up to one hundred

TABLE 1 - GOLD PRODUCTION IN NORTH CAROLINA

1804-1978

Years	Fine Ounces	Value
1804-1823	2,274	$ 47,000
1824	242	5,000
1825	822	17,000
1826	968	20,000
1827	1,016	21,000
1828	2,225	46,000
1829	6,483	134,000
1830	9,869	204,000
1831	14,224	294,000
1832	22,158	458,000
1833	22,980	475,000
1834	18,384	380,000
1835	12,724	263,000
1836	7,165	148,100
1837	5,656	116,900
1838		
1839		
1840		
1841		
1842	140,232	2,898,505
1843		
1844		
1845		
1846		
1847		
1848	22,910	473,543
1849	23,502	485,793
1850	17,200	355,523
1851	15,814	326,883
1852	19,512	403,295
1853	13,334	275,622
1854	10,018	207,073
1855	10,954	226,416
1856	8,276	171,070
1857	4,058	83,870
1858	9,325	192,742
1859	10,381	214,574
1860	7,556	156,182
1861	536	11,088
1862	112	2,313
1863	63	1,309
1864	295	6,094
1865	614	12,693
1866	6,818	140,937
1867	3,208	66,306
1868	4,350	89,906
1869	5,645	116,672
1870	4,892	101,111
1871	4,633	95,766
1872	5,557	114,863
1873	5,822	120,332
1874	5,180	107,070
1875	5,255	108,628
1876	4,411	91,181
1877	3,872	80,026
1878	3,634	75,123
1879	3,971	82,076
1880	4,596	95,000
1881	5,564	115,000
1882	9,192	190,000
1883	8,079	$167,000
1884	7,596	157,000
1885	7,354	152,000
1886	8,466	175,000
1887	10,885	225,000
1888	6,580	136,000
1889	7,102	146,795
1890	5,733	118,500
1891	4,596	95,000
1892	3,801	78,560
1893	2,593	53,600
1894	2,330	48,167
1895	2,622	54,200
1896	2,143	44,300
1897	1,674	34,600
1898	4,064	84,000
1899	1,669	34,500
1900	1,379	28,500
1901	2,685	55,500
1902	4,388	90,700
1903	3,411	70,500
1904	5,994	123,900
1905	6,081	125,685
1906	3,973	82,131
1907	3,976	82,193
1908	4,716	97,480
1909	1,946	40,230
1910	3,292	68,045
1911	3,400	70,282
1912	8,032	166,014
1913	6,117	126,448
1914	6,344	131,141
1915	8,321	172,001
1916	1,269	26,237
1917	590	12,187
1918	79	1,631
1919	5	101
1920	72	1,479
1921	156	3,229
1922	95	1,971
1923	68	1,415
1924	220	4,540
1925	897	18,540
1926	79	1,631
1927	49	1,015
1928	114	2,366
1929	245	5,054
1930	705	14,582
1931	368	7,598
1932	367	7,591
1933	725	18,522
1934	509	17,779
1935	2,176	76,145
1936	1,940	67,900
1937	949	33,203
1938	1,878	65,730
1939	495	17,325
1940	1,943	68,005
1941	3,313	115,900
1942	4,396	153,860

TABLE 1 - GOLD PRODUCTION IN NORTH CAROLINA - Cont.

1804-1978

Years	Fine Ounces	Value	Years	Fine Ounces	Value
1943	137	4,795	1961	2,094	73,000
1944	21	735	1962	460	16,000
1945	---	---	1963	33	1,000
1946	---	---	1964	---	---
1947	---	---	1965	---	---
1948	---	---	1966	---	---
1949	13	455	1967	---	---
1950	---	---	1968	---	---
1951	---	---	1969	---	---
1952	---	---	1970	---	---
1953	---	---	1971*	---	---
1954	214	7,500	1972	---	---
1955	190	6,650	1973	---	---
1956	882	30,870	1974	---	---
1957	1,373	48,000	1975	---	---
1958	876	31,000	1976	---	---
1959	965	34,000	1977	---	---
1960	1,826	64,000	1978	---	---

* Small by-product production from the tungsten mine in 1971.

feet or more wide and have indefinite boundaries, commonly grading gradually into the country rock. Ore grade varies throughout the zone, and gold frequently occurs in only a small portion of the zone. It is common for quartz stringers to cut through the zones. The shape of the zones may be tabular, lenticular, or pipe-like; and they normally trend parallel to the regional strike.

Primary minerals in the mineralized zones include quartz, sericite, chlorite, and pyrite. Other minerals most commonly present are chalcopyrite, pyrrhotite, sphalerite, limonite, and gold. The mineralized zones normally carry low-grade gold ore.

Gold in veins and mineralized zones is normally bright yellow. In the upper oxidized zones of the deposits, it occurs as free gold, apparently having been released by weathering of the sulphides. Below the oxidation zone, gold may be found in small fractures, around grain boundaries, or as irregular masses in quartz. Normally, the gold is so finely disseminated that it is difficult to detect with the unaided eye. It also sometimes occurs within the sulphide minerals, particularly in pyrite.

Placer deposits most commonly are along small streams flowing through areas where the lode deposits occur. The placers include deposits in present stream channels, in old stream gravels on hillsides above the present stream bed, and in residual deposits in saprolite overlying weathered lode deposits. In alluvial deposits (stream deposits), the gold is found with the coarser gravels, usually near the bottom of the deposit close to bedrock. Other heavy minerals such as magnetite, rutile, ilmenite, and zircon frequently are concentrated with the gold. Placers vary in thickness and width depending upon a number of factors including the amount of material available for transport, the size and velocity of the stream, and the terrain through which the stream flows.

Suggestions for Prospecting

Although all of the easily accessible gold deposits in North Carolina have previously been worked, there are still streams where small amounts of gold can be obtained by panning or using small portable dredges. It is unlikely that any significant new gold deposits can be discovered in North Carolina without using the latest exploration techniques and sufficient capital to carry out extensive investigations; however, for the amateur or vacation prospector, the search for small amounts of gold can be an exciting and rewarding experience.

Many of the gold-bearing placers have already been worked at least twice, once during the original mining in the 1800's, and again during the depression of the 1930's, but small amounts of gold can still be panned from many of these streams. Streams draining known gold-producing areas are the most logical sites for panning. Streams such as Little Buffalo Creek in Rowan and Cabarrus Counties, Dutch Buffalo Creek in Cabarrus County, Cabin Creek in Moore County, the Uwharrie River in Montgomery County, and the streams in the South Mountain area would be good places to start. In addition, many of the tributaries to these streams and many smaller streams draining areas where lode deposits have been worked are logical sites for panning. It is also possible that some gold might be panned from streams that have not previously been mentioned in relation to gold production. Probably those streams were prospected at some time, but no significant deposits were found.

North Carolina has no laws pertaining specifically to prospecting for gold. Generally, for the amateur prospector, all that is required for prospecting on private land is the permission of the landowner. Having obtained the landowner's permission to prospect, the individual should use common rules of courtesy and leave the property in as good condition as it was when prospecting began. Prospecting is prohibited in North Carolina state parks. Information for prospecting on other state-owned lands should be obtained from the department having charge of the land, such as the state Forest Resources Division or Wildlife Resources Commission. Permission to prospect in National Forests should be obtained from the U. S. Bureau of Land

Management in Washington, D. C. The use of metal detectors in state and national parks and forests is prohibited.

For those who are more serious about prospecting and are interested in developing a deposit, a lease to the mineral rights of the property should be obtained. Any mining that will affect more than one acre of land must be carried out in accordance with the North Carolina Mining Act of 1971. A copy of this law can be obtained from the Land Quality Section of the Department of Natural Resources and Community Development, P. O. Box 27687, Raleigh, North Carolina 27611. Operations which require the processing of large quantities of water or require discharging water or waste into the state's waters will require a permit from the Environmental Management Division of the Department of Natural Resources and Community Development at the same address given above.

Very little equipment is needed to begin prospecting for placer gold. The two basic items needed are the miners pan and a shovel. Other equipment which is helpful includes a geologist's pick, some type of sturdy hook or spoon for gouging out crevices in bedrock, a magnet for removing magnetite from the heavy mineral concentrates, a magnifying glass, and containers in which to keep the gold and concentrates. Additional equipment such as rockers, long-toms, or sluices can be used when larger volumes of material are being worked.

One important step in prospecting for placer gold is knowing where to look. Good places to start are where streams of moderate gradient begin to widen or change their flow direction -- any place where currents begin to slow. Gold tends to be deposited in streams at a point where the current has slowed, such as in the gravels along the quiet sides of streams (the middle portions of streams flow faster than the portions near the banks), on bars, and on the insides of bends in the stream. Gold tends to work its way to the bottom of the sediment and often accumulates in crevices, depressions, and potholes in the bedrock underlying the stream. Therefore, the ultimate target in stream prospecting should be the bedrock.

Different techniques can be used in prospecting for lode deposits; however, the gold pan can still be used when there is sufficient water available. Lode prospecting usually requires the vein material to be crushed and then panned to determine if gold is present, or assays must be run. In recent years, some use has been made of the many different types of metal detectors available.

An individual new at prospecting might like to develop his panning technique at one of the tourist attractions now open to the public. Doing so will enable the amateur to pan from material that is known to contain gold and also to pick up some hints from more experienced panners. At the Cotton Patch Mine in Stanly County 1.9 miles southeast of New London, placer gold can be panned for a fee. In recent years it has been possible to obtain "colors" from almost every panful of material that is worked there.

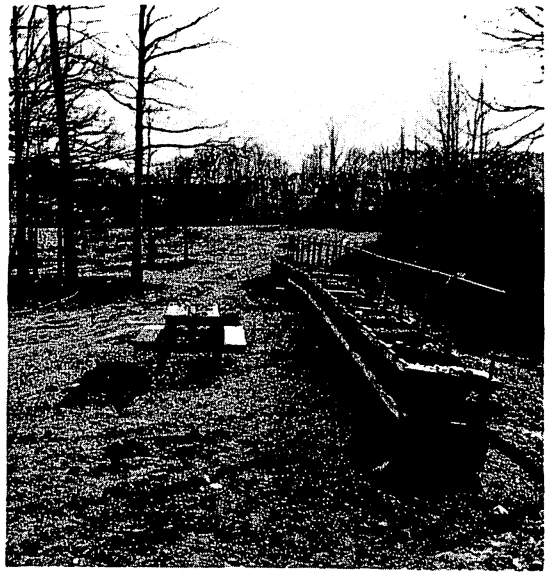


Figure 3. Cotton Patch Mine, Stanly County.

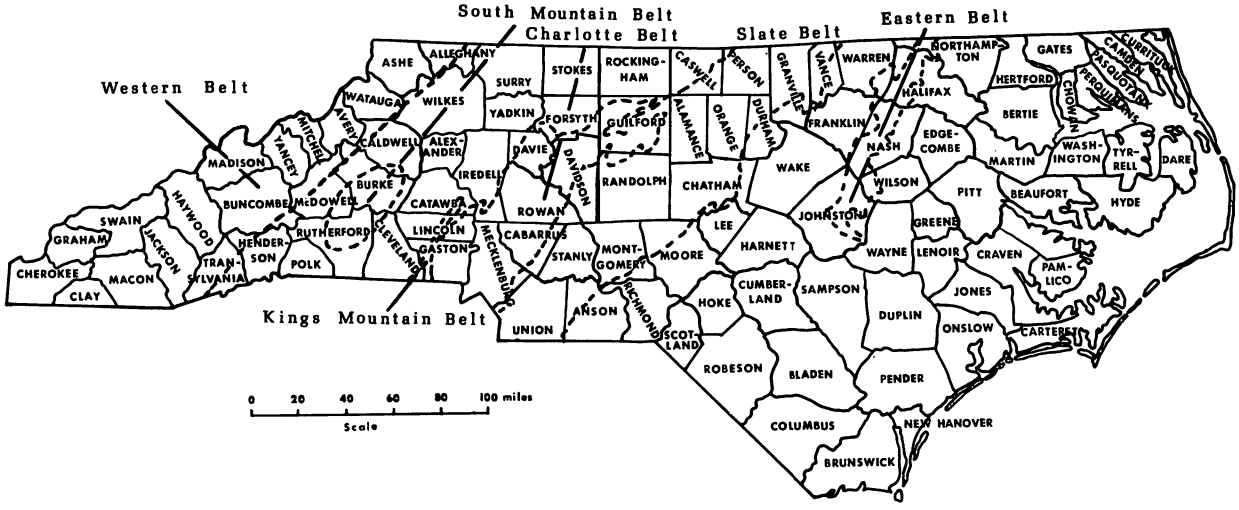


Figure 4. North Carolina's major gold-producing belts.

GOLD DEPOSITS OF NORTH CAROLINA

The gold mining districts of North Carolina are spread throughout the Piedmont and Mountain sections of the state and are usually grouped into one of six belts (Figure 4). These belts are: (1) the Eastern Carolina belt, (2) the Carolina slate belt, (3) the Charlotte belt (Carolina Igneous belt), (4) the Kings Mountain belt, (5) the South Mountain belt, and (6) the Western belt.

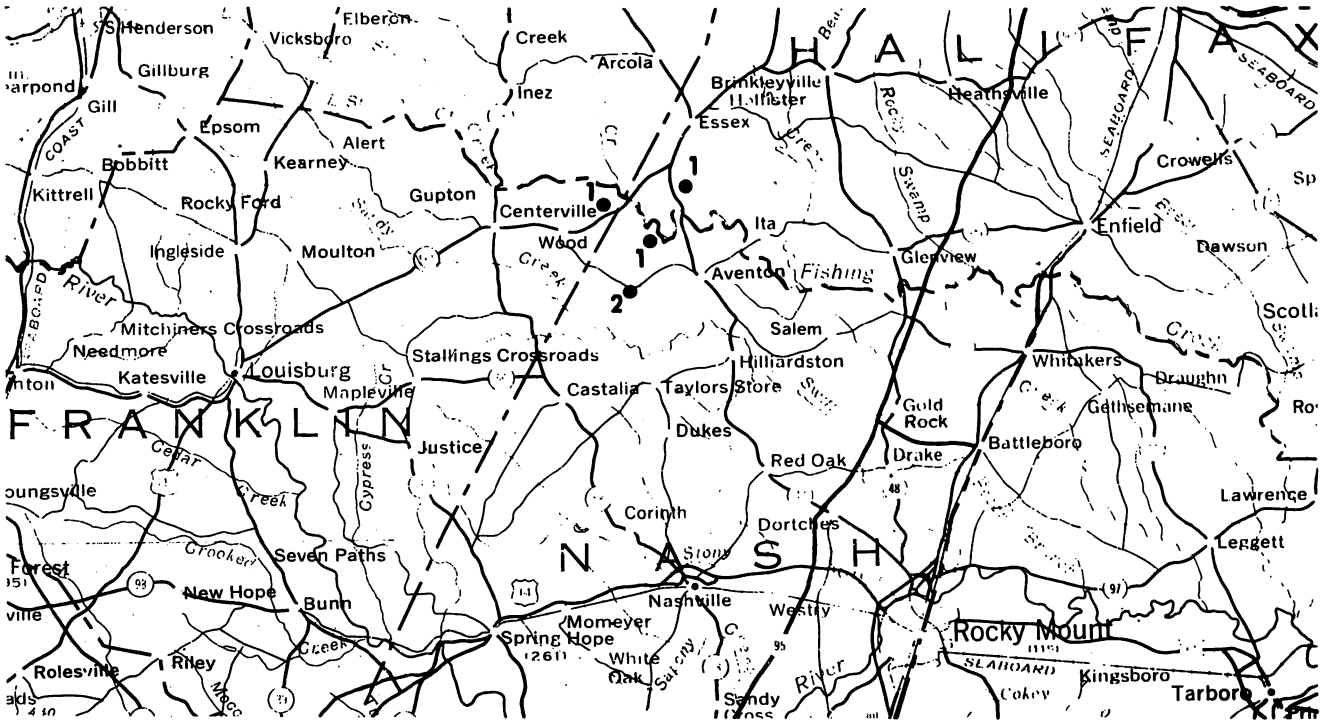
There are approximately 660 inactive gold mines and prospects in the state, most of them in the Piedmont province. Both placer and lode deposits have been worked, although most of the production has been from the lodes.

The general nature of this report does not allow for a detailed description of each gold mine. Instead, a few of the most important mines in each major belt are described. For detailed descriptions of other mines in the state, the reader is referred to previous publications, particularly those by Nitze and Hanna (1896), Nitze and Wilkins (1897), Laney (1910), Pogue (1910), Bryson (1936), and Pardee and Park (1948). Most of these publications are out-of-print but can be seen in many public and institutional libraries.

Most of the mines have been inactive for many years, and now all that remains of the workings are caved and water-filled shafts, weathering dumps of waste rock, and dilapidated buildings. Many of the shafts have been used as garbage dumps; others have been filled with the remaining waste rock from previous mining. In some of the more populated areas, housing developments are beginning to encroach upon the mines. Many of the mines can no longer be found because they have been destroyed by recent construction.

Eastern Carolina Belt

The Eastern Carolina belt (Eastern slate belt) includes an area of approximately 300 square miles in northern Nash and Franklin Counties and southern Warren and Halifax Counties (Figure 5). The rocks underlying the area include northeast-trending gneisses, schists, and metavolcanic rocks that have been intruded by igneous rocks ranging in composition from granite to diabase. The metamorphic rocks are commonly weathered up to 75 feet in depth and to the east are overlain by sediments of the Coastal Plain. To the west, the rocks of the Eastern Carolina belt are bounded by the Louisburg-Rolesville granite pluton.



Franklin

1. Portis

Halifax

1. H & H (House)

Nash

1. Arrington
2. Mann-Arrington (Argo)

N

5 0 5 miles

Figure 5. Mines of the Eastern Carolina belt.

Quartz veins have intruded rocks throughout the area, but the gold is most commonly associated with the smaller, stringer veins. In many instances, particularly near the larger creeks such as Shocco and Fishing Creeks, the quartz veins have weathered and formed gravels 2 to 3 feet thick. Much of the gold produced in this belt came from the gravels and the residual soils overlying the gold-bearing veins.

Portis Mine: The Portis Mine was the first mine discovered in the Eastern Carolina belt and was also the most productive. It is located in northeastern Franklin County 2.4 miles northeast of Wood and 0.4 mile due west of the Franklin-Nash County line.

Most of the production at this mine has come from the hydraulicking of 15 to 30 feet of surface material. There were three main periods of activity. The first was between 1835 or 1840 and the Civil War; the second was in the 1880's; and the third was in the 1930's. The most recent work was done in 1935, by the Norlina Mining Company. The company acquired 955 acres in the Portis tract and 713 acres in the White House tract near Fishing Creek and invested $150,000 in building a recovery plant (Figures 6 and 7). Unfortunately, the operation proved to be uneconomical, and mining ceased in 1936.

The country rock at the Portis Mine is a deeply weathered schist into which two westerly dipping sheets or sills of diorite or granodiorite have been intruded. The sills weather to a light-colored clay referred to as the "White Belt". It is reported that these sills were the source of most of the gold found in the residual soil and the placers along Fishing Creek. The numerous quartz veins that cross-cut the schist and the "White Belt" usually contain free gold.

The upper sill is approximately 8 feet thick, and the lower one is reportedly somewhat thicker. The two sills are separated by only a few feet of schist. The gold content ranges between 0.03 ounce and 0.6 ounce per ton and averages about 0.15 ounce (Stuckey, 1965, p. 301). Recovery of gold at the Portis Mine was always hampered by the sticky clay with which the gold was associated. The total amount of gold mined here is not known but has been estimated from several hundred thousand to nine million dollars.

Other Mines: Other principal mines in the Eastern Carolina belt include the Mann-Arrington (Argo), Arrington, Conyer's, and H and H (House) Mines.

The H and H Mine is in southwestern Halifax County 4.2 miles southeast of Hollister and 4.2 miles southwest of Ringwood. This mine produced gold, lead, zinc, copper, and silver and was worked as recently as 1957. Exploration was first carried out here in 1940, but the principal mining activity was between 1954 and 1957. Total gold, silver, copper, lead, and zinc produced was valued at $35,542. The mine was developed in a quartz

Figure 6. Operations of the Norlina Mining Company, Wood, Franklin County, about 1935.

vein carrying galena, sphalerite, chalcopyrite, bornite, and gold. The vein is enclosed by silicified, sericitized phyllite that is enriched with chlorite, quartz, epidote, and calcite next to the vein.

The Argo Mine in northwestern Nash County was last worked in 1894, although some exploratory work was carried out in the early 1930's. A shaft was opened to a depth of 108 feet. Smaller pits and trenches were opened over an area approximately 1500 feet long and 400 feet wide. Mining was carried out in quartz veins and stringers enclosed by chlorite phyllite that strikes N. 60° E. and dips 40° SE.

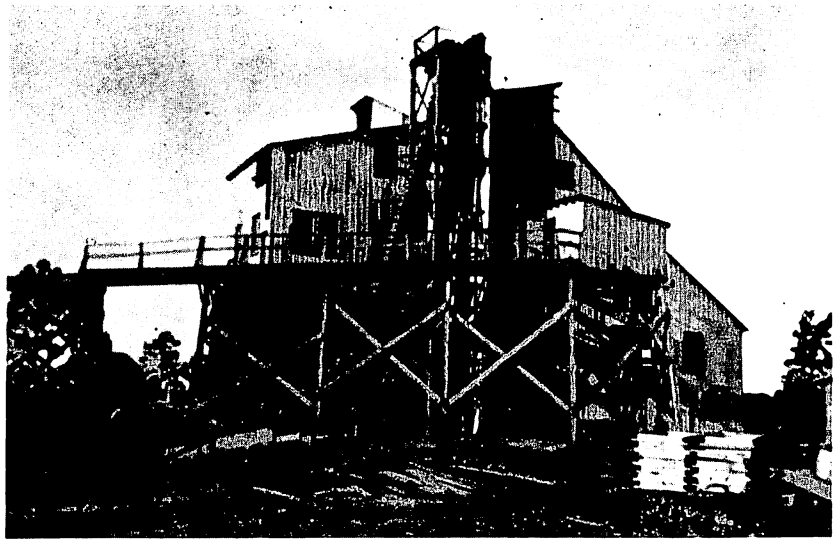


Figure 7. Plant construction by the Norlina Mining Company in 1935 to process ore from the Portis and White House properties.

Carolina Slate Belt

The Carolina slate belt has been the most important gold-producing area in North Carolina. The belt is a northeast-trending series of rocks that crosses the central part of the state, extending from the Virginia line in Person and Granville Counties to the South Carolina line in Union and Anson Counties. The belt varies in width from 25 to 70 miles and is bordered on the east by Triassic rocks and Coastal Plain sediments and on the west by rocks of the Charlotte belt.

The slate belt rocks consist primarily of slightly metamorphosed volcanic rocks and interbedded sedimentary rocks that have been folded into a series of northeasterly trending anticlines and synclines. Large- and small-scale faulting have also taken place, and the two major faults, the Gold Hill and the Silver Hill faults, are near the western border of the slate belt. Most of the gold mines are associated with faulted rocks, and the densest concentration of gold mines occurs within the Gold Hill-Silver Hill fault zone. Although there are few rocks in the belt that can be correctly called slate, the name slate belt has been maintained from the time it was first used by Denison Olmsted in 1825. Olmsted used the term slate in describing the well-developed cleavage of the rocks.

The best-known mining districts in the state are found in the slate belt. These districts include the Gold Hill district in southeastern Rowan and northeastern Cabarrus Counties and the Cid district in southern Davidson County. The southern Guilford County area has also been an important producer. The Gold Hill district contains several of the largest and most productive mines in the Southeast. Total production from 1842 to 1935 from the Gold Hill mines has been estimated at $3,300,000 (based on $20.67 an ounce). Important mines in the district include the Gold Hill Mine (Randolph Shaft), the Barnhardt Shaft, the Miller Shaft, the Honeycutt Mine, the Troutman Mine, the Union Copper Mine, and the Barringer Mine.

The Cid district also contains many important producers, the largest of which was the Silver Hill Mine. Other than the Gold Hill Mine, the Silver Hill Mine was the deepest and most extensively developed mine in the state during the early gold-mining years. Other important mines in the Cid district include the Conrad Hill, Emmons, Silver Valley, and Cid Mines.

Figure 8. Mines of the Central Slate belt and Northern Charlotte belt.

Alamance

1. Faust
2. Robeson

Guilford

1. Heath
2. Fisher Hill
3. Millis Hill
4. Puckey
5. Pine Hill
6. Beard
7. Hodges Hill
8. Gardner Hill
9. Jacks Hill
10. North State
11. Lindsay
12. Deep River
13. Harland
14. Fentress

Montgomery

1. Black Ankle
2. Riggon Hill
3. Russell & Palmer
4. Coggins
5. Morris Mountain
6. Steel
7. Crump
8. Sally Coggins
9. Grandman
10. Troy
11. Star
12. Carter
13. Tebe Saunders
14. Moratock & Worth
15. Harbin
16. Golconda, Montgomery, Iola & Martha Washington
17. Sedberry
18. Sam Christian

Moore

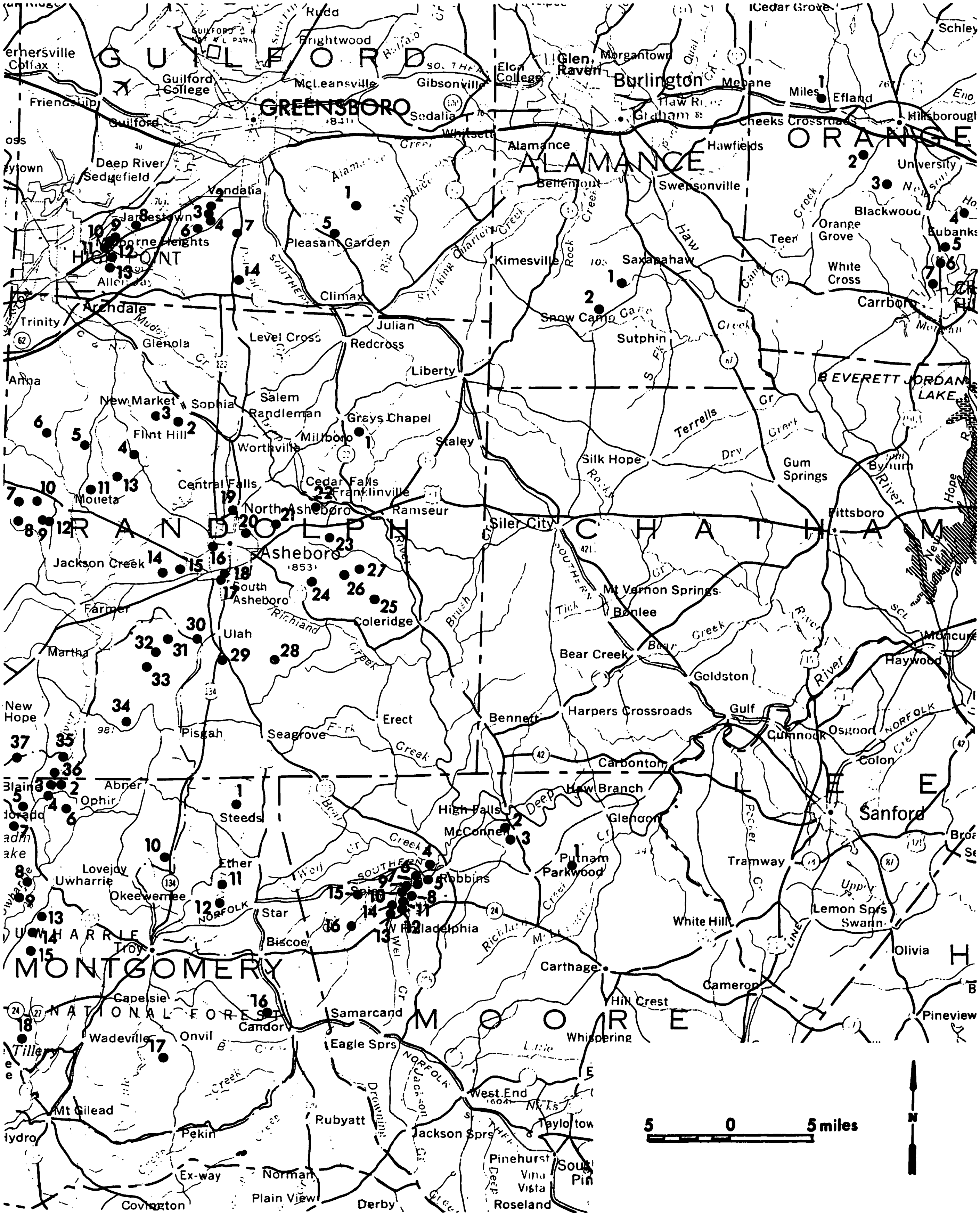
1. Bell
2. Ritter
3. Cotton
4. Wright
5. Clegg
6. Cagle
7. Red Hill
8. Allen
9. Burns
10. Brown
11. California
12. Dry Hollow
13. Richardson
14. Jenkins
15. Shields
16. Monroe

Orange

1. Bradsher
2. Womble
3. Shambley
4. Duke Forest
5. Weaver-Carr
6. Nun Mountain
7. Haw

Randolph

1. Allred
2. New Sawyer
3. Merrill
4. Sawyer
5. Jones & Laughlin
6. Copple, Spencer & Ruth
7. Southern Homestake
8. Delph
9. Parish & Kindley
10. Jones-Keystone
11. Hoover Hill
12. Wilson Kindley
13. Pierce Mountain
14. Newby
15. Davis Hill & Davis Mountain
16. Gray
17. Asheboro & Jones
18. McGrew
19. Scarlett
20. Pritchett
21. Winningham
22. Redding
23. Gold Bowl
24. Spoon
25. Porter & Pilot Mountain
26. Harney
27. Pine Hill
28. Goliham & Smith
29. Lowdermilk
30. Branson
31. Colburn
32. Dowd & Rush
33. Gluyas
34. Uharie
35. Griffin
36. Stafford
37. Talbert & Hill



GUILFORD
ALAMANCE
ORANGE
RANDOLPH
CHATHAM
LEE
MONTGOMERY
MOORE
UWHARRIE NATIONAL FOREST
GREENSBORO
Burlington
Graham
Mebane
Efland
Hillsborough
Gibsonville
McLeansville
Brightwood
Rudd
Guilford College
Guilford
Jamestown
High Point
Sedgefield
Deep River
Archdale
Trinity
Glenola
Vandalia
Pleasant Garden
Climax
Julian
Level Cross
Redcross
Liberty
Staley
Sophia
New Market
Flint Hill
Randleman
Worthville
Millboro
Grays Chapel
Central Falls
Cedar Falls
Franklinville
Ramseur
Asheboro
South Asheboro
Coleridge
Ulah
Farmer
Jackson Creek
Seagrove
Erect
Pisgah
Steeds
Ether
Star
Biscoe
Troy
Candor
Samarcand
Eagle Sprs
Robbins
Philadelphia
High Falls
Carthage
Cameron
West End
Pinehurst
Siler City
Bonlee
Bear Creek
Goldston
Gulf
Cumnock
Sanford
Pittsboro
Moncure
Haywood
Carrboro
Saxapahaw
Snow Camp
Sutphin
Swepsonville
Hawfields
Kimesville
Silk Hope
Gum Springs
Harpers Crossroads
Bennett
Carbonton
Tramway
Lemon Sprs
Olivia
B EVERETT JORDAN LAKE
5 0 5 miles
N

Figure 9. Mines of the Charlotte belt and Southern Slate belt.

Anson

1. Hamilton & Jesse Cox

Cabarrus

1. Whitney
2. Troutman
3. Isenhour
4. Hunnicutt
5. Coates
6. Hopkins No. 2
7. Cline
8. Hopkins No. 1
9. Heilig
10. Joel Reed
11. Montgomery
12. Allison
13. Nash
14. Quaker City
15. Faggart
16. Furniss
17. Phoenix
18. Tucker
19. Sanders
20. Barrier
21. Furniss-Furr
22. Ellsworth & Crosby No. 2
23. Buffalo
24. Crayton
25. Nugget
26. Dan Boger
27. Rocky River
28. Allen Furr
29. Reed
30. Allen Boger
31. Dixie Queen
32. Pioneer Mills
33. Harris

Davidson

1. Black, Eureka & Lalor
2. Conrad Hill-Dodge Hill
3. Billy Allred
4. Baltimore
5. Morgan, Briggs, Plyler & Liberty Mining Co.
6. Nooe
7. Welborn
8. Ida
9. Silver Hill
10. Secrest
11. Hepler and Claud Hepler
12. Silver Valley
13. Brown
14. Cid
15. Ward
16. Emmons
17. Peters
18. Hunt
19. Cross

Gaston

1. Oliver
2. Farrar
3. W. V. Smith
4. Sam Beattie
5. Rhodes & Puett
6. Rumfeldt

Mecklenburg

1. Kearns Copper
2. Mayberry
3. S. I. Pruit
4. Morehead Alexander
5. Dr. T. G. Deal
6. Gold Hill
7. Plummer & Hipp
8. W. L. Dunn
9. McCord
10. Dunlop
11. Clem Abernathy
12. James Hoover
13. Dunn
14. Hoover
15. Wilson
16. McCleary
17. Summerville
18. Means
19. Stuart
20. Capps Hill Group
21. Nolan
22. Ellwood
23. Henderson
24. Alexander
25. Martin Alexander
26. McCombs
27. F. S. Neal
28. R. B. Orr
29. Empire
30. Bleck
31. Henson
32. Black Cat
33. Maxwell & Hagler
34. Surface Hill
35. Harris
36. Champion & Zeb Teeter
37. Caldwell
38. Queen of Sheba & King Solomon
39. Chinquepin
40. Davidson Hill
41. St. Catherine
42. Rudisil
43. Isenhour
44. Trotter
45. Carson & Wilmore, Woods-Smith & Palmer
46. Woodruff & Barringer
47. Cathey
48. Walker
49. Juggernaut
50. Dudley
51. Tom Ferris
52. Mrs. John Helms
53. Bob Hasner
54. Dr. Hunter
55. Frederick
56. Ray
57. Hood Prospects

Rowan

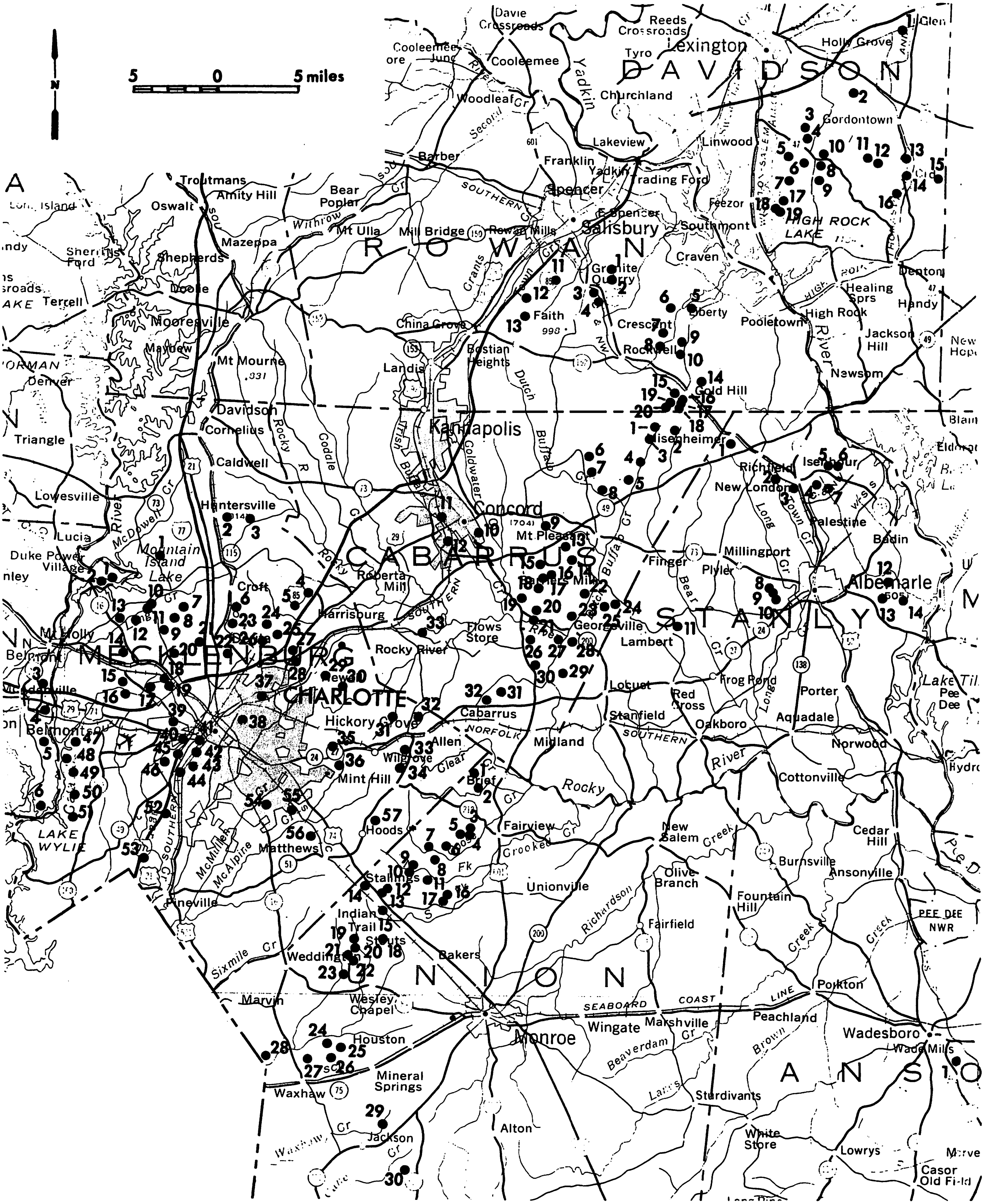
1. New Discovery
2. Dunn's Mountain
3. Reimer
4. Bullion
5. Dutch Creek
6. Gold Knob
7. Varnadore
8. Parks
9. Jacob Haltshauser & Graf
10. Camp Ridge
11. Bame
12. Harrison
13. Southern Bell
14. Rumple
15. Gold Hill
16. Miller Shaft
17. Barnhardt Shaft
18. Old Field Diggins
19. Honeycutt
20. Union Copper

Stanly

1. Barringer
2. Mumford
3. Parker
4. Flint Springs
5. Crowell
6. Kimball Hall
7. Cotton Patch
8. Lowder
9. Haithcock
10. Hearne
11. Eudy
12. Fesperman
13. Ingram
14. Thompson

Union

1. Bright Light
2. Long
3. Moore (Blue Shaft)
4. Moore (Wentz Shaft)
5. New South
6. Stewart
7. Ford
8. Lemmonds
9. Sam Phifer
10. Fox Hill
11. Dulin
12. Secrest
13. Smart
14. Henry Phifer
15. Black
16. Butterfield
17. Crump
18. Brown Hill & Harkness
19. Hemby
20. East Hill & Ore Hill
21. Phifer & Lewis
22. Mint Hill, Folger Hill & Davis
23. Moore Hill
24. Howie
25. Bonnie Belle
26. Vinsons Half Acre & Wyatt
27. McClarty
28. Wiley Rogers & Grady Rogers
29. McNeely
30. Nesbitt


N
5 0 5 miles
DAVIDSON
ROWAN
CABARRUS
MECKLENBURG
STANLY
UNION
ANSON
Lexington
Reeds Crossroads
Tyro
Davie Crossroads
Cooleemee
Churchland
Holly Grove
Glen
Gordontown
Linwood
Lakeview
Franklin
Yadkin
Trading Ford
Spencer
E Spencer
Salisbury
Southmont
Feezor
HIGH ROCK LAKE
Denton
Woodleaf
Barber
Troutmans
Amity Hill
Oswalt
Bear Poplar
Mt Ulla
Mill Bridge
Rowan Mills
Mazeppa
Shepherds
Sherrills Ford
Terrell
Doolie
Mooresville
Mayhew
Mt Mourne
Granite Quarry
Faith
Crescent
Liberty
Rockwell
Craven
Healing Sprs
High Rock
Handy
Pooletown
Jackson Hill
Newsom
China Grove
Landis
Bostian Heights
Gold Hill
Kannapolis
Misenheimer
Richfield
Isenhour
New London
Palestine
Badin
Denver
Davidson
Cornelius
Caldwell
Triangle
Lowesville
Huntersville
Lucia
Mountain Island Lake
Duke Power Village
Concord
Mt Pleasant
Millingport
Plyler
Finger
Albemarle
Croft
Roberta Mill
Harrisburg
Barriers Mill
Georgeville
Lambert
Flows Store
Rocky River
Mt Holly
Belmont
Cramerton
Newell
CHARLOTTE
Hickory Grove
Cabarrus
Locust
Frog Pond
Porter
Red Cross
Stanfield
Oakboro
Aquadale
Norwood
Midland
Allen
Wilgrove
Mint Hill
Brief
Cottonville
Fairview
Hoods
Matthews
New Salem
Cedar Hill
Burnsville
Ansonville
Unionville
Olive Branch
Stallings
Pineville
Indian Trail
Fountain Hill
Fairfield
Stouts
Weddington
Bakers
LAKE WYLIE
PEE DEE NWR
Marvin
Wesley Chapel
Monroe
Wingate
Marshville
Peachland
Polkton
Wadesboro
Wade Mills
Houston
Mineral Springs
Waxhaw
Jackson
Alton
Sturdivants
White Store
Lowrys
Casor Old Field
SOUTHERN
NORFOLK
SEABOARD COAST LINE
Rocky River
Yadkin River
Crooked Cr
Richardson
Sixmile Cr
McAlpine
McMullen
Brown Cr
Beaverdam Cr
Lanes Cr
Waxhaw Cr
Long Cr
Bear Cr
Dutch Buffalo
Coddle
Irish Buffalo
Goldwater
Clear Cr
Second Cr
Withrow Cr
McDowell Cr

Gold Hill Mine: The Gold Hill Mine (Randolph Shaft) is in southeastern Rowan County 0.6 miles southwest of the town of Gold Hill. The main shaft, the Randolph, reached a depth of 820 feet. Drifts and crosscuts on the 800-foot level totaled 2000 feet in length. The largest vein, the Randolph, varied in width from 2 to 15 feet. Mining removed about 1500 feet of the vein along its length to a depth of 700 feet. In the upper levels of the vein, the ore was very rich and free milling, but at depth the gold values decreased as sulphides were encountered. At the 800-foot level, the vein assayed at $2.00 per ton in gold, but the vein was beginning to narrow.

At the 800-foot level, drifting at right angles to the schistosity of the country rock intersected eleven mineralized zones. Drifting was then carried out along those zones, which included the Miller Vein and North Vein. The North vein had not previously been known to exist. Where exposed in the drift, it was striking N. 15-20° E. and averaged 3 feet in width for a distance of 60 feet. Assay samples ranged from $10 to $385 per ton in gold.

Figure 10. Remains of the mill at the Silver Hill Mine, Davidson County, photo 1972.

Figure 11. Caved headframe over the Barnhardt Shaft, Rowan County, photo 1972.

The ore occurred in mineralized zones in the chlorite-sericite phyllite striking N. 35° E. and dipping 80° NW. The veins were not gold bearing across their entire width but consisted of narrow gold-bearing zones in the phyllite. The phyllite contained large amounts of small pyrite cubes disseminated throughout the rock. Chalcopyrite and chalcocite were also present in the phyllite.

Gold production from the Gold Hill Mine through 1935 has been estimated at $1,650,000. During the last period of operation, 1914-1915, 7250 tons of ore were milled with a recovery of 3877 ounces of gold, 603 ounces of silver, and 23,112 pounds of copper. All of this last production reportedly came from the North Vein.

Howie Mine: The Howie Mine is in west-central Union County 2.9 miles northeast of Waxhaw and 3 miles northwest of Mineral Springs. This mine was discovered prior to 1840 and became the largest mine in Union County. The property was worked on a small scale until 1854, when Commodore Stockton acquired the property. He operated the mine until the Civil War, after which the mine was operated by various companies until it finally ceased operations in 1942.

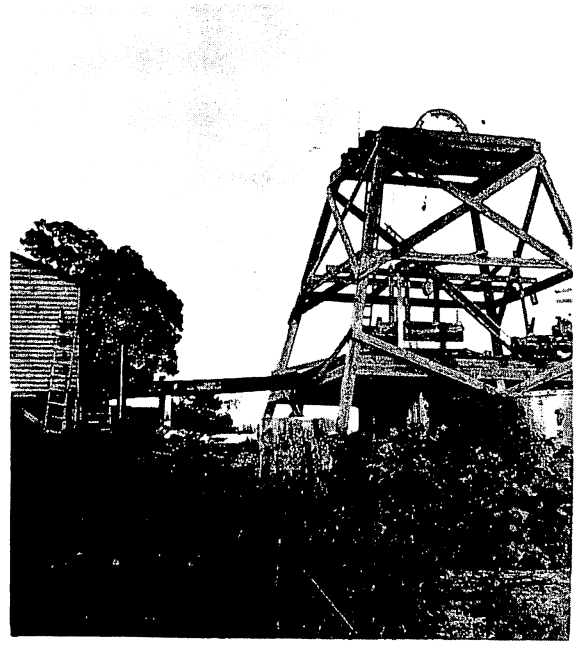


Figure 12. Headframe, Howie Mine, Union County.

The mine was worked along a belt 100 to 300 feet wide and 2800 feet long, trending about N. 60° E. The mine was worked by a series of shafts. One of these shafts, the Cureton, was 365 feet deep. Levels were turned at 147, 262, and 347 feet. In 1935, this shaft and connected workings totaled about 3500 feet in length in a part of the lode that was 800 feet long and 150 feet wide. On the second level, the ore was 6 to 8 feet wide, and assays ran from $10 to $300 per ton in gold. At the 347-foot level, assay values ran $2.40 per ton. Other shafts developed were the Bracy, Bull Face, and Pansy Shafts; but these were less extensively developed than the Cureton. Ore in the Bull Face Shaft ran $40 or more per ton.

The shafts were opened in sheared and silicified felsic volcanic rocks which strike N. 60° E. and dip steeply to the northwest. Pyrite is disseminated throughout the rock. The ore bodies were parts of the lode where gold-bearing seams were abundant. The ore bodies were tabular to cylindrical in shape and consisted of very fine-grained, flinty, pale greenish-gray quartz. The quartz was banded, and gold was found along cleavage surfaces in the rock.

Production figures for the Howie Mine are incomplete. It is reported that by 1854, the mine had produced $250,000 worth of gold from workings less than 80 feet deep. In 1934, the mine was credited with having produced 41,300 ounces in gold. In 1940, 1941, and 1942, the mine (then called the Condor Mine) was the leading gold producer in the state. In 1955 and again in the early 1960's, the mill at the mine site was used for processing gold ore from the Star Mine in Montgomery County. The mine has been inactive since 1943.

Reed Mine: The Reed Mine is in southeastern Cabarrus County 2 miles south of Georgeville and 2.8 miles northwest of Locust. Gold was first discovered on this property in 1799, the first authenticated discovery of gold in the United States. The mine was first worked as a placer operation and was perhaps the richest placer deposit in the state. A total of 153 pounds of nuggets, ranging in weight from 1 pound to 28 pounds, was found on the property. The lodes were first worked in 1831. Ore found near the surface commonly ran $100 or more to the bushel (about 100 pounds). For a while after 1835, the mine was idle, but in 1854, a small amount of work was done. Sporadic mining was carried out between 1881 and 1887 and from 1894 to 1899. A 10-stamp mill was built in 1895, and the last mill run was ore from a 20-foot zone that yielded $.60 per ton. Some placer mining was carried out in 1934 (Figure 13).

Lode mining at the Reed property was from quartz veins and veinlets, ranging in width from 1 to 6 feet, in a zone approximately 200 feet in width. The zone trends northeast and dips 45-70° SE. The lode extends about 2000 feet along strike and forms a ridge east of Little Meadow Creek. The workings are divided into Upper, Middle, Lower, and Lake Hills. Most of the lode mining was on the Upper and Lower Hills. The country rock is primarily tuffaceous argillite interbedded with coarser sediments and volcanic rocks. Most of the gold-bearing quartz veins occur within a greenstone or metagabbro unit. Most of the rocks are sheared and have a cleavage striking approximately N. 35° E. and dipping 70° NW.

Underground development was not extensive, and the ores have probably not been worked below a depth of 120 feet. In 1972, the Reed property was purchased by the State of North Carolina from the Kelly family of Springfield, Ohio. The Reed Mine is now preserved as a State Historic Site. A portion of the underground workings has been restored, and a visitor center offers exhibits illustrating the history of the mine. Tours are conducted through the underground workings, and a series of trails provide access to above-ground workings. Additional information can be obtained from the Reed Gold Mine, Rt. 2, Box 101, Stanfield, N. C. 28163.

Other Mines: The Phoenix Mine, in eastern Cabarrus County, 6 miles southeast of Concord and 4.9 miles southwest of Mt. Pleasant, was first worked prior to 1856. The mine was worked until 1889, and again from 1900 to 1906. The deepest shafts were opened to depths of 600 feet. A total of $400,000 in gold was taken from veins carrying pyrite, chalcopyrite, free gold, and galena.

Figure 13. Placer mining along Little Meadow Creek, Cabarrus County, about 1935.

The Silver Hill Mine, in south-central Davidson County, is 8.9 miles south-southeast of Lexington and 7.0 miles northwest of Denton. This mine was discovered about 1838, and was known primarily as a silver, lead, and zinc mine. During the Civil War, lead from the mine was used to make bullets. Very little work has been done since 1882. In the upper levels of the mine, the ore consisted chiefly of lead carbonate (cerussite) and disseminated native silver, but at depth galena, pyrite, and chalcopyrite were present. The country rock is a felsic tuff that has been sheared in places to a gray to buff, iron-stained quartz-sericite phyllite. The east vein was developed to a depth of 570 feet. Total production of silver, lead, and zinc is estimated at one million or more dollars.

The Hoover Hill Mine is in western Randolph County 9.6 miles west of Asheboro and 10.7 miles southwest of Randleman. The deposit was discovered by Joseph Hoover in 1848, and was worked for several years. The mine was reactivated in 1881, and production continued until 1895. Minor production was reported in 1914 and 1917. Most of the work was carried out from a 350-foot shaft with levels at six depths. Total gold production has been estimated at $350,000. The ore was in pockets and chimney-like shoots in sheared zones in the country rock. The main ore shoot was 12 feet wide at one level and 70 or more feet in length. Assays averaged $8-10 per ton.

Charlotte Belt

The Charlotte belt is the second most important gold-producing section in the state. It is a northeast-trending belt of rocks that lies to the west of the Carolina slate belt and is bordered to the west by rocks of the Inner Piedmont. The Charlotte belt consists of a complex sequence of igneous rocks that have intruded granodioritic or granitic gneisses. The intrusive rocks include granite, quartz monzonite, gabbro, diorite, and syenite and range in size from small dikes to large, irregular-shaped plutons.

The gold deposits occur primarily in Guilford, Davidson, Rowan, and Mecklenburg Counties, with Mecklenburg containing the largest number of mines. The belt contains approximately 250 inactive gold mines. Probably the most important mines are the Fentress, Rudisil, and Gardner Hill Mines. Many of the mines in this belt were begun as gold mines, but at depth the ores of copper were encountered, and copper became the most important product.

Rudisil Mine: The Rudisil Mine is located within the city limits of Charlotte approximately 1 mile southwest of the intersection of Trade and Tryon Streets. Gold was first discovered on this property in 1829, and the mine became one of the largest in the state. In one month, more than $30,000 in gold was recovered. In 1837, the property was acquired by John E. Penman, who operated the mine successfully for several years. Operations continued until the Civil War and again from 1880 to 1887 and from 1905 to 1908.

The ore was worked by a series of vertical shafts and levels. The Pump Shaft was vertical for the first 192 feet and then followed the vein for 158 feet inclined at a 45° angle to a total vertical depth of 302 feet. Levels were driven from the Pump and other shafts for a total of about 2400 feet.

From 1904 to 1906, the mine was unwatered to within 50 feet of the bottom. George E. Price made an estimate of the ore remaining in the stopes as 10,000 tons containing $6 to $9.50 and averaging $8 per ton and another 10,000 tons containing $5 to $6 per ton. Later, "seams and bunches" of higher grade ore were found and were hand picked, averaging $125 per ton.

The mine was reopened in 1934, by the Carolina Engineering Company, and in 1935, a new mill was built. Several ore lenses averaging 3 to 5 feet in thickness with gold values of $5 to $20 per ton were concentrated and shipped to smelters. The mine was closed in 1938, following 35 months of operation. During this time $130,000 in gold was produced. Total production from the mine has been estimated at $1,000,000 in gold.

Mining was from a lode striking N. 30° E. and dipping 45° NW. The ore was in a belt of "slate or schist" between walls of massive granite and occasionally between granite and diorite or diabase. At depth, the slate almost disappears, and the ore bodies along the margins of the slate merge together as one vein at 200 feet. The ore consisted chiefly of pyrite and quartz, and at depth some chalcopyrite was present.

Gardner Hill Mine: The Gardner Hill Mine is in southwestern Guilford County 8.1 miles southwest of Greensboro and 2.6 miles east-southeast of Jamestown. The mine was most extensively developed prior to 1856, and only minor work has been done since 1865. In 1854, it was reported that $100,000 in gold had been produced from the lode and placer workings. The vein was worked for a distance of 5000 feet by a series of five shafts, ranging in depth from 110 feet on an incline to 258 feet vertically. Levels averaging 500 feet in length were driven at depths of 60, 100, 150, and 228 feet.

In 1934, the mine was unwatered and examined. The examination showed that the ore bodies mined out were 1 to 6 feet or more thick, and one of them was 60 to 120 feet long and 270 feet or more in depth. The parts of the vein remaining were from 1 to 7 feet wide and consisted of quartz with pyrite and chalcopyrite. The country rock is coarse- to fine-grained diorite and granite or granodiorite.

Of the three veins on the property, the main vein was the most extensively developed. The veins were up to 20 feet in thickness, striking about N. 20° E. and dipping northwesterly. In the upper levels, the ore was quartz and brown iron-oxides that varied from 6 to 12 inches thick, but at a depth of 60 feet chalcopyrite was present. Ore below this level yielded 20 to 25 percent copper and $3 to $10 per ton in gold.

Fentress Mine: The Fentress Mine is in southern Guilford County 9.3 miles south of Greensboro and 8.1 miles southeast of Jamestown. The mine was opened prior to 1853 as a gold mine, but at a depth of approximately 50 feet, copper sulphides were encountered. The deposit became a copper mine, the first in the state. The mine has been idle most of the time since 1865 except for intermittent production from 1901-1907. The vein was worked by three deep shafts, the deepest of which was 400 feet. Four levels, ranging from 300 to 500 feet in length, were run from the main shaft.

Total production at the mine is estimated at $175,000 through 1935. Up to the end of 1855, $133,000 of this total was produced, and during the period 1901 to 1907, $26,000 was produced.

Pratt examined the mine in 1906, and described the vein as a composite of stringers, containing a little copper on the lowest levels and having gold associated with pyrite. Emmons described a sulphide ore body on the 310-foot level as being 80 to 90 feet long and 34 inches in maximum thickness and yielding ore containing 14 to 23 percent copper.

The veins are in sheared, fine-grained diorite and, in addition to quartz, contain siderite, limonite, chlorite, sericite, pyrite, chalcopyrite, and minor malachite, chalcocite, covellite, and cuprite. The vein strikes N. 25° E. and dips 38° to 60° NW.

Other Mines: The St. Catherine Mine is in the city limits of Charlotte, approximately 2500 feet N. 25° E. of the Rudisil Mine. These two mines are supposedly on opposite ends of the same vein. The main shaft of the St. Catherine Mine was worked to a vertical depth of 370 feet, the first 155 feet of which was vertical and the remaining 305 feet inclined about 45°. The mine, opened prior to 1826, was reported to be the first opened in Mecklenburg County and was active until about 1836. Following a period of idleness, the mine was sold in 1848. The mine was active in the 1880's, and again during the period 1905 to 1908. Mining was carried out in two parallel veins that lie near the contact between "slate" and granite. At a depth of 165 feet, the veins merge into a single vein. No high-grade ore bodies were found below the 250-foot level, but several low-grade bodies were worked between depths of 200 and 370 feet.

The Lindsay, North State, and Jacks Hill Mines are in southwestern Guilford County, 10.6 miles southwest of Greensboro and 1.8 miles south of Jamestown. The mines are on the same northeast-trending vein system and were active prior to the Civil War. Total production from the North State is estimated at $125,000. The veins were 2 to 24.5 feet wide and contained ore in shoots and pockets. The deepest shaft was opened to 350 feet in depth. No work has been done at the mines since 1860, except for minor work during the 1880's.

Kings Mountain Belt

The Kings Mountain belt is a narrow, northeast-trending belt of metamorphic rocks that lies along the west side of the southern half of the Charlotte belt. The belt contains sericite, muscovite, and hornblende schists and phyllites interbedded with quartzite, conglomerate, marble, and minor volcanic rocks. Granite and ultramafic bodies have intruded the belt. To the northeast, the rocks of the Kings Mountain belt extend for about 35 miles and then grade into mica and hornblende gneiss.

Kings Mountain Mine: The Kings Mountain Mine was the most important mine in the Kings Mountain belt. The mine is in southwestern Gaston County, 3 miles southeast of the town of Kings Mountain. It was discovered in 1834, and was worked intermittently until about 1895. Prospecting was carried out from 1910 to 1913.

The property was originally worked as a placer operation, but later mining was carried out in the lodes. Twelve or more shafts were opened on the property, and some open-cut work and sluicing were done. The two deepest shafts reached depths of 330 feet with others ranging from 50 to 200 feet in depth. Some of the shafts were connected by drifts, cross-cuts, and stopes.

There are three veins associated with beds of blue to gray, banded, dolomitic marble enclosed by chlorite-mica schist. The rocks strike N. 70° E. and dip northwest at steep angles. The veins range from 2 to 20 feet in thickness and consist of iron-stained, cellular quartz in a decomposed earthy matrix. Below the water table, the veins consist of siliceous, dolomitic marble containing quartz, pyrite, pyrrhotite, chalcopyrite, galena, sphalerite, and minor quantities of other minerals. Gold averaged about $3 per ton, and reports estimate total production at between $750,000 and $1,000,000. The richest ore consisted of small veins or stringers of quartz and pyrite, but some of the limestone near the veins was rich enough in gold to be mined and milled.

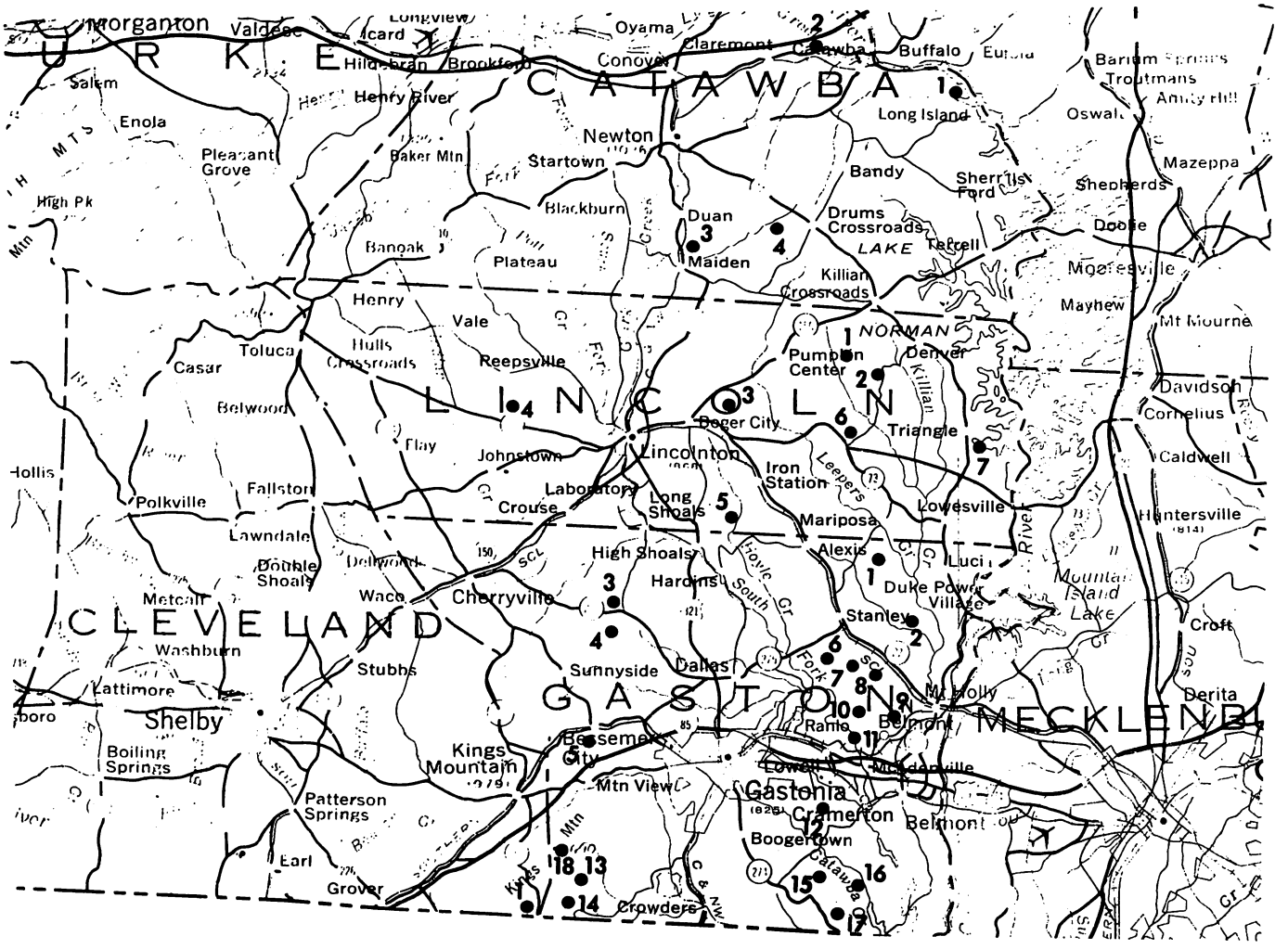
Other Mines: Many small gold mines and prospects were opened in Gaston and Lincoln Counties, but only minor production was reported.

The Crowders Mountain Mine is 4 miles east of the Kings Mountain Mine. Work was started here after 1865, and included two shafts about 500 feet apart. Work was in an 8- to 10-foot wide northeast-trending mineralized zone enclosed by quartzite and schist. Assays of the rock ranged from $1.03 to $9.10 per ton.

The Long Creek Mine is 8 miles northwest of Gastonia and was last worked in 1892. The three veins, the Asbury, Dixon, and McCarter Hill, were worked by a series of shafts, two of which were 140 feet deep. The veins rang in thickness from 3 to 8 feet and contain pyrite, chalcopyrite, galena, and sphalerite. The lodes trend to the northeast and are enclosed by schist striking N. 20°-25° E. and dipping 85° NW. The ore assayed as 0.40 ounce of gold per ton.

Numerous other mines occurring in higher grade gneisses and schists have, in the past, been included in the Kings Mountain belt. While these mines are not actually in the belt, they are included here to conform with previous reports.

The Shuford Mine is in eastern Catawba County approximately 5 miles southeast of Catawba. The deposit is a zone about 300 feet wide and 1000 to 2000 feet long in which the schist and gneiss contain seams of gold-bearing quartz. Shaft and open-cut methods were unsuccessful in extracting the ore, and a drag-line



Catawba

1. Shuford
2. Rufty
3. Maiden
4. Abernathy

Cleveland

1. Durham

Gaston

1. Gap
2. Rhyne
3. Asbury
4. McCarter Hill & Dixon
5. Ormond
6. Reese
7. Clemmer
8. McClurd
9. Oliver

Gaston

10. Duffie
11. Robinson
12. Lineberger
13. Patterson
14. Caledonia (Crowders Mtn.)
15. Eddleman
16. Wright
17. Dameron
18. Kings Mountain

Lincoln

1. Graham
2. H. C. Tucker
3. Mullen
4. Hauss
5. Hole
6. Graham
7. Cherry

Figure 14. Mines of the Kings Mountain belt and vicinity.

scraper was found to be most economical in working the deposit. A pit was opened to a depth of about 90 feet in the saprolite, and 85 percent of the gold was recovered. From 1902 to 1911, 1716 ounces of gold and 586 ounces of silver were recovered.

The Dixon Mine, 8 miles southeast of Yadkinville in Yadkin County, was discovered in 1894. A 35-foot-deep shaft was opened and drifts were run northeast and southwest for 50 to 60 feet. At the bottom of the shaft, the vein was 4 feet wide and assays averaged 0.35 ounce per ton. Mining was discontinued after a short time. Later, the mine was worked from 1913 to 1914, in conjunction with the neighboring Gross Mine.

South Mountain Belt

The South Mountain belt includes an area of about 300 square miles in Burke, McDowell, and Rutherford Counties. The area is underlain by mica and hornblende gneisses and schists that have been intruded by felsic and mafic dikes and by quartz veins ranging in size from small stringers to veins as much as 4 feet wide. The belt is mountainous; elevations range up to 3000 feet above sea level and average 1100 feet above sea level. Rich placer deposits formed along the major streams. The major mining has been from placers along Silver and Muddy Creeks and the First Broad River. The quartz veins in this belt were generally too small to be worked profitably, and no large-scale, underground mining was undertaken. Some deposits, where quartz veins were numerous enough, were worked by hydraulicking (Figure 15).

Figure 15. Veins in the South Mountain belt were commonly worked by hydraulicking methods, such as the operation shown here.

Mills Property: The Mills property is in southwestern Burke County 13 miles southwest of Morganton. Mining began here in 1828, on Brindle Creek. Many placers were mined on the property, and in 1916, the estimated production of the tract was more than $1,000,000. Gold occurred mainly as small grains, and only a few nuggets were found, the largest weighing 1.5 ounces. A considerable amount of monazite was recovered with the gold, and the placers also contained zircon, fergusonite, xenotime, rutile, garnet, and corundum.

Several small veins and stringers of gold-bearing quartz were later discovered. For a while the gold was recovered from the veins with a 5-stamp mill.

Sprouse Mine: The Sprouse Mine is near Demming, southeastern McDowell County. It was worked from placers and lodes from 1885 to 1935, by Capt. J. J. Sprouse. At least 635 ounces of gold were recovered from the

Map Reproduced from U.S.G.S. Professional Paper 213
"Gold Deposits of the Southern Piedmont" by Pardee and Park

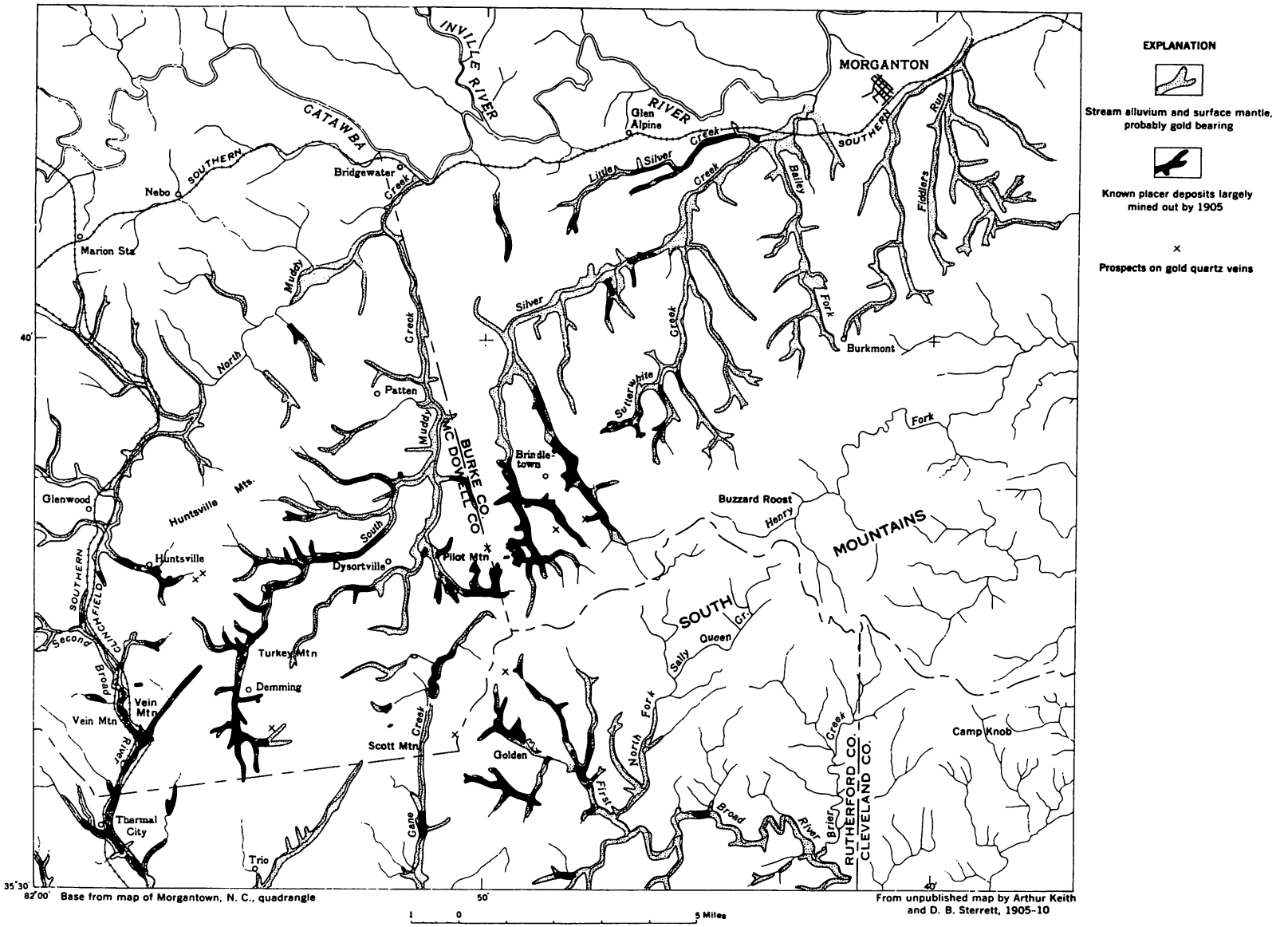


Figure 16. Placer and vein deposits of the South Mountain belt.

placers. Quartz veins 1 to 6 inches wide were on the property, and one of them yielded gold at 0.35 ounce per ton. A 125-foot-deep shaft exposed a vein carrying galena and sphalerite.

Vein Mountain Mine: The Vein Mountain Mine is in southern McDowell County on the Second Broad River approximately 5 miles south of Glenwood. The mine was worked extensively by hydraulic methods prior to 1908. The gold was mined from a series of at least 33 parallel quartz veins that cross Vein Mountain in a belt not over 0.25 mile wide. The Nichols Vein was the largest and was prospected by four shafts, the deepest of which was 117 feet. The strike of the vein is N. 80° E., and the dip varies from 75° NW. to vertical. The veins are enclosed by schist striking N. 10-20° W. and dipping 30° NE. The ore averaged from $15 to $17 per ton.

Other Mines: There are numerous other mines scattered throughout Burke, Caldwell, McDowell, and Rutherford Counties. The Marion Bullion Company Mine is at Brackettown near the headwaters of South Muddy Creek in McDowell County. A number of quartz veins were prospected, and a 126-foot-deep shaft was sunk on a series of six, narrow, closely spaced veins. The quartz contains galena, sphalerite, chalcopyrite, and pyrite and is enclosed by biotite gneiss striking N. 10° W. and dipping 10-15° NE. Assays of the quartz ran $4 to $20 of gold and silver per ton.

The Alta Mine, in Rutherford County 5 miles north of Rutherfordton, was worked from 1845 to 1893 by a series of shallow open-cuts, pits, and shafts. Thirteen parallel quartz veins were explored in a zone 0.5 mile wide.

Mines included in the South Mountain belt but not actually in the South Mountains are those in Caldwell, Polk, and Wilkes Counties.

Western Belt

The Western belt includes the gold mines west of the Blue Ridge Mountains (Figure 17). Most of the deposits are small and have shown little production. The largest quantities of gold in this belt have been obtained as a by-product of copper mining.

Fontana Copper Mine: The Fontana Mine is in southwestern Swain County 2.5 miles northeast of Fontana Village. The ore body was discovered and prospected by the Montvale Lumber Company prior to 1926. In 1926, the property was acquired by the Fontana Mining Corporation, which worked the mine until 1931. The mine was operated by the North Carolina Exploration Company from 1931 until 1944, when it was closed owing to the construction of the Fontana Dam on the Little Tennessee River by the Tennessee Valley Authority.

The deposit is a single, pod-like lens that strikes N. 60° E. and plunges S. 15° E. at a 45° angle. The body was worked from several adits and an inclined shaft with 18 levels at intervals of 31 to 155 feet. The total vertical depth of the workings reached 1700 feet. The ore consisted of pyrrhotite, pyrite, chalcopyrite, sphalerite, and galena. Gold content was 0.0072 ounce per ton. The ore averaged about 7 percent copper.

Ore Knob Mine: The Ore Knob Mine is in eastern Ashe County 8.2 miles east of Jefferson and 1 mile north of N. C. Highway 88. The mine was opened in 1855, and four shafts were sunk to depths of 90, 40, 30, and 40 feet. Work continued until 1856. The mine was not worked again until the period 1873 to 1883. During this second period of activity, rich ores were discovered underlying the gossan, and the shafts were extended to depths of 400 feet. The mine was worked sporadically until 1953, when the Nipissing Mines, Ltd. began exploration. In 1954, work was carried out under the name of Appalachian Sulphides, Inc. Production continued until 1962, when the ore body was completely worked out. A vertical shaft was completed in 1955, to a depth of 1039 feet.

The ore body was a tabular vein striking N. 64° E. and dipping 70° with a rake of 20° to the southwest. The ore shoot, at least 4000 feet long, 14 feet wide, and between 200 and 550 feet in vertical height, was along a narrow shear and breccia zone in mica gneiss. Much of the ore was massive sulphides composed of pyrrhotite, pyrite, and chalcopyrite with quartz, biotite, and amphiboles. Copper, gold, and silver were recovered. Total production of gold through 1961 was 9400 ounces.

Boylston Mine: The Boylston Mine, west of Boylston Creek in Henderson County 12 miles southwest of Asheville, was worked primarily for gold. The quartz veins were prospected during 1885 and 1886, and the Boylston Mining Company was formed in 1886. Operations continued sporadically until 1889. In the 1930's, the mine was reopened and exploration was undertaken in 1935, but there was little production.

The quartz veins crop out on the southern slope of Forge Mountain, which is underlain by mica and hornblende gneisses and schists striking N. 20-30° E. and dipping steeply to the northwest. Four main gold-bearing quartz veins striking N. 30° E. and dipping northwest at 25-75° were mined. The veins range in thickness from 1 to 4.5 feet with a pay streak from 1 to 8 inches wide along the hanging wall side. Free gold was in the upper levels; and gold, pyrite, and minor galena were below the water table.

The No. 2 vein was the most extensively developed, and all of the ore milled on the property was obtained from this vein. Workings were along the length of the vein for 1500 feet with an estimated 3000 tons of $4 per ton ore removed. Assays from the vein ranged from $4.13 to $109.25 per ton. The highest values were obtained from the rich pay streak of reddish-brown quartz along the hanging wall. The ore was processed in a stamp mill, but only 24.63 percent of the assay value was recovered.

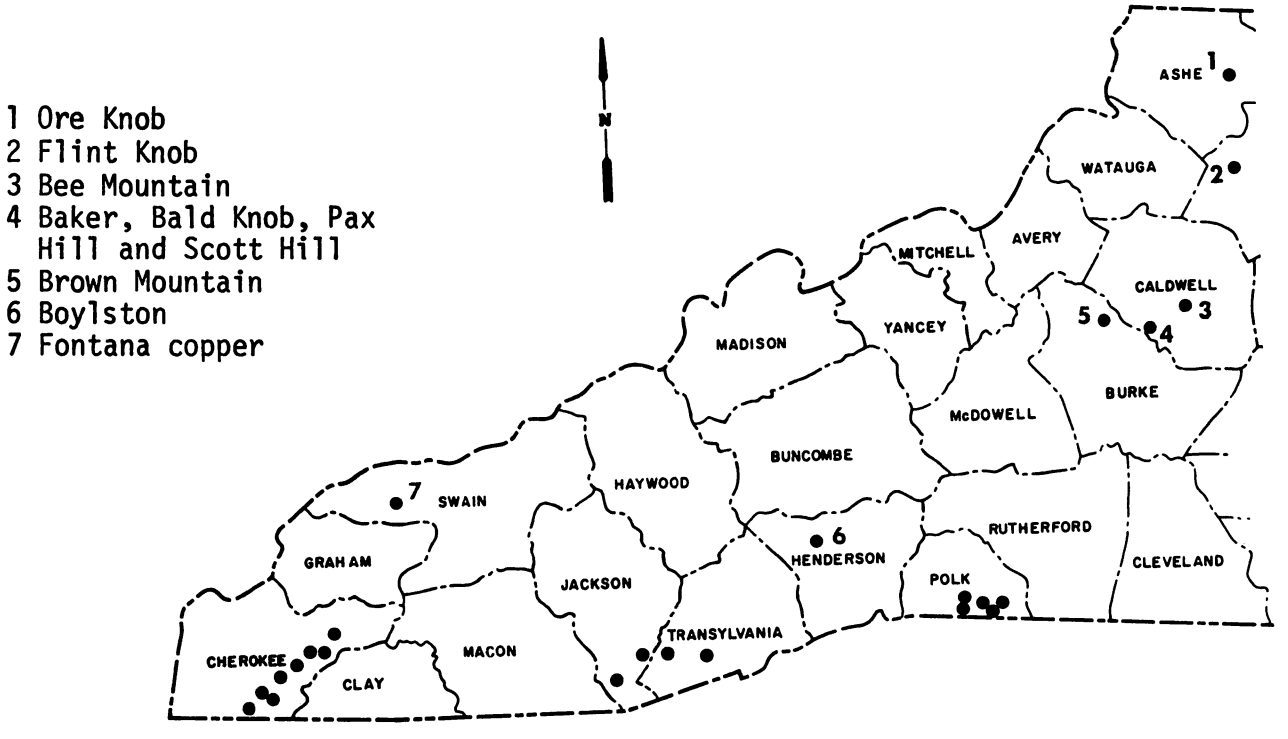


Figure 17. Mines of the Western belt.

Other Mines: In Jackson County, the Fairfield Valley on Georgetown Creek was worked for placer gold. It is reported that from $200,000 to $300,000 in gold was recovered from gravels that extend several miles along the creek. Most of the gold was obtained near the base of a steep wall formed by a gray gneiss.

Gold has been mined in Cherokee County from the sands of Valley River, from veins near Murphy, and along the lower slopes of the mountains from near Valleytown to Vengeance Creek.

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INDEX OF MINES

GLOSSARY

Adit - In underground mining, a horizontal entry driven into deeper zones of a mine so that broken material can be removed by gravity.

Amalgamation - the process in which mercury is used to separate gold from an ore. An ore containing gold is crushed and then passed over metal plates coated with mercury. The gold is absorbed by the mercury, forming an amalgam. This amalgam is then heated in a retort to separate the gold from the mercury.

Anticline - A fold in rocks; it is convex upward; upfolded layers.

Assay - A test or analysis to determine the proportions of metals in an ore.

Contact - The surface between two different types or ages of rocks.

Country rock - a) The rock enclosing or traversed by a mineral deposit; b) The rock intruded by and surrounding an igneous intrusion.

Crosscut - In underground mining, a horizontal tunnel used to connect drifts.

Cyanidation - The process in which a solution of potassium cyanide is passed through crushed ore to remove the gold. This process is not used when the ore contains copper.

Dip - The angle that a structural surface, such as a bedding or fault plane, makes with the horizontal; measured perpendicular to the strike of the structure.

Dredging - The process of using a large floating machine for scooping up or excavating material from the bottom of a body of water, raising the material to the top, and processing the material to remove the gold.

Drift - In underground mining, a horizontal tunnel which follows the ore.

Fault - A surface or zone of rock fracture along which there has been displacement. This displacement may range from a few inches to a few miles.

Felsic - An adjective used to describe a rock in which light-colored minerals predominate.

Flotation - A process of mineral separation in which water, oil, and chemicals are combined to make a froth of air bubbles to which certain minerals adhere and can be collected in a trough.

Hydraulicking - A mining method used for processing placer deposits where gravels are excavated and swept away by powerful jets of water into sluiceways.

Igneous rocks - Rocks which solidified from molten material.

Lode deposit - a) A mineral deposit consisting of a zone of veins; b) A mineral deposit in consolidated rock as opposed to placer deposits.

Mafic - An adjective used to describe a rock in which dark-colored minerals predominate.

Malleability - The ability of a mineral to be plastically deformed under compressive stress such as hammering.

Matrix - The fine-grained interstitial material of an igneous rock or the smaller, fine-grained particles of a sediment which occupy the spaces between the larger particles.

Metamorphism - The mineralogical and structural adjustment of solid rocks to physical and chemical conditions which differ from those under which the rocks originally formed.

Native gold, copper, etc. - Any element (gold, copper, etc.) found uncombined with other elements.

Ore - The naturally occurring material from which a mineral or minerals of economic value can be extracted.

Pinch - A thinning or squeezing of a rock layer or vein.

Placer deposit - A surficial mineral deposit formed by mechanical concentration of mineral particles from weathered debris. This is a natural gravity separation of heavy from light minerals by means of water or air.

Pluton - An igneous intrusion.

Raise - In underground mining, verticle or inclined openings driven upward to connect workings from level to level.

Residual deposit - The residue formed by weathering in place. The weathered material that has not been moved from the site where it formed.

Rocker - A device used for concentrating gold in small-scale placer mining operations work. The rocker is usually hand operated and is used by shoveling gravel into a hopper, bailing water into the hopper, and rocking the device from side to side to wash the gravel and concentrate the gold.

Saprolite - A soft, earthy, clay-rich thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rocks.

Shaft - A vertical or inclined opening sunk from the surface of the ground into or near an ore body.

Sill - A tabular igneous intrusion that parallels the planar structure of the surrounding rock.

Skip - In underground mining, a container used to carry ore to the surface of the ground.

Sluice - A narrow, inclined trough used in placer operations to collect gold. The sluice contains riffles in the bottom which provide collecting sites for the gold.

Smelting - The process of melting ores in blast or reverberatory furnaces to obtain metals.

Specific gravity - A number that expresses the ratio between the weight of a mineral and the weight of an equal volume of water at 4° C. If a mineral has a specific gravity of 2, it means that a given specimen of that mineral weighs twice as much as the same volume of water. This is frequently a helpful aid in identifying minerals.

Stope - In underground mining, the area from which the ore is removed.

Strike - The direction or trend that a structural surface, such as a bedding or fault plane, takes as it intersects a horizontal plane.

Swell - A thickening or enlarged place in an ore body or vein.

Syncline - A fold in rocks; it is concave upward; down-folded layers.

Vein - A thin, sheet-like igneous intrusion or mineral filling in a fracture or crevice in country rock.

Winze - In underground mining, a vertical or inclined passage driven downward.