Mineral Resources – Region 1, con't.

Cambrian-Ordovician Sediment

Mineral Deposit Processes

No significant mineralization appears to be associated with the Cambrian-Ordovician sediment deposition that occurred between mountain building events, but hydrothermal fluids moved through some of these rocks during subsequent mountain building events (and in some cases the hydrothermal fluids migrated as far as the Mississippi Embayment). The fluids followed units of permeable rock, but also migrated along fractures and especially thrust faults.

Metallic Mineral Deposits

Minor occurrences of zinc and lead sulfides are present in the Cambrian-Ordovician passive margin sediments in the Blue Ridge, but there are several large barite ($BaSO_4$) deposits formed along thrust faults. A good example is the barite deposits of the Hot Springs District in Madison County, North Carolina.

Non-metallic Mineral Deposits

Talc ($Mg_3Si_4O_{10}(OH)_2$) deposits are associated with the Murphy Marble in a belt extending through Cherokee and Swain counties, North Carolina. These deposits were mined as early as 1859 and well into the 1980s, but are currently inactive. The district produced over 200,000 tons of high-grade talc. The talc formed through tectonic-metamorphic alteration of the silty dolomite or associated sediments during one of the Paleozoic orogenic events.

Why is Talc Associated with Marble?

Talc is $Mg_3(OH)_2[Si_4O_{10}]$, a hydrated magnesium silicate. Marbles such as the Murphy Marble of western North Carolina and Georgia are not pure calcite ($CaCO_3$) marbles, but rather dolomitic ($MgCO_3$) and slightly silty with detrital quartz grains. During hydrothermal alteration accompanying metamorphism, the calcite, dolomite, and silica react to form talc. Talc is also formed from the alteration of ultramafic rocks, rich in olivine (Mg silicate), but may also contain asbestiform minerals and iron minerals. The talc formed from dolomitic marbles tends to be cleaner and more pure, which made the Murphy deposits economic.

Inner Piedmont Rocks

Mineral Deposit Processes

The volcanic rocks of the Inner Piedmont host numerous sulfide and gold deposits, although most were relatively small and largely mined out in the 19th Century. The gold and sulfide deposits occur generally through hydrothermal processes. Many of the high grade gold deposits occur concentrated within quartz veins. Subsequent weathering and erosion formed rich placer and residual gold deposits that were the initial target of mining in the Piedmont. Alluvial mining gave way to lode mining as the placer deposits were exhausted and the gold was traced to its source in the bedrock.

Metamorphism and igneous intrusions into the Inner Piedmont rocks during the Paleozoic mountain building events also produced numerous small pegmatite deposits (through magmatic processes), and concentrations of aluminum silicates of the kyanite group.

Metallic Mineral Deposits

Figure 5.7: The Virginia Gold-Pyrite Belt.

There are over 300 known gold, silver, and base metal mines and prospects in Virginia, but the most important cluster in a narrow zone of volcanic rocks called the Virginia Gold-Pyrite (FeS) Belt that extends for about 100 miles (Figure 5.7). At least 100 old gold mines are present along this trend, opened along veins and sulfide deposits of hydrothermal origin. Total gold production from Virginia from 1804 through 1947 was 300,000 troy ounces. Copper, zinc, and lead from sulfide deposits also were mined in this area.

Figure 5.8: North Georgia's Dahlomega Belt.

The Dahlonega Belt of volcanic rocks in northern Georgia produced over 500,000 ounces of gold between 1838 and 1941 from mining of gold-bearing quartz veins and sulfide deposits (Figure 5.8). These deposits occurred through hydrothermal processes. There were dozens of small mines, and several large mines including the Battle Branch, Calhoun, and Findley. The Creighton (Franklin) Mine in Cherokee County was active between 1840 and 1909, and produced almost 50,000 ounces of gold. A branch of the U. S. Mint operated in Dahlonega between 1838 and 1861, striking United States coins from Dahlonega gold. The state of Georgia has produced between 1 and 1.5 million ounces of gold since 1828.

Dahlonega and the Trail of Tears

The 'official' discovery of gold in Georgia was made by Frank Logan in present day White County in 1828, well within the territory of the Cherokee Nation. The Cherokee were aware of the presence of gold on their lands, and gold mines were operated illegally in Cherokee Territory as early as 1819. As word of the discovery spread, a systematic campaign to remove the Cherokee and open the area to gold mining was crafted in Georgia and Washington, D.C. In 1830 Congress quickly passed the Indian Removal Act. In December 1835, the U.S. government signed a treaty with a small group of disaffected Cherokee, none elected officials of the Cherokee Nation. Twenty signed the treaty, ceding all Cherokee territory east of the Mississippi to the U.S., in exchange for $5 million and new homelands in the Indian Territory (Oklahoma). More than 15,000 Cherokees protested the illegal treaty, but it was ratified by the U.S. Senate by one vote in 1836. Most of the Cherokee people were forced to leave their ancestral home in Northern Georgia and adjacent states, and relocate to the Indian Territory in the winter of 1838-1839. Over 4000 Cherokee died as a result of the removal, nearly a fifth of the Cherokee population. Their journey is called ìThe Trail of Tears.î

There is also a wide variety of metallic mineral deposits scattered throughout the Inner Piedmont outside the belts of volcanic rocks associated with the Taconic mountain building event, although few have been large producers. Several small deposits of copper and zinc sulfides are known, and extensive though not economical occurrences of tin (Sn) and zinc were explored as recently as the late 1990s.

Residual weathering and stream action formed numerous deposits of heavy mineral concentrates in the Inner Piedmont. Heavy minerals include monazite ((Ce,La,Y,Th)PO4), a major source of thorium (Th), and rutile and ilmenite, important ores of titanium. These minerals are hard, resistant to weathering and erosion, and are concentrated and segregated by stream flow due to their high density. They originated in lower grade concentrations from high temperature metamorphic rocks and granite intrusions from the Taconic mountain building event. Almost all monazite production in the United States from 1880 to 1918 came from the Western Monazite Belt in the Inner Piedmont of North and South Carolina (Figure 5.9).

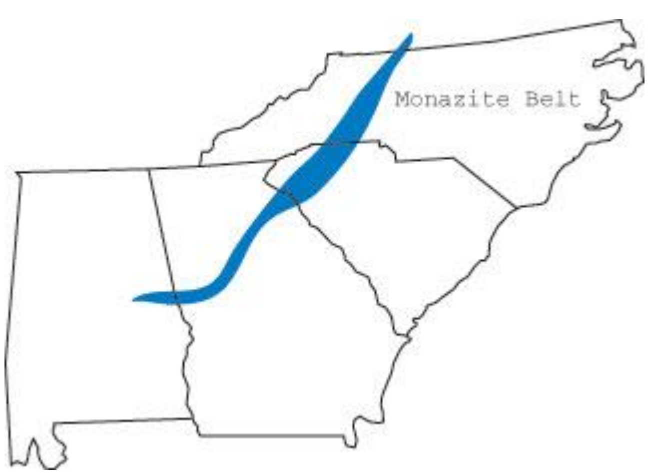

Figure 5.9: The Monazite Belt of the Inner Piedmont.

Non-metallic Mineral Deposits

Pegmatites are widespread in the Inner Piedmont, although generally no longer mined. An unusual group of lithium-bearing pegmatites in Alexander County, North Carolina produces gem quality emeralds and hiddenite, a gem form of spodumene. Lithium (Li) is produced in North Carolina from a series of large lithium-rich pegmatite deposits extending into South Carolina. The lithium occurs in the mineral spodumene ($LiAlSi_2O_6$), and these deposits represent one of the largest concentrations of silicate lithium in the world. The pegmatites contain approximately 20 percent spodumene.

Figure 5.10: The Silliminite Belt of the Inner Piedmont.

Sillimanite (Al_2SiO_5) and kyanite in the Inner Piedmont, formed through recrystallization of aluminum rich sedimentary or volcanic rocks during metamorphism. Extensive deposits of varying grade (10-20%) formed in rock formations in the Blue Ridge and Inner Piedmont. Because they are hard and chemically non-reactive, kyanite and sillimanite may become concentrated by residual weathering. Kyanite deposits are more common in the Blue Ridge, and sillimanite-rich schist form a broad belt in the Inner Piedmont from North Carolina to Georgia (Figure 5.10). Although there has been minor production in the past, kyanite and sillimanite deposits of the Blue Ridge and Inner Piedmont are not economic concentrations.

Alteration of ultramafic rocks in the Inner Piedmont during the Paleozoic mountain building events has formed deposits of vermiculite, used in lightweight concrete aggregates, insulation, agriculture, and other products. The United States is one of the two largest producers of vermiculite in the world. All U.S. production comes from deposits in the Inner Piedmont of Virginia and South Carolina.

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

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