Rock Resources of the Southeastern US:

Rock resources include: the sedimentary, igneous and metamorphic rock that we quarry for buildings, monuments, construction and decoration; and sediment deposited as a result of the rise and fall of sea level, such as clay, peat, sand and gravel. The rock resources exist because various events in the Southeast's geologic history created different environments and geologic processes in which a diverse array of rocks formed. Just as ***fuel*** and ***mineral*** resources are vital to the economy and functioning of modern civilization, so too are the rock resources found in the Southeast. According to the Mineral Information Institute, every American born will need in a lifetime, on average, 3.75 million pounds (1.7 million kilograms) of natural resources, including minerals and fuels (Figure 7.1). The maps in this chapter depict the principal rock resources currently being mined in each region of the Southeast.

see Fuel Resources, p.

see Mineral Resources, p.

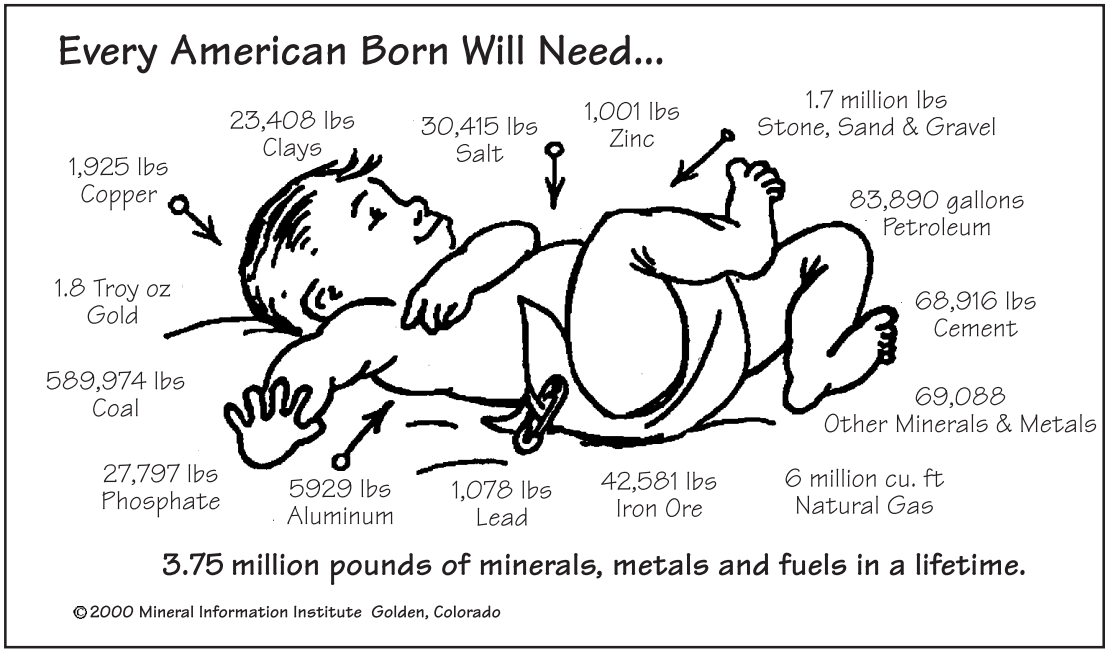
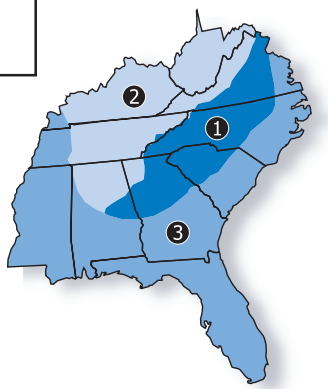


Figure 7.1: Mineral Information Institute mineral, rock, and fuel resource statistics.



Rock Resources of the Blue Ridge & Piedmont

Region 1

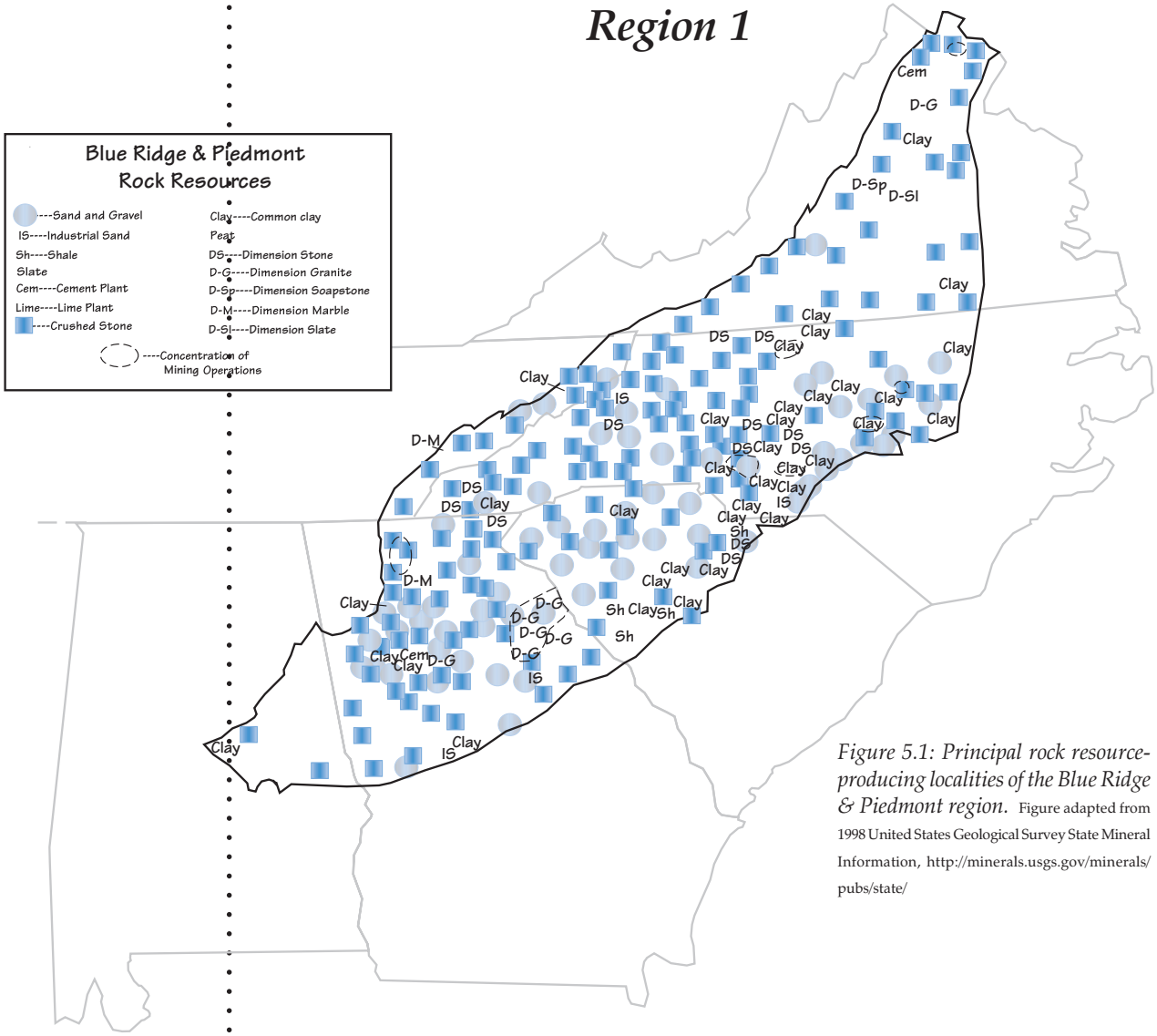
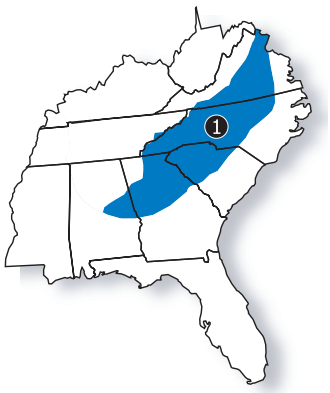


Figure 5.1: Principal rock resource-producing localities of the Blue Ridge & Piedmont region. Figure adapted from 1998 United States Geological Survey State Mineral Information, http://minerals.usgs.gov/minerals/pubs/state/



The primary rock resources of Blue Ridge and Piedmont region are crushed stone, sand and gravel, and common clays *(Figure 5.1)*. Sediment resources are more common in the Piedmont than in the Blue Ridge because the Piedmont is characterized by deep weathering of the bedrock that produced abundant sediment. Sedimentary, metamorphic, and igneous rock resources occur throughout the region.

Rock Resources

Sediment

Recent sand and gravel deposits found along streams and terraces are locally produced for use as construction aggregate. Some types of sand are quartz-rich, which makes them useful for other industrial purposes. These types of sands are called ***industrial sand***, which is used in sandblasting, filtering, and the manufacturing of glass. Industrial sand is locally mined in the Blue Ridge and Piedmont region, as in the other Southeast regions, from quartz-rich Paleozoic sandstone and quartzite (metamorphosed sandstone.) The only significant amount of ***clay*** in the Piedmont resulted from weathering and soil formation. The clay is both within and below the soil horizon. The variety of economic clays is smaller than in the Coastal Plain region, but common clays and kaolin are mined across the Piedmont.

*The "**recent**" sand and gravel deposits were eroded from the region's Precambrian and Paleozoic rocks, and were deposited in the Quaternary.*

Industrial sand *is produced from crushed sandstone, quartzite or quartz-rich sand and is different than construction grade sand and gravel, which may not be as quartz-rich.*

see Rock Resources, p. , for more on **ckays.**

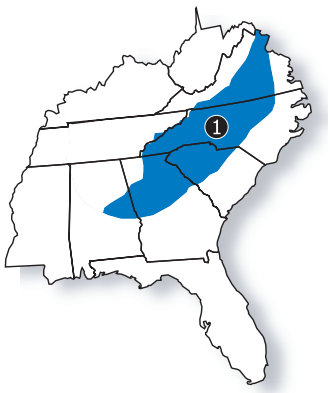
Sedimentary rock

Layers of sandstone, shale, limestone and dolomite formed over hundreds of millions of years in the Iapetus Ocean (the "proto-Atlantic") from the build up of carbonate sand, and deposits of sediment on the ocean floor eroded from land fragments, volcanic islands, and ash. All of these ocean floor sediments were compressed and pushed onto the side of North America during the Paleozoic mountain building events, becoming the sedimentary rocks that are today mined in the Southeast as rock resources.

see Geologic History, for more on how these sedimentary rocks formed.

Limestone, and to a lesser extent dolomite (dolostone), is locally mined in the Blue Ridge and Piedmont region and in the form of crushed stone is used as ***aggregate***. Aggregate consists of gravel to sand size rock from either unconsolidated sand and gravel or crushed stone. Vital to the construction industry, aggregate is used to strengthen concrete, to make blacktop, as road and dam foundations, and to produce building materials. Limestone and sandstone are also quarried as "dimension stone." Dimension stone is the commercial term applied to quarried blocks of rock cut to specific dimensions and used for buildings, monuments, curbing and facing. Shale is quarried in some areas for use in the manufacture of bricks.

According to the Virginia Division of Mineral Resources, Americans on average use 9 tons of **aggregate** *per person per year!*



Metamorphic rock

Metamorphic rocks of the Blue Ridge and Piedmont were formed and metamorphosed over hundreds of millions of years through successive mountain building

Rock Resources

see Geologic History, for more on how these metamorphic rocks formed.

Argillite= *weakly metamorphosed claystone.*
Marble= *metamorphosed limestone.*
Quartzite= *metamorphosed sandstone.*
Slate= *metamorphosed shale.*
Phyllite= *metamorphosed shale, intermediate in grade between slate and schist.*
Schist= *metamorphosed shale, sandstone or slate that has become well foliated.*

Not everything commercially called a **marble** *is a "true" marble in the geological sense, which is recrystallized from limestone and therefore lacks preserved fossils. For example, the brown Tennessee Marble is actually a limestone.*

events in the Appalachians. These rocks were also originally sediments deposited on the Iapetus Ocean floor that later were crushed onto the side of North America.

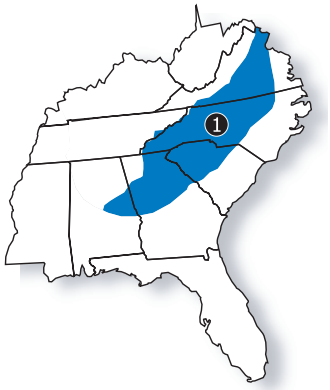
In the compression of mountain building events, some of the rocks were metamorphosed, especially near the center of the collisions. Argillite, marble, phyllite, quartzite, schist, and slate are different types of metamorphic rocks quarried for dimension stone throughout the Southeast. Schist is also locally produced to add color and stability to bricks. The Carolina Slate Belt has a variety of weakly metamorphosed rocks including some slate, which is mostly mined as crushed rock.

Polished dimension-stone ***marbles*** from Georgia and Tennessee were used in the U.S. Capitol building and Jefferson Memorial in Washington D.C. Marble takes a beautiful polish, and is commonly used as a decorative stone for buildings, monuments, interior facings and countertops. Crushed marble is useful as a filler, food additive, and paper coating. Quarrying of marble has significantly declined in the last few decades, as synthetic materials have begun to replace it for many purposes.

Igneous rocks

see Geologic History, p. , for more on the Iapetus and Avalon Rocks

A farmer who bought several thousand acres of farmland in 1872, realized that his purchase included the **Mount Airy** *granite area. He complained to the seller that the 40 acres of bare granite was worthless…so the farmer got it for free! This area has turned out to be far from worthless!*



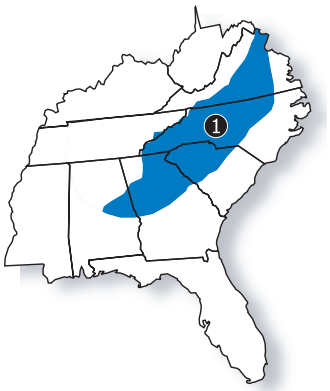
Igneous rocks of the Blue Ridge and Piedmont region formed at several different times over the last billion years: in the cores of the Blue Ridge Mountains as the Paleozoic mountain-building events compressed and melted the crust; in the area that is now the Piedmont as the Iapetus and Avalon Rocks collided with North America, producing volcanic and intrusive igneous rocks; and in the Triassic-Jurassic rift basins when Pangea was breaking apart, causing magma intrusions and lava flows. Granite is the most common type of igneous rock in the Blue Ridge, and the primary rock used for crushed stone in the Blue Ridge and Piedmont region. Forming as magma slowly cools deep below the surface, large crystals develop characteristic of granite. Georgia is the national leader in granite production used as crushed stone and also is a leader in dimension-granite quarrying. The largest open-face granite quarry in the world is located at ***Mount Airy***, North Carolina. Crushed granite is used as aggregate for road and building construction, railroad ballast, and riprap. Granite is also used as dimension stone. Polished granites from Georgia (in particular the Elberton area) and North Carolina have been used in many government buildings and monuments, including the U.S. Capitol building and Jefferson

Memorial in Washington, D.C. The largest high-relief sculpture in the world, the memorial to Confederate generals, is carved into exposed granites at Stone Mountain in Georgia *(Figure 5.2)*. The East Quarry at ***Stone Mountain*** operated until the 1970's. In the 1950's 1200 tons of stone per week were mined from the quarry, most of which was used in Atlanta, Georgia.

Diabase in the Piedmont formed from ***shallow*** intrusions of magma that pushed through the sediments of the Triassic-Jurassic rift basins. Diabase has the same composition as basalt, however, the diabase cools somewhat more slowly below the surface (though not as slowly as granite, deep below the surface.) This allows time for the formation of visible crystals, though not as large generally as those of a granite, which forms deep below the surface. Diabase is commercially called "black granite" (even though it is not a granite) and thus is listed in Figure 5.1 as Dimension Granite (D-G) in Virginia. It is quarried from the Piedmont rift basins and used as a building stone and facing.

The magmas that formed the Mount Airy and **Stone Mountain** *granites are from different Paleozoic mountain building events. The Mount Airy granite formed during the Devonian Acadian mountain building as the Avalon Rocks collided with North America; the Stone Mountain granite formed during the Permian Alleghanian mountain building event when Africa collided with North America. Both granites are very resistant to erosion.*

*"***Shallow***" igneous intrusions of magma occur relatively close to the surface, with a small amount of overlying rock layers. "Deep" intrusions (forming granite, for example) occur at much greater depths, often with a considerable amount of overlying rock.*



Rock Resources of the Inland Basins

Region 2

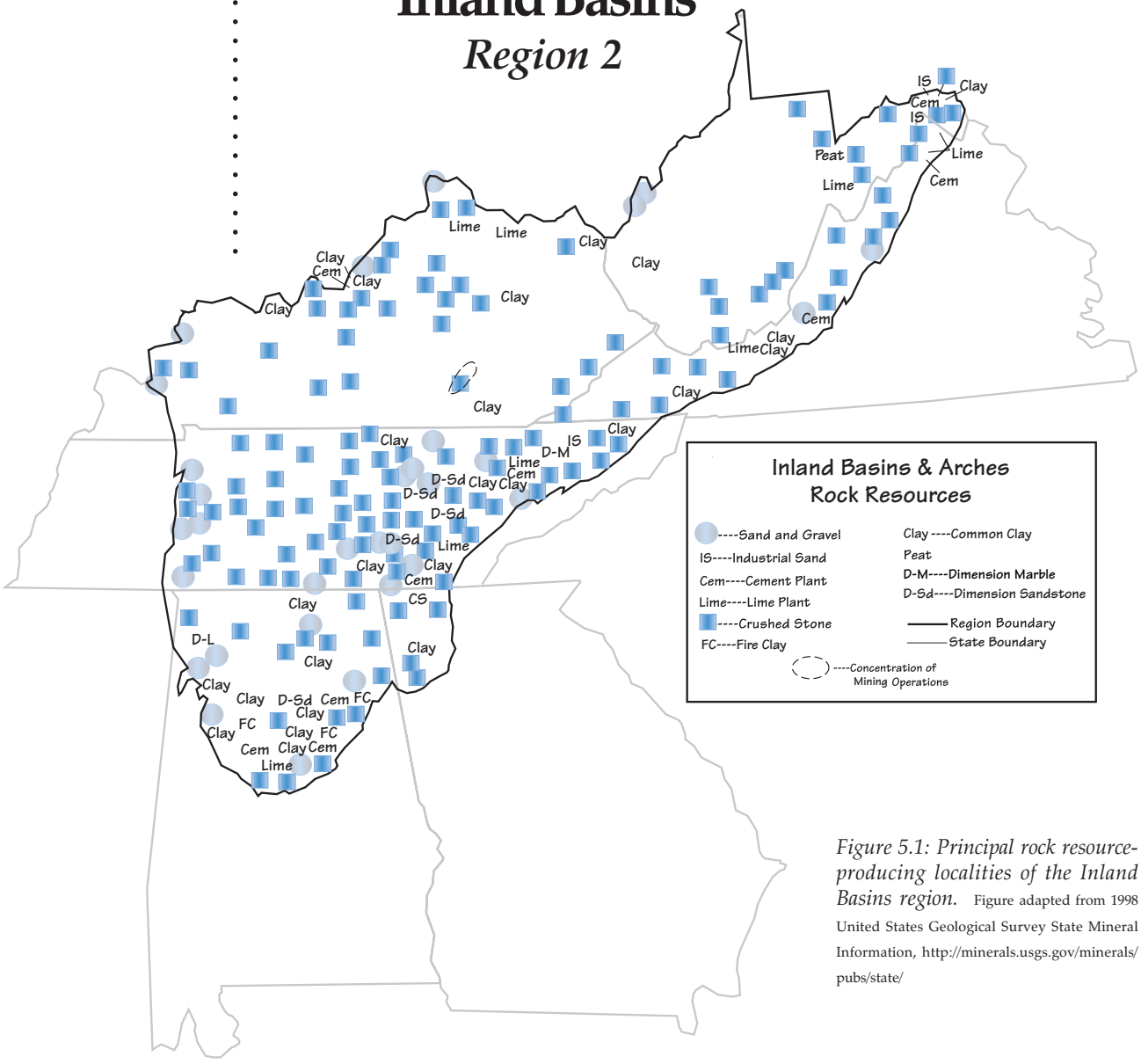


Figure 5.1: Principal rock resource-producing localities of the Inland Basins region. Figure adapted from 1998 United States Geological Survey State Mineral Information, http://minerals.usgs.gov/minerals/pubs/state/

The primary rock resources of the Inland Basins region are crushed stone. Sediment resources such as sand, gravel, and clay are locally important *(Figure 5.3)*.

Rock Resources

Sediment

Sand and gravel, which was deposited in streams flowing westward from the Appalachians, is locally produced and used for aggregate as in the other regions. Common ***clay*** is produced for use in brick making.

see Rock Resources, p. , for more on the different types of **clay.**

Sedimentary rock

Paleozoic limestone and dolomite (dolostone) form the bedrock across much of Inland Basins and Arches region. Bottled spring water in the Kentucky Blue Grass region comes from springs in the Ordovician limestone! These carbonate rocks were deposited in the shallow inland ocean that once covered the Southeast. Limestone and dolomite are quarried for crushed stone. Most of the crushed stone is used for construction aggregate, but in the Inland Basins region it is also used for the production of ***lime*** and cements. Lime, once considered a waste product of crushed stone, is now used in a wide variety of chemical and industrial applications. Lime is also used in steel making, water purification, sulfur removal from smoke stacks, sewage treatment, and paper manufacturing. Lime is even fed to poultry to make their eggshells stronger!) Alabama and Kentucky are two of the top lime producing states in the Nation. ***Kentucky*** also has one of the largest crushed stone quarries in the United States.

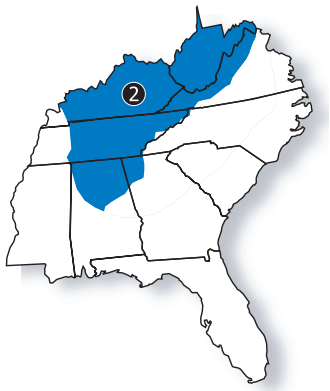
Originating from limestone, dolomite or marble, **lime** *is very important to agriculture, where it is regularly applied to make the soils "sweeter" (less acidic.)*

The Reed Quarry in western **Kentucky** *produces more limestone than any other quarry in the United States!*

Local dimension sandstone and industrial sandstone are quarried in the eastern part of the region within the Valley and Ridge province. The Tuscarora and Oriskany sandstones are commonly mined and crushed for use as industrial sand because they are 98% silica, and therefore useful for glass manufacturing. The quartz-rich Tuscarora and Oriskany sandstones, abundant in West Virginia, have made the state one of the leading glass manufacturers in the Nation. Some Mississippian and Pennsylvanian sandstones also contain natural bitumen, or tar. These tar sands historically have been quarried for the natural asphalt they contain.

see Rock Resources, p.135, for more on **industrial sand** *and* **dimension stone**

see Fuel Resources, p. , for more on **asphalt**



Rock Resources of the Coastal Plain

Region 3

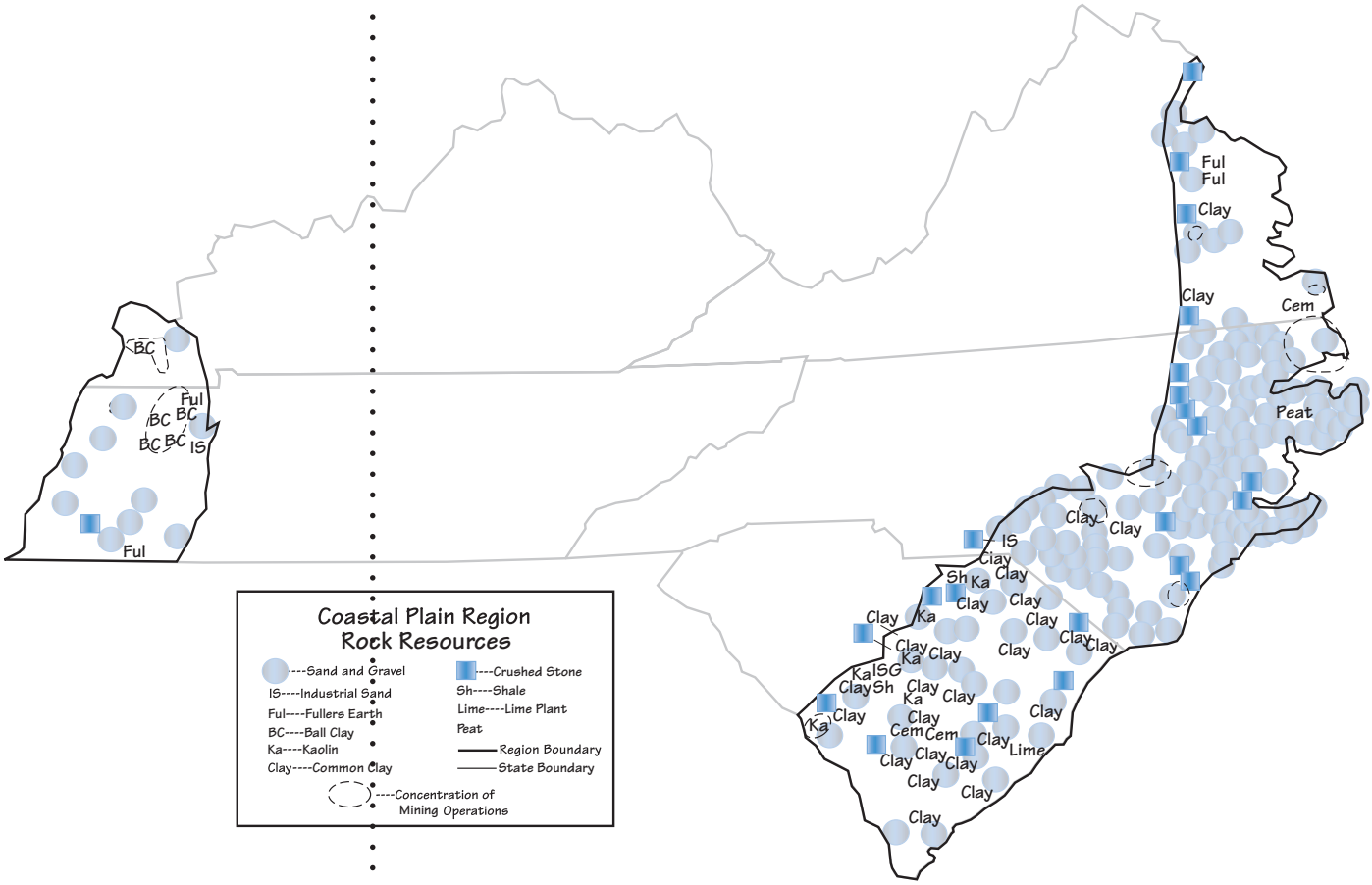


Figure 5.4: Principal rock resource-producing localities of the northern section of the Southeast Coastal Plain region. Figure adapted from 1998 United States Geological Survey State Mineral Information, http://minerals.usgs.gov/minerals/pubs/state/

The primary rock resources of the Coastal Plain are the layers of sediment eroded during the Cretaceous, Tertiary and Quaternary from the Appalachian Mountains (FIGURE 5.3 and 5.4). Because unconsolidated sediment (not rock yet!) dominates the region, the Coastal Plain region has few solid rock resources at or near the surface except in Florida where sediment cover is locally thin.

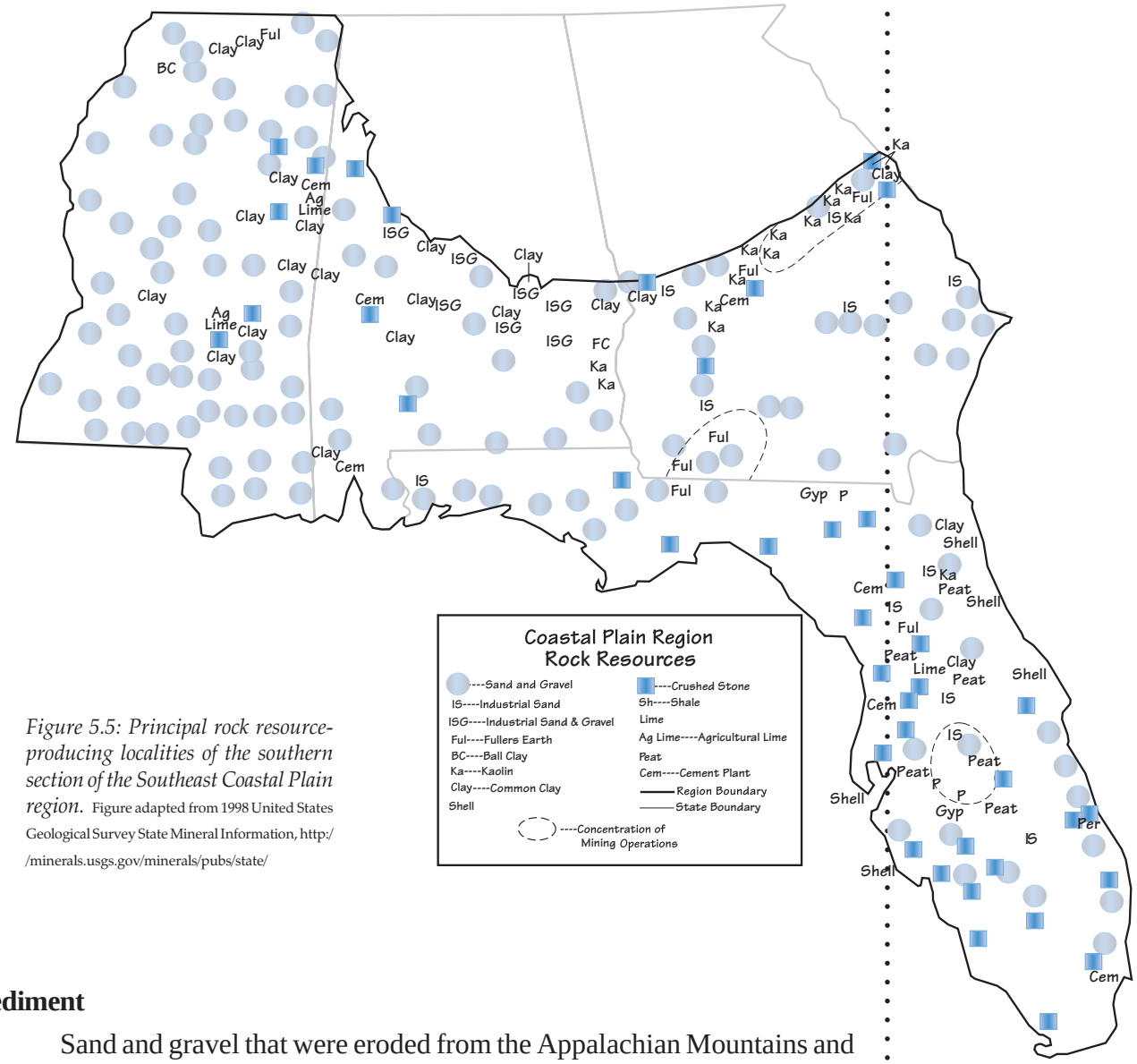


Figure 5.5: Principal rock resource-producing localities of the southern section of the Southeast Coastal Plain region. Figure adapted from 1998 United States Geological Survey State Mineral Information, http://minerals.usgs.gov/minerals/pubs/state/

Sediment

Sand and gravel that were eroded from the Appalachian Mountains and redistributed by rivers and the ocean blanket the Coastal Plain. These materials (along with clay) are the dominant natural resource mined on the Southeast Coastal Plain because they are abundant along the coast, in rivers, and along river terraces. Sand and gravel are primarily used in concrete, and road fill. The Coastal Plain region also produces ***industrial sand*** as in the other regions.

Clay deposits, extremely abundant in the Coastal Plain region, also were originally eroded from the mountains and redistributed. Six of the top ten clay producers in the Nation occur in the Southeast Coastal Plain, with Georgia and South Carolina in the lead. There are several types of clays, each used for different

see Rock Resources, p. , for more on **industrial sand.**

Rock Resources

Kaolin, fuller's earth, ball clay and common clay are each composed of different types of clay minerals, giving the various clays distinctive properties.

Clay	Clay Minerals
kaolin =	*kaolinite*
fuller's earth =	*montmorillonite*
ball clay & common clay =	*illite/montmorillonite*

China clay *(also known as kaolin clay) is the main ingredient in fine china dishes such as Wedgewood. Before the Revolutionary War kaolin from South Carolina was exported to England for production of Wedgewood pottery and china.*

At one time, people known as fullers cleaned sheep's wool before it was spun. The wool was cleaned using a very absorbent type of clay derived from volcanic ash that became known as **fuller's earth**. *Dusting this clay through the sheep's wool absorbed dirt and grease, and made the wool easier to spin.*

purposes: ***kaolin***, ***fuller's earth***, ***ball clay*** and ***common clay***.

Kaolin is earthy white clay, also known as ***china clay***. Deposits of kaolin clay occur along the western margin of the Coastal Plain along a 300-mile-long trend from Aiken, South Carolina, through Macon, Georgia, to Eufaula, Alabama *(Figure 5.6)*. These clays are formed from the weathering of the crystalline rocks of the piedmont and occur as lenses in sediments of Late Cretaceous to Tertiary age. Mining of these deposits accounts for around 90% of total United States kaolin production and 40% of global production. Remaining resources are estimated at billions of tons. Kaolin is used in the manufacture of ceramics such as fine porcelain, as a paper coating, in refractories, and as an additive in rubber products, fertilizers, cosmetics, and detergents. ***Fuller's earth*** is another type of earthy clay with a moisture content that is higher than other clays. Because it naturally absorbs water, it is used in the manufacture of kitty litter, as an adsorbent in refining oils, and as an additive to various types of pastes and putties. Ball clay is a plastic clay that got its name in England, where it was rolled into balls of a certain size for sale. Ball clay is used as a bonding agent in the manufacture of ceramics and is common in the upper Mississippi River Embayment. Common clay is used in the manufacture of bricks, lightweight aggregate, cement, and other structural clay products. In fact, North Carolina is annually the Nation's leader in brick production because of its common clay resources. The extremely fine-grained, smooth nature of pure clay, which makes it ideal for a variety of industrial uses, is a result of its environment of deposition. Clay-sized particles do not settle to the bottom of an ocean or river unless the water is barely moving. Thus, the main sources of clay are the marine shales of the westward reaches of the Paleozoic inland ocean.

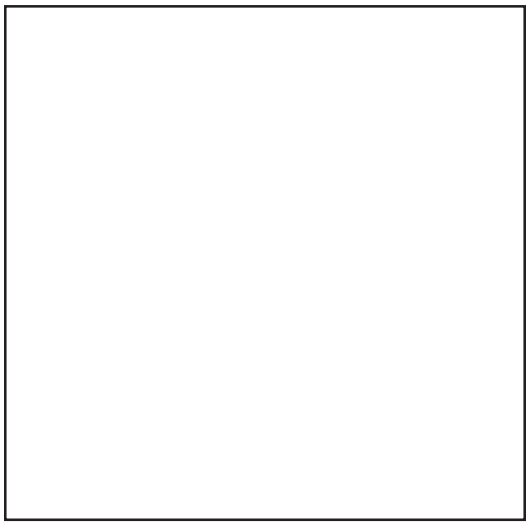


Figure 5.6: The 300-mile long kaolin clay deposit.

Peat

Some of the largest swamps in the Nation are found in the Coastal Plain region of the Southeast, including the Everglades of Florida, the Okefenokee Swamp of Georgia, and the Great Dismal Swamp of Virginia and North Carolina. Swamps, bogs and marshes have abundant vegetation. Thick piles of plant material accumulate as the vegetation naturally dies, and are buried by successive layers of dead plants. This creates a low-oxygen environment in which the plant material is not being decomposed. The more the layers are buried, the more they are squeezed and compressed and gradually they become peat. With further compression, the organic material becomes lignite and then coal. Not surprisingly, peats produced in these swampy environments are a valuable resource in Coastal Plain region. Florida is the top peat producer in the Nation. Peats are used in potting soil, as a soil conditioner, insulation for packing fruits and vegetables and as a protein additive in cattle food.

see Fuel Resources, p. , for more on **peat.**

Sedimentary rock

Although sedimentary rock commonly is not exposed at the surface in the Coastal Plain region, sedimentary bedrock is mined in many quarries where sediment and soil cover are thin. ***Limestone*** is quarried as a building stone and to make crushed stone. Some of the Cretaceous and less commonly the Tertiary layers of sediment at the surface in the Coastal Plain have been sufficiently hardened for use as a dimension stone. In Alabama, the Tertiary Marianna Limestone, though soft enough to be cut with a saw, hardens upon exposure and was commonly used as a ***dimension stone*** in southern Alabama. Crushed stone is principally used as construction aggregate and in the manufacture of cement and lime. Because much of Florida was deposited as a carbonate platform, there are extensive carbonate (limestone and dolomite) resources near the surface. Florida is one of the top producers of crushed stone in the Nation, and annually leads the Nation in the manufacture of masonry cement. There are two varieties of cement: natural and Portland cement. Both types incorporate limestone. Natural cement uses limestone with a particular amount of clay as a hardener. Portland cement is made through a heated combination of limestone with other rocks and minerals. Concrete consists of gravel, pebbles, and broken rock with a cement matrix.

Shell **limestone** *(coquina) can also be easily cut into dimension stone, and was used in many historic buildings of St. Augustine, Florida, including the Castillo de San Marcos, the first permanent European settlement in the United States.*

Dimension stone *is the commercial term applied to quarried blocks of rock cut to specific dimensions and used for buildings, monuments, facing and curbing.*

For More Information...

Internet

National Gas Information and Educational Resources
www.naturalgas.org/

National Mining Association
www.nma.org

Oil and Gas
http://www.dcnr.state.pa.us/topogeo/Oil_Gas_Coal.htm

State Mineral Statistics and Information
http://minerals.usgs.gov/minerals/pubs/state/

Vermont Marble
http://www.vermont-marble.com/home.htm

Organizations

American Coal Foundation
1130 17th St. NW, #220
Washington, DC 20036
(202) 466-8630

Mineral Information Institute
475 17th St. #510
Denver, CO 80202
(303) 297-3226

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